BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE
PILANI (RAJASTHAN)

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PILANI (RAJASTHAN)

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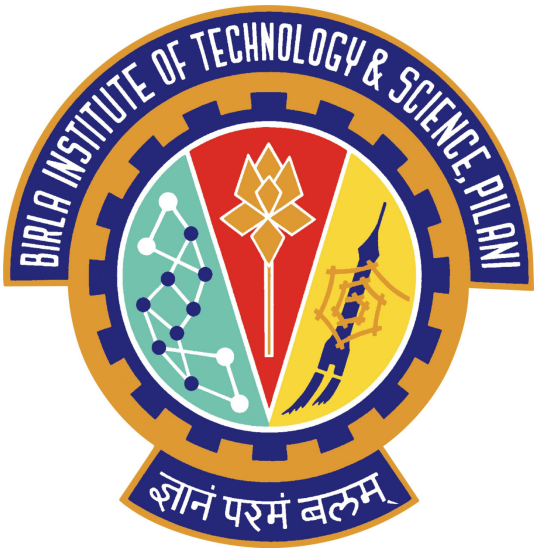

INSTITUTE EMBLEM

The Emblem of the Institute represents a synthesis of Science, Humanities and Engineering with Lotus representing Humanities & Social Sciences, the Structure of Molecule representing Science, and the Figure of Rocket representing Engineering & Technology.

The Motto is –

'Knowledge is power supreme'

BITS VISION

"What do we propose to do here? We want to teach real science whether it is engineering, chemistry, humanities, physics or any other branch. We want to develop a scientific approach in Pilani, which means there would be no dogma. There will be a search for truth. What we propose to do here is to cultivate a scientific mind."

— The Late Shri G.D. Birla
Founder Chairman, BITS, Pilani

" … to prepare young men and women to act as leaders for the promotion of the economic and industrial development of the country and to play a creative role in service to humanity."

— The Late Dr. K.K. Birla
Former Chancellor, BITS, Pilani

"What is it that can empower our nation? The most obvious answer is education. Education that enhances livelihoods but also education that is value-based. Education that gives roots and gives wings as well".

—Dr. Kumar Mangalam Birla
Chancellor, BITS, Pilani

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HIGHLIGHTS

- *Multi-campus University with campuses at Dubai, Goa and Hyderabad*
- *Admission in both semesters*
- *Admission only on merit through a unique computer based on-line admission test, BITSAT*
- *20 – 30 Board toppers join every year*
- *Scholarship to 22% of students*
- *Academic flexibilities – Dual Degree – a unique combination of Science and Engineering education*
- *Modular and flexible academic structure*
- *Vertical transfer option from First Degree to Higher Degree/Ph.D.*
- *Continuous, internal, transparent evaluation system*
- *Practice School – strong linkages with industries*
- *Work-Integrated Learning Programmes for employed professionals*
- *State-of-the-art institutional library with over 2 lac books*
- *State-of-the-art Campus-wide computer network*
- *Large number of Alumni in top positions in India and abroad*
- *Very strong Alumni network*
- *Collaboration with foreign universities of repute*
- *Entrepreneurial Leadership Development*
- *Many societal development projects – Rain Water Harvesting, Desert Development Technologies, Women Empowerment, Healthcare*
- *Major cultural, academic and sports events – OASIS, APOGEE and BOSM - organized by students*
- *Privately funded with an affordable fee structure*

PART I
GENERAL INFORMATION

HISTORY AND PURPOSE

The Birla Institute of Technology and Science (BITS), Pilani is an all-India Institution declared as deemed to be university established under Section 3 of the UGC act. It is privately supported, fully residential and admits both male and female students. The primary objectives of the Institute are "to provide for and otherwise promote education and research in the fields of Technology, Science, Humanities, Industry, Business, Public Administration and to collate and disseminate in such fields effective ideas, methods, techniques and information as are likely to promote the material and industrial welfare of India" and to "train young men and women able and eager to create and put into action such ideas, methods, techniques and information".

The Institute was initially registered as a Society under the Rajasthan Societies Registration Act of 1958 on the 13th May, 1964. Subsequently, by notification published in the Gazette of India dated the 27th June, 1964, the Ministry of Education, Government of India, declared that the Institute being an institution for higher education shall be "deemed to be a University". The Institute started functioning with effect from 1st July, 1964 with late Shri G.D. Birla as its Founder Chairman.

The Institute started as a small "Pathshala" in Pilani way back in the year 1901 by Seth Shri Narainji Birla with one teacher for educating his grandsons, late Shri G.D. Birla and late Shri R.D. Birla. Pilani was then a small isolated desert village in Rajasthan. The Pathshala evolved slowly and steadily into a High School in 1925 and became an Intermediate College in 1929. The Birla Education Trust was founded in the same year. The Intermediate College developed into a Degree College in 1943. In 1947, this college was raised to postgraduate level. In 1950, Pharmacy courses were started in this college, and in 1952, it was bifurcated into College of Arts and the College of Science, Commerce and Pharmacy.

During World War II, the Government of India established a Technical Training Centre at Pilani for the supply of technicians for Defence Services and industry. In 1946, late Shri G.D. Birla decided to convert it into an engineering college with degree programmes in Electrical and Mechanical Engineering. Master's programme in Electronics was started in 1955. B.E. programmes in Civil Engineering and Chemical Engineering were started later. In 1964 with the inception of the Birla Institute of Technology and Science, the colleges, viz., Birla College of Science, Commerce and Pharmacy, Birla College of Arts and Birla College of Engineering situated at Pilani, as also all properties, movable and immovable, together with educational facilities, hostels, staff quarters, playgrounds, etc., became part of the Institute and all these properties were vested in it. During the early years of its inception, i.e., 1964 to 1970, the Institute with the support of Ford Foundation Grant had the advantage of having collaboration with Massachusetts Institute of Technology (MIT), USA. It adopted the semester system, modular structure of courses, continuous and internal evaluation, letter grading, etc. It also created institutionalized linkages with the industries. Over a period of time, the Institute also introduced several flexibilities in its educational programmes.

Dr. K.K. Birla who took over as the Chairman of BITS in 1983 was deeply involved and closely associated with his visionary father in running both the earlier Birla Colleges and the current institute BITS, since its inception. With his spirited involvement in all the activities of the Institute, he was able to see the vision of his father Late Shri G.D. Birla unfolding. Taking over the responsibility of running the institute, Dr. K.K Birla who became the Chancellor in 2003 realized the need for greater number of promising graduates in the field of science and technology in shaping up the nation's development. Hence he initiated an increase in the number of students at Pilani campus during 1999 which gradually carried the total strength from 2500 to 4000. Under his

patronage, BITS started expanding by establishing three campuses, one in Dubai in the year 2000, in Goa in the year 2004 and in Hyderabad in the year 2008.

Consequent upon the sad demise of Dr. K.K. Birla on 30 August 2008, Dr. Kumar Mangalam Birla was elected as the Chancellor and Smt. Shobhana Bhartia was nominated as the Pro-Chancellor of the Institute. Under the leadership of young and dynamic Chancellor, BITS is taking steps to scale greater heights.

In the year 2000, BITS was accredited by NAAC with the highest possible rank in University accreditation. In 2008-2009, the NAAC peer team visited BITS campuses at Pilani, Goa and Dubai and BITS has been reaccredited with CGPA 3.71 on four point scale at the highest 'A' grade.

The Vision 2020: Mission 2012 was conceptualized by Prof. L.K. Maheshwari, Vice Chancellor in 2006. A Task force was created to prepare a Vision 2020 document for BITS, under the convenership of Prof. G. Raghurama, Director, Pilani campus. The purpose of the exercise is to arrive at goals for the foreseeable future and prepare the action plans. All stakeholders, students, faculty, alumni and management from all campuses, were involved in the exercise. Workshops and townhall meetings have been conducted regularly to update everybody. Vision 2020 has give rise to Mission 2012 which involves executing the action plan arrived at to make BITS Pilani the top class Engineering Institute in the world.

Vision 2020: Mission 2012 – A New Strategic Plan for BITS

The Institute has embarked on a journey to become one of the leading universities in the world by the year 2020. Towards this goal, a task force has been constituted to prepare the Vision 2020 documents and the draft 'Vision 2020' was released in February 2009. Following this, a number of steps have been initiated to action the identified goals.

The Goals of Vision 2020 were shared with stake solders through Town hall meetings, Workshops etc. and the same were refined based on the inputs and discussions. Towards the Vision 2020 goals, a Mission 2012 project has been initiated for specific actions to be completed by 2012. The project has been given a logo: Leadership through Excellence. Six thrust areas – Academic Programs and Pedagogy, People, Research & Consultancy, Campus Life, Infrastructure & Facilities and University Administration – have been identified for special focus. Sixteen task forces have been created, with cross-campus teams, to take the goals and actions to fruition. With the full backing and commitment of the top management to this effort, an implementation structure has been put in place to support the Mission 2012 project.

CAMPUSES OF BITS

BITS, Pilani – Pilani Campus

BITS, Pilani – Pilani Campus is located in the Vidya Vihar campus adjacent to Pilani town in Jhunjhunu district, in Rajasthan. Pilani is the home town of the Birla family and has a population of about 50,000. It is about 200 km west of Delhi and about 220 km north of Jaipur. The temperatures during the year go to extremes like 45°C in summer and 0°C in winter. The climate is generally dry and healthy. Annual rainfall is about 30 cms.

The Institute buildings, hostels and residential quarters for staff with neatly laid out roads, lawns and gardens constitute the BITS Campus of about 240 acres.

Pilani can be reached either by rail or by road. The nearest railway stations are Chirawa on W.R. (16 km) and Loharu on N.R. (24 km). There are connecting buses to Pilani from Loharu and Chirawa railway stations. There are regular bus services between Delhi-Pilani and Jaipur-Pilani. The buses leave Delhi from Inter-State Bus Terminal, Kashmere Gate and Jaipur from Rajasthan State Roadways bus stand, Sindhi Camp. The Pilani campus is very close to the Pilani bus stand.

BITS, Pilani – Dubai Campus

BITS, Pilani-Dubai Campus was established in association with ETA-ASCON group in September 2000 in response to the growing need for quality engineering education among the residents of the Middle East. The Institute is beautifully spread over an area of 14.7 acres in Dubai International Academic City in Dubai. BITS, Pilani is the first Indian Higher Educational Institution to set up its campus abroad.

BITS, Pilani – K.K. Birla Goa Campus

BITS, Pilani - K.K. Birla Goa Campus started functioning in August 2004 and was formally inaugurated by Hon'ble Prime Minister of India, Dr. Manmohan Singh on May 5, 2006.

The Campus is spread over an area of 180 acres and the location of campus is unique with respect to scenic beauty and panoramic view of picturesque surrounding with Zuari river, hillocks, waterways and forest. The Campus is about 25 km south of Panaji (capital of Goa), 10 km west of Vasco-Da-Gama and 22 km north of Madgaon. It is 5.5 km east of Goa Airport, along National Highway – 17B, bypass road.

BITS, Pilani – Hyderabad Campus

BITS, Pilani has established its fourth Campus in the city of Hyderabad in 200 acres area in Jawahar Nagar, Shameerpet Mandal, RR District in 2008. For the academic session 2009 – 10, the campus has admitted 592 students in its second batch of I Degree programmes, 31 students in Higher Degree programmes and 11 students in Ph.D programmes.

The campus is located on the Karimnagar highway and is about 25 kms from Secunderabad railway station; 40 kms from Hyderabad (Nampally) railway station; and 70 kms from Hyderabad Rajiv Gandhi International Airport.

FACILITIES AT CAMPUSES

PILANI CAMPUS AND ITS ADJOINING FACILITIES

Shiv Ganga and Saraswati Temple

Shiv Ganga is a central beauty spot of the Vidya Vihar Campus with 400 meters circular canal and the Sharda Peeth, a beautiful white marble temple dedicated to Goddess Saraswati.

Guest Accommodation

Limited facilities are available for board and lodging on payment at the VFAST Hostel (Visiting Faculty and Students Hostel) which is near the entrance of the Campus.

Accommodation has to be booked by prior request addressed to the Chief, Public Relations Unit, BITS, Pilani. Limited accommodations are also available at (i) Alumni Home (Requests should be addressed to Public Relations Officer, Birla Education Trust, Pilani), (ii) CEERI Guest House (Requests should be addressed to Administrative Officer, CEERI, Pilani) and (iii) Some guest houses and dharamshalas in the city operated by private agencies.

Schools/Colleges

There are several Middle and Primary Schools in Pilani. The Secondary schools are affiliated to Central Board of Secondary Education; prominent being Birla Public School, Birla Senior Secondary School, Birla Balika Vidyapeeth (for Girls upto 10+2) and Birla Shishu Vihar, a Co-educational Secondary School, located in Vidya Vihar Campus. Adjoining the Vidya Vihar Campus, there is an Engineering and Technology Institute, Commerce & Arts College and a Polytechnic Institute. There is a Home Science College for girls in Pilani town. These schools and colleges are run by Birla Education Trust and other Educational Societies.

Infant Care Centre

The Community Welfare Unit of the Institute runs an Infant Care Centre to meet the needs of the Campus Community for pre-school education of infants. The Institute helps the Centre by providing the necessary facilities.

Bank and P & T Service

Within the Vidya Vihar Campus there is a branch of UCO Bank with ATM facility. In the adjoining CEERI Campus there is a branch of the State Bank of Bikaner and Jaipur, with its extension counter and ATM facility in the Institute building. The Pilani Post office is located within the Campus, while a Telegraph office is situated in the CEERI Campus.

Shopping Centres

AKSHAY, a Supermarket, located in the heart of the campus in an area of 7500 sq.ft. with an elegant modern building is a part of BITS Consumers' Cooperative Stores Ltd. (BITS Coop). Student volunteers of the Institute have worked with management of the BITS Coop in the establishment of the Supermarket. It has various sections for consumable items where the customers can choose and pick-up the items of their choice and pay on the cash counter. General provision, sanitary goods, cosmetics, snacks and other food items, Bakery and Dairy products, books & stationery, fruits & vegetables are made available to the students and staff at reasonable rates.

The Vidya Vihar Campus has another shopping center (popularly known as "Connaught") with books and magazine stores, stationery shops, general merchandise and provision stores, photocopying and STD phone facilities and several restaurants.

Birla Museum

The Birla Museum is located adjacent to the Institute Building. It is the first science and technology museum established in the country. Most of the exhibits and models incorporate stimulating animations and visual effects.

Central Electronics Engineering Research Institute (CEERI)

Adjoining the Campus, there is the Central Electronics Engineering Research Institute. It is one of the National Laboratories under the Council of Scientific & Industrial Research (CSIR).

STUDENT LIFE

Student Housing

The Institute is fully residential and hostel accommodation is provided to all students. Permission to become day-scholar may be granted only under exceptional circumstances where student's parents or close relatives are residents of Pilani. There are 11 hostels for boys and one hostel complex for girls, the details of which are given in the following:

Name of the Hostel	*No. of single seated rooms*	*No. of double seated rooms*
Boys' Hostel:		
Ashok Bhawan	152	–
Bhagirath Bhawan	152	–
Budh Bhawan	190	36
Gandhi Bhawan	190	36
Krishna Bhawan	190	36
Malaviya Bhawan – A	140	–
Malaviya Extension – B	140	–
Malaviya Bhawan – C	182	–
Malaviya Extension – D	–	105
Shankar Bhawan	190	36
Vishwakarma Bhawan	192	38
Vyas Bhawan	190	36
Girls' Hostel:		
Meera Bhawan	448	117

There is a common kitchen cum mess unit for every set of two boys' hostels. Each unit of

the mess serves vegetarian and non-vegetarian food and the unit operates under the management of different students' committees. The girls' hostel, however, has a separate mess of its own, situated within the boundary of the hostel. Students staying in the hostel have to necessarily take their food in the Hostel Messes. The messes attached to hostels are fully managed by the students. Every inmate of the hostel is provided with necessary furniture and fixtures in the room. Each hostel is equipped with solar water heating systems. Common room facilities are available in each hostel. Internet connectivity has been provided in all hostel rooms.

Student Activities Centre

The Institute has a Student Activities Centre housed in a separate building where students have their union office and rooms for various activities. This building also has badminton courts, a squash court, a Table tennis room, a Health Club, an open air amphi theatre and a cafeteria.

Cultural and Recreational Activities

The Institute has following clubs and societies: Music, Dance, Hindi Drama, English Drama, Hindi Press, English Press, Creative Activities, and Mime clubs; English Language Activity and Hindi Activity societies. These are entirely managed by the students and have been nurturing the creative and cultural talents of the students. In addition, the Institute runs Recreational Activity Forum, Photography Club, Swimming Club, and Health Club whose membership is open to students and staff. The Institute also organises Theatre and Dance workshops. A classical music group called 'Ragamalika' aims at encouraging budding talent among the students in music and dance. It also arranges performances by leading artists in the field of classical music and dance. In addition, there is also a BITS Pilani Chapter of SPIC-MACAY which organizes programmes to promote Indian classical music and culture amongst youth.

Recreational Activity Forum (RAF) regularly organizes film shows and cultural programmes for the BITS community. BITS being an all-India Institute, students have also established regional associations representing almost all Indian States conducting several special programmes on festive occasions.

Physical Education

Physical Education of the Institute aims at providing a safe atmosphere to enable students and staff members to exercise to their potential whilst achieving their goals. It offers a variety of fitness, wellness, and recreation opportunities, and Fitness Programmes including Yoga and Martial Arts. The Physical Education has major facilities include Health Club, Swimming Club and Sports Club. Health Club is equipped with single and multi-stationed machines and weight training facilities to provide students with an opportunity of doing exercise for physical fitness. Swimming Club has a swimming pool of 25 m length while Sports Club has various indoor and outdoor facilities for students to take part in sports and games. The indoor facilities are Badminton, Table Tennis and Squash with synthetic flooring while outdoor facilities are Basketball, Football, Hockey, Volleyball, Cricket, Tennis, Track & Field (400 m) etc. Sports and fitness activities are supervised by the qualified and experienced staff members of the Institute.

Festivals on Campus

Traditionally students organize three festivals during an academic year. BOSM (BITS Open Sports Meet) in September, a sports festival; OASIS, a cultural festival in October and APOGEE (A Professions-Oriented Gathering Over Educational Experience), an Academic Festival in March thus bringing about a beautiful blend of sports, cultural and academic milieu of the campus. All the three festivals are entirely managed by students in which a large number of students from all over India actively participate.

Students' Participation in Institute Activities

Students actively participate in various continuing and developmental activities of the Institute as follows:

There are four students as members of the Senate, two students in the Senate-appointed Academic Counselling Board and one student in the Senate-appointed Standing Committee for Students' Discipline. In addition, senior students act as mentors to junior students in the registration process. Some students are also associated with the course development activities. Students participate as associate members in the activities of various Divisions of the Institute. Their contribution in projects and research activities of the Institute has proved to be very useful.

STUDENT SERVICES

Orientation and Counselling

At the time of admission, the Institute organises an orientation programme in order to familiarise the new students with the highlights of the Academic Programmes at BITS and to give them an idea about their campus-life and co-curricular activities. The Vice Chancellor and senior faculty members meet the parents of Freshmen at an interaction session organized at the time of admission.

Faculty members act as Advisors and Mentors for groups of students to guide them in the registration process, and encourage them to discuss any matter –academic and non-academic with them during their stay at BITS. Students can also approach their wardens for any help or guidance related to academic or personal matters. Hostels have Resident and Non-resident Wardens drawn from the faculty. In addition, there are Hostel Superintendents to assist the Wardens in matters related to the upkeep of the hostels and attending to the needs of the students.

Medical Facilities

The Campus has a Medical Centre, which caters to the medical needs of the students and staff. It has a Physician (MD) and a lady doctor, who attend to the patients both in the morning and evening outdoor hours. A dental surgeon visits the centre once in every week. Similarly the centre also provides services of part time ENT and Ayurvedic specialists. The Centre has a good clinical laboratory for all major Biochemical, Hematological, urine, stool and other routine tests. The Biochemical tests are performed by a semi-auto analyzer. Certain Serological tests are also done using ELISA counter. An automatic ECG machine and a Computerized Siprometer are also used as diagnostic tools. The centre also has a small Physiotherapy unit and a dental X-ray unit. Health awareness camps are organized in the centre from time to time. BITS Coop Medical Store is located in the Medical Centre where medicines prescribed by the doctor can be purchased. Other medical needs of the students are attended to at the Birla Sarvajanik Hospital, which is situated at a distance of about 3 kms from the Institute Campus. It is a 170-bed hospital staffed with Surgeons, Physician, Gynecologist Orthopedist etc. and has facilities for pathological tests, X-ray etc. There is a special ward reserved for students. However, for serious illness it becomes necessary to go to nearby cities like Delhi/Jaipur. The Institute maintains Ambulance services and has an arrangement with Holy Family Hospital, New Delhi for this purpose. Mahadeo Singhi Eye Hospital at Pilani caters to the eye and dental care of the campus residents.

Communication Facilities

STD Public Call Office, FAX and Photocopying are available for the benefit of students and staff. Pilani post office in the campus offers speed post services also.

The Institute has Internet connectivity by which all faculty and students can have access to electronic mail, remote login, browsing, etc.

INTERNATIONAL STUDENTS ASSOCIATION

The International Students Association is a body of foreign students studying at BITS with a faculty member as the International Students Advisor. The association organises cultural activities and extends all possible help to foreign students whenever required. The Institute has also established a separate

'Community Welfare and International Relations Unit' headed by a faculty member as its Chief to promote exchange of students both for academic and cultural purposes.

PLACEMENT AND CAMPUS INTERVIES

A separate Unit deals with this important activity. About 125 companies visit the Institute every year to interview students who are about to graduate. The number of such interviews actually has grown considerably over the years. As the student-population in the final year is divided into two batches with one batch going to practice school in the first semester and the other in second semester, only one half of the final year students will be available for campus interview during a particular semester. Hence many organizations find it worthwhile to conduct the campus interviews in both the semesters so that they can interview both the batches on the campus itself. The Institute also tries to arrange interviews for practice school students in and around their own practice school centers. The impressions given by the representatives of industries about the students are continuously fed back to the concerned Divisions and discipline Groups. Some of the organizations that have been conducting campus interviews are shown in the following table.

Organizations conducting Campus Interviews

Absolute Data, New Delhi	Boston Analytics Pvt. Ltd., Mumbai
Aditi Technologies Pvt. Ltd., Bangalore	Brocade Communications Systems Pvt. Ltd., Bangalore
Aobe Systems (I) Pvt. Ltd., Noida	Business Objects S/W India Pvt. Ltd., Bangalore
ADP Pvt. Ltd., Hyderabad	Cambridge Classes Ltd., Udaipur
Altair Engineering India Pvt. Ltd., Pune	Capgemini India Pvt. Ltd., Hyderabad
Amazon Deve. Centre (I) Pvt. Ltd., Hyderabad	Catapult, Bangalore
Ansys Fluent India Pvt. Ltd., Bangalore	C-Dot, New Delhi
Apex-Decisions Pvt. Ltd., Bangalore	Cavium Networks (India) Pvt. Ltd., Hyderabad
Aricent Technologies Ltd., Gurgaon	CE Infosystems Pvt. Ltd., New Delhi
Ashok Leyland Ltd., Chennai	Cerner Healthcare Solutions Pvt. Ltd., Bangalore
Atrenta India Pvt. Ltd., Noida	CISCO Systems (India) Pvt. Ltd., Bangalore
Avtech Limited, New Delhi	Citrix R&D India Pvt. Ltd., Bangalore
Axiom Education, Bangalore	Cognizant Technology Solutions India P. Ltd.,Chennai
Azingo Software Systems India Pvt. Ltd., Hyderabad	Computer Associates, Hyderabad
Bain & Company, Gurgaon	Computer Sciences Corporation India Pvt. Ltd., Noida
Bajaj Allianz, New Delhi	Cosmic Circuits Pvt. Ltd., Bangalore
Barclays Technology, Pune	Covansys (India) Private Ltd., Bangalore
Belden, New Delhi	Crompton Greaves Ltd., Mumbai
Beroe Inc., Chennai	Cummins India Ltd., Pune
Bharat Petroleum Corp Ltd., Mumbai	Cybage Software Pvt. Ltd., Pune
Bharat Heavy Electricals Limited, New Delhi	Cypress Semiconductor (I) Pvt. Ltd., Bangalore
Bharti Airtel Limited, Gurgaon	D.E. Shaw India Software Pvt. Ltd., Hyderabad
Bharti Reality Limited, Gurgaon	Dell International Services India Pvt. Ltd., B'lor
BILT, Yamunanagar	Deloitte, Hyderabad
Biocon Ltd., Bangalore	Directi, Mumbai
Birla Tyres Ltd., Haridwar	
BOC India Ltd., Kolkata	

Organizations conducting Campus Interviews (contd.)

DMV Business & Market Research Pvt. Ltd., Hyderabad
Dr. Reddy's Laboratories Ltd., Hyderabad
E-Frontier Technology India Pvt. Ltd., Chennai
Elecon Enginering Ltd., Gujarat
Embedded Infotech, Hyderabad
Energy Infratech Pvt. Ltd., Gurgaon
Enterprise One Consulting Services, Hyderabad
Essar Group, Hazira
Evalueserve.Com Pvt. Ltd., Gurgaon
Exeter Group, Bangalore
Exxon Mobil, Delhi
Fiberlink Software Pvt. Ltd., Bangalore
Financial Information Network Operations Ltd., Noida
Fiorano Software Technologies Pvt. Ltd., Bangalore
Fluor Daniel India Pvt. Ltd., New Delhi
Freescale Semiconductor India Pvt. Ltd., Noida
Frost & Sullivan, Mumbai
Future First Info Services Pvt. Ltd., Bangalore
GAIL India Ltd., New Delhi
GE Energy, Hyderabad
Global Logic, Noida
Google India, Bangalore
Habits, Hyderabad
Hewlett Packard India Ltd., Bangalore
Hindustan Aeronautics Limited, Bangalore
Histogenetics, NY
I2 Technologieis India Pvt Ltd. Bangalore
IBIBO Web Pvt. Ltd., Gurgaon
IBM India Private Limited, Bangalore
i-Flex Solutions Ltd., Mumbai
Indian Army, Bikaner
Indian Oil Corporation Limited, New Delhi
Indian School of Business, Hyderabad
Infineon Technologies India Pvt. Ltd., Bangalore
Infosys Technologies Ltd., Bangalore
Ingersol Rand, Hyderabad
Insead Business School, Singapore
Intel Technology (I) Pvt. Ltd., Bangalore
Intuit Technology Services Pvt. Ltd., Bangalore
Invensys Development Centre India Pvt. Ltd., Hyderabad
J.K. Tyres, Kankroli
J.P. Morgan Chase, Mumbai
Jindal Industries Ltd., Hisar
John Deere Equipments Pvt. Ltd., Pune
Juno Online, Bangalore
KEC Intertational Limitd, Mumbai
Kinapse India, Gurgaon
KPMG, Mumbai
Kony Labs, Hyderabad
L&T Ltd., New Delhi
LSI Technologies, Bangalore
Mckinsey, Gurgaon
Michelin India Tyres Pvt Ltd., Chennai`
Microchip Tech. Designs (India) Pvt. Ltd., Bangalore
Microsoft India (R&D) Pvt. Ltd., Hyderabad
Mid Mac, Doha-Qatar
Morgan Stanley, Mumbai
Motorola India Private Limited, Bangalore
Mphasis Limited, Bangalore
Mu Sigma Business Solution, Bangalore
National Instruments, Bangalore
Network Appliances Systems (India) Pvt. Ltd., Bangalore
Nicholas Piramal India Ltd., Pithampur
Niksun India Pvt. Ltd., Gurgaon
Nokia Siemans, Bangalore
Novell Software Dev. (I) P. Ltd., Bangalore
NTPC, New Delhi
Nvidia Graphics Pvt. Ltd., Bangalore
Orbees Infolab (I) Pvt. Ltd., Hyderabad
Ohana Media, Hyderabad
Omaxe, New Delhi
Oracle Communication Global Business Unit, Bangalore
Oracle India Pvt. Ltd. Bangalore
Patni Computer Systems Ltd., Mumbai
PharmARC Analytic Solutions, Bangalore
Pipal Research, Bangalore
Quest Global Engineering, Bangalore

Organizations conducting Campus Interviews (contd.)

Rave Technologies, Pune	Syngenta, Mumbai
Redpine Signals Inc., Hyderabad	Tata Consulting Engineers Ltd., Mumbai
Reflexis, Pune	Tata Motors Limited, Ahmedabad
Reliance Communications Ltd., Navi Mumbai	Tata Power, Mumbai
Sabre Holdings, Bangalore	Tata Technologies., Pune
Samsung Electronics, Noida	Tejas Netwworks India Ltd., Bangalore
Samsung India Software, Bangalore	Thermax Limited, Pune
Sasken Communication Technologies Ltd., Bangalore	UBS, Delhi
Satyam Computer Services Limited, Hyderabad	Unitedlex, Gurgaon
Schlumberger Asia Services Ltd., Mumbai	UOP India Pvt. Ltd., Gurgaon
Schlumberger Manufacturing, Pune	V E Commercial Vehicles (Volvo) Ltd., New Delhi
Seshasai Paper, Chennai	V M Ware (I) Pvt. Ltd., Bangalore
Shell Technology, India Pvt. Ltd., Bangalore	Vedanta Group, Silvassa
Sierra Atlantic Software Services Ltd., Hyderabad	Virginia Transformer India Pvt. Ltd., Mumbai
SNC-Lavalin, New Delhi	Verizon Data Services India Pvt. Ltd., Chennai
Sonus Network, Bangalore	Voltas Ltd., Mumbai
ST Microelectronics, Noida	VA Tech Wabag India Ltd., Chennai
Sungard Solutions (India) Pvt. Ltd., Bangalore	Wells Fargo, India Dev. Ltd, Hydrabad
Symantec Software India Pvt. Ltd., Pune	Wipro Technologies, Bangalore
	Yahoo Software Development India Pvt. Ltd., Bangalore
	ZS Associates India Pvt. Ltd., Gurgaon

BITS ALUMNI ASSOCIATION

BITS Alumni Association (BITSAA) at the Institute is a nodal agency for maintaining liaison with the Alumni all over the world and involves them in the development of the Institute. BITSAA promotes and encourages the Alumni to exchange professional knowledge by undertaking and facilitating conferences, seminars, lectures and meetings amongst alumni, students, faculty and others. It also honors and felicitates distinguished alumni. Creation of new Chapters and maintaining relations with existing Chapters are also some of the roles played by BITSAA.

BITSAA lays the foundation for a stronger alumni relation even before the students graduate by involving them in various activities like bringing out yearbooks and souvenirs; orgainsing batch snaps, reunions, graduation party, etc. A quarterly newsletter, "The BITSian" is published regularly and mailed to all registered BITSAA members. BITSAA organizes Silver Jubilee and Golden Jubilee reunions every year and promotes fraternity and belongingness among the BITS community.

The 'BITS Connect' project for providing campus- wide networking, supporting needy students through scholarships, setting up of labs and centers for research, and providing subject-expertise through video-conferencing under Project Embryo are standing examples of the Alumni's urge to contribute to their Alma Mater.

EARN WHILE YOU LEARN PROGRAMME

Under this programme, students are selected for part-time jobs such as tutorial work, office assistance, magazine distribution or other services to the student community. Some students are also selected as Professional

Assistants each semester for well-defined tasks such as course development, laboratory development work and for other tasks in Divisions and Units. A number of students also work as volunteers in the Supermarket 'AKSHAY', where they are active in maintaining, planning and running of the store. The honorarium for the work is decided on a case-by-case basis depending upon the quantum and level of work completed by the student.

NATIONAL SERVICE SCHEME

The Institute has a National Service Scheme (NSS) which enrolls about three hundred students every year. This is managed by an Executive Committee consisting of student volunteers, Programme Officers and the Programme Coordinator.

NSS aims at developing amongst students a sense of participation in nation building through social work. This deepens their understanding of the social environment and enriches their personality through actual participation in day to day life.

The students are exposed initially to the rural environment through short-duration social service camps in nearby villages. In recent years the NSS volunteers of the Institute worked in the surrounding villages and helped the villagers in the construction of school building, deepening the ponds, road leveling, afforestation, local handicrafts promotion and medical camps. Other activities like blood donation camps, eye care camps and tutorial classes for local school children are also conducted with great zeal and enthusiasm. The NSS has adopted some nearby villages and the student volunteers visit these villages regularly in order to participate in developmental activities.

NIRMAAN

Nirmaan is the brainchild of the students of BITS Pilani. It was organized with an aim of starting a movement across the country that would mobilize the youth into doing their bit for the motherland. Started as a small group in 2005 this forum has now chapters in five states, namely – Rajasthan, Andhra Pradesh, Karnataka, Tamil Nadu and Maharashtra. Currently the Nirmaan workforce stands at 500 across India.

Creating knowledge awareness and generating employment opportunities are two major objectives of Nirmaan. Knowledge projects like Gyan Bodh, School adoption program (SAP) and inter connectivity of schools (ICS) are being run for the underprivileged. The Rural Employment Incubator and the Self Help groups aim at providing sustainable employment prospects, particularly to women. Apart from that, efforts are also made to look for and provide suitable markets for rural products. Women Studies & Societal Development Unit helps in consolidating activities of Nirmaan at BITS, Pilani.

DISCIPLINE ASSOCIATIONS

Associations formed by students of various academic disciplines organize extension lectures, paper reading seminars, etc. They also arrange symposia in which professionals from industries and other universities participate. These associations organize exhibitions of working models during APOGEE, the academic festival.

IEEE - STUDENT BRANCH

The IEEE Student Branch, BITS, Pilani is a branch of the international organization "Institute of Electrical & Electronics Engineers, Inc. (IEEE), USA". The branch fosters among the students interests in specific areas and gives its members the opportunity to learn about the latest technological developments, conferences and workshops. It helps students to interact with and learn from each other and from experts and practitioners in these areas. Through video shows, lectures, panel discussions and workshops on current and emerging areas of technology, it develops leadership and widens the horizon of students.

Any student who is taking at least 50% of a full time academic programme can join as a student member. All members get a personal copy of the IEEE flagship magazine, SPECTRUM, and can join IEEE societies at 50% discount. Student members get recognition through 'paper contests' and awards, fellowships and scholarships based on merit.

CENTRAL FACILITIES

Central Library

The library is housed in a state-of-the-art new building, covering about 65000 sq.ft area and is located close to all academic blocks of the Institute. With attractive interiors and a seating capacity of 750, the library includes well-lit reading halls, stacks, display area, e-library, audiovisual library and study carrels. The library has a collection of over 2,28,000 volumes, books and manuscripts, a good collection of rare books with back volumes since 1920s. About 2500 books are added every year. It subscribes to over 555 printed journals. The catalogue is completely computerized. About 5000 full-text e-journals and many important databases have been made available on the campus network and can be accessed in the hostel rooms and staff residences. These include the journals of IEEE, ASCE, Elsevier, IOP, BIOSIS, ACS, Emerald, etc. There are 20 public access terminals in the library. The wireless internet in the library provides Internet connectivity even for the readers' laptops. BITS is also a partner in the networking of university library programme of INFLIBNET.

Educational CDs, videos, theses, dissertations, old question papers and Practice School reports are available in the library. The Text Book section provides all text and reference books for study in the library. Photocopying facility is also available in the library premises.

The library has an arrangement with CEERI library under which a student/faculty can become a member of the latter and borrow books. The Inter Library Loan System can be used to share resources with other Libraries. A member of British Council Library and Delnet, the library also makes arrangements for getting rare books and photocopies of articles from foreign libraries such as British Library, Australian National Library and DU Delft (Netherlands). It also operates satellite libraries at some Practice School stations.

The library remains open throughout the year (except on three national holidays) from 9 am to 12 midnight on week days, from 9 am to 6 pm on Saturdays and 9 am to 5 pm on Sundays and holidays. The opening hours of the library are extended till 12 midnight during semester-end examinations.

Central Workshop

The central workshop of the Institute imparts training to the students as well as caters to the maintenance & fabrication needs of the Institute. Student's training consists of training all integrated first degree students through the course "Workshop Practice" by imparting skills in various production processes like machining, fitting, carpentry, smithy, sheet metal, electroplating, welding, *etc*. In addition, students are imparted training for other discipline specific courses like 'Production Techniques' (Mechanical Engineering) and 'Production & Processing' (Engineering Technology). Apart from routine maintenance, fabrication and training, the workshop also accepts jobs on precision fabrication of project work of students, staff and research scholars. Workshop store caters to the needs of regular and urgent purchasing of materials for groups, units and divisions of the Institute.

The workshop housed in 3519 sqm built up area comprises of the following sections: machining, welding, electroplating, fitting, smithy & sheet metal, carpentry, foundry & patterns, tool room, metrology, painting, metal processing & metallurgy, electrical, CNC training centre and stores.

The major equipments include industrial vertical machining center (LMW KODI 40 Klein); five CNC trainers (three turning centers and two vertical machining centers); industrial robot (pick and place); five

universal milling machine tools; universal cylindrical, centreless, surface (hydraulic), and tool & cutter grinders; gear hobbing machine tool; NC machine tool (retrofitted at workshop); twenty eight lathes (centre, turret, precision and dc supply heavy duty); seven shapers; planner; slotter; twelve drilling machines; ten wood working lathes; two wood working planers; band, circular and universal wood saws; TIG, gas and arc welding equipments; power press, pneumatic hammer, etc.

Instrumentation Centre

The centre maintains EPABX and Cable TV network of the Institute. It provides and maintains public address system, stage lights, video recording equipment, overhead projectors, LCD projectors. The Instrumentation Centre is involved in the installation, testing, service and maintenance of all instruments across the Institute. The Centre provides facilities for design, development, fabrication and testing of projects concerning areas of Electronics and Instrumentation. Some of the important laboratory facilities are Instrumentation Technology Lab., Virtual Instrumentation Lab., VLSI Design Lab., Embedded System Lab. Centre is also involved in programmes to train the technical staff in the maintenance of instruments. The centre serves as a customer service facility.

Reprography Services

The Reprography section provides services such as Web browsing, word processing, off-set printing, binding, and photocopying to staff and students of the Institute. All Institute publications and forms, etc. are printed in this section. The equipments include off-set printing machines, photocopiers and machines for finishing, cutting, stitching, laminating, etc. This section takes care of the centralised postal dispatch service for the Institute and also houses a color laboratory for photography.

Computing Facilities

The central computing facility of BITS, Pilani referred to as the IPC (Information Processing Centre) hosts and manages the computing/networking infrastructure for the campus. The infrastructure includes local and external connectivity including email as well as computer services. IPC operates early morning to midnight on 360 days a year. Some specialized labs/centers offer round the clock computing facility.

The campus hosts about 1000 latest desktops/ workstations (including 350 in a central location), about a dozen compute-servers (Intel-based SMP Systems, IBM Blade Center with several blades), multi-Tera-byte storage (including a SAN) a variety of peripherals (printers/scanners/plotters). These systems support heterogeneous operating environments (Sun Solaris, Linux, SCO UNIX and Windows XP/NT/2000/2003), Languages (C, C++, Java, FORTRAN, perl) and development tools/packages (e.g. MS Visual Studio, GCC, ECLIPSE) and databases (MS SQL, MY SQL) for students and staff.

Campus-wide Computer Network

The campus hosts a state-of-the-art, completely switched, voice-enabled local network. The network enables 5000 Ethernet ports providing connectivity to all hostel rooms and all residences (of staff) as well as to instructional/ administrative and library buildings. A few wireless hotspots are also part of the network. The campus backbone is a 1Gbps fiber optic cable on a dual ring configuration. The external (Internet) connectivity is supported through 48 Mbps of leased line services.

Computer Assisted Housekeeping Unit

The Computer Assisted Housekeeping Unit (CAHU) is responsible for design, development, management and operations of software services for maintenance and processing of institute-wide information

pertaining to academics, finances and administration. CAHU meets the wide-ranging computerized house keeping needs of the Institute by developing in-house softwares. Students' academic and personal data are fully computerized and students are monitored from admission to graduation. Institute timetable, faculty teaching load etc. are computerized and the student's academic registration is done at the beginning of each semester through a completely computerized process. Also semester by semester progress monitoring of students, likely and final eligibility, results, transcripts, and provisional & degree certificates are processed and produced at CAHU for Pilani and the other new campuses. On the administrative and finance side, data related to the staff payrolls, administrative and personal information of staff, provident fund, family pension, budget preparation and monitoring, are also computerized and maintained by CAHU. All operations pertaining to institute accounts are handled electronically. CAHU also helps in establishing and maintaining similar systems at the new campuses of the institute.

CAHU is equipped with HP-9000 (E35 and rp3440), HP ML-350 and intel servers, HP-8150 and 9050 printers, PC nodes, Oracle 10G database, ANSI-C and FORTRAN-90 compilers. Apart from administrative work, CAHU also provides computer facilities for students working on administrative and application oriented software projects.

Central Analytical Laboratory

Available as a centralized facility for students and faculty members across the Institute, used by Pharmacy, Biosciences, Physics, Chemistry and Chemical Engineering Groups, this laboratory is well equipped with a number of sophisticated analytical instruments. The laboratory facilities are also used by staff/ scientists of other organizations and for carrying out research & consultancy projects.

The instruments present in the laboratory are UV-Visible, Scanning Spectro-photometers, IR and FT-IR spectro-photometers, Scanning Spectrofluorimeter, 90 MHz NMR Spectrometer, Paper Electrophoresis, manually operated and Digital Polarimeters, Gas Chromatograph, Visual Digital Melting Point apparatus, High Pressure Liquid Chromatographs (Binary, Gradient) with Amino acid station, Double beam UV-VIS-NIR Scanning Spectrophotometer, HPTLC, Flame Photometer, Differential Scanning Calorimeter, High Speed Vacuum Concentrator cum Lyophilizer, Gel Drying instrument, Brookfield viscometer, Ultra and Refrigerated Centrifuges, Humidity Chambers (Environmental Cabinets), etc.

Central Animal Facility

Central Animal House at BITS Pilani is a CPCSEA (Committee for the Purpose of Control and Supervision on Experimentation on Animals) approved facility with total floor area of 5330 sq. ft. The Animal House maintains animal species like rats, mice, guinea pigs, hamsters and rabbits. The facility was built up in accordance with guidelines issued by CPCSEA and other regulatory bodies. It is equipped with an Incinerator (electrically operated) for the disposal of the biological and other biomedical waste. The facility is maintained by well-trained manpower and with a full-time veterinarian to take care of the various requirements of the animals. It caters to the needs of the various research groups such as Pharmacy, Biological Sciences etc., and incorporates pharmacokinetics and pharmacology research laboratory for carrying out advanced research in the areas of pre-clinical pharmacokinetics, bioavailability studies, and pharmacological screening of various synthetic/natural origin drugs. The facility is geared to take up various industrial or governmental funded projects in these areas.

BITS Astronomical Observatory

An Observatory, equipped with two telescopes, a 5" diameter refracting telescope and a 11" diameter Schimelt-Cassegrain telescope, is maintained by the Physics group of the institute. There is a

students' astronomy club which functions under BITS Physics Society. The club conducts regular astronomical observation sessions as well as workshops for students to learn basic astronomy as a hobby. Special observation sessions are also held for the campus community to generate interest in astronomy.

Pilani Meteorological Observatory

The Institute runs and maintains Pilani Meteorological Observatory on behalf of the Meteorological Department of the Government of India. Daily meteorological data regarding the weather at Pilani are recorded and transmitted by the observer, under the supervision of a professor in-charge, appointed by the Institute. The observatory is in the process of being converted into an automated weather station.

BITS CONSULTANTS

"BITS Consultants" was established in 1983 to offer specific services in areas relating to planning, design and implementation of educational and institutional operations and innovations. Over the years several universities/institutes have been provided such services. It also coordinates all other consultancy services, like soil and concrete testing, development of pharmaceutical formulations for pharmaceutical industries, analysis and testing of pharmaceutical formulations, phytochemical products and other engineering consultancy projects, management development programmes for industry personnel, bank officers and human resources of other sectors. Presently, discussions are in progress on request from few universities.

CENTRES OF RESEARCH AND DEVELOPMENT

The Institute has established the following centres of Research and Development:

Technology Innovation Centre

Engineers/Scientists from industry bring their research and developmental projects for investigation in the campus. Such investigations are carried out in collaboration with Institute faculty associated with students registered in assigned research or project courses. Several industries have been participating in this programme. While in the campus, these engineers and scientists from industry are given a de-facto status of faculty members, so that they are encouraged to extend their professional interest much beyond the original scope of operation. Students also undertake identified projects by the industry wherein professional guidance is extended by professionals from industry virtually.

Centre for Entrepreneurial Leadership (CEL)

The CEL, setup during 2002-2003, encourages students to develop skills towards creativity and innovation and conduct programmes for nurturing entrepreneurial skills. The centre aims at inspiring BITSians to play a prominent role in leading diverse entrepreneurial activities in the country and make significant contribution in global entrepreneurial innovation. CEL has been actively involved in promotion of entrepreneurial leadership across all disciplines. CEL facilitates entrepreneurial activities on the campus, bridges the gap between industry and academics, and promotes commercialization of R & D efforts at BITS etc. The Wadhwani Foundation has selected BITS as one of the five reputed institutions for forming a Hub for National Entrepreneurship Network (NEN). The Center has identified key areas – education and research, experiential learning, rural entrepreneurship, business simulation, networking, business incubation and student-led activities for promotion of entrepreneurial thinking amongst BITSians. The CEL takes initiative to introduce new educational programme in the field of entrepreneurship development and introduce new courses, strengthen its capabilities in the field, experiential learning, rural entrepreneurship, business simulation, networking and technology incubation.

Technology Business Incubation Cell

The Institute has set up a Technology Business Incubation Cell (TBI) in Embedded Systems &

VLSI Design with a view to promote technology based enterprises with the financial assistance from Department of Science & Technology (DST), Govt. of India. The TBI is considered as one of the important instruments for promoting technological awareness among the Small and Medium scale Enterprises (SMEs). The cell provides state-of-the-art facilities, office space and other infrastructural facilities to the prospective entrepreneurs to incubate their ideas so as to come out with technology based entrepreneurial ventures.

Centre for Software Development (CSD)

This centre functions under the Software Development and Educational Technology Unit (SDET Unit: URL: http://sedtu.bits-pilani.ac.in/) of BITS-Pilani.

The CSD has three wings namely *Media Laboratory*, the *BITS-IBM Laboratory for Open Source Computing* and *BITS-Microsoft Laboratory for Mobile Computing*.

The Project Grid-One, initiative taken at CSD, BITS - Pilani, involves building of a medium-sized campus-wide IPv6 native support-based grid involving several computing systems and select mobile computing devices. The next phase would involve connecting the resultant grid to a bigger IPv6-enabled Grid for experimentation. More details are available at the project website: http://discovery.bits-pilani.ac.in/ GridOne/.

The centre is also involved in the "*Tiny6*" (codename) Project involving research in IPv6, Mobility and Power-conservation aspects of Sensor Networks in pervasive computing environments. This is funded by the French Ministry of Foreign Affairs, with project partners from France, China, Korea and India. It has a total project grant of Euros 81,000. BITS will contribute mainly to IPv6 Stack Architecture and the integration of Sensor Networks and IPv6 Mobility. Under this project, currently two French scholars are resident at BITS.

The CSD is also involved in the *BITS – Virtual University Project* which is an on going long-term project, focusing on the design and development of the Internet-based distributed learning architecture and asynchronous-delivery-based content development. In addition, it has complementary features of Digital Video delivery over the Internet. Three phases of this project have already been completed. Recently, the BITS-VU has added the live interactive (bi-directional audio/video/text-based) classroom feature to value add its off-campus student population.

One of the other projects in which the CSD has been involved is the Journal Server Project which is a freeware international virtual digital library project, being led by Oxford University and BITS, involves over fifteen major universities in UK, India, USA, Norway, Italy, South Africa, Germany, Pakistan, Taiwan and Bangladesh, BITS has contributed to the overall architecture and Search Engine aspects of this project. Pilot phase is likely to be over shortly.

The CSD has played a major role nationally and internationally in several areas including the research, development and deployment specific to the next-generation internetworking technologies like IPv6. It has brought several firsts to BITS and has contributed to funded international research projects in this area.

Along with the Massachusetts Institute of Technology (MIT), Cambridge, the Centre had started the 'iCampus India Initiative' with BITS-Pilani as the first iCampus Hub Institution in India. (http://disovery.bits-pilani.ac.in/iCampus) CSD researchers have been involved in creation of a new remote laboratory in the areas of computer networking and pervasive computing. This project has led to the initiation of the NetFirst Project at BITS. At of time of this write-up going to the press, a set of new experiments have been successfully developed and tested based on a combination of the iLabs

and NI LabView in the areas of measurement techniques. More details are available at the URL: http://iLabs.bits-pilani.ac.in.

The CSD has also presented the research and development work being done at BITS at several international fora apart from being actively involved in IEEE and IETF activities in the area of networking research and standardization.

Centre for Educational Technology (CET)

Run by the Software Development and Educational Technology Unit (SDET Unit) of BITS-Pilani, the CET comprises of a modern digital video studio and is equipped with the Satellite (EDUSAT)-based as well as Leased Line based high-quality Video-conferencing facilities meant for use of the University for Delivery of live interactive lectures to its various campuses in India as well as cater to select student groups of work-integrated off-campus learning programmes.

This is further complemented by the Internet-based, highly scalable distributed desktop video-conferencing facility allowing medium–quality but more interactive live classroom sessions where all students cannot come to on or off-campus classrooms and may be resident in different parts of country / world. The Centre is equipped with the IP-based Video-on-Demand and Scheduled Video Multicast facilities which can allow reuse / review / streaming of lectures delivered earlier for the benefit of students.

A recent addition to the CET's responsibilities has been the establishment and operation of yet another Studio in connection to the Pan-African e-Network Initiative (envisioned by the former President of India: Dr. A P J Abdul Kalam) with the Telecommunications Consultants India Limited (TCIL) and with funding support from the Ministry of External Affairs, Govt. of India. This operation is expected to be started shortly and is likely to involve delivery of live interactive lectures straight from BITS Pilani to several countries in the West Africa. Currently, installation work is in progress consequent to which a few Certificate Programmes are slated to begin.

Centre for Research on Educational Innovation & Institutional Development

This centre was established with financial support from the University Grants Commission, New Delhi. The objective of the center is to become a nerve centre of the Institute in terms of ideas, creativity and innovation. The centre has promoted research on educational management and administrative processes. It systematically documents and integrates knowledge and skills generated at the workbench for all levels of education. It has also enabled and motivated forces behind operation, expansion, strengthening, updating and modernization of teaching, research and consultancy in education. It organizes workshop on certain specific programmes like practice school and vocational courses for other educational institutions who wish to implement such innovations. It also collects the data-base from UGC, AIU and various universities relevant for educational reforms and innovations.

Centre for Robotics and Intelligent Systems

The objective of the Centre for Robotics and Intelligent Systems (CRIS) is to develop prototypes that provide greater intelligence and higher versatility for robotic tasks under ever-changing constraints of the environment. This objective is set forth to make Indian industry competitive by developing indigenous technical skills, manpower and innovative spirit. Each prototype is developed in four different stages viz. (i) Conceptualization, (ii) Algorithmic development and verification in simulated environment, (iii) Real-time testing and (iv) Integration to automated system. The Centre is well equipped with good computational facilities; advanced software packages for circuit design, image processing and mechanical design; micro controller and DSP based driver card for real-time experimentation; experimental bed

(CRS-Plus robot manipulator, 4 DOF SCARA manipulator, 5 degree of freedom articulated manipulator, Hydra mobile base, Pendubot inverted pendulum, Labmate, mobile base and pH reactor) and many other facilities. The lab facilities are geared to provide research facilities in areas such as intelligent robotics and system design, intelligent control, neural and fuzzy neural based system modeling and control, evolutionary computation, robotic vision and virtual reality.

During the year under review, the students working at CRIS developed a number of models and working robots. To name a few of these, mention may first be made of *Acyut I* and *II* (humanoids) which are dancing robots and which won laurels at international competitive events at Robogames held at USA. The models were also demonstrated at Korea and Japan. Besides *Acyut I* and *II,* BITSUMO which is an autonomous assistant robot was also developed. In addition to these, an autonomous glider, a autonomous hovercraft, a 14 DOF robotic arm, a mechatronics ball, a micro-mouse platform and a micro-mouse testing base were developed at CRIS.

Embedded Controller Application Centre

This Centre was set up in Collaboration with Motorola India Ltd. The objective of the Centre is to impart detailed understanding of important features of embedded controller architectures and familiarization of advanced concepts in the field of embedded controllers through

- Students projects/Industrial projects
- Imparting training to the industry professionals and running short term courses in the field of Embedded System design
- Developing course modules

The infrastructure of the centre includes Pentium machines, Microcontroller Modular Evaluation Systems, Microcontroller Development Systems, Emulators, Assemblers and Cross compilers for various microcontroller families (ARM, ATMEL, Microchip, Cypress, ST Microelectronics, etc.) DSP processors, logic analyser and other bench equipments.

Centre for Renewable Energy and Environment Development (CREED)

CREED is an interdisciplinary Centre that co-ordinates educational and research activities in the active areas of renewable energy and environment. The objectives of the Centre are (i) to conceive, develop and implement renewable energy applications and environment protection projects, (ii) to develop courses and organize awareness programmes, and (iii) to collaborate with external organizations in the areas of renewable energy education, training and technology development. The Centre is presently collaborating with MNES, IREDA and RRECL. Some of the existing facilities at CREED include an experimental set up for solar water heating, solar air-heating system, solar stills, and solar photovoltaic power pack with storage battery bank, SPV lighting systems, and portable energy audit instruments.

Currently, active research areas of CREED include emissions and environmental impact of thermal power plants, planning and economics of renewable energy systems, real time operation and control of renewable systems, industrial cogeneration, integrated renewable systems, demand side management and integrated resource planning.

The *BITS Energy Club* is an exclusively a student managed body that operates under CREED. The Club has undertaken active work in carbon footprint analysis and carbon credits. Commercial organizations in these areas have evolved out of the *Energy Club*, and are currently owned and operated by BITS alumni.

Centre for Biotechnology

The 'Centre for Biotechnology' has fully equipped Laboratories to conduct basic and advanced level teaching, training and

research in the areas of biotechnology. Besides having various facilities for routine work, the centre has inhouse facilities of Genomics, Recombinant-DNA Technology, plant and animal tissue culture, Green House hardening of tissue culture raised plants, radioisotope storage and handling. The objectives of the centre are to take up research and development projects from various sponsoring organizations, establish university-industry linkage through various R & D contract projects and conduct periodic workshops and hands on training for faculty members, industry personnel and students in the area of advanced molecular biology/biotechnology.

Centre for Materials Science and Technology

The objective of the Centre for Materials Science and Technology is to develop and implement projects related to modern materials such as smart materials, biomaterials, fibre-reinforced plastic composites and also related to conventional materials such as metals, ceramics and polymers. The Centre undertakes mechanical and non-destructive testing of various engineering materials and products for evaluating their mechanical properties and for evaluating defects such as cracks, voids, delamination, inclusions etc. Other activities include providing consultancy related to testing/development and analysis in the field of materials science and technology. The testing facilities available at the Centre include a conventional Universal Testing Machine of 50 Ton capacity, as well as a fully computerised Microprocessor based Electronic Universal Testing Machine of 100 kN capacity, Hounsfield Tensometer, various hardness testing machines such as Brinell, Rockwell, and Vickers Hardness Testers, Rotating Bending Fatigue Testing Machine, Combined Bending and Torsion Fatigue Testing Machine, Circular Polariscope, Strain-gauge testing facility, Izod Impact Testing Machine, X-Ray Diffractometer, Ultrasonic Flaw Detector, Liquid Penetrant Test kit, Magnetic Crack Detector, Eddy Current Tester, Acoustic Emission Testing equipment, Acousto-ultrasonic pocket hand-held AU scanner etc.

Centre for Women Studies

A Centre for Women Studies has been established at Birla Institute of Technology & Science, Pilani by the University Grants Commission. The objective of the Centre is to work towards social and economic upliftment of women, mainly through technological interventions. The Centre undertakes diverse range of academic, research and extension activities.

Some of the activities include making a need assessment field study in and around Pilani with primary focus on rural and urban women and to further address issues of concern in order to improve their socio-economic status. Dissemination of information on women issues is made through periodic documentation of research and field studies. The Centre undertakes training and skill building programs such as computer literacy handicraft, tailoring and paper recycling with the objective of inculcating entrepreneurial skills. Health awareness programs are undertaken such as 12 by 12 initiative to combat anemia. The Centre for Women Studies further works towards gender sensitization by organizing gender related Seminars, Workshops and other academic pursuits. The Centre reaches out to various agencies for forging linkages with national and international organizations working towards women development.

Centre for Desert Development Technologies (C-DDT)

Established with the financial support from BITS Alumni, C-DDT functions with the primary objective of developing world-class desert development technologies for making the desert bloom. It has joined hands with the Jacob Blustein Institute for Desert Research (BIDR) of Ben Gurion University, Negev, Israel to work in the area of desert development. The activities of the centre revolve around developing affordable and technically less esoteric technologies and integrating them

with the existing practices of the desert areas of Rajasthan for economic upliftment, employment generation and poverty alleviation of the people of Rajasthan.

Professional Development Center (PDC), Bangalore

The Professional Development Center is a unique initiative by BITS, Pilani in the area of Microelectronics to conduct educational and research programs. The center will offer courses in Microelectronics so as to upgrade the skills of VLSI Professionals. Each course will be a complete unit with appropriate credits awarded to all participating professionals. The training programs conducted in this center will be modular in nature and will eventually develop into degree programs if the sponsored employees take the required number of modules. Faculty drawn would be from BITS, Pilani and other reputed universities, Industry professionals from India and abroad. The Center is located at 1155, First Floor, 12th Main, 4th Cross, H.A.L IInd Stage, Indiranagar, Bangalore-560008.

SPECIALISED LABORATORIES

Apart from the Centres described above, the following specialised laboratories have been established with a view to strengthen research and development in the respective areas:

(i) Fibre Optics Laboratory: The infrastructure in the laboratory includes PC based instrumentation for characterization of optical fibres, opto-electronic sources and detectors, facilities for fabrication and calibration of fibre optic sensors, Training kits for analog and digital fibre optic communications and from computational facilities.

(ii) Process Control Laboratory: Infrastructure includes computer control of process variables such as temperature, pressure, level, flow and pH in Chemical Engineering Processes/ Operations such as distillation column, heat exchangers, reactors, etc.

(iii) Flexible Manufacturing Systems Laboratory: The Flexible Manufacturing Systems (FMS) Laboratory conducts training and research in Manufacturing Systems and Manufacturing Management Practices, which are designed to assist the Indian industry to become internationally competitive. The goal is to conduct integrated research in order to develop appropriate manufacturing systems, manufacturing management techniques/ strategies/practices for the revitalization of Indian industries. The FMS lab aims to be foremost research centre in design of manufacturing systems and manufacturing excellence practices. The following facilities are available in the FMS Lab.

- **Hardware**
  - KODI - 40 KLEIN CNC Vertical Machining Centre (Industrial)
  - MTAB STARTURN CNC Lathe Trainer
  - MTAB FMS Cell
  - ROBOT
  - Rapid prototyping machines
    - Dimension Elite 3D Printer
    - FDM 200mc
  - IBM Intelli Workstations and Computers
- **Software tools**
  - CATIA – PLM tool
  - QUEST – 3D Simulation tool
  - ARENA – 2D Simulation tool
  - MINITAB – Quality Control tool
  - DFMA – Product design tool
  - LINDO/LINGO – Optimisation tool
  - Multi-Attribute Decision Models

(iv) Oysters Lab. (VLSI DESIGN Laboratory):

This laboratory has been established to support the Micro-electronics program and to carry out projects in the field of

VLSI design. The facilities in the Lab. include the centralized SUN Fire V250 and AMD X2200 as the main servers connected to NAS 3310 and SDLT320 for the storage and back-up respectively. The main servers connect to the compute farm consisting of five AMD X2200 workstations, six Ultra-20 workstations, twenty Ultra-2 workstations and 40 Sun thin clients, via a 1 Gbps switch connectivity. The compute farm resources are allocated as per the load distribution controlled by the Sun Grid Engine software. The lab is equipped with the complete set of front-end and back-end EDA (Electronic Design Automation) tools from the vendors like Cadence, Magma and Mentor Graphics for ASIC design, Altera for FPGA design, and Silvaco- device & process simulator. The design kits for ASIC include UMC 90 nm, 130nm, and 180nm, TSMC 180nm and 250nm and the FPGA kits include 40 UP3 kits, 10 DSP development kits and 10 NIOS-II development kits.

(v) Instrumentation Technology and Virtual Instrumentation Laboratory: The facility in the laboratory includes general purpose and specialized bench equipments, transducers and signal conditioning kits, PC based data acquisition and control cards, Virtual Instrumentation softwares and data acquisition & signal conditioning modules, Programmable Logic Controllers with I/O modules and interfaces, Microprocessor and Microcontroller kits with interfacing cards.

(vi) CISCO-BITS Networking Laboratory: The laboratory has been set up with financial support from CISCO Inc., USA to support research activities in the area of virtual private networks, and video on demand. In addition, this laboratory provides facilities for hands on training to first degree and higher degree students.

(vii) ST-BITS Systems Laboratory: This laboratory has been setup with hardware and software support from ST Microelectronics, Noida. The laboratory undertakes research projects in the area of VLSI design and Embedded systems, with particular focus on Analog-Mixed signal activities.

(viii) Environmental Engineering Laboratory: Infrastructure of this laboratory includes several gas and water pollutant sampling and analysis equipment such as high volume sampler, air and water analysis kits, underground water sampling kit, respirable dust sampler, pH meter, ion meter, conductivity meter, dissolved oxygen meter, BOD incubator, UV-VIS spectrophotometer, Gas chromato-graph, BET Surface-Area Analyzer, etc.

(ix) Language Laboratory: Two language laboratories with 20 and 40 booths are functioning to conduct practice sessions pertaining to the courses offered by the group and to provide adequate practice to the students in various languages namely English, French, German and Japanese. These computer assisted labs facilitate the teacher to transmit information through a computer network to all students simultaneously, explaining the concepts and also to speak to selected students if necessary. Students and faculty across the institute also use these labs for the self-practice and self-assessment of their language and communication skills. The labs have a good collection of audio visual teaching materials in the form of Audio/Video CDs, Audio cassettes and Learning software which are used to enhance the communication, language and interpersonal skills of the students.

DUBAI CAMPUS AND ITS FACILITIES

Student Housing

BITS, Pilani-Dubai offers its students segregated, conveniently located and cost-effective hostel accommodation facilities in the campus for both boys and girls. The hostels are suitably equipped to provide a safe and secure living environment with single-seat accommodation to each student. Each hostel room is fully air-conditioned and provided with adequate furniture to suit the student's requirement. All the hostels have internet connection, television, microwave ovens, Gymnasium, Laundromat and first aid kits.

Both vegetarian and non-vegetarian foods are available. The learning environment is provided and supported by well-defined hostel rules and regulations.

Library

The BPD Library is located in a separate block behind the main academic block. The Library is spread over two floors and has great ambience and excellent infrastructural facilities for internet browsing, a huge reading area in the ground and first floor, stack area for Library resources to accommodate 75000 volumes, periodicals section for current magazines and journals, Digital Library and an exclusive lounge for faculty and staff. ***D space,*** a digital Library software has been installed and uploading of Faculty's research papers is in progress.

The Library has a collection of over 12,000 books and subscribes to 13 International Journals including ACM and 24 magazines. The Library provides online access to IEEE - IEL Online and ASME. Library is computerized and the catalogue is accessible throughout the campus. Library operates with web enabled OPAC (Online Public Access Catalogue), and the students and faculty can access to over 300 journals and back volumes and more than 2000 Electronic books on various subjects, number of open source electronic journals, databases and other reading materials. A good collection of Books, reputed journals, magazines, CDs, Videos, Audio and Internet facilities are available in the Library so as to provide maximum opportunities for learning and to access information in different formats. Network printing, photocopying and scanning facilities for academic material and other relevant content are also available. BPD has subscribed to plagiarism detection software, called "***Turnitin***", which can be accessed by all the faculty from the computer systems kept in the Library exclusively for this purpose. Library services are closely monitored by a competent committee which also has student members and its steady growth in holdings and services are given utmost priority.

Graduation Hall

The institute has a large auditorium with a seating capacity of 1100 seats and is provided with the movable partitions to bifurcate the hall as per the requirements. The Graduation hall is equipped with suitable acoustic panelling and carpeted floor, four units of LCD Projectors, the remote controlled screens and speakers along with a professional grade audio mixer. A carpeted wooden stage of approximately 10 metre x 5 metre is also provided with stage focus lights.

Computing Facilities

The campus fulfils the computing needs of students as required by current Information Technology's demand. There are 10 IBM Blade serverswith centralized SAN storage, 2 Compaq DL380, 3 DL320 servers, one ML350 server catering to the needs of the Campus at present. These are provided in the server room in the First Floor of the Main Block. The entire building is networked through CAT6 cabling. All the floors in the Main Block, Library and the Mechanical Block are connected through Fiber Optic cable to the server room. In all, there are 500 computers of various configurations in the campus at

different locations, all linked in the network with a variety of printing and drafting accessories. The necessary softwares such as AUTOCAD, MATLAB, CATIA, SYNOPSIS and LINUX etc are provided for the practical components of courses such as Engineering Graphics, Computer Programming 1 & 2 etc.

Communication Facilities

The Institute has high speed broad band internet connectivity for the students and faculty. The entire campus is equipped with Panasonic TDA600 IPPBX system. All the faculty chambers, offices and the hostel reception area are provided with telephones.

Medical Facilities

The medical clinic (Prime Medical Centre) with one doctor and nurse available on the campus round the clock provides first aid and emergency care. Two vehicles are available for transporting students to the hospital in cases of emergency. The PMC regularly ensures that all students are vaccinated for chicken pox or any other such contagious diseases.

Central Workshop

The central workshop imparts training to the students in workshop practice course which is compulsory for the disciplines of the integrated first degree programmes and caters to the needs of maintenance work of the institute. It also caters to the fabrication needs of students working on experimental setups and various project works. The workshop comprises of Machine shop, Welding, Electroplating, Smithy, Carpentry, Foundry, Tool room, Metrology, Fitting sections, CNC tool crib and stores.

The major equipments include all geared lathes and shapers, universal milling machine, radial drilling machine, wood turning lathe, and smithy hearth furnace, AC & DC welding machines. In addition to these facilities there is provision for sheet cutting & bending, wood planning, grinding, sawing and casting. The workshop has sophisticated machines like CNC train master T70 and CNC trainer VMC200.

Laboratories

The campus has all the required laboratories, namely, Measurement Techniques I laboratory for Physics, Chemistry, and Biology, Measurement Techniques II laboratory, Transport Phenomena Laboratory, Prime Movers and Fluid Machinery Laboratory, Digital & Analog Electronics Laboratory, Instrumentation Technology Laboratory, Communication Systems Laboratory, Electromechanical Energy Conversion Laboratory, Microprocessor Programming & Interfacing Laboratory, Process Control Laboratory, Heat Transfer Operations Laboratory, Selected Chemical Engineering Operations Laboratory, Microbiology Laboratory, Instrumental methods of Analysis (IMA) Laboratory, Biotechnology Laboratory, Advanced Molecular Biology and Bioprocess Laboratory and Genetic Engineering Laboratory. These labs are well equipped with latest instruments to facilitate students in carrying out various projects of interest.

Specialized Laboratories

Advanced Molecular Biology Laboratory

Advanced Molecular Biology Laboratory is fully equipped with PCR, refrigerated centrifuge, CO_2 incubator, Luminometer, Shaker incubator, Electrophoresis system, Water Purification system, etc., for gene manipulation, protein expression, purification and cell culture techniques. The Advanced Molecular Biology Laboratory supports advanced biology experiments for the course experiments in Biotechnology. The facility is also used for laboratory oriented projects, thesis in molecular biology/ biotechnology under supervision.

Biotechnology Instrumental Methods of Analysis (IMA) Laboratory

Biotechnology Instrumental Methods of Analysis (IMA) Laboratory is equipped with the modern instruments like ICP-OES, HPLC, HPTLC, FTIR, GC, Spectroflourometer, UV

visible spectrophotometer, etc. The equipments available in the laboratory are used as a central facility for teaching CDC and other laboratory oriented courses. The facility is also used for laboratory oriented projects and thesis.

Genetic Engineering Laboratory

Genetic Engineering Laboratory is equipped with UV spectrophotometer, centrifuges, analytical balances, incubator, Autoclave, pH meter etc. The equipments available in the laboratory are used to train the students in the area of molecular biology techniques. The facilities available in the laboratory are also used for laboratory oriented projects.

Bioprocess Engineering Laboratory

Bioprocess Laboratory is equipped with bioreactor, refrigerated centrifuges, lyophilizer, PCR, incubator, etc. The Lab will be used for downstream processing of industrially important products. The facility is also used for screening and analysis and scale up of industrially important enzymes, fine chemicals, and bioactive compounds for biotechnology applications. The facility is also used for laboratory oriented projects and thesis.

STUDENT SERVICES

Orientation and Counseling

The Institute organises an orientation programme at the time of admission of fresh men, which is designed to familiarise them with many aspects of the BITS, Pilani system such as the academic system, infrastructural facilities, hostel facilities and various other policies and procedures at BITS, Pilani-Dubai. The Vice-Chancellor, the Director and the Institute Officers of other units such as Academic Registration, Instruction, Practice School and Placement, Student welfare, Library, Information Technology, etc., meet the parents of freshmen at an interaction session at the time of admission. Further more, the students will receive important information about the Student Services, Learning Resources, Financial Aid, Student Activities, Career Counseling, Academic Advising, and Industry Internship, etc.

Academic Advising

In BPD, Academic Advising is carried out through the faculty members as academic advisors to students. The academic advisors interact with their advisees on a regular basis and discuss their performance and progress in the registered academic programme. Students are advised to contact the academic advisors periodically. The goal is to help the students reduce their programme-related stress and maximise opportunities for academic performance improvements leading to a high quality professional life.

Counseling Services Cell

The purpose of student counseling is to assist the first degree students in understanding and resolving their personal problems. BITS, Pilani-Dubai provides counseling for all needy students. A dedicated counselor will interact periodically with students discussing all issues which affect their academic performance and help students in resolving their psychological issues if any. Students are advised to contact the counselor directly. Counseling services are confidential services to the students. The goal is to help students reduce their stress, maximize academic and personal success, enhance personal development and quality of life. Besides, students can meet the Director BPD in his chamber to discuss any of their problems and difficulties.

Student Council

BPD has an active Student Council, the office bearers of which are President, Vice President, General Secretary, Joint secretary and Treasurer. Other members of the Student Council are academic, cultural, sports and class representatives. Students are also part of many committees like discipline, library, academic monitoring board etc. Meritorious students are given a chance to nominate themselves for the elections of the Student Council. Elections for the Student Council are

conducted in fair manner at the beginning of the academic year.

Grievance Cell

BITS, Pilani - Dubai has a Students Grievances Cell (SGC) to solve the issues, which concerns the students particularly and to maintain the well-being of the students community in general. The SGC will address the issues, investigates and recommends feasible solutions for the issues to the office of the Director of the Institute for the mutual benefit of the students and the Institution.

Earn-while-you-learn

BPD enables students to earn while learning under the earn-while-you-learn scheme. The students of second, third and fourth years are given the opportunity to be Professional Assistants in laboratories of junior years (first and second years). Professional Assistants help the junior students and assist the faculty in conducting experiments in the laboratory. They are paid an honorarium based on the work done and also receive certificate issued by the Director.

Placement and Campus Interviews

BITS, Pilani-Dubai offers Campus Placement Programme to all its graduating students year after year since the first graduating batch in 2004. Reputed companies from UAE, Middle East Countries and India come for placement.

STUDENT ACTIVITIES

Cultural and Sports activities

The Dubai campus provides facilities & services that encourage the personal development of every student in the social, cultural & interpersonal domains. These are in direct support to its mission to produce self reliant young professionals. A variety of extra curricular activities such as Drama, elocution, debate, essay/story/slogan writing, painting, sketching, singing, dancing, salad dressing, gift wrapping, flower arrangement, quizzing, gaming, T-shirt designing, digital art, face painting, Indian art-rangoli, henna, etc. have become a regular feature of the Campus calendar. These activities are organized by different clubs. It has also started its intercollegiate cultural festival 'JASHN' where universities from all over UAE participate in Debate & Literary Events, Drama, Dance, Music and quizzing competitions. The Campus also encourages students and faculty to be involved in recreational sports through intramural, extramural competitions and tournaments. The Student Sports Committee is committed to health and well being of student community.

To achieve the above mentioned aim, the Campus provides sports facilities separately for boys and girls. The indoor Sports Complex consists of badminton courts, TT tables, and a boxing training room in addition to the outdoor courts for football, basketball, volleyball, throwball, tennis and handball. Also separate Gyms of international standards are provided for girls and boys. Four Cricket practicing nets of sizes 20m x 5m are also provided. These facilities are supervised and maintained by separate instructors who are also responsible for training the students and supervising their activity.

The "BITS SPORTS FESTIVAL" has colleges and universities participating from all over UAE. The tournament includes throwball, football, cricket, table tennis, chess and badminton. Dubai campus has been the first institution to introduce badminton as an inter university sport event in UAE for both boys and girls. Besides this, the students have won several laurels in various other inter university events organised by other colleges.

Student Clubs

Student clubs are formed around academics and national themes to add to the rich mosaics of student life. Students who have common interest in debating come together to form a debating club; those committed to traditional life come together to form a club for preservation of culture; those committed to voluntary social service organise blood donation and environmental awareness camps and so on. At present BPD has 15

clubs namely Dance Club, Music Club, Art and Craft Club, Photography Club, Drama Club, Science & Technology Club, Debating Society, Management Club, Quiz Club, F1 Club, Social Activities, Pixel, Literary Club, Environment Club etc.

The aim of such clubs is to enrich the social and cultural life on the Institute campus.

Student Professional Bodies

BITS, Pilani – Dubai (BPD) has student branches of several professional bodies of international repute such as the IEEE Inc., ASME, ASHRAE, SAE, ACM, Linux Group, Dot Net Club. Towards the development of professionalism and inculcate professional skills, students at BPD actively engage themselves in the activities of these professional bodies utilizing the opportunities provided not only by the corresponding Headquarters but also those provided by their UAE chapters.

In addition to the regular activities of the professional bodies, as part of celebrating a decade of academic excellence in UAE, during the academic year 2009-10, BPD held a year- long 10th year celebrations during which, BPD organized seminars on a) Biotechnology b) Electrical and Electronics Engineering, c)Renewable Energy. Knowledgeable Scientists from International Centre for Biosaline Agriculture, the IEEE UAE Section, and reputed Renewable energy institutes of UAE such as MASDARS & Higher College of Technologies were the speakers in these seminars.

Technical Events

BITS, Pilani-Dubai organizes technical festivals such as TECHNOFEST, ENGINuity etc., to enable students from the campus as well as other institutions to participate, showcase their technical acumen and share their ideas:

- "Technofest" is the technical competition conducted annually at the Institute. Generally there are three categories in the competition namely development of a working model, development of a non – working model and technical paper presentation in the various fields of science, engineering and technology. The event generates lot of enthusiasm among the students and it brings out the best of the creative talents of the students and generally they come up with wonderful models and good quality technical papers.
- BITS, Pilani – Dubai organises intercollegiate tech-festival 'ENGINuity 'which challenges the students from various universities around Dubai to showcase their technological talent and acumen in the various events on the show. The events comprising ENGINuity are Computer Gaming, Computer Programming, 'Jargon' (a Tech Quiz), 'Bridge Building' and an 'On-the-spot Model Making' competition.

Social Activities

The social activities & Environment club organizes a lot of activities like tree plantation , blood donation camp, clean up drive, standing up against poverty and standing for protecting the environment to support the United Nations Millennium Goals. Many events like making environment friendly paper bags, Collage etc., are organized on the Earth Day to instill a sense of responsibility in the students towards conserving the environment. The drama club organizes shows related to social issues.

Alumni Association

The BITS, Pilani - Dubai Alumni Association fosters long term relationships among its alumni through various programs. Its mission is to enable the alumni, students, faculty and friends to maintain their contact with the Institute and each other for shared benefit. The BPD website is periodically updated to enable the entire alumni to have an access to the information on World Wide Web.

For more details please see:

http:// www.bitsdubai.com

K.K. BIRLA GOA CAMPUS AND ITS FACILITIES

The facilities available at BITS, Pilani - K.K. Birla Goa campus include:

Student Housing

The institute is fully residential. There are separate hostels for boys and girls comprising of 2400 rooms, providing single-seat accommodation to each student.

Each room of the hostel is provided with modern furniture and Internet connectivity. Hostel common rooms are equipped with recreational facilities like Table Tennis, carrom & chess along with Cable TV and telephones.

There are two large sized Dining Halls with a seating capacity of 1200 students at a time. Each dining hall is well equipped with modern equipment and furniture.

Guest Accommodation

Excellent facilities are available for board and lodging on payment at Visitor's Guest House built in the southern corner of the campus.

Central Library

Spread over 50000 sq. ft. area, the central library has a seating capacity of 450 and includes several reading halls, exhibition rooms, digital library with internet access terminals, and a large area for book storage. It has a good collection of over 30,000 books on a wide range of subjects. The library subscribes to 140 print journals, national and international. Educational CDs, audio/video cassettes and question bank are also, available. The textbook section provides all prescribed texts and reference books. The library has been provided with a wireless network whereby users can access the internet using laptops. The library is managed using LIBSYS Library Management Software to automate its entire house keeping activities. The database of library books can be accessed from anywhere in the campus through Local Area Network. Important databases like IEL online, Science Direct and ASME provide access to thousands of online journals to students and researchers.

Computer Centre

Computer center is well equipped with 300 IBM, DELL & HP computers connected through LAN and WAN network. The computer center has three other labs each having a capacity of 36 systems. These systems operate under LINUX, Windows XP and DOS environment and support variety of software tools such as AutoCAD, AutoLisp, C, C++, Microsoft visual tools, Matlab etc. Computer Center supports all disciplines for their software requirements. Computer Center provides computing facility for students and staff of the Institute. Presently, with the existing facilities, the center provides support for conduct of online examinations in several courses including Engineering Graphics, Computer Programming-I, Computer Programming-II, Control Systems, English Language. Admissions and student elections are also, conducted online.

Workshop

The workshop is spread over 20,800 sq.ft. area and is well equipped with lathes, radial-drilling machines, shapers, pedestal grinders, tool and cutter grinders, milling machine, cylindrical grinder, hydraulic press, pipe bending machine, metrology and rotational molding equipments.

There is a separate CNC machining section with CNC lathe, CNC Milling, Co-ordinate Measuring Machine, CNC Engraving Machine and Electric Discharge Machine. The carpentry section has the facilities of wood working lathes, planing machines and band saw machine.The workshop also, has separate sections for welding and metal fitting.

Laboratories

The Institute provides labs equipped with sophisticated instruments and apparatus for students, faculty and research scholars.

Some of these include: Electric machine Lab, Optics Lab, IMA Central Lab, Advanced Computing Lab, Digital Communication Lab, Materials Testing Lab, Biotechnology Lab, Genetic Engineering Lab, Microbiology Lab, Instrumentation, VLSI Simulation, Embedded Systems Lab, Robotics Lab, Micro-Electronics Lab, Advanced Measurement Techniques Lab and an English Languages Lab.

Students Activity Centre (SAC)

Constructed in an area of 37000 sq.ft. the Students Activity Centre is equipped with indoor sports facilities like badminton, table tennis, billiards, squash and well-equipped gymnasium. It also, has a music room with both eastern and western musical instruments.

Auditorium

A centrally air-conditioned auditorium with a seating capacity of 2200 is available for cultural activities, seminars, annual functions and other such activities.

Shopping Complex & Bank

The Shopping complex provides the facilities of a super market, vegetable and fruit shop, cafeteria, gent's saloon, beauty parlor, laundry, book store, stationery shop with public telephone and photocopying facility. State Bank of India, Zuarinagar, Goa has provided a branch and ATM facility centre within the campus for all banking requirements of residents.

Medical Centre

Medical centre provides outpatient and in-patient services through a dedicated medical team. Medical facilities such as ECG, X-ray, Multi-parameter monitors, Defibrillator, Syringe pumps, Pharmacy services etc. are available on campus for quick and efficient treatment. 24 x 7 Emergency Help Line service is available. Specialists are available on routine and on-call basis for out-patient care: General Medicine / General Surgery / orthopaedics / Dermatology / Paediatrics / Gynaecology. The institute has tie-ups with hospitals like SMRC, Vivus and Goa Medical College.

Children Activity Centre

A Children Activity Centre has been started to provide day care and education to small children in the campus. The Centre runs a playschool for infants in the morning and a Day Care in the afternoon. It is provided with all necessary facilities (toys, activities, educational material and infrastructure).

Communication Facilities

These include a PCO in the shopping complex, telephones in hostel common rooms and Internet facility across the Institute, in hostel rooms, staff quarters, faculty chambers and guest houses. The VOIP telephone service connects everybody in the campus.

Placement and Campus Interviews

A placement cell coordinates the Practice School and campus placement process along with the Placement Unit at Pilani Campus.

Activities

Games and Sports

The Institute encourages students to participate in sports and recreation.. The Gymnasium at SAC is equipped with mechanized treadmill and other latest exercise equipment. The campus has well maintained football, volleyball, hockey and cricket grounds, and lawn tennis and basketball courts.

Cultural and Recreational Activities

Various student clubs – photography, music, foreign languages, movie, painting, dance and drama – enrich the quality of campus life at Goa.

Students organize various inter-institute festivals: "Waves" is the Annual Cultural Festival and "Quark" the Annual Technical Festival.An inter-institute sports festival "Spree"

draws enthusiastic participation from young sportspersons.

Students and staff also, celebrate major Indian festivals such as Ganesh Chaturthi, Onam, Durga Puja, Diwali, Holi and Christmas with enthusiasm.

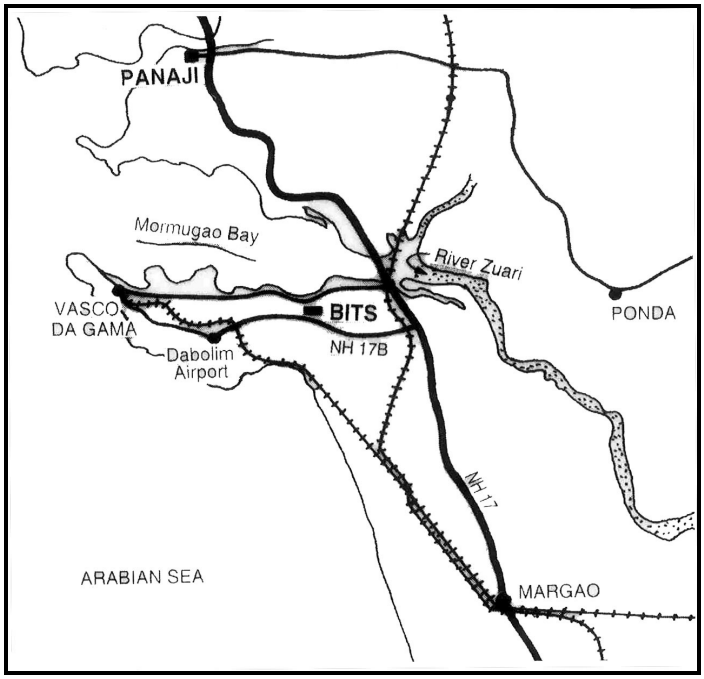
Environmental Awareness

The *Plant a Tree* drive is an ongoing activity and has resulted in 2700 trees in the campus. In addition there are campaigns to promote social awareness for energy conservation, utilization of renewable energy and environment protection.

For more details please visit:

http://www.bits-goa.ac.in

ROUTE TO BITS, PILANI – K.K. BIRLA GOA CAMPUS



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HYDERABAD CAMPUS AND ITS FACILITIES

The campus houses the main building, hostels for boys and girls, Student Activity Centre (SAC), a library, residential quarters for faculty and staff, medical centre, playgrounds and a shopping complex. The main building comprises of centrally air conditioned classrooms, laboratories, lecture theatres and administrative offices.

Student Housing

BITS, Pilani - Hyderabad Campus is fully residential. The campus provides single room accommodation to each student. Each room is provided with modern furniture and internet connectivity. Common room, recreational facilities, cable TV and telephone are provided in the hostels. There is a large dining hall furnished with modern equipment in the kitchen.

Information Processing Centre

Information Processing Centre (IPC) manages a central pool of resources for the computing requirements of all faculty, staff and students of the Institution. IPC has five terminal rooms for students' use, one server room, and provides computing facilities at offices and faculty chambers.

There are 6 IBM Blade servers and a SAN box on the network supporting 400 Pentium based PCs and Workstations of Lenovo make. These machines are equipped with Windows and Linux environments supporting a variety of software tools like Autocad, C, Jdk 1.3, Visual Studio, Tel/TK, Perl 5.0, and a few open source software for the practical components of courses like Engineering Graphics, Computer Programming I and II, Network security, Distributed Systems etc. IPC has facilitated opening of a Center of Excellence (CoE) by GSS America Online for research and project development activities. IPC hosts the campus website. It has developed a Course Management Tool for the effective management of courses, and also made educational videos available over the LAN.

Workshop

The workshop is well equipped to impart skills in various processes like machining, fitting, carpentry, smithy, sheet metal, electroplating, welding, foundry, etc. The equipments include cylindrical grinding machine, tool and cutter grinder, milling machine, radial drilling machine, wood gauge planer, LPG fired furnace, arc and gas welding equipments, electroplating setup, 9 lathes, 5 wood working lathes, 2 shaper machine, 2 bench drilling machines, power hacksaw, flywheel press, power tools, etc.

Medical Centre

A full-fledged medical centre has been established with all necessary facilities including 24x7 ambulance service. The institution has also tied up with reputed corporate hospitals in the city. The services of specialists are sought periodically.

Shopping Complex & Bank

The Shopping complex (Connaught Place) comprises of super market, restaurant, gents saloon, beauty parlours, laundry, Medical shop, Book shop, stationery shop with photocopying facilities, bakery, Dairy Parlour, a fruit and vegetable shop, and a telephone service outlet. An ice cream parlour is located close to the Shopping Complex. State Bank of Hyderabad, Jawahar nagar Branch, and an ATM are located in the shopping complex. A Post Office will be operational soon.

Laboratories

Advanced research laboratories for pharmacy, chemistry and biology have been setup. Programmable system on a Chip(PSoC) Lab has also been setup in collaboration with Cypress Semi conductors. There is a computer based English language lab to strengthen communication skills of students through interactive practice sessions.

Library facility

Open 7 days a week, the library has a collection of over 9500 books, 500

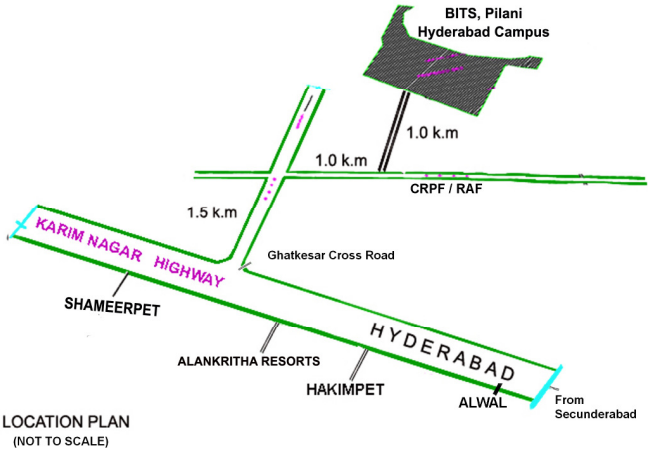
educational CD-ROMs and subscribes to over 75 Indian and 30 foreign journals. The Library also subscribes to e-journals like American Chemical Society (ACS), American Society for Civil Engineers (ASCE), American Society of Mechanical Engineers (ASME) IEEE and Science Direct. The Digital Library has a collection of e-books and question papers of previous years' examinations of the other BITS campuses. At present, the library is functioning in a temporary location in the main building. The exclusive library building with two floors spread over 45000 sq.ft. is under construction. The library operations are fully computerized and students can have access to the Online Public Access Catalogue (OPAC) from their hostel rooms. The air conditioned Library has WI-FI facility as well.

Students Activity Centre (SAC)

Student Activity Centre (SAC) offers facilities for various indoor games like Carroms, Chess, Table Tennis, Pool Table, Billiards and Foosball. There are Badminton courts with wooden flooring and a Gymnasium with state of the art equipment for boys and girls. A separate hall with wooden flooring is being provided for Yoga and Aerobics training. Various Clubs like Dance Club, Music Club (Indian and Western), Photography Club, Dramatics Club, Arts and Crafts Club and English Language Activities Society are provided with facilities in the SAC to pursue their activities. A variety of musical instruments like synthesizers, drums, guitars, etc., are made available for students of the Music Club to encourage them to practice and perform.

Games and Sports

The institute offers several sports and recreation facilities by providing TT tables, Foosball, chess and carrom boards in the hostels. Lawn Tennis courts with synthetic surface and Basket ball courts are getting ready.



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Home page: http://www.bits-hyderabad.ac.in

MEMBERSHIP OF DISTINGUISHED BODIES

The Institute is an institutional member of the following Associations and Bodies:

(i) Association of Commonwealth Universities, London.

(ii) Association of Indian Universities, New Delhi.

(iii) Indian Association of Social Science Institutions, New Delhi.

(iv) National Council of Applied Economic Research, New Delhi.

(v) Pharmacy Council of India, New Delhi.

(vi) World Association for Cooperative Education, Boston, USA.

(vii) International Association of Universities, Paris.

(viii) India International Centre, New Delhi.

(ix) International Council for Open and Distance Education, Oslo, Norway.

(x) Indian Society for Technical Education, New Delhi.

(xi) Indian Distance Education Association, Hyderabad.

(xii) The Institution of Engineers (India), Kolkata.

(xiii) Indian Institute of Foreign Trade, New Delhi.

(xiv) Petrotech Society, New Delhi.

(xv) Federation of Indian Chambers of Commerce and Industry – Higher Education Network, New Delhi

COLLABORATION WITH FOREIGN EDUCATIONAL INSTITUTIONS

The Institute has collaborative arrangements in terms of exchange of students, faculty and information with the following institutions:

1. The University of Oklahoma, Norman, Oklahoma, U.S.A.
2. Tulane University Medical Centre, New Orleans, Louisiana, U.S.A.
3. Purdue University, West Lafayette, Indiana, U.S.A.
4. Uniformed Services University of the Health Sciences, Bethesda, Maryland, U.S.A.
5. Kathmandu University, Kathmandu, Nepal.
6. University of Otago, Dunedin, New Zealand.
7. Rivers State University of Science and Technology, Nigeria.
8. University of Colombo, Srilanka.
9. George Mason University, Fairfax, USA.
10. ETA Ascon, Dubai, UAE
11. University of Windsor, Windsor, Canada.
12. The George Washington University, Washington, USA.
13. Massachusetts Institute of Technology, Cambridge, Massachusetts,USA.
14. Cornell University, Ithaca, USA.
15. Northeastern University, Boston, USA.
16. Waseda University, Tokyo, Japan.
17. Högskolan i Borås (University College of Borås), Sweden.
18. The University of New South Wales, Sydney, Australia.
19. Binghamton University (State University of New York), Binghamton, New York, USA.
20. Victoria University of Technology, "Victoria University", Melbourne, Australia.
21. University of Southern California, California, USA.
22. Iowa State University of Science and Technology, Ames, Iowa, USA.
23. University of Maryland, College Park, USA.
24. Kansas State University (KSU), Manhattan, Kansas, USA.

25. Arizona State University IRA A. Fulton School of Engineering, USA.
26. The Tun Hussein Onn National Eye Hospital, Petaling Jaya, Malaysia and National Institute of Ophthalmology, Petaling Jaya, Sede Boquer Campus, Malaysia.
27. Universities of Ontario, Canada.
28. The Jacob Blaustein Institute for Desert Research (BIDR) of Ben Gurion University (BGU), Israel.
29. Utah State University, Logan, USA.
30. York University, Toronto, Ontario, Canada.
31. University at Buffalo, The State University of New York, USA.
32. University of Dundee, United Kingdom.
33. Lund University, Sweden
34. Helsinki University of Technology, Espoo, Finland.
35. Carnegie Mellon University, Software Engineering Institute, Pittsburgh, PA 15213, USA.
36. TELECOM Bretagne, Cedex 3, France.
37. The University of North Carolina at Greensboro, Greensboro, NC, USA.
38. The University of Toledo, College of Engineering Toledo, Ohio, USA.
39. Lunghwa University of Science and Technology, Taoyuan, Taiwan.
40. Ecole Nationale Supérieure D'Ingénieurs De Limoges (ENSIL), Université de Limoges, France.
41. Concordia University, Montereal, Quebec, Canada.
42. Technische Universität Braunchweig, Germany.
43. Faculty of Engineering and Graduate School of Science and Technology, Kumamoto University, Japan.

PART II

EDUCATIONAL PROCESS AND PROGRAMMES OF STUDIES

EDUCATIONAL PROCESS

The mission of BITS is to prepare young men and women to act as leaders for the promotion of the economic and industrial development of the country and to play a creative role in society. It has the reputation of a highly purposive and innovative university often setting the pace for workable reforms in higher education, suitable and relevant for the Indian cultural milieu.

BITS has been following semester system with continuous and internal evaluation since its inception. The educational programmes are modular and flexible. Through its Practice School programme, BITS has established purposeful linkages with universities. The Institute has evolved a direction for Research which makes research relevant to the national development and social needs. It has developed and adopted a unique academic administrative structure which makes all its innovations possible and workable.

The Institute operates educational programmes at three tiers of education, namely, the Integrated First Degree programmes, Higher Degree programmes and the Doctoral programmes. All programmes in the Institute are designed to allow as many components of science and applied science as are necessary for the graduates of the programmes to function effectively and efficiently in the technological society. All programmes contain certain structural commonality and the common courses are invariably operated together irrespective of the clientele who are required to take the courses. Similarly, irrespective of the ultimate degree for which a student qualifies, the large factor of this commonality between all students creates an educational basis which provides easy professional linkage, communication and group activity among students graduating in different degrees. This similarity among different students graduating with different degrees is further welded in a stronger professional bond when they work as internees in the Practice School stations or as members in a team working on mission-oriented time-bound research and development projects.

The various structural flexibilities provide not only scope for multiple point entries but also enable the system to accommodate many legitimate educational and operational needs of students. Some of these aspects are described in various sections that follow.

PROGRAMMES OF STUDIES

All programmes of studies are based on the principle that a series of courses make up the hierarchy of the structure where each course is self-contained but nevertheless acts as a bridge between what precedes and what comes after. A formal contact hour is such that a student is invariably required to spend several times of these hours towards self-study. Attempt here is to awaken curiosity in the mind of the student and train him to think rationally and scientifically and enable him to face the unfamiliar. Through the Practice School option, the flavour of the professional world is sought to be imbibed by the student as well as the teacher. Even many co-curricular activities are converted into a learning situation whereby the growth of a student becomes a continuing operation.

The Institute also conducts Off-campus Work-Integrated degree programmes as a means of continuing education for employed professionals as part of the human resource development programmes of specific organizations at the various off-campus centres. In all these programmes, emphasis is on self-learning and the pedagogy attempts to incorporate as many modern technologies as desirable. While each one of these programmes requires collaboration of an organization, some programmes have a highly structured collaboration with planned classroom activities and some programmes may have less structured planning. While a number of degrees are offered through structured collaboration with many collaborating organizations, there are also degrees, which are available in an open

manner for a large number of organizations, each of which may sponsor only few students. For all these programmes, faculty/resource persons are drawn from the Institute and the participating organizations as well as other Institutions.

The Three Tier Structure shown on page II-3 gives all the programmes offered by the Institute.

Integrated First Degree Programmes

The Integrated First Degree Programmes are offered at the first tier with nomenclatures like B.E. (Hons.), B.Pharm. (Hons.), M.Sc. (Hons.), and M.Sc. (Tech.). These are all level wise equivalent degrees. These are called integrated degrees for two reasons: (i) there are several common courses amongst these degrees, and (ii) no intermediate degrees, like, B.Sc., B.Sc. (Hons.), etc. are awarded. These degrees are based on a modular structure and their academic requirements are spelt out in respect of the number of courses and units rather than the number of years. All these programmes are structured in such a way that normally a student will be able to finish a programme in eight semesters. Of course, the flexibility of the Institute allows a student to do his programme at a faster pace and finish it earlier than 8 semesters or at a slower pace to finish it later than 8 semesters.

(a) B.E. (Hons.)

These programmes in engineering are mathematics and hard science based and incorporate many up-to-date techniques of analysis and synthesis.

(b) B.Pharm. (Hons.)

This programme has been so structured that it not only meets the requirements of the Pharmacy Council of India but also has additional courses which give a shape and flavour of both engineering and fundamental sciences to the programme.

(c) M.Sc. (Hons.)

These are integrated degree programmes without any intermediate B.Sc. degree. While these programmes ensure the required science component in any comparable postgraduate science degrees of other universities, they also incorporate many courses which have been notionally considered to be the preserves of engineers. The integrated nature of the programmes and their analytical and engineering science contents give them a professional character and enable students to participate usefully in industrial jobs. While a good 10+2 input may be able to complete these programmes in four years, any person coming from 10+2+3 system with a B.Sc. degree admitted on advanced standing basis will require two to three years to finish the programme. Almost all students who are admitted for these degrees also aspire and work for a second degree from B.E.(Hons.) and B.Pharm. (Hons.) degrees under the dual degree scheme.

(d) M.Sc. (Tech.)

These programmes are basically multi-disciplinary and technological in character and are designed to meet the requirements of newly emerging professional activities. The areas which are currently incorporated in these degree programmes are Information Systems, Finance and General Studies.

The programme on Information Systems gives among other things a good exposure to the students on computer software and software engineering techniques, both at the conceptual and application levels. The Finance degree has been designed to meet the manpower needs arising due to the new thrust given to growth patterns in the economy. The courses planned for this programme are of such a nature that they fulfil the requirements of financial institutions as well as financial management needs of any industry. This programme is complementary to the M.Sc.(Hons.) Economics programme.

Birla Institute of Technology & Science, Pilani

Three Tier Structure of Education

Ph. D. Degrees	
Higher Degrees	
On-campus programmes	**Off-campus Work-Integrated Learning Programmes**
M.E. Biotechnology, Chemical, Chemical with specialization in Petroleum Engineering, Civil with specialisation in Structural Engineering, Civil with specialization in Infrastructure Systems, Civil with specialization in Transportation Engineering, Communication Engineering, Computer Science, Design Engineering, Electrical with specialization in Power Electronics & Drives, Embedded Systems, Manufacturing Systems Engineering, Mechanical, Microelectronics, Software Systems **M.Pharm.** M.Pharm., M.Pharm. with specialization in Pharmaceutics, M.Pharm. with specialization in Pharmaceutical Chemistry **M. Phil.** Biological Sciences, Chemistry, Economics, English, Management, Mathematics, Physics **Master of Business Administration (MBA)** Engineering & Technology Management, IT Enabled Services Management **Master of Public Health (MPH)**	**M. Phil.** Hospital & Health Systems Management, Optometry, Physician Assistant **M.S.** Consciousness Studies, Consultancy Management, Educational System Management, Embedded Systems, Engineering Management, Manufacturing Management, Mechanical Systems Design, Medical Laboratory Technology, Microelectronics, Pharmaceutical Operations and Management, Pharmaceutics, Quality Management, Science Communication, Software Engineering, Software Systems, Systems Engineering, Telecommunications & Software Engineering.

Integrated First Degrees			
On-campus programmes			**Off-campus Work-Integrated Learning Programmes**
Group A **B.E. (Hons.)** Biotechnology, Chemical, Civil, Computer Science, Electrical & Electronics, Electronics & Communication, Electronics & Instrumentation, Manufacturing, Mechanical **B. Pharm. (Hons.)**	**Group B** **M.Sc. (Hons.)** Biological Sciences, Chemistry, Economics, Mathematics, Physics	**Group C** **M.Sc. (Tech.)** Engineering Technology, Finance, General Studies, Information Systems,	**B.S.** Engineering Design, Engineering Technology, Industrial Engineering & Technology, Information Systems, Manufacturing Engineering, Marine Engineering, Nautical Sciences Nautical Technology, Ophthalmic Assistant, Optometry, Physician Assistant, Power Engineering, Process Engineering **M.Sc. (Tech.)** Pharmaceutical Chemistry

For Admission to on-campus programmes

Integrated First Degree :

For admission to all the above programmes: Candidates should have passed the 12th examination of 10+2 system from a recognized Central or State board or its equivalent with Physics, Chemistry, and Mathematics and adequate proficiency in English.

Higher Degree :

Normal input: Integrated First Degree of BITS or its equivalent.

Ph.D. Degree:

Normal Input: Higher Degree of BITS or its equivalent.

The General Studies programme aims at providing an opportunity to the students to acquire specific skills to meet varied career objectives through judicious use of electives and project oriented courses. Students are given opportunities to take two different streams, namely Communications and Media Studies or Developmental Studies by choosing courses of specific streams. Further, the requirements of mathematics, science and applied science, etc. are normally different from B.E. (Hons.) and M.Sc. (Hons.). Candidates admitted to this programme have to take humanities courses as well as certain general science and technology courses.

All the Integrated First Degree programmes described above have a Practice School option which consists of two courses, Practice School I and Practice School II. A student goes to Practice School I of two months' duration during the summer following second year and to Practice School II of five and a half months' duration during the final year. The curriculum, through Practice School, finds a formal method of bringing the reality of professional environment into the educational process.

For the various programmes in all the three tiers of education, the admission policy and the educational process at BITS take care of multiple entry into the programmes and allow several other flexibilities. The on-campus integrated first degree programmes are divided into Groups A, B and C. The following table provides a tabular condensation of the information.

INTEGRATED FIRST DEGREE PROGRAMMES

Name of the Programme	Normal Input	Special features
Group A programmes: B.E. (Hons.) : Biotechnology : Chemical : Civil : Computer Science : Electrical & Electronics : Electronics & Instrumentation : Electronics & Communication : Manufacturing : Mechanical B.Pharm. (Hons.) **Group B Programmes:** M.Sc. (Hons.) : Biological Sciences : Chemistry : Economics : Mathematics : Physics **Group C Programmes:** M.Sc. (Tech.) : Engineering Technology* : Finance : General Studies : Information Systems	**For admission to all the programmes:** Candidates should have passed the 12th examination of 10+2 system from a recognized Central or State board or its equivalent with Physics, Chemistry, and Mathematics and adequate proficiency in English. **Admission to all the programmes is subject to the conditions given below:** Admissions will be made purely on merit. The merit position of the candidate will be based on the score obtained by the candidate in a Computer based Online Test (BITSAT) conducted by BITS, Pilani. The candidate should have obtained a minimum of aggregate 80% marks in Physics, Chemistry and Mathematics subjects in 12th examination, with at least 60% marks in each of the Physics, Chemistry, and Mathematics subjects.	**Duration:** Planning has been made such that a student will be able to finish any of the integrated first degrees in 4 years (8 semesters). However, the flexibilities available and the modular structure of the system will allow individual student to have variation in the duration of his degrees. Some can finish earlier than 4 years and some may take more than 4 years. Students who take two degrees simultaneously under dual degree scheme will spend about 5 years (10 semesters). **Practice School:** All the integrated first degree programmes have Practice School options. **Dual Degree:** Institute offers dual degree facility to number of students who are admitted. The features of dual degree scheme are described later in this part under the section 'Flexibilities'. **Electives:** By judicious choice of electives, students of any of these programmes can make themselves prepared for (i) admission to Higher Degree programme (ii) a good career in teaching & research, (iii) Multidisciplinary professional career etc.

* Admission to M.Sc. (Tech.) Engineering Technology is not planned this year.

HIGHER DEGREE PROGRAMMES

M.E./M.Pharm./M.Phil.

The requirements of these programmes are described in terms of the total number of units which a student is required to complete rather than the duration. However, a normal student may be able to complete such a programme in four semesters, wherein the last semester may be spent for either of the two available alternatives, namely, Dissertation and Practice School. Certain well prepared motivated and hardworking students who are in dissertation stream may finish the programme in three semesters by starting the dissertation component right in their first semester. The programmes are intended to give a penetrating professional experience and an opportunity to acquire further competence either in one's own discipline or in many other traditional areas of Engineering, Pharmacy as well as interdisciplinary areas, like, Embedded Systems, Microelectronics, Software Systems, Biotechnology, Manufacturing Systems, Design Engineering, Transportation Engineering, etc.

Following is the exhaustive list of all the higher degree programmes approved by the Senate.

Name of the programme	Input
M.E.	**Normal input**
: Chemical : Chemical with Specialisation in Petroleum Engineering : Civil with Specialisation in • Structural Engineering • Infrastructure Systems • Transportation Engineering : Computer Science : Mechanical	Integrated first degree of BITS in the same discipline or its equivalent.
: Communication Engineering : Electrical with specialization in Power Electronics and Drives.	Integrated first degree of BITS in Electrical & Electronics or in Electronics & Instrumentation or its equivalent
: Embedded Systems	Integrated first degree of BITS in Electrical & Electronics or Electronics & Instrumentation or Computer Science or its equivalent.
: Design Engineering : Manufacturing Systems Engineering	Integrated first degree of BITS in Mechanical or its equivalent. Any other Integrated first degree of A & B groups or M. Sc. (Tech.) Engineering Technology of BITS or its equivalent with the requirement of taking certain additional courses.
: Microelectronics	Integrated first degree of BITS in Electrical & Electronics or Electronics & Instrumentation or Computer Science or Physics or its equivalent.
: Software Systems	Any first degree of the Institute, provided the minimum component of MATH, TA, AAOC, ENGG, prescribed in each of the groups A, B and C through compulsory requirements or conventional options.

Name of the programme	Input
	Other inputs: (a) For those Integrated first degree programmes under Work Integrated Learning Programmes which have no counterpart in Groups A, B and C, the minimum requirement should be at least what is prescribed in Group C (b) Any equivalent degree from other University with preparation indicated above.
: Biotechnology	Any Integrated first degree of BITS or its equivalent with adequate preparation in Bio-Chemistry and Microbiology.
M.Pharm.	Integrated first degree of BITS in Pharmacy or its equivalent.
: M.Pharm.	
: M.Pharm. with Specialisation in Pharmaceutics	
: M.Pharm. with Specialization in Pharmaceutical Chemistry	
M.Phil.	Any Integrated first degree of BITS or its equivalent in respective discipline.

Special features of Admissions to any M.E. programme:

Students coming with integrated first degree of BITS in A & B groups may be considered for admission to any M.E. Programme with the requirement of taking additional courses. The duration in these cases may be more than the normal duration and will be determined on a case by case basis. Similar dispensation may also be possible for students coming with an engineering degree from IITs and other reputed institutions.

Note: While no direct admissions are planned for M.Phil. degree, except M.Phil. (Chemistry) students who are admitted to Ph.D. may be asked whenever necessary, to register for this degree.

Master of Business Administration

The Institute has been running a Management programme namely Master of Management Studies (MMS) with a strong foundation in Science & Engineering. Based on feedback from industry, a new MBA programme has been introduced with input requirement as first degree of BITS or its equivalent. The programme endeavors to create manpower who have scientific and engineering approach to business administration. Students will also have a reasonable exposure to certain modern technologies. The programme is designed to have many flexibilities and a very strong component of industry project experience. The input for the programme may have multiple entry points. While principal input will be students already possessing an engineering degree, those who have other qualifications like B.Sc., B.A., B.Com. may also apply provided they have aptitude towards having training in science, mathematics and technology as well. The requirements of the programme will necessitate such students to spend additional time which may vary from 1 to 4 semesters depending upon their qualifications. For students not having an engineering degree, the course requirement

will be worked out, looking at the earlier training on a case-by-case basis at the time of admission. However, for the current year, admissions are planned for an input with engineering degree only in which case the normal duration is 4 semesters.

Master of Business Administration (MBA) in	Input
(i) Engineering & Technology Management (ii) IT enabled Services Management	Any Integrated first degree of BITS or BE/BTech in Engineering from other recognized Universities

Master of Public Health

Keeping in view that Public Health has become an area of great concern world wide, the Institute has introduced Master of Public Health programme at Pilani. This new programme aims to impart knowledge to working public health professionals and others who seek to upgrade themselves in the field of health care management and administrative tasks in health care organizations. Notwithstanding the substantial progress that India has made in health since independence, the country still faces a serious health challenge. The root causes of this challenge are inadequate human resource capacity and poor support systems in health (eg: health surveillance system). Institutions in India collectively churn out <500 graduates against a total requirement of 10,000+ professionals annually.

This programme is aimed at developing public health administrators with expertise in related areas of community health including disease characteristics, their prevention and control, management in crisis situations, forecast strategic disease prevention policies, quality assurance and regulatory affairs. The main focus of this programme is to emphasize on preventive measures that pose a threat to public health than treatment that has become a focal point in the current global scenario. The programme is targeted at health care professionals / managers / administrators in governmental / non-governmental and public sector organizations, hospitals, academicians, physicians as well as other professionals with related background. Apart from BITS faculty, experts/faculty from collaborating Institutes are involved in teaching as well as training of the enrolled students.

Name of the programme	Input
Master of Public Health	Any integrated First Degree of BITS or its equivalent; M.B.B.S., B.D.S., M.Sc. (Nursing) or their equivalent

DOCTORAL PROGRAMMES

The Institute's Ph.D. programme is structured on the basis of a preferred input of those who have completed one of the Institute's higher degrees. It requires each student to finally qualify for formal acceptance in the programme only after passing a qualifying examination.

The Institute also offers a unique opportunity for professionals of collaborating organizations to work for Ph.D. in the settings of their own work environments through Off-campus Ph.D. scheme.

Ph.D.	**Normal input** Any Higher degree of BITS or its equivalent. **Other inputs** a) Integrated First Degree of BITS or its equivalent. b) Any preparation between the above described first degree and higher degree. c) High professional standing and proven competence even without a formal degree. Note: Each case of other inputs will be decided on a case by case basis regarding admission and with the requirement of doing higher degree courses before taking qualifying examination. In the case of inputs with qualification like B.E., M.Sc., etc. without experience, the application will be first examined for suitability to any of the higher degrees of BITS.	**Structure:** Qualifying examination, Teaching practice, Foreign language when required, Thesis and Seminar. Course work as specified for various input and prior preparation. **Locale:** Normally any of the BITS campuses and other off-campus locations with prior approval. **Ph.D. Aspirant:** To help in the development of professionals at large, provision exists for taking directly the qualifying examination as a `Ph.D. Aspirant' even before seeking admission to the Ph.D. Programme. The Aspirants can work in the settings of their own work environment with the approval of Research Board.

PROGRAMMES OFFERED AT BITS, PILANI – PILANI CAMPUS

Integrated First Degree Programmes

B.E. (Hons.) Chemical
B.E. (Hons.) Civil
B.E. (Hons.) Computer Science
B.E. (Hons.) Electrical & Electronics
B.E. (Hons.) Electronics & Instrumentation
B.E. (Hons.) Manufacturing
B.E. (Hons.) Mechanical
B.Pharm. (Hons.)
M.Sc. (Hons.) Biological Sciences
M.Sc. (Hons.) Chemistry
M.Sc. (Hons.) Economics
M.Sc. (Hons.) Mathematics
M.Sc. (Hons.) Physics
M.Sc. (Tech.) Finance
M.Sc. (Tech.) General Studies
M.Sc. (Tech.) Information Systems

Higher Degree Programmes

M.E.:

: Biotechnology
: Chemical
: Chemical with Specialization in Petroleum Engineering
: Civil with specialization in Structural Engineering
: Civil with specialization in Infrastructure Systems
: Civil with specialization in Transport Engineering
: Communication Engineering
: Computer Science
: Design Engineering
: Electrical with specialization in Power Electronics & Drives
: Embedded Systems
: Manufacturing Systems Engineering
: Mechanical
: Microelectronics
: Software Systems

M.Pharm:

: M.Pharm.
: M.Pharm. with specialization in Pharmaceutics
: M.Pharm. with specialization in Pharmaceutical Chemistry

Master of Business Administration (MBA)

Master in Public Health (MPH)

PROGRAMMES OFFERED AT BITS, PILANI – GOA CAMPUS

Integrated First Degree Programmes

B.E. (Hons.) Chemical
B.E. (Hons.) Computer Science
B.E. (Hons.) Electrical & Electronics
B.E. (Hons.) Electronics & Instrumentation
B.E. (Hons.) Mechanical
M.Sc. (Hons.) Biological Sciences
M.Sc. (Hons.) Chemistry
M.Sc. (Hons.) Economics
M.Sc. (Hons.) Mathematics
M.Sc. (Hons.) Physics
M.Sc. (Tech.) Information Systems

Higher Degree Programmes

M.E.:

: Biotechnology
: Chemical
: Design Engineering
: Embedded Systems
: Software Systems

All these programmes have the same educational process, syllabus, evaluation method and academic flexibilities like transfer, dual degree etc. as followed at BITS, Pilani – Pilani Campus.

PROGRAMMES OFFERED AT BITS, PILANI – HYDERABAD CAMPUS

Integrated First Degree Programmes

B.E. (Hons.) Chemical
B.E. (Hons.) Civil
B.E. (Hons.) Computer Science
B.E. (Hons.) Electrical & Electronics
B.E. (Hons.) Electronics & Communication
B.E. (Hons.) Mechanical
B.Pharm. (Hons.)
M.Sc. (Hons.) Biological Sciences
M.Sc. (Hons.) Chemistry
M.Sc. (Hons.) Economics
M.Sc. (Hons.) Mathematics
M.Sc. (Hons.) Physics
M.Sc. (Tech.) Information Systems

Higher Degree Programmes

M.E.:

: Computer Science
: Microelectronics
: Embedded Systems

M.Pharm:

: M.Pharm.
: M.Pharm. with specialization in Pharmaceutics
: M.Pharm. with specialization in Pharmaceutical Chemistry

All these programmes have the same educational process, syllabus, evaluation method and academic flexibilities like transfer, dual degree etc. as followed at BITS, Pilani – Pilani Campus.

PROGRAMMES OFFERED AT BITS, PILANI – DUBAI CAMPUS

Integrated First Degree Programmes

B.E. (Hons.) Biotechnology
B.E. (Hons.) Computer Science
B.E. (Hons.) Electrical & Electronics
B.E. (Hons.) Electronics & Communication
B.E. (Hons.) Electronics & Instrumentation
B.E. (Hons.) Mechanical
B.E. (Hons.) Chemical
M.Sc. (Tech.) Engineering Technology
M.Sc. (Tech.) Information Systems

Higher Degree Programmes

M.E.:

: Biotechnology
: Design Engineering
: Microelectronics
: Software Systems

Master of Buiness Administration (M.B.A.)

All these programmes have the same educational process, syllabus, evaluation method and academic flexibilities like transfer, dual degree, etc. as followed at BITS, Pilani – Pilani Campus.

TEACHING-LEARNING PROCESS

The objective of class room education is to awaken the curiosity of the student, generate habits of rational thinking in him/her, gear his/her mind to face the unfamiliar and train him/her to be able to stand on his/her own. With its team of committed and dedicated faculty, BITS aims at maximizing the learning through teaching. Through their innovative teaching, the teachers enable the student search for knowledge on his/her own and motivate him/her to use the facilities like the library, laboratory and the environment to optimise his/her learning process. Self-study by the student is therefore an important factor in the planning of teaching and evaluation and in this environment the student exhibits interest and responds to this challenge. Teaching and evaluation form a unity of function and operate in a climate of mutual understanding and trust.

Every course whether single section or multi-section is conducted by a member of the faculty called instructor-in-charge, with the assistance, where necessary, of the required number of instructors – who will be partners with him in meeting the full academic perceptions and organisational needs of teaching the course and evaluating the students.

Within one week of the beginning of classwork, the instructor-in-charge/ instructor announces to his class/section through a hand-out, the necessary information in respect of (i) the operations of the course (its pace, coverage and level of treatment, textbooks and other reading assignments, home tasks etc.); (ii) various components of evaluation, such as tutorials, laboratory exercises, home assignment, several quizzes/tests/examinations (announced or unannounced, open book or closed book), regularity of attendance, etc., (iii) the frequency, duration, tentative schedule, relative weightage etc. of these various components; (iv) the broad policy which governs decisions about make-up; (v) mid-semester grading; (vi) grading procedure (overall basis, review of border line cases, effect of class average, etc.) and (vii) other matters found desirable and relevant.

EVALUATION

All courses are conducted and evaluated in a continuous & internal manner by the faculty who teach these courses. The student registers for a certain number of courses each semester; the year being divided into two semesters, and a summer term, whenever offered. A faculty member, as registration advisor, helps a student to draw up his programme, suitable to his pace and needs, which is made possible by the coursewise time-table of the Institute. Every student gets, incidentally, a training in decision-making through (i) choice of load, i.e. number of courses per semester to suit his/her pace, (ii) selection of his/her own time-table to suit his/her convenience, and (iii) picking up courses as electives to meet his/her own aspirations. It is the responsibility of the student to attend classes regularly and to maintain a required level of scholastic standing.

The performance of a student in each course is assessed by the teacher by means of continuous evaluation throughout the semester in classwork, periodical quizzes (sometimes unannounced), tests (both open and closed book), tutorials, laboratory work, home work, seminars, group discussions, project, etc., and a comprehensive examination at the end of the semester. The student is thereby given a large number of opportunities to carryout various academic assignments and be evaluated. Besides encouraging and rewarding continuous and systematic study, the system provides a constant feedback to the student as to where he/she stands, thus enabling him/her to cultivate regular habits of studying and preparing himself/herself for the future.

The system discards the conventional emphasis on a single final examination and numerical marks as the only absolute indication of the quality of student's performance. Thus, at the end of the

semester the teacher of the course awards letter grades **A, B, C, D, E** to the student based on the total performance of the student and it is relative to the performance of others taking the same course. These letter grades stand for quality performance: A-Excellent, B-Good, C-Fair, D-Poor and E-Exposed. Further, these letter grades have points associated with them in a quantified hierarchy. There are also courses in which the teacher awards non-letter grades which have only a qualitative hierarchy. The teacher may also pronounce the performance of a student in a course in terms of certain reports which should not be misconstrued as grades.

Although BITS does not stipulate a minimum percentage of attendance before a student is permitted to appear in any test/examination, the Institute, being a fully residential university with internal and continuous evaluation system, expects every student to be responsible for regularity of his/her attendance in classrooms and laboratories, to appear in scheduled tests and examinations and to fulfil all other tasks assigned to him/her in every course. The system has adequate resilience to accommodate unforeseen situations through withdrawal from a course, make-up test, feedback from examinations and interaction with teachers. In spite of all these facilities when a student fails to cooperate with the teacher in the discharge of his/her part of the contract to such an extent that the teacher is unable to award any grade, the teacher is authorised to give a "Not Cleared" (**NC**) report.

A student is deemed to have cleared a course if he/she obtains a grade in the course. However, the educational philosophy of the Institute interlinks and at the same time distinguishes between the performance of a student in a single course and his/her overall cumulative performance. The overall performance of a student is indicated by an index known as the "Cumulative Grade Point Average" (CGPA). It is the weighted average of the grade points of all the letter grades received by the student since his/her entry into the Institute and is expressed on a 10-point scale. In the case of Integrated First Degree programmes the final division for the degree is decided on the basis of CGPA and there are three classifications, namely Distinction, First Division and Second Division. However, in the case of Higher Degree and the Doctoral programmes no division is awarded.

During the student's stay in the Institute, the Institute expects him/her to show a certain minimum performance and progress. The minimum academic requirements regarding the performance and progress for the Integrated First Degrees and Higher Degrees are:

(i) A CGPA of at least 4.5 at the end of every semester for integrated first degree students and 5.5 for higher degree/Ph.D. students.

(ii) Not more than one E grade in a semester for integrated first degree programmes and no E grade in the higher degree programmes.

(iii) The pace of progress of a student should be such that at any stage of reckoning he/she should not have spent more than 50% extra time than what is prescribed for him/her upto that stage in his/her programme.

The Institute's Academic Regulations must be consulted regarding the minimum academic requirements for the pursuit of the Ph.D. programme and also for off-campus programmes.

Students who fail to meet the minimum academic requirements stipulated above are put under an appropriate committee which monitors their programmes and give guidance so that they are properly rehabilitated at the earliest. In case of Ph.D., this is done by the Doctoral Counselling Committee and in the case of higher degrees and integrated first degrees this is done by Academic Counselling Board (ACB). These

Committees are appointed by the Senate and are given authority to take appropriate action including discontinuance of the student or transfer to other programme.

FLEXIBILITIES

The admission policy and the educational process at BITS take care of multiple entry into the programmes and allow several other flexibilities.

Wherever a flexibility is possible according to the Academic Regulations of the Institute, the implementation of the decision invariably takes place along with registration at the beginning of a semester for the continuing students. As in the admission process, the decision is guided by the principle of merit, preferences and facilities available.

It is obvious that CGPA cannot serve as the only measure of merit when the total number of courses/units is different between two competing candidates. To normalise all competing candidates, generally the Institute uses a Progressive Branching Index (**PBI**).

Admissions in both the Semesters

The structural flexibilities available in the Institute make it possible to admit students in both the semesters. However, in the case of first degree programmes most of the admissions are made during the first semester itself. The few admissions made in the second semester are essentially to meet the depletion during the first semester and also to get the most outstanding students who could not apply in time for the first semester admissions. In the case of higher degree programmes, Ph.D. and off-campus degree programmes, admissions are planned in both the semesters. However, a separate advertisement is given for the second semester admissions and applications for the same are made available only after an advertisement is issued.

Admission with Marginal Deficiency

While the academic preparation required for the admission to each degree has been clearly spelt out there is a provision in the Institute Academic Regulations whereby brilliant students whose prior preparation has been marginally deficient in terms of stated courses/subjects may also be admitted with the condition that they are required to do additional courses over and above those prescribed for a student with normal preparation and the sequence is determined by the institute. This flexibility is invariably used in the case of higher degree programmes where students may come without sufficient exposure to courses like computer programming.

Admission with Advanced Standing

When a candidate for any programme in the three tiers of education of the Institute comes with a preparation beyond the minimum requirement for admission in that programme, the admission of such a candidate is handled under what is known as admission with advanced standing. While such admission is not available as a matter of right, at the time of admission the Institute would spell out in detail the advanced credit it proposes to give to the candidate and the matter would be handled within the framework of the Institute's operation for normal students. Essentially the guiding principle is two-fold : the courses the candidate has already done before entering the Institute cannot be repeated and also that the time spent elsewhere is not wasted. Such an open-ended situation is handled on a case by case basis. It is important that the candidate supplies all the pertinent data in respect of syllabus of courses taken by him/her, examinations passed, question papers of the examinations and the grades/marks obtained by him/her in different subjects. A candidate who is shortlisted for such admissions would be asked to come to Pilani and explore a workable programme that would be appropriate for him/her before admission is completed. If required, the candidate may have to take certain examinations in various subjects that he/she has completed before a prescribed programme is pronounced for him/her there onwards.

However, there are certain situations which cannot be treated as advanced standing. In view of the uncertainty of the level to which some of the courses of the First Degree programmes is treated as optional subjects in the 10+2 system, to be consistent with the past tradition, no student is allowed to register in a course if he/she is considered to be overprepared in relation to the content of the course. Some examples of such courses are: General Biology, Graphics and Workshop Practice. Such an overprepared student is required to take an appropriate higher level course, as determined by the Dean, Instruction.

Dual Degree Scheme

To meet the ambitions of the students who could not get admission to B.E.(Hons.)/B.Pharm. (Hons.) programmes, the Institute has created facilities by which any student who is admitted to M.Sc. (Hons.) programmes is accommodated in a dual degree scheme for a second degree in B.E. (Hons.)/B.Pharm. (Hons) programmes. This assignment is made by competition on their performance at BITS at the end of the first year, separately in Pilani, Goa and Hyderabad campuses.

Students in any other group seeking a second degree from amongst the programmes in the same group or another group will also be considered under other 'priorities'.

Transfer

(i) Within the same tier

It is possible for a student to seek transfer from one programme to another in the middle of a programme without starting from the beginning. This is possible because he/she is given credit for what he/she has done till then towards the requirements of the programme to which he/she seeks the transfer. Details have to be seen in the Academic Regulations. Transfer is possible from M.E.(all branches) and M.Pharm. to M.Phil. On the other hand, very restricted and tutored transfer would be possible from M.Phil. to M.E./ M.Pharm.

Since admission to a programme is done on assigned and competitive basis, there cannot be any scope of undoing the fact of an assigned admission through transfer. Thus only exceptionally meritorious students in a limited number of cases can expect to compete for transfer to a more sought-after programme. On the other hand, transfer to a less sought-after programme for a student who is unable to cope with the rigours of the programme in which he/she has been admitted would be readily used to rehabilitate him/her without much loss of time. In any event, transfer must be treated as an admission process.

(ii) From first degree to higher degree / Ph.D. degree:

In the case of bright and promising student of the Integrated First degree programmes a transfer to Higher Degree and/or Ph.D. degree may also be provided.

(iii) Between Ph.D. and higher degree programmes:

Under special situations a transfer between Ph.D. and higher degree programmes may be permitted. Movement in either direction is theoretically possible. The Institute's Academic Regulations must be consulted for details.

Audit

The facility of taking a course on audit is principally conceived to give an opportunity to a student to update his/her knowledge in selected courses. It is expected to meet primarily the needs of casual students (not enrolled for degree). No degree of the Institute can be acquired by merely taking courses on audit.

There are certain courses like Foreign Languages, Music, etc. which are neither part of a degree programme nor are available through electives. Any student who wishes to take such courses can take them only on audit basis and also on payment of additional fees.

Other Flexibilities

The structure of degree programmes and the Academic Regulations also provide certain other flexibilities like choice of electives, number of electives, repetition of courses, departure from normal pace, withdrawal from or substitution of course(s) etc.

Academic Regulations

The operations described above are not exhaustive. For precise rules, Academic Regulations of the Institute may be consulted.

UNIVERSITY-INDUSTRY LINKAGE

A recurring theme in the realm of educational reform and innovation has been that of linking university education with industry experience. Since its very inception in 1964, the Institute has been committed to University-Industry Collaboration. Beginning in 1973, the Institute has taken pioneering initiatives towards the development of institutionalized linkages with industry, through its (i) Practice School, (ii) Technology Innovation Center, and (iii) Off-campus work-integrated learning programmes. The details of Practice School are described here.

PRACTICE SCHOOL

All Integrated First Degree and Higher Degree Programmes of the Institute provide for a Practice School option. A student who exercises this option receives, on successful completion of the requirements of the programme, a degree which carries the tag, "With Practice School".

Theme

BITS is strongly committed to the view that university education must be oriented so as to (i) meet the rapidly changing needs and challenges of the environment, (ii) help people become more intelligent and capable of facing unfamiliar, open-ended real-life situations, and (iii) bear an economic relevance to the society.

The Practice School (PS) method of education links the university with the professional world, by bringing the reality of the world of work into the educational process. The classroom is taken for a period of 7½ months to a professional location where the students, under the supervision of the faculty, are involved in applying the knowledge acquired in the classroom to finding solutions to real life problems. The PS experiment began with a small group of 12 students in 1973 and was extended to accommodate all students from all disciplines. The distinguishing features of the PS method of education - (i) the work of the students is supervised and evaluated by faculty, (ii) the credits earned by the student count towards the total credit requirement of the degree, and (iii) the PS option is available to students of all disciplines - make it a bold and radical educational reform with no parallel.

Operation of the PS Programme

The **PS** programme for the Integrated First Degree has two components, namely **PS-I** of two months duration implemented during the summer following the 2nd year and **PS-II** of five and a half months duration implemented during either of the semesters of the final year. (Refer to the chart on page II-16) Dual degree students can also opt for PS-II in both the semesters of the final year.

The **PS** Programme for Higher Degree has a single component, namely Practice School for Higher Degree operating in an identical fashion to PS-II, in the final semester of the Higher Degree Programme.

Practice School - I (PS-I)

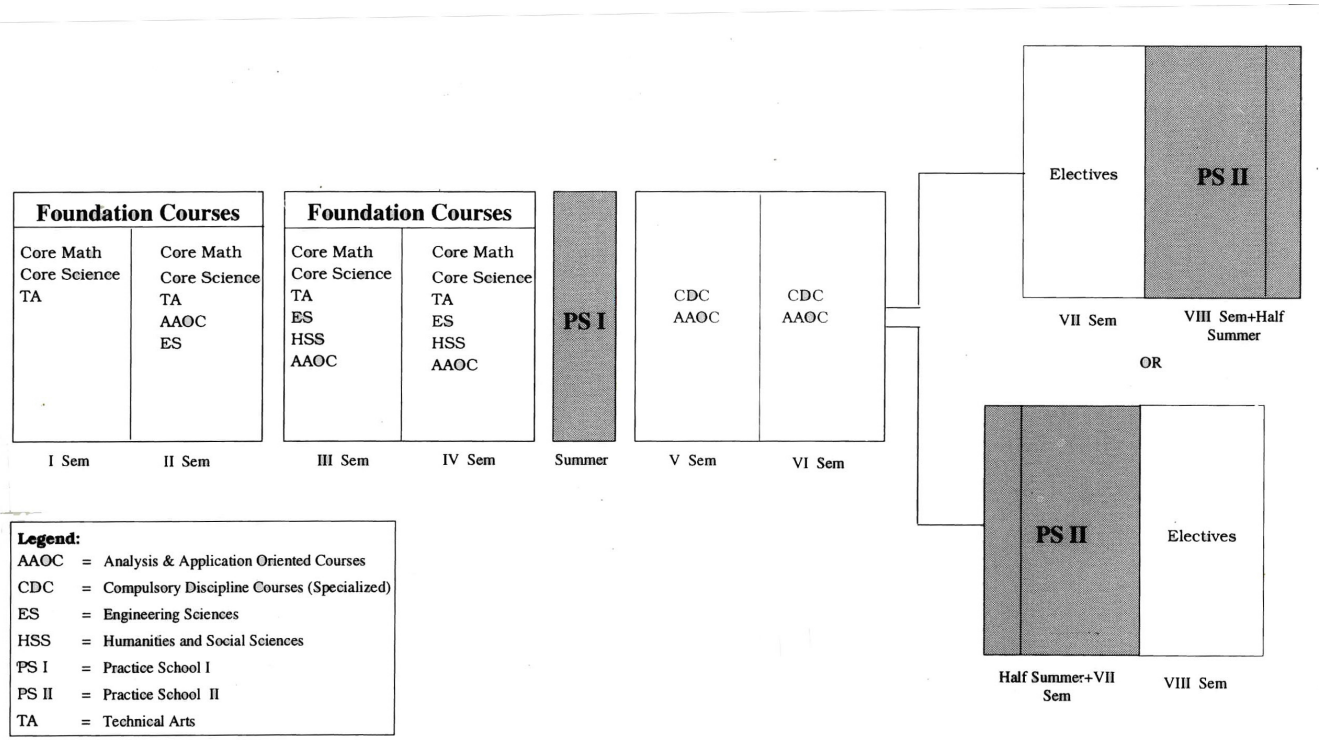
This component is the first exposure to the world of work, necessary for the subsequent problem solving experience during PS-II. It is implemented at large industrial complexes, research and development centers, software development houses, pharmaceutical companies, etc. While the general aim of PS-I is to afford an opportunity for the student to learn how work is organized and carried out, by a process of observation and participation, the learning can be quite

varied and exhaustive depending on the nature of the organization. It provides an opportunity for a detailed understanding of vast engineering operations and its various facets such as inventory, productivity, management, information systems, human resource development, etc. Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also observe the principles of management they have learnt in class, being put into practice and see how multidisciplinary teams of experts from engineering, science, economics, operations research, and management participate in dealing with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems. The students are accompanied by a teacher, who is responsible for coordination with the organization and the day-to-day educational as well as evaluation details.

Some of the places where this component has been implemented are Bangalore Stock Exchange Ltd, Bangalore; Steel Authority of India Ltd., Bhadravathi; Hindustan Motors Ltd., Chennai; National Thermal Power Corporation Ltd., Dadri; Indian Institute of Remote Sensing, Dehradun; National Physical Laboratory, Delhi; TEXMACO Ltd., Kolkata; Centre for Water Resources Dev. & Mgt., Kozhikode; Century Rayon, Kalyan; Central Food Technological Research Institute, Mysore; Heavy Engineering Corporation Ltd., Ranchi; Bharat Heavy Electricals Ltd., Trichy; Hindustan Zinc Ltd., Udaipur.

Practice School - II (PS-II)/ PS for Higher Degree

PS-II is attended by the students of the Integrated First Degree Programmes in their final year of study. This is also faculty supervised, and for this purpose, teachers are located at various centers around the country where PS stations operate. In order to maintain continuity of operation, the students are divided into two batches, about half the students doing PS-II in the first semester and the other half in the second semester. In either case, the time duration is augmented by a part of the summer term (preceding or following the semester). The operation is therefore round the year with batches coming about every six months. PS for Higher Degree is however available only in the final semester of the programme, after completion of the campus-based courses. The PS-II/PS component is implemented at Production and Manufacturing units, Design, Development and Consulting Agencies, Research and Development Centers, Financial Institutions, Software Development organizations, etc. The student education here is in terms of the direct involvement of the student in problem solving efforts of specific interest to the host organization. The assignments are identified by the PS faculty well in advance in consultation with experts from the host organization. The problems are often multidisciplinary in nature, which are assigned to a group of students drawn from different disciplines. The professional expert in charge of a particular problem and the PS faculty play the roles of consultant and supervisor respectively. The students are encouraged to work independently and are required to defend the technical aspects of their work through periodic written and oral presentations. Emphasis is laid on realizing the importance of teamwork, development of leadership qualities, and the need for effective time management.



The Structure of Integrated First Degree Programme
(Practice School Option)

Some of the typical assignments that the students have undertaken are: Pivot Bracket Design and Analysis for Reconfiguration of Naval Version of Fighter and Trainer Aircraft; Stress and Fatigue Analysis of a Rupture Plate In The Shock Absorber of a Combat Helicopter; Benchmarking I2 ABPP Performance for Wmape Functionality in the Inventory Optimization Solution; Use of "Hudson" as a Continuous Integration Tool in Mobile Software Development; Study and Design of Bioreactors & Optimization of Growth of Yeast for an Industrial Bioreactor; Comparative Evaluation of the Various International Codes of Practice for Seismic Base Isolation Design and Draft a Code Pertaining to the Indian Context; Bit Error Rate Estimation Setup Decelopment for High Speed Serial Data Links; Dissecting the Hierarchy of Protein Functional Associations: from Pairwise Correlations to Interaction Networks; Development of Static Brew Extension for RVE and using that to Enhance Smartsound Application to Enable and Extraction of MP3 ID3 Tags to EFS; Development of Dependency and Usages Analyxer and a Tool to Reverse Engineer Memory Dumps and Unit Test Frame Work and Test Suite for SD Card Controller; Impact Evaluation of Integrated Child Development Services (ICDS).

Typical PS Station – A Model

The PS station is the analogue, in the professional world, of the university classroom and laboratory. The Institute endeavours to ensure that each PS station has all the physical facilities necessary to carry out meaningful education. It should be mentioned here that host organizations have always come forward with all possible assistance. At least one faculty member is attached with each PS station. Since a city may have more than one PS station, the term PS Centre is used to designate a location where one or more PS stations are present.

PS Assignments

The general nature of PS-I assignments is of study and orientation. However, the assignment plays a pivotal role in PS-II and is of direct and immediate relevance to the host organization. The educational challenge is therefore that of evolving the pedagogy for teaching, learning, and evaluation while the students are involved in their problem solving efforts. The tasks are generally multidisciplinary, mission oriented and therefore time bound and open ended. The development of solutions to such problems requires a scientific attitude, technical competence, discipline and adherence to procedure, decision making ability, and a spirit of curiosity and exploration. Often, the assignments form a part of long term research and development projects.

Student Allotment in PS

Allotment in PS-I is done keeping the student's preferences and academic performance in view, along with the availability of physical facilities, in particular, accommodation. Student allotment in PS-II is, however, a much more complex and multi-dimensional task. With the help of the PS faculty, information is collected from the host organization with regard to the total set of skills and attributes required of the student for the task at hand. Simultaneously, a profile of each student is prepared, incorporating details such as CGPA, performance in various categories of courses including electives and projects, assignment worked on in PS-I, professional interests, and extra-curricular achievements. With this information base, a matching is carried out, keeping in view the student's preferences and constraints of physical facilities.

The various activities related to PS, such as profile preparation, allotment, monitoring, and feedback are computerized to make the entire process expeditious and efficient.

Evaluation in PS courses

The PS method of education, as has been emphasized earlier, is a medium for integrating real-life situations with the learning process. In line with this objective, the student is given the responsibility of planning, scheduling, implementing, and defending the steps to the solution of the assigned problem. The students work under the supervision of the faculty, in consultation with the professional expert(s). As with all other courses, a process of continuous evaluation is followed. The PS method of education seeks out and focuses attention on many latent attributes which do not surface in the normal classroom situation. These include professional judgment and decision making capacity, inter-disciplinary approach, data-handling skills, ability in written and oral presentation, leadership qualities, ability for team work, sense of responsibility, ability to meet deadlines, etc. These attributes are judged by the faculty through various instruments of evaluation, namely, quiz, viva, seminar, group discussion, project report, diary, and daily observation. At the end of each PS course, a student is awarded a letter grade based on his total performance. Supplementing the degree transcript issued by the Institute, the PS Division issues a 'Practice School Transcript' to those students who opt for the PS stream. This transcript gives a complete record of the performance of the student in the PS programme.

It also includes a rating sheet which describes qualitatively the student's personality traits mentioned earlier.

Since the PS programme interfaces with the world outside the campus, whenever the progress of a student in a PS course is found to be unsatisfactory and/or guilty of conduct unworthy of the professional world, the PS option may be withdrawn by the Institute, without any reason being assigned.

Role of Professional Experts in PS

The PS programme clearly places demands on the time and energy of various officers from the host organization. However, every effort is made to ensure that they are not burdened with the day-to-day details concerning the educational and administrative organization of the PS programme, these being the responsibility of the PS faculty.

In the case of PS-I, the preparation of the educational schedule is initiated at the Institute itself. On reaching the PS station, the faculty discusses the same with officers from the host organization, seeking their concurrence and their suggestions. The faculty engages the students on various assignments and periodically informs the experts of the progress made. The faculty may also arrange meetings of the students with the experts and also invite them to participate in seminars given by the students from time to time. At the end of the course, the faculty seeks the expert's critical comments on the report submitted by the student, to receive essential feedback on the quality of the work.

In respect of PS-II, the officers from the host organization first come into picture when the faculty is compiling the problem bank for the batch of students to come. At this stage, the experts provide the details of the various problems on which the students will work, as well as their requirements in terms of the type of student input for each assignment. After the arrival of the students at the PS station too, the faculty remains at the helm of affairs, forming student groups, assigning projects, conducting evaluation components, etc. The faculty also ensures that each student blends well with the group of fellow students and staff from the host organization, in which he/she is working. When seminars or group discussions are held, the faculty invites the officers to participate. During the course of the assignment, the students seek consultation with the expert, normally through the faculty, who ensures that the student is well-prepared for these meetings. At the end of the course, the student is required to present a seminar and defend the technical credibility of the work before as large a

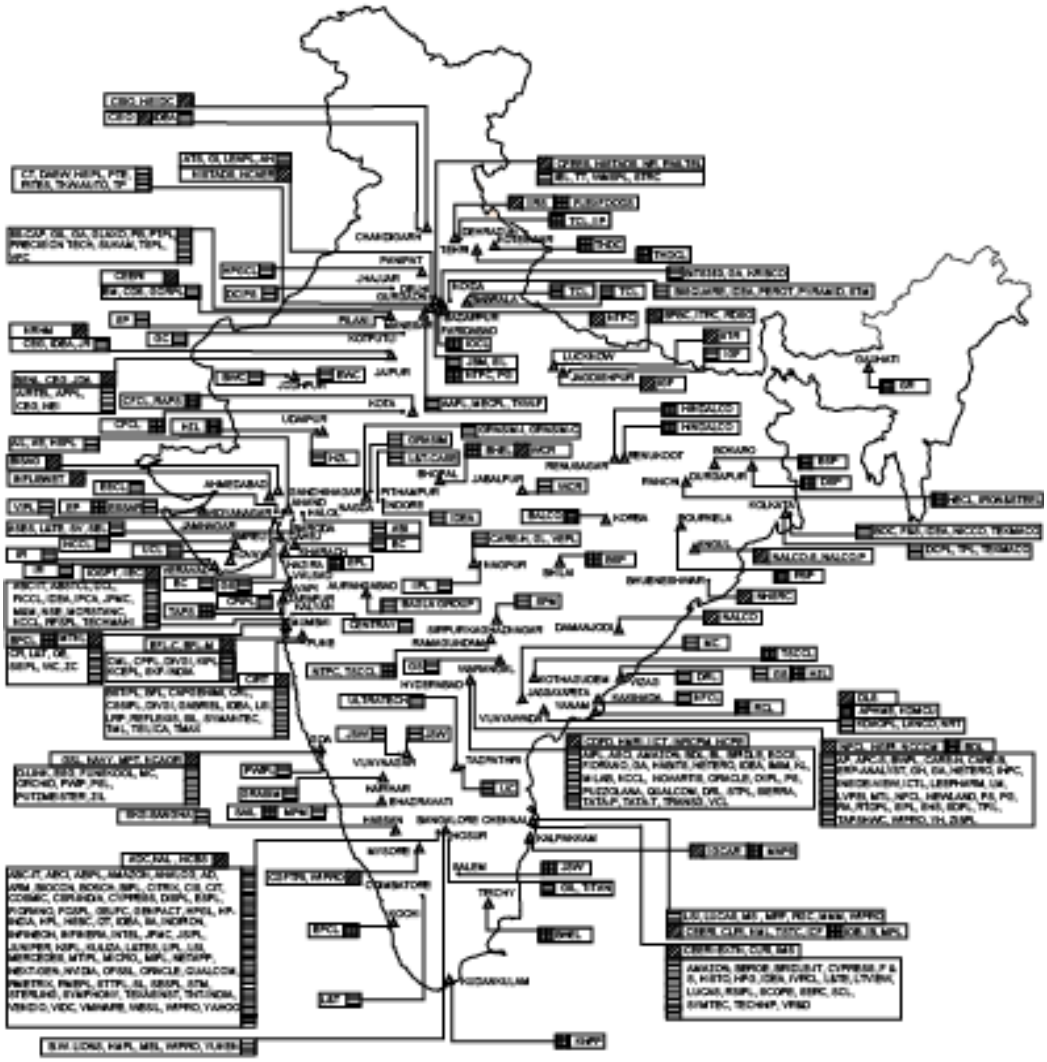
gathering of experts as possible. Detailed discussions ensue on various technical aspects of the problem, often resulting in the resolution of critical issues involved.

Some PS Statistics

Ever since its beginning in the year 1973 with just one station accommodating 12 students and 4 faculty members, the PS has grown immensely. In the academic year 1975-76 the programme was thrown open to all the students of the Institute. During an academic year arrangements have to be made for PS programme for a steady number of 3725 students, accompanied by nearly 131 faculty members. Specifically, it means accommodating a steady number of 1921 students and 100 faculty members at about 203 different organisations for PS-I in the summer term and arranging for about 1804 students accompanied by about 62 faculty members to attend PS-II operated round the year at about 246 different host organisations. So far about 36,700 students have been benefited by this programme. While all the host organisations pay the students out-of-pocket allowance, some organisations provide the students and the faculty with housing and other facilities as well.

The list of organisations where PS programmes are in operation is given below. There are also organizations outside India where the PS programme is being conducted for several years. (Refer to the following map showing PS Stations).

BITS PRACTICE SCHOOL STATIONS
2010-2011



△ PS-I CENTERS OPERATIVE DURING THE SUMMER

* PS-II CENTERS OPERATIVE ROUND THE YEAR

GOVERNMENT ORGANIZATIONS HOSTING PS STATIONS

SEMI-GOVERNMENT ORGANIZATIONS HOSTING PS STATIONS

PRIVATE ORGANIZATIONS HOSTING PS STATIONS

PUBLIC SECTOR ORGANIZATIONS HOSTING PS STATIONS

LIST OF PS-I STATIONS

Ahmedabad

Inflibnet Centre (INFLIBNET)

Amreli

NCCL

Anand

Anupam Industries Ltd. (AIL), Atlanta Electricals (AE), Himsons Steel Pvt Ltd. (HSPL)

Angul

National Aluminium Company Ltd. (Power Plant) (NALCO), National Aluminium Company Ltd. (Smelter Plant) (NALCO)

Aurangabad

Bagla Group (BAGLA GROUP)

Babrala

Tata Chemicals Ltd. (TCL)

Badarpur (Delhi)

National Thermal Power Corporation Ltd. (NTPC)

Bangalore

B.W. Lions Super Speaciality Eye Hospital (B.W. LIONS), Hical Magnetics Pvt. Ltd. (HMPL), Manjushree Extrusions Ltd. (MEL), Wipro Technologies (WIPRO), Yuken India Ltd. (YUKEN)

Bhadravathi (Shimoga)

Steel Authority of India Ltd. (SAIL), The Mysore Paper Mills Ltd. (MPM)

Bhilai

Bhilai Steel Plant (BSP)

Bhopal

Bharat Heavy Electricals Ltd. (BHEL), West Central Railway (WCR)

Bokaro

Bokaro Steel Plant (BSP)

Chandigarh

Central Scientific Instruments Organization (CSIO), HSIIDC

Chennai

Central Electronics Engineering Research Institute Chennai Centre (CEERI Extn.), Central Leather Research Institute (CLRI), Indian Bank (IB), Indian Overseas Bank (IOB), Integral Coach Factory (ICF), Laser Soft Infosystems Ltd. (LSI), Lucas TVS Ltd. (LUCAS), Maarga Systems (MS), Manali Petrochemical Ltd. (MPL), Medical Research Foundation (MRF), National Metallurgical Laboratory Madras Centre (NML), Rane Group of Companies (RGC), Tamilnadu Science & Technology Centre (TSTC), The Madras Medical Mission (MMM), Wipro Technologies (WIPRO)

Damanjodi

National Aluminium Company Ltd. (Smelter Plant) (NALCO)

Dehradun

Flexfoods Ltd. (FLEXFOODS), Indian Institute of Remote Sensing (IIRS)

Delhi

Center for Fire Explosive and Environment Safety (CFEES), Intercorp Biotech Ltd. (IBL), National Inst. of Science & Tech. Dev. Studies (NISTADS), Northern Railways (NR), Railtel Corporation (RAILTEL), Sigma Test Research Centre (STRC), Tata Teleservices (TT), Wone Management Systems Pvt. Ltd. (WMSPL)

Durgapur

Durgapur Steel Plant (DSP)

Faridabad

JBM Auto Components (JBM), NTPC (NTPC), Power Grid (PG), Superseals India Ltd. (SIL)

Gandhinagar

Bhaskaracharya Institute of Space Applications & Geoinformatics (BISAG)

Gauhati

Gauhati Refinery (GR)

Goa

D-Link India Ltd. (D-LINK), Entertainment Society of Goa (ESG), Funskool (FUNSKOOL), Goa Shipyard Ltd. (GSL), Meta Copper (MC), Mormugao Port Trust (MPT), National Centre for Antartic and Ocean Research (NCAOR), Navy (NAVY), Orchid Bio Medical Systems (ORCHID), Pentair Water India Pvt. Ltd. (PWIP), Persistent Systems Ltd. (PSL), Putzmeister (PUTZMEISTER), Zuari Industries Ltd. (ZIL)

Gurgaon (Delhi)

Convergent Technologies (CT), Demm Auto Engineering Works (DAEW), Hughes Systeque

(India) Pvt. Ltd. (HSIPL), Precision Tech Enterprises (PTE), Rites Ltd. (RITES), TKW Auto.com (TKW-AUTO) Trident Products (TP)

Harihar (Karnataka)

Grasim (GRASIM)

Hassan

SKG Sangha (SKG-SANGHA)

Hazira

Essar Power Ltd. (EPL)

Hyderabad

Aceva Polymers (AP), APC Schinder (APC-S), Bevcon Wayors Pvt. Ltd. (BWPL), Bharat Dynamics Ltd. (BDL), Care Hospital (Nampally) (CARE-N), Care Hospital (Banjara Hills) (CARE-B), ERP Analyst (ERP-ANALYST), Global Hospitals (GH), GSS America (GA), Hetero Drugs Ltd. (HETERO), Indian Hume Pipes Company (IHPC), Inside View (INSIDE-VIEW), Integrated Cleanroom Technologies Ltd. (ICTL), Lee Pharma (LEE-PHARM), Lokesh Machines (LM), L.V. Prasad Eye Institute (LVPEI), Moldtek Technologies Ltd. (MTL), Nagarjuna Fertilizers & Chemicals Ltd. (NFCL), National Geophysical Research Institute (NGRI), NCCCM, Newland Lab (NEWLAND), Pennywise Solutions (PS), Placebo Gears (PG), Raaga Associates (RA), Renuka Tools & Dies Pvt. Ltd. (RTDPL), Servomex India Pvt. Ltd. (SIPL), Sneha Hydro Systems (SHS), Suchirindia Developers Pvt. Ltd. (SDPL), Tecumseh Products India Ltd. (TPIL), The Andhra Pradesh State Handloom Weavers Co. (TAPSHWC), Wipro Technologies (WIPRO), Yashoda Hospitals (YH), Zolt Info Solutions Pvt. Ltd. (ZISPL)

Jabalpur

West Central Railway (WCR)

Jagdishpur

Indo Gulf Fertilizers (IGF)

Jaggayapet

Madras Cements (MC)

Jaipur

Airtel (AIRTEL), Amol Pharmaceuticals Pvt. Ltd. (APPL), Bharat Sanchal Nigam Ltd. (BSNL), Consulting Engineers Group (CEG), Jaipur Development Authority (JDA), National Engineering Industries Ltd.(NEI)

Jamnagar

Essar Oil (ESSAR), Essar Power (EP)

Jodhpur

Birla White Cement (BWC)

Kakinada

Nagarjuna Fertilizers & Chemical Ltd. (NFCL)

Kalpakkam

Indira Gandhi Centre for Atomic Research (IGCAR), Madras Atomic Power Plant (MAPP)

Kharach (Gujarat)

Birla Cellulosic (BC)

Kochi

Bharat Petroleum Corporation Ltd. (BPCL),

Kolkata

Development Consultants Pvt. Ltd. (DCPL), Tata Projects Ltd. (TPL), TEXMACO Ltd. (TEXMACO)

Korba

Bharat Aluminium Company Ltd. (BALCO)

Kota

Chambal Fertilizers and Chemicals Ltd. (CFCL), Rajasthan Atomic Power Site (RAPS)

Koteswar

Tehri Hydro Development Corporation Ltd. (THDC)

Kottagudam

The Singareni Collieries Company Ltd. (TSCCL)

Kovaya

Ultratech Cement (UC)

Kudangulam

Kudangulam Nuclear Power Project (KNPP)

Lucknow

Biotech Park in Biotechnology City (BPBC), Industrial Toxicological Research Centre (ITRC), Research Dev. and Standardization Organization (RDSO)

Manesar

ASK Automotive Pvt. Ltd. (AAPL), Maxop Engineering Co. Pvt. Ltd. (MECPL), TKW Fasteners (TKW-F)

Mumbai

Bharat Petroleum Corporation Ltd., (BPCL), Century Rayon (CR), Larsen & Toubro Ltd. (L&T), MTNL (MTNL), Orient Enterprises (Phoenix Interplast) (OE), Starflex Sealing India Pvt. Ltd. (SSIPL), Wat Consultant (WC), Zenith Computers (ZC)

Mysore

Central Food Technological Research Institute (CFTRI), Wipro Infotech (WIPRO)

Nagda

Grasim Industries Ltd. (GRASIM-I), Grasim Chemicals (GRASIM-C)

Nagpur

Care Hospitals (CARE-H), Global Logic (GL), Vidharbha Enviro Protection Ltd. (VEPL)

Noida

BITS360, Global Autotech (GA), Kribco (KRIBCO)

Panipat

Haryana Power Generation Corp. Ltd. (HPGCL)

Pilani

Birla Museum (BM), CDS Solutions (CDS), Central Electronics Engineering Research Institute (CEERI), Grey Orange Robotics Pvt. Ltd. (GORPL)

Pune

Bharat Forge Ltd.(Chakan Plant) (BFL-C), Bharat Forge Ltd. (Mundhawa Plant) (BFL-M), Cameo Media Lab (CML), Cipy Polyerethanes Pvt. Ltd. (CPPL), Divgi-Warner Ltd. (DIVGI), KBK Chem Engineering Pvt. Ltd. (KCEPL), Kenersys India Pvt. Ltd (KIPL), SKF India Ltd. (SKF-INDIA)

Raigad

ONGC Uran Plant (ONGC)

Ramagundam

National Thermal Power Corporation Ltd. (NTPC), The Singareni Collieries Company Ltd. (TSCCL)

Ranchi

Heavy Engineering Corporation Ltd. (HECL), R&D Centre for Iron and Steel (IRON & STEEL)

Renusagar

Hindustan Aluminium Company Ltd. (HINDALCO)

Renukoot

Hindustan Aluminium Company Ltd. (HINDALCO)

Rourkela

Rourkela Steel Plant (RSP)

Sirpur Kaghaznagar

The Sirpur Paper Mills Ltd. (SPM)

Tadpathri

Ultratech (ULTRATECH)

Tarapur

Tarapur Atomic Power Stations (TAPS)

Tehri

Tehri Hydro Development Corporation Ltd. (THDCL)

Trichy

Bharat Heavy Electricals Ltd. (BHEL)

Udaipur

Hindustan Zinc Ltd. (HZL)

Vapi (Gujarat)

Creative Portico India Pvt. Ltd. (CPIPL)

Veraval

Indian Rayon (INDIAN-RAY)

Vijayanagar

JSW Steel Ltd. (JSW)

Vijayawada

Andra Pradesh Heavy Machinery & Engineering Ltd. (APHME), Diesel Loco Shed (DLS), Kanak Durga Agro Oil Products Ltd. (KDAOPL), Lanco Kondapally (LANCO), Navata Road Transport (NRT), The Krishna District Milk Producers Mutually Aided Cooperative Union Ltd. (KDMCU)

Vizag

Gyan Shodh (GS), Hindustan Zinc Ltd. (HZL)

Warangal

Gyan Shodh (GS)

Yanam (Kakinada)

Regency Ceramics Ltd. (RCL)

LIST OF PS-II STATIONS

Anand (Gujarat)

Vrindi India Pvt. Ltd. (VIPL)

Babrala (UP)

Tata Chemicals Ltd. (TCL)

Bangalore

Aditya Birla Corporate IT (ABC-IT), Airbus Engineering Center India (AECI), Altair Engg. India Pvt. Ltd. (AEIPL), Amazon Development Centre India Pvt. Ltd., (AMAZON), Analog Devices (ANALOG), Apex Decisions (AD), ARDC Design Complex – HAL (ADC), ARM (ARM), Biocon (BIOCON), Bosch Ltd. (BOSCH), Broadcom India Pvt. Ltd. (BIPL), Citrix R&D India Pvt. Ltd. (CITRIX), Cisco Systems (India) Pvt. Ltd. (CIS), Citrix R&D India Pvt. Ltd. (CIT), Cosmic Circuits Pvt. Ltd. (COSMIC), CSR India Pvt. Ltd. (CSR-INDIA), Cypress Semiconductors Tech. India Pvt. Ltd. (CYPRESS), Dhanax Information Services Pvt. Ltd. (DISPL), Expicient Software Pvt. Ltd. (ESPL), Fiorano Software Technologies Pvt. Ltd. (FIORANO), Flipkart Online Services Pvt. Ltd. (FOSPL), GE-John F Welch Technology Centre (GEJFC), Genpact Analytics (GENPACT), HP Global (HPGL), HP India Software Operation Pvt. Ltd. (HP-INDIA), HP Labs (HPL), HSBC Global (HSBC), i2 Technologies India Pvt. Ltd. (i2T), Idea Cellular Ltd. (IDEA), Indian Institute of Astrophysics (IIA), Indrion Technologies (I) Pvt. Ltd. (INDRION), Infineon Technologies India Pvt. Ltd. (INFINEON), Infinera (INFINERA), Intel India Tech. Pvt. Ltd.(INTEL), J.P. Morgan Chase (JPMC), Jivox Software Idia Pvt. Ltd. (JSIPL), Juniper Networks India Pvt. Ltd. (JUNIPER), Knolskape Solutions Pvt. Ltd. (KSPL), Kuliza Technologies (KULIZA), L&T E Engineering Solutions (L&TES), Lantiq India Pvt. Ltd. (LIPL), LSI Logic India Pvt. Ltd. (LSI), Mercedes Benz (MERCEDES), Microchip Technology (I) Pvt. Ltd. (MTIPL), Microsoft Research India Pvt. Ltd. (MICRO), Modelytics India Pvt. Ltd. (MIPL), National Aerospace Laboratories (NAL), NetApp (NETAPP), National Centre for Biological Sciences (NCBS), NextGen Pvt. Ltd. ((NEXT-GEN), Nvidia Graphics India Pvt. Ltd. (NVIDIA), Oracle Financial Services Software Ltd. (OFSSL), Oracle India Pvt. Ltd. (ORACLE), Qualcomm India Pvt. Ltd. (QUALCOM), Reametrix (RMETRIX), Rotary Mechanical Engineering Pvt. Ltd. (RMEPL), Sabre Travel Technologies Pvt. Ltd. (STTPL), Sap Labs (SL), Sirius Embedded Software (P) Ltd. (SESPL), ST Microelectronics (I) Pvt. Ltd. (STM), Sterling Commerce India Solutions Pvt. Ltd. (STERLING), Symphony (SYMPHONY), Texas Instruments (I) Pvt. Ltd. (TEXASINST), TNT India Pvt. Ltd. (TNT-INDIA), Vendio Technologies India Pvt. Ltd., (VENDIO), Verisign India Development Centre (VIDC), VMware (VMWARE), Weir Engineering Services India Ltd. (WESIL), Wipro InfoTech. (WIPRO), Yahoo Software Dev. India Pvt. Ltd. (YAHOO)

Baroda

Ankur Scientific Energy Systems (ASES), L&T E Engineering Solutions (L&TE), Sandvik Asia (SV), Sterling Biotech Ltd. (SBL)

Bhubaneswar

National Health Systems Resources Centre (NHSRC)

Chandigarh

Central Scientific Instruments Organization (CSIO), Idea Cellular Ltd. (IDEA)

Chennai

Amazon Development Centre India Pvt. Ltd., (AMAZON), Beroe (BEROE), Bridle IT (BRIDLE-IT), Central Electronics Engineering Research Institute Chennai Centre (CEERI EXTN), Central Leather Research Institute (CLRI), Cypress Semiconductors India Pvt. Ltd. (CYPRESS), Frost & Sullivan (F & S), Histogenetics (HISTO), HP Global (HPG), Idea Cellular Ltd., (IDEA), Institute of Mathematical Sciences (IMS), IVRCL Infrastructures & Projects Ltd. (IVRCL), L&T E Engineering Solutions (L&TE), LatentView Analytics (LTVIEW), Lucas TVS Ltd. (LUCAS), Reflexis Systems India Pvt. Ltd. (RSIPL), SCOPE International Pvt. Ltd. (SCOPE), Structural Engineering Research Centre (SERC), Sundaram Clayton Ltd. (SCL), Symantec Corporation R&D Division (SYMTEC), Technip India Ltd. (TECHNIP), Vestas R&D (VR&D)

Coimbatore

L&T (L&T)

Dahej (Gujarat)

Birla Copper (BC)

Dehradun

Indian Institute of Petroleum (IIP)

Delhi

AspirantHunt (AH), ATS Services Pvt. Ltd. (ATS), Gammon India (GI), LEA Associates South Asia Pvt. Ltd. (LEAPL), National Council of Applied Economic Research (NCAER), National Institute of Science and Tech. Dev. Studies (NISTADS)

Faridabad

Indian Oil Corporation Ltd. (IOCL)

Finland

Helsinki University of Technology

France

Insead Business School, Fontainebleau

Goa

Pentair Water India Pvt. Ltd. (PWIPL)

Gurgaon (Delhi)

6S Capital (6S-CAP), Gabriel India Ltd. (GIL), Genpact Analytics (GA), Glaxosmithkline Consumer Healthcare R&D (GLAXO), Parsons Brinckerhoff (PB), Paxcel Technologies Pvt. Ltd. (PTPL), Precision Tech Enterprises (PRECISION TECH), Sukam Power Systems Ltd. (SUKAM), Tekriti Software Pvt. Ltd. (TSPL), ValueFirst Connect (VFC)

Halol (Baroda)

Aditya Birla Insulator (ABI)

Hosur

Gabriel India Ltd. (GIL), Titan Industries Ltd. (TITAN)

Hyderabad

Adaequare Info Pvt. Ltd. (AIPL), Administrative Staff College of India (ASCI), Amazon Development Centre (AMAZON), Bharat Dynamics Ltd. (BDL), Bravo Lucy (BL), Bridle IT (BRIDLE), Centre for DNA Fingerprinting and Diagnostics (CDFD), Enterprise One Consulting Services (EOCS), Fiorano Software Technologies Pvt. Ltd. (FIORANO), Genpact Analytics (GA), Habits Edutainment (HABITS), Health Management Research Institute (HMRI), Hetero Drugs Ltd. (HETERO), Idea Cellular Ltd. (IDEA), imi Mobile (IMIM), Indian Institute of Chemical Tech. (IICT), International Advanced Research Center for Powder Metallurgy & New Materials (IARCPM), Kony Labs (KL), Matrix Labs Ltd. (M-LAB), Nagarjuna Construction Co. Ltd. (NCCL), National Consultancy for Planning & Engineering (NCPE), Novartis (NOVARTIS), Oracle India Pvt. Ltd. (ORACLE), Orbees Infolabs (India) Pvt. Ltd. (OIIPL), Perot Systems (PS), Puzzolana Heavy Machineries (PUZZOLANA), Qualcomm India Pvt. Ltd. (QUALCOM), Dr. Reddys Laboratories Ltd. (DRL), Scube Technologies Pvt. Ltd. (STPL), Sierra Atlantic Software Services Ltd. (SIERRA), Tata Projects (TATA-P), Tata Teleservices (TATA-T), Transgraph Consulting Pvt. Ltd., (TRANSG), Vasant Chemicals and Organics (VCL)

Indore

Idea Cellular Ltd. (IDEA)

Jagadishpur

Indo Gulf Fertilizers (IGF)

Jaipur

Consulting Engineers Group (CEG), Idea Cellular Ltd (IDEA), Jaipur Rugs (JR), National Rural Health Mission (NRHM)

Jhajhar

Development Consultants Industrial Plant Services Pvt. Ltd. (DCIPS)

Kalyan (Mumbai)

Century Rayon (CENTRAY)

Kolkata

BOC India Ltd. (BOC), Frost & Sullivan (F&S), Idea Cellular Ltd. (IDEA), Nicco Group (NICCO), Texmaco (TEXMACO)

Kota

Chambal Fertilizers and Chemicals Ltd. (CFCL)

Kotputli

Grasim Cements (GC)

Lucknow

Indian Institute of Toxicology Research (IITR)

Mumbai

Aditya Birla Corporation IT (ABC-IT), Aditya Birla Science & Technology Company Ltd.

(ABSTCL), Development Consultants Ltd. (DCL), Fullerton India Credit Co. Ltd. (FICCL), Idea Cellular Ltd. (IDEA), Institute of Oil & Gas Production Technology (IOGPT), International Institute for Energy Conservation (IIEC), Ipca Laboratories Ltd. (IPCA), J.P. Morgan Chase (JPMC), Mahindra & Mahindra (M&M), Morgan Stanley Capital Services (MORSTANC), Nagarjuna Construction Company Ltd. (NCCL), National Stock Exchange of India Ltd. (NSE), Rupeetalk Financial Services Pvt. Ltd. (RFSPL), Tech Mahindra (TECHMAHI)

Nagda

Grasim Industries Ltd. (GRASIM)

Nagpur

Infospectrum India Pvt. Ltd. (IIPL)

Noida

Bisecure Networks Pvt. Ltd. (BISECURE), Idea Cellular Ltd. (IDEA), Perot Systems (PEROT), Pyramid Consulting (PYRAMID), ST Microelectronics (I) Pvt. Ltd. (STM)

Pilani

Source Pilani (SP)

Pithampur

L&T-Case Equipment Pvt. Ltd. (L&T-Case)

Pune

Battelle Science & Technology India Pvt. Ltd. (BSTIPL), Bharat Forge Ltd. (BFL), Capgemini (CAPGEMINI), Central Institute for Road Transport (CIRT), Computational Research Laboratories Ltd. (CRL), Credit Suisse Services India Pvt. Ltd. (CSSIPL), Divgi Warner (P) Ltd. (DIVGI), Gabriel India Ltd. (GABRIEL), Idea Cellular Ltd. (IDEA), LSI Logic India Pvt. Ltd. (LSI), Lupin Research Park (LRP), Reflexis Systems Inc. (REFLEXIS), Spicer India Ltd. (SIL), Symantec Corporation R&D Division (SYMANTEC), Tata Motors Ltd. (TML), Tensilica (TSILICA), Thermax Ltd. (TMAX)

Salem

JSW Steel (JSW)

Taadipatri

Ultratech Cement (Andhrapradesh Cement Works) (UC)

Thailand

Aditya Birla Chemicals Ltd. (ABCL)

Udaipur

Hindustan Zinc Limited (HZL)

USA

Cypress Semiconductor, San Jose, California, Dream Works Animation, Los Angeles, Histogenetics

Vallabh Vidyanagar

Elecon Engineering Co. Ltd. (EECL)

Valsad

Gadhia-Solar (GS)

Veraval

Indian Rayon (IR)

Vijayanagar

Jindal Steel Works (JSW)

Vizag.

Dr. Reddys Laboratories Ltd. (DRL)

RESEARCH AT BITS

Research is an important academic activity at BITS and a large number of students at all levels of the educational programmes are involved in research that exploits the multidisciplinary educational base emerging out of the broad-based integrated education in engineering, science and humanities. Strong emphasis is laid on interdisciplinary, mission-oriented and relevant research. The Practice School, which is an important component of the integrated programmes of BITS, provides an opportunity to identify research problems relevant to industrial needs. The participation of students and the faculty members in research ensures a team effort towards problem solving activities. Such a total involvement of the faculty as well as the student population integrate the research and teaching activities of the Institute in such a manner that they draw strength and support from each other.

Research Areas

Topics of Research can be chosen from any of the disciplines in which the Institute offers

Higher Degree and First Degree programmes and also from the areas given in Table at the end of this Part.

Research Linkages

The Institute has built up research linkages with a large number of R & D organizations in the country and abroad and provisions exist for candidates to work for a part or whole of the research work at these organizations in their thrust areas. Some of the organizations are: Uniformed Services University of Health Sciences, Bethesda, USA; Tata Institute of Fundamental Research, Mumbai; Central Electronics Engineering Research Institute, Pilani; Chennai Mathematical Institute, Chennai; Central Drug Research Institute, Lucknow; Institute of Pathology, New Delhi; Sankara Nethralaya and Elite School of Optometry, Chennai; LV Prasad Eye Institute, Hyderabad; and Institute of Cardio-Vascular Diseases, Chennai.

Research Components in the Educational Programme

Research is emphasized in all the educational programmes of the Institute. At the first degree level, Thesis and at the higher degree level Dissertation are optional alternatives to the Practice School. Thesis is an integral component of the Ph.D.

While some salient features are described below, for further details, please refer to Academic Regulations.

(A) First Degree

(i) In the First tier, a single degree student must take either Thesis or PS and a dual degree student has to normally do Thesis for one degree and PS for the other degree. Such a student can also opt for PS/Thesis for both the degrees.

(ii) Thesis and Seminar courses are to be registered concurrently.

(iii) Students will be assigned a topic of research and a supervisor after giving due consideration to the student's preference, the research goals of the Institute and the equalisation of the work-load of the supervisors.

(iv) Thesis is a time-bound activity requiring total commitment. Registration in any course except the seminar course, is not allowed alongwith the Thesis course. The Thesis units cannot be split in different semesters. Thus, if a student fails to submit his thesis within the prescribed time, a fresh registration in a subsequent semester would be required.

(v) Thesis and Seminar are graded in terms of non-letter grades.

(B) Higher Degree

For students who do not opt out for Practice School, Dissertation of 15-25 units is a required component. Dissertation may be registered for one full semester after completing all courses or may be registered concurrently for varied units along with other courses. This is a course in which the student takes up a research topic under the supervision of a faculty. Pursuit of research through this course in any semester must end up in a written report at the end of the semester. The performance is graded in terms of non-letter grades.

(C) Ph.D. Degree

Thesis is an integral component in the Ph.D. degree programme. It requires a minimum of 40 units to be registered normally in four semesters. A Ph.D. student can register for the Thesis course only after passing the Qualifying Examination and after approval of his topic of research and a supervisor by the Research Board.

The pursuit of the thesis can be done on campus or at Practice School Centres and in certain circumstances at other specific centres with prior permission.

Other Components and Features of the Ph.D. Programme

(i) Types of Input

While the preferred input is a Higher Degree of BITS or its equivalent, the Institute's

Academic Regulations permit an input which is at least a first degree of BITS or its equivalent or any input between these two extremes. Further, in a rare case of a person of high professional standing and proven competence who is deemed to have acquired mastery over all or substantial part of the course-work of a higher degree of the Institute through long professional experience exhibited through published papers, technical reports, etc. would also be an acceptable input.

(ii) Qualifying Examination

Every student admitted to Ph.D. must pass the qualifying examination which is based on the courses of a higher degree programme which the candidate had earlier pursued or on the named courses of a BITS higher degree currently in vogue. The qualifying examination tests the student's knowledge, grasp of fundamentals and his ability to use them in unknown situations and is designed to be equivalent to the standard, content and intent of the comprehensive examination of the named courses.

The admission to On-campus Ph.D. programme is provisional in the first instance and gets confirmed only after passing the Qualifying examination within the prescribed time. Whenever a candidate is unable to pass the qualifying examination within the prescribed time, he will automatically be discontinued from the programme.

(iii) Seminar / Independent Study

Normally a Ph.D. student will have to register every semester in the Seminar course or in the Independent Study course.

(iv) Course work

The various categories of courses for the whole possible range of input of Ph.D. students are described in the Academic Regulations. In simple terms, in most cases, the course work consists of courses which are required to be completed for a higher degree programme of the Institute. Further, the qualifying examination is conducted on the basis of these courses. Departure from these normal situations is described in the Academic Regulations.

(v) Teaching Practice

There are two courses of Teaching Practice required to be done by every Ph.D. student. These courses attempt to train the student in the art, methodology and skill of teaching. Alternatively, Dean R & C may permit a student to register in Practice Lecture Series courses.

(vi) Language Requirement

The foreign language is prescribed as an eligibility requirement for the Ph.D. only when the supervisor and/or the Dean Research & Consultancy have made recommendations for the same for a particular topic of research and this recommendation is accepted by the Research Board. Otherwise English or an Indian language, as the case may be, would suffice.

A Ph.D. student for whom foreign language is prescribed is expected to demonstrate an ability to translate a piece from current periodicals in the area of major interest of the student in one of the modern European languages into English with the help of a dictionary.

(vii) Fellowships and Scholarships

Students admitted to Ph.D. Programme normally get fellowship from some reputed agencies like UGC, CSIR, DBT, DST, ICMR, MNES, etc. However, BITS resources are intended to take care of needs not covered by these sources.

Off-campus Ph.D. under 'Ph.D. Aspirants' Scheme

The Institute also offers an unique opportunity for employed professionals working in industries and R&D Organizations and having long experience and proven competence to work towards Ph.D. degree of the Institute in the settings of their respective work environments and makes it possible for practicing professionals to be offered the same challenge and standard which traditionally have been given to teachers in

universities. Such candidates are called as 'Ph.D. Aspirants'. Normally candidates working in an organization collaborating with BITS are considered under this scheme. Industries/organizations interested in the scheme for the development of their manpower at the doctoral level are invited to seek collaboration with BITS and sponsor their suitable candidates.

Admission

The admission modalities given in the next part also apply to Ph.D. wherever applicable.

Eligibility

* A candidate with a formal higher degree which is the minimum qualification for the Ph.D. programme; namely M.E./ M.E. (Coll.)/ M.Phil./ M.Phil. (Applied)/ M.Pharm./M.S. of BITS or an equivalent degree of another university of standing.
* A person of a long and high professional standing and proven competence not possessing a higher degree but whose experience can measure upto a higher degree.
* A student coming after clearing all courses of a higher degree of the Institute or its equivalent without completing the degree.

There may be occasions where the admissions of Ph.D. Aspirants end up in protracted correspondence. If the admissions are finalised before the starting of the semester the students will be registered in that semester. Otherwise the admission will be deferred to a subsequent semester. For administrative purposes there will be a last date for submission of application in each semester. However, an application submitted beyond the last date will be automatically considered for the next semester.

All 'Ph.D. Aspirants' after passing the qualifying examination shall seek formal admission to the Ph.D. programme at the earliest opportunity available to them and register in the Ph.D. Courses.

Components of Ph.D. Programmes

The components are (a) Course work, if necessary; (b) Qualifying Examination; (c) Foreign Language, when required; (d)Teaching Practice/Practice Lecture Series; (e) Seminar/Independent Study; and (f) Ph.D. Thesis.

Operational Features

a) Place of work:

On-Campus: Any of the BITS Campuses.

Off-campus Centre: Any of the Off-Campus centres of BITS where Practice School, Work-Integrated Learning programmes are conducted and organisations having collaborations and research linkages with BITS.

Outside Centre: In worthy circumstances, an outside centre not covered by the above may be approved.

b) Topic of Thesis:

From areas of focus of the Institute or from problems of intimate concern to the in-house R & D needs of the host organisation.

c) Supervisor:

Subject to final approval by the Research Board, technically any person of standing, authority and competence can become the supervisor for the Ph.D. thesis. A supervisor at any point of time is any senior faculty member of the Institute or a person with equivalent responsibility in the campus or in an off-campus centre. However, rules provide for any outstanding person outside the Institute and the name can be suggested by the candidate.

d) Places and Dates of Qualifying Examination:

Normally arranged in January and August each year at Pilani but may also be arranged on other dates or at an off-campus centre with prior approval.

S.No.	Areas of Research
1.	**Biological Sciences**: Environmental Biotechnology, Bioinformatics, Microbial Biotechnology, Molecular Parasitology, Molecular Biology, Molecular Diagnostics, Genomics, Plant Biotechnology.
2.	**Bioengineering:** Biomaterials, Biomechanics, Bioinstrumentation, Bio-transport Process.
3.	**Civil Engineering:** Structures, Water Resources, Geotechnical, Transportation, Environmental Engineering, Image Processing and G.I.S., Disaster Management, Earthquake Engineering, Solar Architecture, Finite Element Method, Non-traditional optimization algorithms, Artificial Neural Networks, Fuzzy Logic and Multicriterion Decision Making and their applications.
4.	**Chemical Engineering:** Biochemical Engineering, Biomass Gasification, Computation Fluid Dynamics, Energy Engineering, Environmental Engineering, Evolutionary Computation, Modeling and Simulation, Multi-Objective Optimization, Multiphase Reactors, Process Dynamics and Control, Process Integration and Process Intensification, Reaction Engineering, Polymer Science and Engineering, Process Synthesis and Design, Separation Processes and Petroleum Refining and Petrochemicals.
5.	**Chemistry:** Organic Chemistry including natural products, Bioorganic, Inorganic, Bioinorganic Chemistry, Physical, Medicinal, Analytical, Green, Theoretical and Computational Chemistry, Nanomaterials, X-ray crystallography.
6.	**Computer Science & Information Systems:** Computer Networks, Distributed Systems, Database Systems, Software Engineering, Operating Systems, Multimedia, Computer Control Systems, Computer Architecture, Compilers, Formal Methods, Information Retrieval
7.	**Economics and Finance**: Macroeconomic Models and Policy, Microeconomic Analysis, Money and Financial Markets, Financial Engineering, Econometric Studies, Financial Modeling, Mathematical Economics, Environmental Economics, Resource Management Systems, Growth Economics, Banking, Micro Finance, Capital Markets, Macroeconomic Modeling, Applied Finance, Environment and Resource Economics International Trade and Finance, Strategy, Financial Management, Corporate Planning, Entrepreneurship, Project Management.
8.	**Electrical and Electronics Engineering:** Communication Systems, Wireless and Mobile Ad-hoc Networks, Optical Communication and Networks, Microelectronics and VLSI Design, Signal Processing and Embedded Systems, Power Electronics and Drives, Power Systems, Telecommunication, Robotics and Intelligent Systems, Fiber Optic Sensor, Artificial intelligence techniques in robotics, Instrumentation & control, Wearable computing, Energy and Power Systems.
9.	**Humanistic Studies:** Gender Issues including Women Studies, Medical Sociology, Developmental Sociology, Indology, Governance, Business Ethics, Conflict Management, Ethical Communication, Social Development, Sustainable Livelihoods, Consciousness Studies, Social Ecology.

S.No.	Areas of Research
10.	**Languages:** Professional Communication, ELT, Literature and Cinema, English Language and Literature, Softskills, Mass Communication.
11.	**Mathematics:** Coding Theory, Cryptology, Algebraic Geometry, Parallel Computing, Fuzzy Logic and its applications, Water pollution, Mathematical Modelling, Nonlinear functional analysis, Computational fluid dynamics, Optimization, Operations Research, Mathematical Biology, Differential equations, Fractional Calculus, Dynamical System, Epidemiology.
12.	**Mechanical Engineering:** Product Design & Development, Manufacturing Engineering, Manufacturing Excellence Practices, Thermal Engineering, Materials Engineering, Fracture Studies, Non-destructive Testing, Energy Systems Engineering, Robotics and Intelligent Systems.
13.	**Management**: Strategic Management, Total Quality Management, Performance Management, Knowledge Management, Services' Management, Entrepreneurship, Managerial competencies, Innovation and Business creativity, Marketing Research, Marketing, Retail Management, Quantitative methods and Business simulation, International Business, Business Ethics, Management Information systems, R & D Management, Operations Management, Operations Research, Supply Chain Management, E-Commerce, Project Appraisal, Project Management, Risk Management, Financial Management, Strategic Cost Management, Capital Markets, Corporate Restructuring Mergers & Acquisitions, Organizational Behavior, Conflict Management & Negotiations, Human Resource Management, Organizational Change & Development, Leadership, Managerial Practices, Corporate Social responsibility, Enterprise resources planning.
14.	**Pharmacy**: Drug Design, Synthesis and Screening of New Bioactive Molecules, Drug Delivery Systems, Phytochemistry and Natural Drugs.
15.	**Physics**: Materials Physics, Condensed Matter Physics, Nuclear, Particle & High Energy Physics, Optics & Spectroscopy.
16.	**Interdisciplinary Research:** Nanotechnology and nanoscience, Nano-robotics, Micro-electro-mechanical systems (MEMS), Nanomaterials, Mechatronics
17.	**Educational Innovation and Institutional Development**

PART III
ADMISSION MODALITY

ADMISSION MODALITY

Admissions are made on an all India basis. English is the medium of instruction for all the programmes in the Institute. Selection is based entirely on candidate's merit, his/her preference, facilities available and availability of seats. Some details of admission modality for all the three tiers of education are described in the following paragraphs.

INTEGRATED FIRST DEGREE PROGRAMMES

Admissions will be made purely on merit. The merit position of the candidate will be based on the score obtained by the candidate in a Computer based Online Test (**BITSAT**) conducted by BITS, Pilani.

Eligibility for admission:

For admission to all the Integrated First Degree programmes candidates should have passed the 12th examination of 10+2 system from a recognized Central or State board or its equivalent with Physics, Chemistry, and Mathematics and adequate proficiency in English.

The candidate should have obtained a minimum of aggregate 80% marks in Physics, Chemistry and Mathematics in 12th examination, with at least 60% marks in each of the Physics, Chemistry, and Mathematics subjects.

For **BITSAT–2010,** candidates who fulfill the following conditions are eligible to appear:

- Students appearing for 12th examination in 2010
- Students who have passed the 12th examination in 2009 provided they explain the reasons for the gap. The admissions committee will examine all such cases before taking a final decision on their eligibility.
- Should have taken Physics, Chemistry, and Mathematics (PCM) subjects in 12th class.

Note:

1. Students should have appeared in/ passed the 12th examination of the 10+2 system from a recognized Central/ State board.
2. Students who have passed 12th examination in 2008 or previous years and have already joined any other educational Institution for higher studies will be considered for admission under 'Advanced standing' basis, which is explained in the earlier part.
3. Students who are presently studying in BITS at any of its campuses are NOT eligible to appear in BITSAT.
4. The Institute considers only the latest performance through a public examination for admission. If the results of the latest examination are not available within the due date for submission of application, the candidate will not be considered even if there are some earlier performances of 12th class or its equivalent or any higher examination available with him/her. If a candidate has taken more than one attempt in 12th class or its equivalent, only his latest performance is considered, provided this attempt has been for the full component of subjects/courses prescribed.

Direct Admission to Board Toppers:

In the past, admission process of the Institute always ensured guaranteed admission to all the students who obtained first ranks in their respective board examinations. This has given a very vital input of highly meritorious students from all over India. Continuing this tradition, the Institute will give direct admission to first rank students of all the central and state boards to the programme of their choice, irrespective of their BITSAT-2010 score. However, they should have obtained the minimum marks in PCM SUBJECTS in 12th examination, as described above. For more details, see the later sections in this part and also the BITS website.

The mechanism of admission procedure:

(i) Applying for admission:

All candidates who have appeared in BITSAT-2010 and are interested in admission will be required to submit application forms with 12th marks and programme preferences **before 30th June 2010. All applications are to be filled Online.** The filled forms are to be printed and should be posted along with the enclosures to reach the Institute before the deadline, which is **30th June 2010.**

(ii) Preparation of Merit List for Admission:

The merit position of all eligible candidates (i.e., those who have appeared in BITSAT-2010 and have submitted application form for admission in the prescribed format with 12th marks, preferences and the required fees) will be prepared on the basis of their total scores in BITSAT-2010.

When the BITSAT score of two candidates are the same:

- First their scores obtained in Mathematics in BITSAT will be considered for separating them
- If the tie still exists, then their scores in Physics in BITSAT will be considered for separating them.
- Further tie is eliminated using their scores in Chemistry in BITSAT.
- Finally, their PCM total marks in 12th examination will be considered for their separation.

The candidate have to fill only a single application form for seeking admission to all the degree programmes offered at Pilani, Goa and Hyderabad campuses. The candidate's order of preference for different programmes offered at Pilani, Goa, and Hyderabad campuses of the Institute is processed through a computer and the offers are made. This may take a few iterations and at each stage, the status is made available to the candidates at the Institute's website www.bitsadmission.com through Internet.

For a candidate to remain in the race, it is mandatory that the following conditions are fulfilled and strictly adhered to by the candidates:

(i) The Data provided by the candidate in the application form with respect to the candidate's background, academic performance, and order of preference for various degree programmes etc. is final.

(ii) The required fees as mentioned in the communication from the Institute are paid in advance and the candidate does not raise any new arguments in this connection.

(iii) A candidate, whether offered admission/ placed on waiting list, cannot withdraw and claim refund of fees once he has entered the competition.

Any candidate who seeks to alter the above conditions in the middle of this process is liable to disqualify himself/herself and forfeit 20% of total fees (i.e., admission fee and one semester fee). See the section on 'Advance Fees, Refund and Forfeiture of Fees' later in this part.

(iii) The Actual Mechanism of Admission:

The facilities of the Institute are pronounced invariably in terms of the ratio of seats allotted between the different programmes rather than in terms of a fixed number of seats. The total number of admissions made may vary from year to year. The change in the total number of seats takes place primarily to adjust to the requirements of a highly flexible system which accommodates a second semester admission, dual degree, admission with advanced standing, transfer, etc.

In order to reduce the number of iterations, based on earlier experience and on a statistical projection of the responses received, the Institute might make admission

offers to a larger number of candidates than the number of seats earmarked.

The computer is programmed to assign the seats starting from the first candidate on the merit list and going down the same until all seats are filled up. At any time when the computer considers a candidate, it first tries to accommodate the first preference of the candidate and goes to his/her second preference if his/her first preference could not be accommodated and so on. Assignments for all programmes are thus completed and immediate admission offers are made.

Based on our past experience, a certain number of candidates would be placed on waiting list. Whenever vacancies arise, the procedure of assignment would be exactly the same as described above. During each iteration, a *de novo* assignment starting from the first candidate in the merit list will be made. Of course, in this operation, candidates who have declined the offer and/or who have not paid fees would be removed from the merit list. It is now clear that in this process not only some of the candidates who are on the waiting list will get an assignment but also certain students who have already got an assignment may now get a new assignment to one of their higher preference if seats are now available. The waiting list of the Institute has the following characteristics namely:

(i) The cut-off point for the waiting list is arrived at by our past experience in terms of the responses from the candidates, the number and the quality of candidates who have applied in the current year with a view to complete the admissions and start the classes in time.

(ii) Those who are admitted to a programme will continue to be on the waiting list for their higher preferences.

(iii) The waiting list is for admission to the Institute and not for a particular programme, Hence it will not be possible to assign a waiting list number for a student for a particular programme.

(iv) A student who has a higher BITSAT score may be on the waiting list while a student who has a lesser BITSAT score may have got admission because the former crossed out a programme which the later has opted for and seats were available in that particular programme.

(v) Those who cross out a programme not only cease to be candidates for admission to the programme but also for consideration on the waiting list of the programme.

(vi) Those who get offers to be on the waiting list must pay their fees in advance to remain in the waiting list.

Some tips on showing preferences and crossing out: The candidates are strongly advised to exercise their preferences after careful consideration. ***No candidate at any time of the operation can change his/her preferences or refuse to slide up in his/her order of preference till the entire admission process is completed.*** If a candidate wishes to join BITS irrespective of the programme so that he can float up until the admission process is complete or he can avail of certain unusual flexibilities like dual degree etc. it would not be in his interest to cross out any programme. The other extreme is where a candidate is absolutely sure of his inclination and such candidates would be advised to show preferences to those limited programmes only and cross out the rest.

Normally a candidate cannot change the preferences once submitted. However, if for any reason a candidate discovers a mistake in his preferences already submitted, he can submit a request for change of preferences in the prescribed format, before the last date for submitting applications. Please see BITS website for details.

Admissions at Pilani Campus, K.K. Birla Goa Campus and Hyderabad Campus:

As already announced, admissions to BITS, Pilani - Pilani Campus, BITS, Pilani - K.K. Birla Goa campus and BITS, Pilani - Hyderabad

Campus will be made through a single admission process. In the different admission iterations mentioned in the earlier paragraphs, it is possible that a student who has got an admission offer for a programme in one campus gets slided up for a programme at the other campus in the next iteration. Once a student reports for admission at a particular campus, he remains in the waiting list for the programmes of his higher preferences at the other campuses, till all admissions are finalized. To minimize inconvenience to students, once the student has reported for admission at any one of the campuses, he/she will be given a chance to opt out of the race for the programmes offered at the other campuses and he/she will be considered only for programmes of his/her higher preferences at the campus where he/she has joined. The student has to make the decision on this option on the day of reporting for admission. Further instructions in this regard will be sent to those who have been offered admission.

In all the above matters, the Vice-chancellor's decision shall be final.

Dual degree for Group B students: To meet the ambitions of the students who could not get admission to B.E.(Hons.)/B.Pharm.(Hons.) programmes, the Institute has created facilities by which any student who is admitted to M.Sc.(Hons.) programmes is accommodated in a dual degree scheme for a second degree in B.E.(Hons.)/ B.Pharm.(Hons.) programmes. This assignment is made by competition on their performance at BITS at the end of first year, separately in Pilani, Goa and Hyderabad campuses. Requirements of both the degrees are structured to be completed normally in five years.

Eligibility criteria for admission under 'Direct admission to Board toppers' scheme:

To be eligible for admission under the 'Direct admission to Board toppers' scheme, the candidate should be the topper from the science stream having taken Physics, Chemistry, Mathematics subjects in 12th. To identify the topper the following criteria will be adopted.

The topper is the student who fulfills the following criteria:

(a) has taken Physics, Chemistry, and Mathematics subjects in 12th and

(b) has obtained the highest aggregate percentage of marks in 12th among all the students who have taken Physics, Chemistry, and Mathematics subjects in 2010 from the Board. For the purpose of calculating the aggregate percentage, the aggregate marks should include the marks of Physics, Chemistry, and Mathematics subjects in addition to other subjects which are required to pass the 12th examination from the Board under consideration. Further, the Physics, Chemistry, Mathematics subject marks should be included in the aggregate, irrespective of whether the Physics, Chemistry, and Mathematics subjects are identified as main/optional/elective in his marksheet(s).

Applicants under the scheme should attach documentary proof in support of their claim, along with the 12th mark sheet and a letter from the Board declaring the candidate as the topper in the specified stream. The Institute will also make efforts to get these data from the different boards on its own. In all cases, the Institute will be guided by the data provided by the concerned Board. In cases where for a particular board, the data available before the deadline is insufficient or inconclusive, the admission committee may decide not to make any offer under the scheme for that specified Board. In all such cases, the decision of the Vice chancellor will be final and binding on the applicants.

The applications are to be made online. The filled forms are to be printed and should be posted along with the enclosures to reach the Institute before the deadline, which is **30th June 2010**. See the BITS website for more details.

HIGHER DEGREE PROGRAMMES

Admissions to **Higher degree Programmes** are based on the performance of the candidates in the **computer based online test** and/or written test, group discussions and interviews conducted by BITS at its campuses/any other places. The final selection is based on the performance of the candidates in the tests, group discussions and interviews. The details of test, syllabus for the test, etc., are available at the BITS website, http://www.bitsadmission.com.

Ph.D. PROGRAMME

For admission to the on-campus Ph.D. programme of the Institute, the marks/grades of the candidate in the latest examination as well as his performance in a specially designed admission test and/or interview would be considered.

OFF-CAMPUS Ph.D. UNDER Ph.D. ASPIRANT SCHEME

The Institute offers a unique opportunity for employed professionals working in Industries and R&D organizations and having long experience and proven competence in various fields to work towards Ph.D. degree of the Institute in the settings of their respective work environments. Candidate holding any of the BITS degree or working in an organization collaborating with BITS will normally be considered under this scheme. Industries interested for the development of their manpower at the doctoral level are invited to seek collaboration with BITS and sponsor their suitable candidates along with their applications in the prescribed format.

FOREIGN STUDENTS OR INDIAN STUDENTS HAVING QUALIFICATIONS FROM FOREIGN COUNTRIES

The Institute welcomes foreign students but the admission is strictly made on the basis of merit. There is no separate provision for admission of such candidates and they have to compete with all other candidates, as per the procedure already described above for various degree programmes.

In order to verify the eligibility for admissions, the candidates should enclose, with their application, documents explaining grading/marking system and calculation of cumulative grade point average/ aggregate percentage of marks along with their transcript/ mark sheet. Further the candidates must send a copy of syllabus of courses and rules and regulations for the examinations they have passed well in advance.

Students should request their examining authorities to send the transcript/ mark sheet with relevant documents directly to Admissions Officer, BITS, Pilani - 333 031, India so as to reach him before the deadline.

A specially appointed committee examines all applicants with foreign qualifications regarding their eligibility for admissions.

Graduates of BITS

Candidates who come with a degree where the structure and the features of the programme are similar to that of BITS are naturally ready to fit more effectively into the BITS educational system. This experience prompts the Institute often to describe the prior preparation for another degree in the same tier or a degree in a higher tier in terms of not only a minimum qualification but also specific courses which they should have done.

Admission with advanced standing

For details refer to the section on flexibilities in the previous part.

Admission with marginal deficiency

For details refer to the section on flexibilities in the previous part.

Casual Students

Persons, other than regular students of BITS who desire to register for some courses to update their knowledge are designated as casual students. Casual students can register for courses on audit only and cannot enroll for a degree. The facility of taking a course on audit is principally conceived to give an

opportunity to a person to update his knowledge and he cannot claim acceptance of such a course for the fulfillment of requirements of any programme, current or future.

This scheme has been devised to take care of professionals from various industries and organisations who express a desire to update their knowledge, although they, ipso-facto, have no desire to work for a degree.

Persons desiring to register as casual students should apply on the prescribed form within the last date.

Whenever such a student is admitted he may be allowed to continue as a student for a maximum period of eight registered semesters. However, he should request at the end of every semester for permission to continue him as a casual student in the succeeding semester.

The Institute may offer direct admission to a limited number of children of the staff of BITS and BET and also to some meritorious students from the schools of BET in Pilani to non-professional programmes with a proviso that the students admitted to these programmes will not be eligible for any of the flexibilities like transfer to and dual degree in any of the professional programmes.

INFORMATION FOR CANDIDATES

(To be read in conjunction with the instructions given in the application form and any other communications sent from the Institute).

APPLICATION PROCEDURE

Application for admission should be made on the prescribed form. Separate application forms are prescribed for (i) Integrated First Degree Programmes (ii) Higher Degree, MBA and MPH Programmes (iii) Doctoral Programmes.

(i) Integrated First degree Programmes:

In order to apply for admission to the Integrated First Degree programmes, the candidate should have appeared in the online computer based test (BITSAT) as per the announcement made by the Institute through separate advertisement and brochures. The last date for registering for BITSAT-2010 was 30th January 2010 and BITSAT-2010 tests are scheduled between 10th May and 10th June 2010.

In addition to the application made earlier for registering for BITSAT test, they should apply for admission by submitting the prescribed form, complete in all respect, so as to reach the Institute before the deadline, i.e., 5:00 PM on 30th June 2010.

The application forms are available at the BITS website and are to be filled online. The print out of the filled forms should be sent to the Institute along with an Admission application fee of Rs. 200/- only with each form.

Last Date for Submission of Completed application for Integrated First degree Programmes:

First Semester: 5.00 P.M. on 30th June 2010

Second Semester: 5.00 P.M. on 30th November 2010 (Refer to section on Flexibilities in the earlier part).

(ii) Higher Degree and Ph.D. programmes:

Interested and eligible candidates should apply through the prescribed application form available online at **http://www.bitsadmission.com/** and take the printout of the filled form and submit the filled form to the Institute before the deadline mentioned below. The filled form should be accompanied by requisite fee of Rs. 1500/- for higher degree and Ph.D. programme.

Last Date for Submission of Completed applications:

First Semester: 5.00 P.M. on 31st May 2010

Second Semester: 5.00 P.M. on 30th November 2010 (Refer to section on Flexibilities in the previous part).

Some Important Instructions

(1) The application process, announcement of results after each iteration, detailed instructions etc. are all announced at BITS website during the various stages of the admission process. It is the responsibility of the candidate to follow these announcements and instructions.

(2) Application forms sent by FAX or Email will not be accepted.

(3) The number on your application form is unique. Quote this application number in all subsequent correspondence with the Institute.

(4) If you are accepting the offer of admission/accepting to be placed on the waiting list you will be required to pay fees in advance, as per the instructions mentioned along with the offer.

(5) Whenever admissions are made in the second semester a separate notification to this effect will be issued. Applications for second semester admission should be submitted only after such a notification.

(6) If you desire to be considered for the award of Institute merit-cum-need scholarships, you will be required to submit an income certificate showing gross income of your Parents/Guardian, duly signed by the 1st Class Magistrate/Notary Public. Persons in service should submit a certificate from employer showing separately basic salary and other allowances.

Enclosures with Application

Applications for admission to integrated first degree programmes should be accompanied by the following documents:

(1) An attested photocopy of the X pass/ Matriculation/Secondary School certificate issued by the Board.

(2) An attested photocopy of the marksheet of the qualifying and any other higher University/Board examinations passed.

The BITSAT score for each of the candidate will be taken from the Institute records.

SELECTION FOR ADMISSION

Candidates are finally admitted to the Institute subject to the following conditions:

(1) They have paid the requisite fees asked for in their admission/waiting list letters.

(2) They are declared medically fit by a registered medical practitioner.

(3) They have submitted all required original marksheets & certificates, with photocopies, and the statements made in their application forms are verified against their originals.

(4) They fulfill the eligibility requirements.

For Integrated first degree programmes, on the reporting day at Pilani/Goa/Hyderabad, a Dean/Senior faculty member of the Institute will interact with the candidates. If any candidate fails to be personally present on that day, his admission will stand automatically cancelled.

Every admitted student is required to undergo a registration process on the day announced for the purpose. One of the objectives of the registration process is to name the courses to be pursued during a given semester, after allowing for the student's options within the prescribed rules and regulations. By this

process, each student makes his own Time Table at his own responsibility, to be followed in that semester. **No student will be permitted to attend classes or use any of the Institute facilities without completing the registration process.**

Advance fees, Refund and Forfeiture of fees

In the Integrated First Degree programmes, a candidate selected for admission/placed on the waiting list will be required to pay fees in advance subject to the following conditions:

(1) If a candidate is offered admission to any programme of his preference, he has to pay within the deadline prescribed requisite fee of Rs. 65,000/- *(which includes the admission fee of Rs. 15,000/- and one semester fee)*. However, if a candidate is placed on the waiting list, he has to pay only part fees of Rs. 15,000/- and subsequently, if he is offered admission he has to remit in advance the balance fee *(of Rs.50,000/-)* before reporting for admission or deposit the same on the day of reporting for admission as announced in the wait list offer.

(2) If a candidate is offered admission either directly or from the waiting list but he does not join the Institute, his admission will automatically stand cancelled and **he will forfeit Rs. 13000/- which is 20% of total fees (i.e., admissions fee plus ones semester fees)** and the balance of the fees paid by him will be refunded. However, if he joins the Institute and subsequently withdraws either before the registration or after the registration, **he will forfeit the total amount of advance fees paid by him**.

(3) If the Institute is not able to offer a Wait-listed candidate admission to any programme of his preferences as shown in his application form, the total amount of advance fees will be refunded to him.

(4) A candidate, whether offered admission/ placed on waiting list, cannot withdraw from competition and claim refund of fees once he entered the competition by paying the required advance fees.

(5) While remitting advance fees no candidate can stipulate any conditions such as changing order of preferences, addition/deletion of preferences etc. Even if any such conditions are mentioned while remitting fees, it will be ignored.

For higher degrees, conditions stipulated in the Instructions sheet sent to the shortlisted candidates, will be applicable.

The Institute reserves the right to refuse admission to any candidate without assigning any reason. The decision of the Vice-chancellor in the matter of admission and allotment of programmes of study shall be final.

SCHEDULE OF FEES

A. The following is the details of the fees payable by all students admitted in the academic year 2010-2011 at **BITS, Pilani - Pilani Campus.**

Fees	Integrated First Degrees	Higher Degrees	Ph.D. Programme
Admission Fees	15,000/-*	15,000/-	15,000/-
Semester Fees			
First Semester	50,000/-	50,000/-	25,000/-
Second Semester	50,000/-	50,000/-	25,000/-
Summer term	25,000/-	25,000/-	15,000/-
Students' Union fee	200/- pa	200/- pa	—
Students' Aid Fund	50/- pa	50/- pa	—
Hostel fee (for on-campus students only)			
First Semester	2000/-	2000/-	2000/-
Second Semester	2000/-	2000/-	2000/-
Summer term	1000/-	1000/-	1000/-
Ph.D. thesis examination fees	-	-	1000/-
Mess & Electricity advance			
First Semester	6000/-	6000/-	6000/-
Second Semester	6000/-	6000/-	6000/-
Summer term	3000/-	3000/-	3000/-
(Payable at the beginning of each semester/term and adjustable at the end of the same)			
Hostel, ICT, Infra Structure Modernization Fees	1000/-	1000/-	1000/-
Institute Caution Deposit	2000/-	2000/-	2000/-
Fee for Eligibility Test(s) / Ph.D. Qualifying Examination	Institute reserves its right to charge such a fee, which would be adjustable against admission fees if the candidate secures admission		

B. The following is the details of the fees payable by all students to be admitted in the academic year 2010-2011 at **BITS, Pilani – K.K. Birla Goa /Hyderabad Campus.**

Fees	Integrated First Degrees	Higher Degrees
Admission Fees	15,000/-*	15,000/-
Semester Fees		
First Semester	50,000/-	50,000/-
Second Semester	50,000/-	50,000/-
Summer term	25,000/-	25,000/-
Students' Union fee	200/- pa	200/- pa
Students' Aid Fund	50/- pa	50/- pa
Hostel fee (for on-campus students only)		
First Semester	3000/-	3000/-
Second Semester	3000/-	3000/-
Summer term	1500/-	1500/-
Mess & Electricity advance		
First Semester	6000/-	6000/-
Second Semester	6000/-	6000/-
Summer term	3000/-	3000/-
(Payable at the beginning of each semester/term and adjustable at the end of the same)		
Hostel, ICT, Infrastructure Modernization Fees	1000/-	1000/-
Institute Caution Deposit	2000/-	2000/-

Notes (Applicable to Pilani, Goa and Hyderabad Campus candidates):

1. The above prescribed semester fees is for students admitted in the academic year 2010-11. For these students, the semester fees will be increased in 2012-13 subject to a maximum of 20%.
2. If a student is admitted to a second degree programme under dual degree scheme, he/she has to pay Rs. 15,000/- towards admission fees of the second programme at the time such admission is made.
3. Course-wise Fees (Per Course): Rs. 1000/- (*Applicable to only certain limited courses outside academic requirement after paying full semester fees. No semester fee is computable on the basis of course wise fees*).
4. All fees are to be paid in advance. Only caution deposit and mess advance are refundable after adjustment of dues at the time of graduation or withdrawal from the Institute. This applies to prospective candidates who are seeking admission as well as ongoing students of the Institute.

Instructions for Payment

(1) The above schedule of fees is for a normal situation. Wherever a student's programme gets modified or his progress is delayed beyond the maximum permissible time, such a student is advised to consult the appropriate authority before registration.

(2) All students admitted earlier than July, 2010 will continue to be governed by the same schedule of fees as before. However it should be clear that they will have to pay along with the new students the same amount of fees for students' union fee, students' aid fund, hostel fee and mess & electricity advance.

(3) The fees and other charges are payable in advance in each semester/term on the notified dates before registration. No withdrawal from a course or courses will entitle a student for refund of fees.

(4) Students who go for Practice School II will be charged semester fees and the summer term fees because the practice school is longer than a semester and extends in to summer.

(5) Casual students will pay fees prescribed for regular students.

(6) Institute caution deposit is refundable only at the time of graduation or withdrawal from the Institute.

(7) If there are dues outstanding from a student, his grades will be withheld.

(8) Mess dues are to be cleared by each student every month. Students who accumulate mess arrears would be required to pay a prescribed additional advance at the time of next registration.

(9) Refunds, if any, will be made through crossed cheques/Bank drafts.

SCHOLARSHIPS

A large number of scholarships, fellowships and other financial assistance are available to the students of the institute. Past experience shows that about 30% of the students receive some form of financial assistance or other. For continuance of scholarships, scholarship holders are required to maintain good scholastic standings and good conduct.

(I) Assistance through Scholarships

A) Institute sources

I) For first degree students:

i) Merit scholarship, which covers reimbursement of full semester fees and admission fee, is awarded to top 10 students based on their academic performance.

ii) Merit-cum-need scholarship, which covers reimbursement either 50% or 25% of the semester fee, is awarded to the eligible students.

iii) Financial assistance from Students Aid Fund is also provided to the needy students.

All scholarships are made for one semester only and their continuance in the subsequent semester(s) will depend on the candidates performance in the Institute and his/her needs. On an average 25% of the students are benefited by these scholarships.

II) For full-time research scholars: If you are selected as a full-time research scholar, you may get Institute scholarship. For details, contact Research & Consultancy division.

B) Government and other agencies

(i) Scholarships under National Talent Search/ National Science Talent search Schemes.

(ii) Government of India National Loan Scholarship to under graduate students. Some State Governments also extend the loans.

(iii) Government of India National Scholarships.

(iv) Merit Scholarships, Merit-cum-need Scholarships and Need-cum-Merit Scholarships awarded by State Governments like PRATHIBA from Government of Andhra Pradesh.

(v) Government of India Scholarships for Scheduled Caste and Scheduled Tribe students.

(vi) National Scholarships to the children of Primary and Secondary School teachers.

(vii) Scholarships to children and Grandchildren of Political Sufferers.

(viii) Scholarships from various charitable trusts/ foundations like BHARTI Scholarship, Angira foundation Scholarship etc.

(ix) Students can also participate in the nationwide competitions for prestigious scholarships such as Aditya Birla Scholarship, Lucent Global Science Scholars programme and GE fund India Scholarship.

(x) Financial assistance from BITS Alumni through various BITSAA Scholarships like Bhushan Bhatia Scholarship, S K Agarwal Scholarship etc.

(xi) Goldmann Sachs Global Leader Scholarship of US $3000.

(xii) Two Scholarships from The Ministry of Non-conventional Energy Sources (MNES), Government of India for advanced study in the area of renewable Energy.

(xiii) Students admitted to higher degrees and Ph.D. will be recommended for award of scholarships/Fellowships from various sources like UGC, CSIR, DST, DBT, ICMR, etc. Those Scholarship are operated as per rules & regulations stipulated by the awarding authorities. Students admitted to higher degree programmes and who are qualified in GATE may apply to the UGC for GATE Scholarship and the Institute will forward such application to the UGC. It should be noted that the decision regarding award of the GATE Scholarship to the admitted students is made by UGC as per its existing norms and the Institute cannot guarantee such awards.

(xiv) Meritorious and committed students in higher degree may be awarded financial aid by the Institute. Every candidate who is awarded any financial aid will be required to discharge certain extra academic duty in lieu of this aid to the entire satisfaction of the Institute, failing which the aid may be terminated forthwith. The institute's decision on the award of this financial aid is entirely worked out by the Institute's own pre-declared procedure and is not dependent on the nationally conducted test like GATE etc.

(xv) Veltech Scholarship for higher degree students.

(xvi) HP Lab India provides three doctorial fellowships of Rs. 40,000/-p.m.

(xvii) Microsoft Research India provides one doctorial fellowships of Rs. 17,000/-p.m.

For financial assistance from Institute funds you can apply in response to the notices which generally appear at the end of each semester. If you are at the Practice School station the notices will reach you at your stations. File your application in accordance with specified conditions and do not forget to submit the needed documents along with it. If you fail to submit your application in time or do not submit required documents you will not be considered for award of financial assistance.

The procedure for making applications for aid from Government sources and other external agencies is as follows:

a) Obtain a blank application form from the Director of College Education of the State Government concerned or the appropriate authority. If forms are received in Institute offices, this fact is duly notified. The last date for submission of these forms is generally August 15.

b) Complete the form in all respects, viz. fill up all entries, attach all enclosures (true copies of marks sheets, photo, income affidavit, certificate of being a bonafide student, being a hosteller, joining date, etc.).

c) Hand over these papers at least 10 days before the due date to the office of Dean, Student Welfare Division along with a covering letter.

d) Past experience shows that outside agencies send their sanction letters very late, sometimes even after the month of December. As such, interim enquiries would be unnecessary. As and when sanction letters or cheques are received, students will be informed. They should then note down the number and date of sanction letter for their future reference.

e) Encashment of out-station bank drafts takes some time. Hence the dates of actual payment by the Institute will always be later than receipt of drafts and will be duly notified.

f) All scholarship amounts are directly transferred to the mess accounts of the concerned students.

STUDENT RECORD

The students' records are computerized and a grade sheet for each semester is issued to the student normally within one week after the comprehensive examination.

The grade sheet will be withheld when a student has not paid his dues or when there is a pending case of breach of discipline or a case of unfair means against him.

The Institute issues a transcript (an up-to-date performance of a candidate from the date of his entry to the date of his leaving the Institute) to all the passing out candidates at the end of each semester/summer term normally within four weeks of the last examination. The provisional certificate and a cheque for refund of deposits in the Institute are also issued at the same time. This estimate is based on an assumption that each candidate has ensured by prior initiative that there is nothing pending against him on academic, financial and disciplinary matters.

Since all student records are computerized, each student is assigned a unique identification number (ID No.) which is constructed by building in the number certain information to assist in data storage and data retrieval. No two ID numbers are ever identical.

Degree programmes are assigned codes as below and the ID No. carries the degree programme code(s) along with other information such as year of admission, whether in Practice School (PS) or Thesis (TS) stream and the last character indicates the campus which a student belongs to. For example, 2009A1PS350P refers to a student admitted in 2009-10 to B.E.(Hons.) Chemical Engg. (with Practice School) programme at Pilani Campus. The higher degree students are assigned ID No. indicating whether the candidate is in PS stream (K1) or in the Dissertation (H1) stream. For example, 2009K103350P refers to a student admitted in 2009-10 to M.E. Computer Science (with Practice School) programme at Pilani Campus.

Programme Codes

First Degree Programmes	
B.E. (Hons.) Chemical	A1
B.E. (Hons.) Civil	A2
B.E. (Hons.) Electrical & Electronics	A3
B.E. (Hons.) Mechanical	A4
B.Pharm. (Hons.)	A5
B.E. (Hons.) Computer Science	A7
B.E. (Hons.) Electronics and Instrumentation	A8
B.E. (Hons.) Biotechnology	A9
B.E. (Hons.) Electronics & Communication	AA
B.E. (Hons.) Manufacturing Engineering	AB
M.Sc. (Hons.) Biological Sciences	B1
M.Sc. (Hons.) Chemistry	B2
M.Sc. (Hons.) Economics	B3
M.Sc. (Hons.) Mathematics	B4
M.Sc. (Hons.) Physics	B5
M.Sc. (Tech.) General Studies	C2
M.Sc. (Tech.) Engineering Technology	C5
M.Sc. (Tech.) Information Systems	C6
M.Sc. (Tech.) Finance	C7

Higher Degree Programmes	
M.E. Biotechnology	29
M.E. Chemical	01
M.E. Chemical with specialization in Petroleum Engineering	45
M.E. Civil with specialization in Structural Engineering	43
M.E. Civil with specialization in Transportation Engineering	30
M.E. Civil with specialization in Infrastructure Systems	44
M.E. Communication Engineering	24
M.E. Computer Science	03
M.E. Design Engineering	41
M.E. Electrical with specialization in Power Electronics & Drives	31
M.E. Embedded Systems	40
M.E. Manufacturing Systems Engineering	42
M.E. Mechanical	06
M.E. Microelectronics	23
M.E. Software Systems	12
M.Pharm.	08
M.Pharm. with specialization in Pharmaceutics	46
M.Pharm. with specialization in Pharmaceutical Chemistry	47
M.B.A.	49
MPH	37
M.Phil. (Chemistry)	36

RULES AND REGULATIONS

All students admitted to the Institute will be governed by the Rules and Regulations that are prescribed from time to time.

Anti-Ragging

As per the directive from the Honourable Supreme Court of India, Institute has formulated strict anti-ragging guidelines and all the students are required to sign an affidavit to abide by these guidelines. Students, if found violating these guidelines are liable to disciplinary action including lodging of a criminal case against the erring students at the Police Station as well as expulsion from the institute. The institute has formed anti-ragging committee and anti-ragging squads at institute and hostel level to combat ragging. Students may contact Dean, Student Welfare Division / Chief Warden / Wardens of respective hostels, if required. The students can also communicate directly with the Dean, Student Welfare Division, through the Institute SWD webpage.

INFORMATION FOR CANDIDATES FOR ALL OFF-CAMPUS PROGRAMMES

Prospective candidates must consult the separate section in the Institute Bulletin. They should note that a separate application form is provided for admission to Off-Campus programmes. It is further to be noted that all rules, regulations will automatically apply in the Off-Campus programmes. Information about these can also be obtained at http://www.bits-pilani.ac.in/dlp-home/

INFORMATION FOR CANDIDATES APPLYING FOR DUBAI CAMPUS

Prospective Candidates interested in admission to B.E (Hons.) Programmes at BITS, Pilani - Dubai Campus may download a copy of the online Bulletin and admission form from http://www.bitsdubai.com/

Admission to BITS, Pilani – Dubai (BPD) is based entirely on the candidate's merit, his/her preferences, and availability of seats in the discipline preferred. The merit position of the candidate for admission will be based only on the overall aggregate secured by the candidate in the Qualifying Examination and not based on any entrance test. While the Dubai Campus has been set-up, specially to cater to the educational requirements of the residents of the GCC (Gulf Cooperation Council) countries, candidates from India and other countries are also eligible to apply.

The admission process at BITS, Pilani – Dubai Campus takes place through two merit lists separately for GCC and Non-GCC candidates. Last date for receipt of Applications for GCC candidates is 15th June, 2010 – 5.00 p.m. and their admission list will be declared on 16th June, 2010. Last date for receipt of Applications for Non-GCC candidates is 4th July, 2010 – 5 p.m. and their admission list will be declared on 6th July, 2010. Admissions in the following programmes are offered for the Academic year 2010-2011 commencing 29th August 2010.

- B.E. (Hons.) Computer Science
- B.E. (Hons.) Electrical & Electronics
- B.E. (Hons.) Electronics & Communication
- B.E. (Hons.) Electronics & Instrumentation
- B.E. (Hons.) Mechanical
- B.E. (Hons.) Chemical
- B.E. (Hons.) Biotechnology

For more details, please visit BITS, Pilani - Dubai campus home page: http://www.bitsdubai.com/

PART IV
DETAILS OF PROGRAMMES

Legend

AAOC	Analysis and Application Oriented Courses
Bio	Biological Sciences
BIOT	Biotechnology
CDC	Compulsory Discipline Courses
CDP	Courses on Development Process
CE	Civil Engineering
Che	Chemical
Chem	Chemistry
CHI	Chinese
CS/Comp/Comp Sc	Computer Science
DCOC	Discipline Courses other than Compulsory
EA	Emerging Area
Econ	Economics
ECE	Electronics and Communication Engineering
EEE	Electrical & Electronics Engineering
EI	Electronics & Instrumentation
ES	Engineering Science
ET	Engineering Technology
Engg	Engineering: Chemical, Civil, Computer Science, Electrical & Electronics, Electronics & Instrumentation, Electronics and Communication, Manufacturing, Mechanical
ENGL	English
Exptl Sc	Experimental Science: Biological Sciences, Chemistry, Physics
Fin	Finance
FRE	French
GER	German
HSS	Humanities and Social Sciences
IS	Information Systems
ITEB	Internet Technology and e-Bussiness
JAP	Japanese
L	Lecture hours per week
Math	Mathematics
MBA	Master of Business Administration
Mech	Mechanical
MF	Manufacturing Engineering
Min/Max	Indicates minimum/maximum number of units specified in a course or semester programme
Mgts	Management
MGSYS	Management Systems
MM	Manufacturing Management
MPH	Master in Public Health
MST	Material Science and Technology
P	Practical, Seminar & Project, etc. hours per week
PHIL	Philosophy
Pharm	Pharmacy
Phy	Physics
RUS	Russian
SS	Software Systems
Sc.	Biological Sciences, Chemistry, Economics, Mathematics, Physics
T	Suffixed to a course number indicates that a non-letter grade will be awarded in such a course
TA	Technical Arts
TOC	Technique Oriented Courses
U	Number of units associated to a course

Course descriptions are available at: **www.bits-pilani.ac.in/courses/fs_coursedescriptions.html**

STRUCTURE OF THE INTEGRATED FIRST DEGREE PROGRAMMES

GROUP A, B AND C PROGRAMMES (More specifically B.E. (Hons.): Biotechnology, Chemical, Civil, Computer Science, Electronics & Communication, Electrical & Electronics, Electronics & Instrumentation, Manufacturing, Mechanical, B.Pharm. (Hons.) in Group A, M.Sc. (Hons.) : Biological Sciences, Chemistry, Economics, Mathematics, Physics in Group B and M.Sc. (Tech.): General Studies, Engineering Technology, Information Systems, Finance in Group C).

The structure of these programmes has sought to identify commonality amongst the various programmes as well as their divergence. Broadly the structural requirements are classified under various categories of courses as given below.

The actual requirements for these degree programmes are spelt out in terms of courses belonging to different categories. The table on page IV-8 gives these requirements in terms of minimum and maximum number of units as well as minimum and maximum number of courses of each category for Group A, B and C programmes.

The semester-wise pattern for completing the programme, is planned by a Senate appointed Committee called Academic Regulations – Clause 1.08 Committee and the current operative semester-wise patterns are given in later sections. While this has been planned in such a way that a normal student will finish the programme in 8 semesters, the completion of the programme by a student can be shorter or longer than this duration because of the flexibilities. There may be cases where, apart from the courses listed below, certain remedial courses may be required in which case the Dean, Instruction will design these courses from time to time and report the same to the Senate. The list of courses in the various categories and other courses which are used for making these programmes are given below.

(i) Language and Literature

ENGL C261	Creative Writing	3
ENGL C262	Effective Speaking	3
ENGL C353	Effective Public Speaking	3
HINDI C201	Elementary Hindi	3 0 3
HINDI C211	Novel & Short Stories	3 0 3
HINDI C212	One Act Play & Drama	3 0 3
SANS C111	Sanskrit	3 0 3

In addition to the above, the following courses are specially designed for Group C only which cannot be taken by Group A & B students under any circumstances.

ENGL C121	English Language Skills I	3
ENGL C122	English Language Skills II	3
ENGL C123	English Language Skills	3 0 3
ENGL C221	Readings from Popular Science Writings	3 0 3
ENGL C222	Readings from Drama	3 0 3
ENGL C231	Readings from Prose and Poetry	3 0 3
ENGL C251	Linguistics	3 0 3
ENGL C252	Phonetics and Spoken English	3 0 3

(ii) Core Science

BIO C111	General Biology	3 0 3
BIO C211	Biological Chemistry	3 0 3
BIO T216	Introductory Molecular Biology	3 0 3
BIO C241	Microbiology	2 3 3
CHEM C141	Chemistry I	3 0 3
CHEM C142	Chemistry II	3 0 3
CHEM C211	Atomic and Molecular Structure	3 0 3
CHEM C222	Modern Analytical Chemistry	3 0 3
CHEM C232	Chemistry of Organic Compounds	3 0 3
PHA C212	Pharmaceutical Analysis	2 3 3
PHA C241	Microbiology	2 3 3

PHY C131	Physics I (Mechanics, Waves & Optics)	3 0 3
PHY C132	Physics II (Electricity, Magnetism & Modern Physics)	3 0 3
PHY C212	Classical Mechanics	3 0 3
PHY C221	Modern Physics	3 0 3

In addition to the above, the following courses are specially designed for M.Sc. (Tech.) General Studies programme which can be taken by students of other programmes with prior permission from appropriate authority.

BIO C111	General Biology	3 0 3
CHEM C221	General Chemistry	3 0 3
PHY C122	General Physics	3 0 3
SCI C121	Social Hygiene	3 0 3
SCI C212	Applied Nutrition	3 0 3
SCI C311	Agricultural Science	3 0 3

(iii) Core Mathematics

MATH C191	Mathematics I(Advanced Calculus)	3 0 3
MATH C192	Mathematics II (Complex Variables and Linear Algebra)	3 0 3
MATH C222	Discrete Structures for Computer Science	3 0 3
MATH C241	Mathematics III (Differential Equations)	3 0 3

(iv) Technical Arts

TA C111	Engineering Graphics	2 4 4
TA C112	Workshop Practice	2 4 4
TA C162	Computer Programming I	3 0 3
TA C211	Measurement Techniques I	0 4 2
TA C222	Measurement Techniques II	1 6 4
TA C231	Business Communication	3 0 3
TA C252	Computer Programming II	3
TA C312	Technical Report Writing	3

(v) Engineering Science

CE C212	Transport Phenomena I	3 0 3
CE C241	Analysis of Structures	3 0 3
CHE C213	Fluid Flow Operations	3 0 3
CHE C221	Chemical Process Calculations	3 0 3
ECE C272	Circuits & Signals	3 0 3
EEE C272	Circuits & Signals	3 0 3
ES C112	Thermodynamics	3 0 3
ES C221	Mechanics of Solids	3 0 3
ES C232	Transport Phenomena I	3 0 3
ES C241	Electrical Sciences I	3 0 3
ES C242	Structure and Properties of Materials	3 0 3
ES C263	Microprocessors Programming & Interfacing	3 2 4
ES C272	Electrical Sciences II	3 0 3
INSTR C272	Circuits & Signals	3 0 3
ME C211	Applied Thermodynamics	3 0 3
ME C212	Transport Phenomena I	3 0 3
MF C211	Applied Thermodynamics	3 0 3
MF C212	Transport Phenomena I	3 0 3
NA C211	Ocean Engineering	3 0 3
NA C212	Transport Phenomena I	3 0 3

In addition to the above, the following courses are specially designed for Group C only which cannot be taken by Group A & B students under any circumstances.

ENGG C111	Electrical and Electronics Technology	3 0 3
ENGG C212	Introduction to Systems	3 0 3
ENGG C232	Engineering Materials	3 0 3
ENGG C241	Mechanical Technology	3 0 3
ENGG C242	Maintenance & Safety	3 0 3
ENGG C264	Fluid and Solid Mechanics	3 0 3
ENGG C272	Process Technology	3 0 3

ENGG C282	Industrial Engineering Techniques	3 0 3
ENGG C291	Electronics and Instrumentation Technology	3 0 3
ES C233	Logic in Computer Science	3 0 3
ES C261	Digital Electronics and Microprocessors	3 0 3

(vi) Analysis and Application Oriented Courses

AAOC C111	Probability and Statistics	3 0 3
AAOC C221	Graphs & Networks	3 0 3
AAOC C222	Optimisation	3 0 3
AAOC C311	Data Processing	3 0 3
AAOC C312	Operations Research	3 0 3
AAOC C321	Control Systems	3 0 3
AAOC C322	Systems	3 0 3
AAOC C341	Numerical Analysis	3 0 3
BIO C391	Instrumental Methods of Analysis	4
CHEM C391	Instrumental Methods of Analysis	4
PHA C391	Instrumental Methods of Analysis	4
PHY C391	Instrumental Methods of Analysis	4

In addition to the above, the following courses are specially designed for Group C only which cannot be taken by Groups A & B students under any circumstances.

TOC C112	Book Keeping	3 0 3
TOC C211	Book Keeping & Accountancy	3 0 3
TOC C212	Library Science	3 0 3
TOC C213	Civil Engineering Practice	3
TOC C215	Language Lab Practice	0 6 3
TOC C223	Comfort Conditioning and Refrigeration	3
TOC C224	Corporate Taxation	3 0 3
TOC C235	Electrical and Electronics Engineering Practice	0 6 3
TOC C236	Electronics and Instrumentation Engineering Practice	0 6 3
TOC C244	Production and Processing	0 6 3
TOC C253	Computer Oriented Problem Solving I	3
TOC C254	Computer Oriented Problem Solving II	3

(vii) Humanities & Social Sciences (HSS) and Other Courses

HSS Courses

ECON C211	Fundamentals of Finance and Accounting	3 0 3
ECON C212	Principles of Economics	3 0 3
HIST C112	Main Trends in Indian History	3 0 3
HIST C211	Main Currents of Modern History	3 0 3
HIST C212	Middle East History	3 0 3
HIST C213	Gulf History & Culture	3 0 3
HSS C231	Economic Legislation	3 0 3
HSS C232	Indian Financial Systems	3 0 3
HSS C241	Legal Environment of Business	3 0 3
HSS C311	Taxation	3 0 3
HSS C312	Bureaucracy	3 0 3
HSS C313	Critical Analysis of Literature and Cinema	3 0 3
HSS C314	Print and Audio-Visual Advertising	3 0 3
HSS C321	Commercial Law	3 0 3
HUM C232	Indian Financial System	3 0 3
HUM C311	Journalism	3
HUM C312	Contemporary India	3 0 3
HUM C321	Appreciation of Indian Music	3 0 3
HUM C322	Commercial Art	3
HUM C331	Appreciation of Art	3 0 3

HUM C332	Cinematic Art	3
HUM C341	Comparative Indian Literature	3 0 3
HUM C342	Graphic Art	3
HUM C351	Public Administration	3 0 3
HUM C352	Painting	3
HUM C361	Accounting in Management	3 0 3
HUM C362	History of Mathematics	3 0 3
HUM C371	Linguistics	3 0 3
HUM C372	Phonetics and Spoken English	3 0 3
HUM C381	Musicology - An Introduction	3 0 3
HUM C382	Sankara's Thoughts	3 0 3
HUM C383	Srimad Bhagavad Gita	3 0 3
HUM C411	Professional Ethics	3 0 3
HUM C412	Heritage of India	3 0 3
HUM C413	Indian Traditions of Science and Technology	3 0 3
HUM C421	Comparative Religion	3 0 3
HUM C422	Aesthetics	3 0 3
HUM C431	Theatre Art-Acting and Production	3 0 3
MGTS C211	Principles of Management	3 0 3
MGTS C233	Principles of Marketing for Engineers	3 0 3
PHIL C211	Introductory Philosophy	3 0 3
PHIL C221	Symbolic Logic	3 0 3
POL C211	Indian National Movement	3 0 3
POL C212	Modern Political Concepts	3 0 3
POL C311	Gandhian Thoughts	3 0 3
POL C312	Marxian Thoughts	3 0 3
POL C321	International Relations	3 0 3
PSY C211	Introduction Psychology	3 0 3
PSY C311	Psychology of Human Adjustment	3 0 3
SOC C211	Dynamics of Social Change	3 0 3

B. Other Courses

BIO C231	Biology Project Laboratory	3
BITS C214	Introduction to Mass Communication	3 0 3
BITS C217	Environment, Development and Climate Change	3 0 3
BITS C224	Corporate Taxation	3 0 3
BITS C313	Lab. Oriented Project	3
BITS C314	Lab. Oriented Project	3
BITS C321	Legal and Economic Environment of Business	4*
BITS C323	Study Oriented Project	3
BITS C324	Study Oriented Project	3
BITS C331	Computer Projects	3
BITS C332	Culture and Significance of Modern Mathematics	3 0 3
BITS C333	Project on Organisational Aspects	3
BITS C334	Project on Organisational Aspects	3
BITS C335	Computer Projects	3
BITS C341	Selected Computer Languages	3
BITS C364	Human – Computer Interaction	3 0 3
BITS C372	Data Communications and Networks	3 0 3
BITS C381	TIC Projects	3
BITS C382	Reading Course	3
BITS C383	TIC Projects	3
BITS C385	Introduction to Gender Studies	3 0 3
BITS C386	Quantum Information and Computation	3 0 3
BITS C393	Current Affairs	3 0 3
BITS C394	Mass Media Content and Design	3 0 3
BITS C395	Short Film and Video Production	3 0 3

BITS C396	Reporting and Writing for Media	3 0 3
BITS C397	Techniques in Social Research	3 0 3
BITS C398	Creative Multimedia	2 2 3
BITS C432	Entrepreneurship	3 0 3
BITS C461	Software Engineering	3
BITS C462	Renewable Energy	3 0 3
BITS C463	Cryptography	3 0 3
BITS C464	Machine Learning	3 0 3
BITS C467	Bioethics and Biosafety	3 0 3
BITS C468	New Venture Creation	3 0 3
BITS C469	Financing Infrastructure Projects	3 0 3
BITS C471	Management Information Systems	3 0 3
BITS C472	e-Business	3 0 3
BITS C473	Nonlinear Dynamics and Chaos	3 0 3
BITS C474	Rural Infrastructure Planning	3 0 3
BITS C481	Computer Networks	3 0 3
BITS C482	Creating and Leading Entrepreneurial Organizations	3 0 3
BITS C483	Indian Wisdom for Modern Management	3 0 3
BITS C484	Introduction to Conflict Management	3 0 3
BITS C485	Marketing Audit	3 0 3
BITS C486	Product & Brand Management	3 0 3
BITS C487	Global Business, Technology & Knowledge Sharing	3 0 3
BITS C488	Services Management Systems	3 0 3
BITS C489	Enterprise Resource Planning	3 0 3
BITS C493	Business Analysis and Valuation	3 0 3
BITS C494	Environmental Impact Assessment	3 1 4
CHEM C212	Colloid and Surface Chemistry	3 0 3
CHEM C231	Chemistry Project Laboratory	3
MATH C231	Number Theory	3 0 3
PHA C213	Introduction to Physical Pharmacy	2 1 3
PHY C231	Physics Project Laboratory	3
PHY C232	Computational Physics	3 0 3
PHY C241	Atmospheric Physics	3 0 3
PHY C242	Theory of Relativity	3 0 3

The following Courses on Development Process (CDP) are specially designed for Group C only which cannot be taken by Groups A & B students under any circumstances.

CDP C211	Agricultural Growth of India	3 0 3
CDP C212	Industrial Growth of India	3 0 3
CDP C221	Growth of Social Health in India	3 0 3
CDP C231	Transport & Communication	3 0 3
CDP C313	Security Analysis & Portfolio Management	3 0 3
CDP C323	Functions & Working of Stock Exchanges	3 0 3
CDP C332	Contemporary India	3 0 3
CDP C364	Industrial Relations	3 0 3
CDP C371	Development Economics	3 0 3

(viii) Electives

While Table on page IV-8 gives range of electives for the construction of the semester-wise pattern of the programme by the Clause 1.08 Committee, the same Committee will specify the exact number of electives required for each programme (Refer the Semester-wise charts given in later sections). Apart from the electives specified in these charts, students will be allowed to register normally four additional courses as electives. In special cases Clause 1.08 Committee may

relax this upper limit on a case by case basis. Students can choose electives from across the offerings of all the courses which are not compulsory to his programme subject to any restrictive conditions described in this Bulletin and in the Academic Regulations. Some of the other courses which can be taken as electives are given below:

Emerging Area Courses

EA C342	Computer Aided Design	3
EA C412	Flexible Manufacturing Systems	3 2 4
EA C413	Intelligent Manufacturing System	3 0 3
EA C414	Introduction to Bioinformatics	3 0 3
EA C415	Introduction to MEMS	4
EA C416	Introduction to Nanoscience	3 0 3
EA C422	Fibre Optics and Optoelectronics	3
EA C441	Robotics	3
EA C442	Remote Sensing and Image Processing	3
EA C443	Image Processing	3 0 3
EA C451	Internetworking Technologies	3 0 3
EA C452	Mobile Telecommunication Networks	3 0 3
EA C461	Artificial Intelligence	3
EA C462	Superconductivity Theory and Applications	3 0 3
EA C463	Neural Networks and Applications	3 0 3
EA C471	Pattern Recognition	3
EA C472	Photovoltaic Devices	3 0 3
EA C473	Multimedia Computing	3 0 3
EA C474	Retail Management Systems	3 0 3
EA C475	Financial Engineering	3 0 3
EA C476	Power Apparatus and Networks	3 0 3
EA C477	Foundations of Nanomechanics	3 0 3
EA C481	Expert Systems	3
EA C482	Fuzzy Logic and Applications	3 0 3

While each programme has a unique number of courses under the 'elective' category, the option embedded in the range shown against each category in the category-wise chart may not be mistaken to be an 'elective'. Thus each student is required to take courses within the range of minimum to maximum from the uniquely named courses in each category. The list is not open-ended and is also not negotiable. For fulfilling the elective category, theoretically speaking, a student can choose any course listed in this Bulletin if that course is not a named compulsory course of his/her programme, provided he/she fulfils the prerequisite and the prior preparation requirements and any other restrictive condition.

Apart from the courses described here, a student can also take courses of the higher degree programmes as electives subject to any pre-requisite and other restrictions.

A wise choice within the range prescribed in each category supplemented by planned deployment of the electives can prepare an individual student for a multi-faceted professional aspiration.

Few electives given below are available for all A, B and C group programmes and their units may be one or two depending upon the nature and the duration of the course:

BITS C211	Introduction to IPR	1
BITS C212	Introduction to Human Rights	1
BITS C213	Introduction to Environmental Studies	1
BITS C317	Managerial Skills	1 0 1
BITS C318	Workshop on Film Production	1
BITS C319	Negotiation Skills and Techniques	2 0 2

(ix) Audit Type Courses

These courses are not part of any programme. They are available on audit only. The registration in these courses is permitted after payment of due fees in addition to the semester fees. The available audit type courses normally are as follows.

BITS N101T	Physical fitness and Wellness	1
CHI N101T	Beginning Chinese	3 0 3
FRE N101T	Beginning French	3 0 3
FRE N102T	Technical French	3 0 3
GER N101T	Beginning German	3 0 3
GER N102T	Technical German	3 0 3
JAP N101T	Beginning Japanese	3 0 3
MUSIC N103T	Indian Classical Music (Vocal) I	3*
MUSIC N104T	Indian Classical Music (Vocal) II	3*
MUSIC N203T	Indian Classical Music (Vocal) III	3*
MUSIC N204T	Indian Classical Music (Vocal) IV	3*
MUSIC N113T	Indian Classical Music (Instrumental) I	3*
MUSIC N114T	Indian Classical Music (Instrumental) II	3*
MUSIC N213T	Indian Classical Music (Instrumental) III	3*
MUSIC N214T	Indian Classical Music (Instrumental) IV	3*
MUSIC N303T	Advanced Indian Music Practice (Vocal)	0
MUSIC N313T	Advanced Indian Music Practice (Instrumental)	0

For a student with advanced standing or on transfer, the number of courses to be done in each category will be decided anywhere in the range depending on the estimate of courses he/she has done before the point of admission with advanced standing or transfer.

The above is the general guideline, but it must be remembered that each student or a category of students will be given a complete semester-wise pattern for the duration of the programme as is illustrated by the type of semester-wise patterns presented in this Bulletin.

Special features of Group C Programmes

The semester-wise patterns for M.Sc. (Tech.) Information Systems, M.Sc.(Tech.) Engineering Technology and M.Sc.(Tech.) Finance are designed in such a way that the first year is common with A and B groups. This allows the students of these programmes to benefit in terms of saving time if they are allowed to exercise their options for any of the flexibilities of seeking for a transfer or dual degree into Group A or B. The course structure for M.Sc.(Tech.) General studies is designed in such a way that a student admitted to this programme will be taking humanities courses as well as certain general science and technology courses. The set of first year courses of this programme is therefore different from those of other M.Sc.(Tech.) programmes. (see the semester-wise pattern later in this section).

But the structure of Group C programmes permits the possibility of an individual student, to combine in his/her programme specially in the categories of core mathematics and core science courses, a combination of courses which require high dependence on mathematics and analysis or science courses which are more narrative and integrated at the conceptual plane. In view of this, students admitted to M.Sc.(Tech.) Information Systems, M.Sc.(Tech.) Engineering technology and M.Sc.(Tech.) Finance programmes will be given an opportunity to choose the first year courses mentioned against M.Sc.(Tech.) General studies programme, instead of the first year courses mentioned in their semester-wise patterns. This will allow the student to have an understanding of modern science and mathematics, their methodology and their conceptual approach without the necessity of rigorous training in the mathematical understanding and manipulation. However, such an option can be exercised only with prior permission from appropriate authority.

Category wise Structure of Groups A, B & C Programmes

Programme → / Category ↓	A, B, C Programmes Except M.Sc. (Tech.)General Studies		M.Sc. (Tech.) General Studies	
	No. of Units Required	No. of Courses Required	No. of Units Required	No. of Courses Required
Language and Literature	0-15	0-5	0-15	0-5
Core Science	8-23	3-7	8-23	3-7
Core Mathematics	6-12	2-4	6-15	2-5
Technical Arts	12-26	4-8	12-21	4-7
Engg. Science	6-24	2-8	6-21	2-7
AAOC	8-24	3-8	9-27	3-9
HSS & Other Courses	3-33	1-10	9-45	3-15
CDC	15-40	6-10	-	-
Elective	12-40	5-10	12-40	5-10
Sub Total	125 (Min.)	42 (Min.)	125 (Min.)	42 (Min.)
PS I & II OR Thesis & Seminar	25 OR 16	2 OR 2	25 OR 16	2 OR 2
Total	140 (Min)	44 (Min.)	140 (Min.)	44 (Min.)

Pattern 1	**Semester-wise Pattern for Students Admitted to Group A and Group B Admitted in First Semester**	
Year	First Semester	Second Semester
I	BIO C111 General Biology CHEM C141 Chemistry I ES C112 Thermodynamics MATH C191 Mathematics I PHY C131 Physics I TA C111 Engineering Graphics	AAOC C111 Probability and Statistics CHEM C142 Chemistry II MATH C192 Mathematics II PHY C132 Physics II TA C112 Workshop Practice TA C162 Computer Programming I
II	ES C241 Electrical Sciences I MATH C241 Mathematics III TA C252 Computer Programming II BIO C211 Biological Chemistry (for Bio, BIOT, Pharm) BIO C241 Microbiology (for Bio, BIOT) ECON C212 Principles of Economics (for Econ, Pharm) ES C221 Mechanics of Solids (for Engg) MGTS C211 Principles of Management (Exptl Sc, Math, BIOT, Che, MF) PHA C241 Microbiology (for Pharm) PHY C221 Modern Physics (for Phy) SOC C211 Dynamics of Social Change (for Econ) TA C211 Measurement Techniques I (for Econ, Engg, Exptl Sc, Math, Pharm) TA C312 Technical Report Writing (for Engg, except BIOT, Che, MF) Elective 1 (for Chem, Math)	ES C242 Structure and Properties of Materials ES C272 Electrical sciences II CE C212, ME C212, MF C212 Transport Phenomena I (for Civil, Mech., MF) CHE C213 Fluid Flow Operations (for Che) CE C241 Analysis of Structures (for Civil) CHE C221 Chemical Process Calculations (for Che) CHEM C211 Atomic & Molecular Structures (for Chem) CHEM C232 Chemistry of Organic Compounds (for Chem, Pharm) ECON C211 Fundamentals of Finance & Accounting (for Econ) EEE C272, ECE C272, INSTR C272 Circuits & Signals (for EEE, ECE, EI) ES C263 Microprocessor Programming & Interfacing (for CS, EEE, ECE, EI) MATH C222 Discrete Structures for Computer Science (for CS) ME C211, MF C211 Applied Thermodynamics (for Mech, MF) MGTS C211 Principles of Management (for Econ, Pharm, Engg except BIOT, Che, MF) PHA C212 Pharmaceutical Analysis (for Pharm) TA C222 Measurement Techniques II (for Econ, Engg, Exptl Sc, Math) TA C312 Technical Report Writing (for Econ, BIOT, Che, MF, Exptl Sc, Math, Pharm) BIOT C216 Introductory Molecular Biology (for BIOT) Electives 2 (for Bio, Math, Phy)
Summer	BITS C221 Practice School I (for PS Option Only)	
III	Compulsory Discipline Courses* AAOC C222 Optimisation AAOC C221 Graphs and Networks (for Math) AAOC C311 Data Processing (for Econ, Math) AAOC C321 Control Systems (for Che, EEE, ECE, EI) AAOC C341 Numerical Analysis (for BIOT, Civil, Mech., MF, CS) BIO C391, CHEM C391, PHA C391, PHY C391 Instrumental Methods of Analysis (for Exptl Sc, Pharm) PHY C212 Classical Mechanics (for Phy) Elective 1 (for Bio, Chem, Econ)	Compulsory Discipline Courses* AAOC C312 Operations Research AAOC C321 Control Systems (for BIOT, Civil, Mech., MF, CS) AAOC C341 Numerical Analysis (for Che, EEE, ECE, EI, Exptl. Sc., Math) Elective 1 (for Econ, Pharm)
IV	Electives 5 (for Bio, Pharm.) 6 (for BIOT, Chem, Econ, Engg, Math, Phy)	BITS C412 Practice School II OR BITS C422T Thesis BITS C442T Seminar

Note : This is currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants

* These are specialized discipline courses to be selected from a pool of courses. Their total number will range from six to nine. Details are given elsewhere in this Part.

Pattern 2	**Semester wise Pattern for Students Admitted to Group A and Group B Admitted in Second Semester**	
Year	First Semester	Second Semester
I		BIO C111 General Biology CHEM C141 Chemistry I MATH C191 Mathematics I PHY C131 Physics I TA C112 Workshop Practice TA C162 Computer Programming I
II	CHEM C142 Chemistry II ES C112 Thermodynamics MATH C192 Mathematics II PHY C132 Physics II TA C111 Engineering Graphics TA C252 Computer Programming II	AAOC C111 Probability and Statistics ES C242 Structure and Prop. of Materials MATH C241 Mathematics III MGTS C211 Principles of Management TA C312 Technical Report Writing Elective 1
III	AAOC C222 Optimisation ES C241 Electrical Sciences I AAOC C311 Data Processing (for Math) BIO C211 Biological Chemistry (for Bio, BIOT, Pharm) BIO C241, PHA C241 Microbiology (for Bio, BIOT, Pharm) ECON C212 Principles of Economics (for Econ, Pharm) ES C221 Mechanics of Solids (for Engg) PHY C212 Classical mechanics (for Phy) PHY C221 Modern Physics (for Phy) SOC C211 Dynamics of Social Change (for Econ) TA C211 Measurement Techniques I (for Econ, Engg, Exptl Sc, Math, Pharm) Elective 1 (for Bio, Econ, Phy) Electives 2 (for BIOT, Che, Chem, Civil, CS, EEE, ECE, EI, Math, Mech., MF)	ES C272 Electrical Sciences II AAOC C312 Operations research AAOC C321 Control Systems (for Civil, Mech, MF, CS) AAOC C341 Numerical Analysis (for Che, EEE, ECE, EI, Exptl Sc., Math) BIOT C216 Introductory Molecular Biology (for BIOT) CE C212, ME C212, MF C212 Transport Phenomena I (for Civil, Mech, MF) CE C241 Analysis Structures (for Civil) CHE C213 Fluid Flow Operations (for Che) CHE C221 Chemical Process Calculations (for Che) CHEM C211 Atomic & Molecular Structures (for Chem) CHEM C232 Chemistry of Organic Compounds (for Chem, Pharm) ECON C211 Fundamentals of Finance & Accounting (for Econ) EEE C272, ECE C272, INSTR C272 Circuits & Signals (for EEE, ECE, EI) ES C263 Microprocessor Programming & Interfacing (for CS, EEE, ECE, EI) MATH C222 Discrete Structures for Computer Science (for CS) ME C211, MF C211 Applied Thermodynamics (for Mech, MF) PHA C212 Pharmaceutical Analysis (for Pharm) TA C222 Measurement Techniques II (for Econ, Engg, Exptl Sc, Math) Elective 1 (for BIOT, Chem) Electives 2 (for Bio, Econ, Math, Pharm, Phy)
Summer	BITS C221 Practice School I (For PS Option only)	
IV	Compulsory Discipline Courses* AAOC C221 Graphs and Networks (for Math) AAOC C311 Data Processing (for Econ) AAOC C321 Control Systems (for Che, ECE, EEE, EI) AAOC C341 Numerical Analysis (for BIOT, Civil, Mech., MF, CS) BIO C391, CHEM C391, PHA C391, PHY C391 Instrumental Methods of Analysis (for Exptl Sc, BIOT, Pharm) Elective 1 (for Che, Civil, CS, EEE, ECE, EI, Mech, MF, Pharm) Electives 2 (for BIOT, Econ, Math, Exptl Sc)	Compulsory Discipline Courses* Electives 2
V	BITS C412 Practice School II OR BITS C422T Thesis BITS C442T Seminar	

Note : This is currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

* These are specialized discipline courses to be selected from a pool of courses. Their total number will range from six to nine. Details are given elsewhere in this Part.

Pattern 1 **Semester-wise Pattern for Students Admitted to Group C**
M.Sc. (Tech.) Engineering Technology, Information Systems, Finance admitted in First Semester

Year	First Semester			Second Semester		
I	CHEM	C141	Chemistry I	AAOC	C111	Probability & Statistics
	ES	C112	Thermodynamics	CHEM	C142	Chemistry II
	BIO	C111	General Biology	MATH	C192	Mathematics II
	MATH	C191	Mathematics I	PHY	C132	Physics II
	PHY	C131	Physics I	TA	C112	Workshop Practice
	TA	C111	Engineering Graphics	TA	C162	Computer Programming I
II	ECON	C212	Principles of Economics	ENGG	C212	Introduction to Systems
	ENGG	C111	Electrical and Electronics Technology	ES	C261	Digital Electronics and Microprocessors (for ET, IS)
	ENGG	C241	Mechanical Technology (for ET)	MGTS	C211	Principles of Management
	ENGG	C264	Fluid & Solid Mechanics (for ET)	TA	C312	Technical Report Writing
	TA	C252	Computer Programming II	TOC	C223	Comfort Conditioning & Refrigeration (for ET)
	TOC	C213	Civil Engineering Practice (for ET)	TOC	C244	Production & Processing (for ET)
	TOC	C235	Electrical & Electronics Engineering Practice (for ET,IS)	TOC	C224	Corporate Taxation (for Fin.)
	AAOC	C221	Graphs & Networks (for IS)	MATH	C222	Discrete Structures for Computer Science (for IS)
	AAOC	C311	Data Processing (for Fin.)	SOC	C211	Dynamics of Social Change (for IS, Fin.)
	ES	C233	Logic in Computer Science (for IS)	ECON	C211	Fundamentals of Finance & Accounting (for Fin.)
	BITS	C321	Legal and Economic Environment of Business (for Fin.)			
	HUM	C351	Public Administration (for Fin.)			
	TA	C231	Business Communication (for Fin.)			
	MATH	C241	Mathematics III (for IS)			
Summer	BITS C221 Practice School I 5 Units (for PS Option Only)					
III	Compulsory Discipline Courses*			Compulsory Discipline Courses*		
	AAOC	C222	Optimization	AAOC	C312	Operations Research
	ENGG	C232	Engineering Materials (for ET)	CDP	C364	Industrial Relations (for ET)
	ENGG	C242	Maintenance and Safety (for ET)	AAOC	C341	Numerical Analysis (for IS)
	CDP	C323	Functions and Working of Stock Exchanges (for Fin.)	BITS	C471	Management Information Systems (for Fin.)
	Elective		1 (for IS, Fin.)	CDP	C313	Security Analysis and Portfolio Management (for Fin.)
IV	Electives		5	BITS	C412	Practice School II
						OR
				BITS	C422T	Thesis
				BITS	C442T	Seminar

Note : This is currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

* These are specialized discipline courses to be selected from a pool of courses. Their total number will range from six to nine. Details are given elsewhere in this Part.

Pattern 2	**Semester-wise Pattern for Students Admitted to Group C** **M.Sc. (Tech.) Engineering Technology, Information Systems, Finance admitted in Second Semester**	
Year	First Semester	Second Semester
I		CHEM C141 Chemistry I BIO C111 General Biology MATH C191 Mathematics I PHY C131 Physics I TA C111 Engineering Graphics TA C162 Computer Programming I
II	CHEM C142 Chemistry II MATH C192 Mathematics II ES C112 Thermodynamics PHY C132 Physics II TA C112 Workshop Practice TA C252 Computer Programming II	ENGG C212 Introduction to Systems MGTS C211 Principles of Management TOC C244 Production & Processing (for ET) AAOC C111 Probability & Statistics TA C312 Technical Report Writing (for ET) ES C233 Logic in Computer Science (for IS) SOC C211 Dynamics of Social Change (for IS, Fin.) HUM C351 Public Administration (for Fin.) TOC C224 Corporate Taxation (for Fin.) Elective 1 (for ET, IS)
III	ECON C212 Principles of Economics ENGG C241 Mechanical Technology (for ET) ENGG C242 Maintenance & Safety (for ET) ENGG C264 Fluid & Solid Mechanics (for ET) TOC C213 Civil Engineering Practice (for ET) TOC C235 Electrical & Electronics Engineering Practice (for ET, IS) ENGG C111 Electrical & Electronics Technology AAOC C221 Graphs & Networks (for IS) AAOC C311 Data Processing (for Fin.) BITS C321 Legal and Economic Environment of Business (for Fin.) TA C231 Business Communication (for Fin.) MATH C241 Mathematics III (for IS) Elective 1 (for IS, Fin.)	AAOC C312 Operations Research (for ET, Fin.) CDP C364 Industrial Relations (for ET) MATH C222 Discrete Structures for Computer Science (for IS) TOC C223 Comfort Conditioning and Refrigeration (for ET) ES C261 Digital Electronics and Microprocessors (for ET, IS) AAOC C341 Numerical Analysis (for IS) TA C312 Technical Report Writing (for IS, Fin.) CDP C313 Security Analysis & Portfolio Management (for Fin) ECON C211 Fundamentals of Finance & Accounting (for Fin.) Electives 2 (for ET, IS, Fin)
Summer	BITS C221 Practice School I 5 Units (for PS Option only)	
IV	Compulsory Discipline Courses* AAOC C222 Optimization ENGG C232 Engineering Materials (for ET) CDP C323 Functions and Working of Stock Exchanges (for Fin.) Elective 1 (for ET, IS, Fin)	Compulsory Discipline Courses* AAOC C312 Operations Research (for IS) BITS C471 Management Information Systems Exchanges (for Fin.) Elective 1 (for ET, IS) Electives 2 (for Fin.)
V	BITS C412 Practice School II OR BITS C422T Thesis BITS C422T Seminar	

Note: This is currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

* These are specialized discipline courses to be selected from a pool of courses. Their total number will range from six to nine. Details are given elsewhere in this Part.

Pattern 1	**Semester-wise Pattern for Students Admitted to M.Sc. (Tech.) General Studies in First Semester**							
Year	First Semester			U	Second Semester			U
I	CHEM	C221	General Chemistry	3	AAOC	C111	Probability & Statistics	3
	ENGG	C111	Electrical & Electronics Technology	3	BIO	C111	General Biology	3
					MATH	C192	Mathematics II	3
	ENGL	C123	English Language Skills	3	PSY	C211	Introductory Psychology	3
	MATH	C191	Mathematics I	3	TA	C112	Workshop Practice	4
	PHY	C122	General Physics	3	TA	C162	Computer Programming I	3
	TA	C111	Engineering Graphics	4				
II	ECON	C212	Principles of Economics	3	AAOC	C311	Data Processing	3
	ENGG	C212	Introduction to Systems	3	MGTS	C211	Principles of Management	3
	TA	C252	Computer Programming II	3	SOC	C211	Dynamics of Social Change	3
	BITS	C216	Selected Readings	3	TA	C312	Technical Report Writing	3
	BITS	C217	Environment, Development & Climate Change[2]	3	BITS	C214	Introduction to Mass Communication[1]	3
	CDP	C221	Growth of Social Health in India[2]	3	ENGL	C261	Creative Writing[1]	3
					PHIL	C221	Symbolic Logic[2]	3
	TA	C231	Business Communication[1]	3	POL	C212	Modern Political Concepts[2]	3
	TOC	C215	Language Lab Practice[1]	3				
Summer	BITS C221 Practice School I (For PS Option Only)							5 Units
III	AAOC	C222	Optimization	3	AAOC	C312	Operation Research	3
	ENGL	C353	Effective Public Speaking	3	CDP	C332	Contemporary India	3
	BITS	C393	Current Affairs[1]	3	HUM	C351	Public Administration	3
	BITS	C394	Mass Media Content and Design[1]	3	BITS	C385	Introduction to Gender Studies[2]	3
	BITS	C396	Reporting and Writing for Media[1]	3	BITS	C395	Short Film & Video Production[1]	3
	HSS	C313	Critical Analysis of Literature and Cinema[1]	3	HSS	C314	Print & Audio Visual Advertising[1]	3
	BITS	C484	Introduction to Conflict Management[2]	3	BITS	C397	Techniques in Social Research[2]	3
	BITS	C487	Global Business, Technology & Knowledge Sharing[2]	3			Elective	3
	CDP	C371	Development Economics[2]	3				
			Elective[2]	3				
IV			Elective(s) 6	18	BITS	C412	Practice School II	20
							OR	
					BITS	C422T	Thesis	15
					BITS	C442T	Seminar	1

Note: a. The Units mentioned for Electives are minimum units and in actual cases they may be more, depending upon the nature of the course.

b. This is a currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

c. As there is no clearly defined set of so-called discipline courses in respect of the M.Sc. (Tech.) General Studies Programme, the courses with superscript 1 mentioned in the above chart have been introduced for Communication and Media Studies stream and the courses with superscript 2 have been introduced for Developmental Studies stream. Courses with no superscript are common for both the streams.

Pattern 2	**Semesterwise Pattern for Students Admitted to Group C: M.Sc.(Tech.) General Studies in Second Semester**							
Year	First Semester			U	Second Semester			U
I					AAOC	C111	Probability & Statistics	3
					BIO	C111	General Biology	3
					MATH	C191	Mathematics I	3
					PSY	C211	Introductory Psychology	3
					TA	C111	Engineering Graphics	4
					TA	C162	Computer Programming I	3
II	CHEM	C221	General Chemistry	3	MATH	C192	Mathematics II	3
	ENGG	C111	Electrical & Electronics Technology	3	MGTS	C211	Principles of Management	3
					SOC	C211	Dynamics of Social Change	3
	ENGL	C123	English Language Skills	3	TA	C312	Technical Report Writing	3
	BITS	C216	Selected Readings	3	BITS	C214	Introduction to Mass Communication[1]	3
	PHY	C122	General Physics	3				
	TA	C112	Workshop Practice	4	PHIL	C221	Symbolic Logic[2]	3
	TA	C252	Computer Programming II	3			Elective	3
III	ECON	C212	Principles of Economics	3	CDP	C332	Contemporary India	3
	ENGG	C212	Introduction to Systems	3	HUM	C351	Public Administration	3
	BITS	C217	Environment, Development & Climate Change[2]	3	AAOC	C311	Data Processing	3
					ENGL	C261	Creative Writing[1]	3
	CDP	C221	Growth of Social Health in India[2]	3	POL	C212	Modern Political Concepts[2]	3
	TA	C231	Business Communication[1]	3			Elective (2)	6
	TOC	C215	Language Lab Practice[1]	3				
	HSS	C313	Critical Analysis of Literature and Cinema[1]	3				
	CDP	C371	Development Economics[2]	3				
			Elective	1				
Summer	BITS C221 Practice School-I 5 Units (for PS Option only)							
IV	AAOC	C222	Optimization	3	AAOC	C312	Operation Research	3
	ENGL	C353	Effective Public Speaking	3	BITS	C395	Short Film & Video Production[1]	3
	BITS	C393	Current Affairs[1]	3				
	BITS	C394	Mass Media Content and Design[1]	3	HSS	C314	Print & Audio Visual Advertising[1]	3
	BITS	C396	Reporting and Writing for Media[1]	3				
	BITS	C484	Introduction to Conflict Management[2]	3	BITS	C385	Introduction to Gender Studies[2]	3
	BITS	C487	Global Business, Technology & Knowledge Sharing[2]	3	BITS	C397	Techniques in Social Research[2]	3
			Elective[2]	3			Electives(3)	9
V	BITS	C412	Practice School II					
			OR					
	BITS	C422T	Thesis					
	BITS	C442T	Seminar					

Note : a. This is a currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

b. This is a currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

c. As there is no clearly defined set of so-called discipline courses in respect of the M.Sc. (Tech.) General Studies Programme, the courses with superscript 1 mentioned in the above chart have been introduced for Communication and Media Studies stream and the courses with superscript 2 have been introduced for Developmental Studies stream. Courses with no superscript are common for both the streams.

(x) Specialized Discipline Courses

All the courses marked (#) are the courses currently decided to be Compulsory Discipline Courses (CDC) by the Clause 1.08 Committee. In addition, one or two courses are required to be taken compulsorily in some Disciplines from the courses marked (*). The remaining courses will be available as electives under the category Discipline Courses Other than Compulsory (DCOC).

Course No.	Course Title	L	P	U
Biological Sciences				
# BIO C312	Developmental Biology[2]	3	0	3
# BIO C321	Cell Biology[1]	3	0	3
# BIO C322	Ecology[2]	3	0	3
# BIO C331	Biophysics[1]	3	0	3
# BIO C332	Genetics[2]	3	0	3
# BIO C342	General Physiology[1]	3	0	3
BIO C352	Cell and Tissue Culture Technology	3	0	3
# BIO C411	Laboratory[2]	0	9	3
BIO C412	Introduction to Bioinformatics	3	0	3
BIO C413	Molecular Biology of Cell	3	0	3
BIO C416	Immunology	3	0	3
BIO C417	Biomolecular Modeling	3	0	3
BIO C418	Genetic Engineering Techniques	1	9	4
BIO C419	Molecular Evolution	3	0	3
BIO C421	Enzymology	3	0	3
BIO C431	Reproductive Physiology	3	0	3
BIO C441	Biochemical Engineering	3	0	3
BIO C451	Bioprocess Technology			3
BIO C461	Recombinant DNA Technology	3	0	3
BIO C491	Special Projects			3
Biotechnology				
# BIOT C332	Genetics[1]	3	0	3
# BIOT C336	Cell Physiology[1]	3	0	3
# BIOT C337	Industrial Microbiology & Bioprocess Engineering[1]	2	3	4
# BIOT C338	Introduction to Environmental Biotechnology[2]	3	0	3
# BIOT C339	Biophysical Chemistry[2]	3	0	3
BIOT C343	Genomics	3	0	3
BIOT C344	Proteomics	3	0	3
BIOT C345	Immunotechnology	3	0	3
# BIOT C346	Experiments in Biotechnology	0	9	3
BIOT C413	Molecular Biology of Cell	3	0	3
BIOT C416	Immunology	3	0	3
BIOT C417	Biomolecular Modeling	3	0	3
# BIOT C418	Genetic Engineering Techniques[1]	1	9	4
# BIOT C461	Recombinant DNA Technology[2]	3	0	3
BIOT C491	Special Projects			3
EA C414	Introduction to Bioinformatics	3	0	3
Chemical Engineering				
# CHE C311	Chemical Engineering Thermodynamics[1]	3	0	3
# CHE C312	Kinetics and Reactor Design[2]	3	0	3
# CHE C322	Chemical Process Technology[2]	3	0	3
# CHE C351	Heat Transfer Operations[1]	3	3	4
# CHE C332	Process Design Decisions[2]	3	0	3
# CHE C361	Mass Transfer Operations	3	0	3
CHE C411	Environmental Pollution Control	3	0	3
CHE C412	Process Equipment Design	3	0	3
CHE C413	Process Plant Safety	3	0	3
CHE C414	Transport Phenomena	3	0	3
CHE C421	Biochemical Engineering	3	0	3
CHE C422	Combustion Engineering	3	0	3
# CHE C431	Selected Chemical Engineering Operations[1]	3	3	4

1 Compulsory Discipline Course normally offered in First Semester.
2 Compulsory Discipline Course normally offered in Second Semester.

CHE C432	Computer Aided Process Plant Design	3 0 3
CHE C433	Corrosion Engineering	3 0 3
#CHE C441	Process Control[2]	3 0 3
CHE C471	Refrigeration and Air Conditioning	3 0 3
CHE C473	Advanced Process Contro	3 1 4
CHE C491	Special Projects	3

Chemistry

#CHEM C311	Chemical Kinetics[1]	3 0 3
CHEM C312	Chemistry of Nontransitional Elements	3 0 3
#CHEM C321	Chemical Thermodynamics[1]	3 0 3
#CHEM C322	Quantum Chemistry[1]	3 0 3
#CHEM C331	Structure and Reactivity of Organic Compounds[1]	3 0 3
#CHEM C332	Synthetic Organic Chemistry[2]	3 0 3
* CHEM C341	Biophysical Chemistry	3 0 3
CHEM C342	Coordination Chemistry	3 0 3
* CHEM C351	Computational Chemistry	3 3 4
#CHEM C352	Bonding in Inorganic Compounds[2]	3 0 3
* CHEM C361	Polymer Chemistry	3 0 3
* CHEM C362	Chemistry of Inorganic Compounds	3 0 3
#CHEM C411	Chemical Experimentation[2]	0 9 3
CHEM C412	Photochemistry and Laser Spectroscopy	3 0 3
CHEM C421	Theoretical Inorganic Chemistry	3 0 3
* CHEM C422	Statistical Thermodynamics	3 0 3
* CHEM C431	Stereochemistry and Reaction Mechanisms	3 0 3
CHEM C441	Biochemical Engineering	3 0 3
CHEM C451	Physical Pharmacy	2 3 3
CHEM C461	Nuclear & Radiochemistry	3 0 3
CHEM C491	Special Projects	3

Civil Engineering

# CE C322	Construction Planning and Technology[2]	3 0 3
#CE C342	Water and Waste Water Treatment[2]	3 2 4
#CE C361	Soil Mechanics and Foundation Engineering[1]	3 2 4
#CE C371	Hydraulics and Fluid Mechanics[1]	3 2 4
#CE C381	Design of Steel Structures[1]	3 0 3
#CE C383	Design of Concrete Structures[2]	3 2 4
#CE C391	Transportation Engineering[2]	3 2 4
#CE C392	Geodesy[1]	3 2 4
CE C411	Transportation Engineering	3 0 3
CE C412	Disaster Management	3 0 3
CE C414	Introduction to Environmental Engineering	3 0 3
CE C415	Design of Prestressed Concrete Structures	3 0 3
CE C416	Computer Application in Civil Engineering	3 2 4
CE C417	Applications of Artificial Intelligence in Civil Engineering	3 0 3
CE C418	Introduction to Water Resources Engineering	3 0 3
CE C419	Geotechnical Earthquake Engineering and Machine Foundation	3 0 3
CE C422	Design of Bridge Structures	3 0 3
CE C432	Structural Dynamics	3 0 3
CE C441	Design of Water Resources Systems	3 0 3
CE C461	Refrigeration and Air Conditioning	3 0 3
CE C471	Introduction to Finite Element Methods	3 0 3
CE C491	Special Projects	3

1 Compulsory Discipline Course normally offered in First Semester.
2 Compulsory Discipline Course normally offered in Second Semester.

Computer Science

CS C313	Object Oriented Programming and Design	3 2 4
CS C321	Computers and Programming	3 2 4
#CS C342	Advanced Computer Organization[2]	3 0 3
#CS C351	Theory of Computation[1]	3 0 3
#CS C352	Data Base Systems[2]	3 0 3
#CS C362	Programming Languages & Compiler Construction[2]	3 0 3
#CS C363	Data Structures and Algorithms[1]	3 2 4
#CS C372	Operating Systems[1]	3 0 3
#CS C391	Digital Electronics and Computer Organization[1]	3 3 4
CS C414	Telecommunication Switching Systems & Networks	3 0 3
CS C415	Data Mining	3 0 3
CS C422	Parallel Computing	3 0 3
CS C424	Software for Embedded Systems	3 0 3
CS C441	Selected Topics from Computer Science	3
CS C442	Advanced Algorithms & Complexity	3 0 3
CS C444	Real-Time Systems	3 0 3
CS C446	Data Storage Technologies and Networks	3 0 3
CS C451	Combinatorial Mathematics	3 0 3
CS C453	Discrete Mathematical Structures	3 0 3
#CS C461	Computer Networks[2]	3 0 3
CS C471	Computer Graphics	2 2 3
CS C481	Graphical User Interfaces	3 0 3
CS C491	Special Projects	3

Economics

#ECON C311	Microeconomics[1]	3 0 3
#ECON C321	Macroeconomics[1]	3 0 3
#ECON C322	Public Finance: Theory and Practice[2]	3 0 3
#ECON C341	Economics of Growth & Planning[1]	3 0 3
#ECON C342	Econometrics[2]	3 0 3
#ECON C362	Money, Banking and Financial Markets[2]	3 0 3
#ECON C372	International Trade and Balance of Payments[2]	3 0 3
ECON C411	Project Appraisal	3 0 3
ECON C412	Security Analysis & Portfolio Management	3 0 3
ECON C422	Functions & Working of Stock Exchanges	3 0 3
ECON C431	Regional Economics	3 0 3
ECON C436	Strategic Financial Management	3 0 3
ECON C451	Technology Forecasting	3 0 3
ECON C461	Analysis of Indian Economy	3 0 3
ECON C471	Resources and Environmental Economics	3 0 3
ECON C481	Financial Management	3 0 3
ECON C491	Special Projects	3

Electrical & Electronics Engineering

CS C341	Data Structures & Algorithms	3 0 3
# EEE C364	Analog Electronics[2]	3 3 4
# EEE C371	Electromechanical Energy Conversion[1]	3 3 4
* EEE C374	Power Systems	3 0 3
# EEE C381	Electronic Devices & Integrated Circuits[1]	3 0 3
# EEE C383	Communication Systems[2]	3 3 4
# EEE C391	Digital Electronics and Computer Organization[1]	3 3 4
* EEE C414	Telecommunication Switching Systems & Networks	3 0 3
EEE C415	Digital Signal Processing	3 0 3
EEE C416	Digital Communication	3 0 3
EEE C417	Computer Based Control Systems	3 0 3

1 Compulsory Discipline Course normally offered in First Semester.
2 Compulsory Discipline Course normally offered in Second Semester.

EEE C418	Digital Systems	3 0 3
EEE C422	Modern Control Systems	3 0 3
EEE C423	Combinatorial Mathematics	3 0 3
#EEE C424	Microelectronic Circuits[1]	3 0 3
EEE C432	Medical Instrumentation	3 0 3
* EEE C433	Electromagnetic Fields & Waves	3 0 3
EEE C441	Television Engineering	3 0 3
* EEE C443	Analog & Digital VLSI Design	3 0 3
EEE C444	Real-Time Systems	3 0 3
EEE C452	Electromagnetic Fields & Microwave Engineering	3 0 3
EEE C453	Discrete Mathematical Structures	3 0 3
* EEE C461	Power Electronics	3 0 3
EEE C462	Advanced Power Systems	3 0 3
EEE C471	Electronic Measurements and Instrumentation	3 0 3
EEE C472	Satellite Communication	3 0 3
EEE C491	Special Projects	3

Electronics & Communication Engineering

CS C341	Data Structures and Algorithms	3 0 3
CS C461	Computer Networks	3 0 3
EA C473	Multimedia Computing	3 0 3
# ECE C313	Microelectronic Circuits[1]	3 0 3
# ECE C364	Analog Electronics[2]	3 3 4
# ECE C383	Communication Systems[1]	3 3 4
# ECE C391	Digital Electronics and Computer Organization[1]	3 3 4
# ECE C392	Modern Communication Technologies[1]	3 0 3
# ECE C393	Information Theory & Coding[2]	3 0 3
# ECE C394	Communication Networks[2]	3 0 3
# ECE C452	Electromagnetic Fields & Microwave Engineering[1]	3 0 3
ECE C491	Special Projects	3
EEE C414	Telecommunications Switching Systems and Networks	3 0 3
EEE C415	Digital Signal Processing	3 0 3
EEE C416	Digital Communication	3 0 3
EEE C443	Analog and Digital VLSI Design	3 0 3
EEE C472	Satellite Communication	3 0 3

Electronics & Instrumentation Engineering

CS C341	Data Structures & Algorithms	3 0 3
* EEE C381	Electronic Devices & Integrated Circuits	3 0 3
# INSTR C312	Industrial Instrumentation and Control[2]	3 0 3
# INSTR C313	Microelectronic Circuits[1]	3 0 3
# INSTR C355	Electronic Instruments and Instrumentation Technology[2]	3 3 4
# INSTR C364	Analog Electronics[2]	3 3 4
* INSTR C371	Electromechanical Energy Conversion	3 3 4
# INSTR C381	Transducers & Measurement Systems[1]	3 0 3
# INSTR C391	Digital Electronics and Computer Organization[1]	3 3 4
* INSTR C392	Analysis Instrumentation	3 0 3
INSTR C411	Opto-Electronic Instruments	3 0 3
INSTR C414	Telecommunication Switching Systems & Networks	3 0 3
INSTR C421	Digital Systems	3 0 3
INSTR C444	Real-Time Systems	3 0 3
* INSTR C451	Process Control	3 0 3
* INSTR C461	Power Electronics	3 0 3
* INSTR C471	Electronic Measurements and Instrumentation	3 0 3
INSTR C481	Medical Instrumentation	3 0 3
INSTR C491	Special Projects	3

1 Compulsory Discipline Course normally offered in First Semester.
2 Compulsory Discipline Course normally offered in Second Semester.

Engineering Technology

# ET C341	Instrumentation and Control[1]	3 0 3
# ET C342	Materials Management[2]	3 0 3
# ET C351	Chemical Process Technology[2]	3 0 3
# ET C352	Energy Management[2]	3 0 3
# ET C362	Environmental Pollution Control[2]	3 0 3
ET C411	Concepts of Engineering Design	3
# ET C412	Production Planning & Control[1]	3 0 3
ET C413	Advances in Materials Science	3 0 3
# ET C414	Project Appraisal[1]	3 0 3
ET C421	Computer Aided Project Planning and Monitoring	3
ET C422	Computer Aided Manufacturing	3 0 3
ET C431	Technology Forecasting	3 0 3
ET C432	Quality Control, Assurance & Reliability	3 0 3
ET C441	Technology Management	3 0 3
ET C491	Special Projects	3

Finance

# FIN C312	International Financial Markets and Services[2]	3 0 3
# FIN C321	Theory of Finance[1]	3 0 3
# FIN C322	Project Finance[2]	3 0 3
FIN C331	Management Accounting	3 0 3
# FIN C332	Econometrics[2]	3 0 3
# FIN C341	Investment Banking and Financial Services[1]	3 0 3
# FIN C342	Financial Management[1]	3 0 3
FIN C411	Project Appraisal	3 0 3
FIN C413	Risk Management and Insurance	3 0 3
FIN C421	Financing International Trade	3 0 3
FIN C422	Public Finance: Theory and Practice	3 0 3
FIN C424	Money Banking and Financial Markets	3 0 3
FIN C431	Marketing	3 0 3
FIN C432	Issues in Indian Economy	3 0 3
FIN C433	Advertising & Sales Promotion	3 0 3
FIN C436	Strategic Financial Management	3 0 3
FIN C441	Organisational Behaviour	3 0 3
FIN C442	Corporate Planning	3 0 3
FIN C451	International Business	3 0 3
FIN C462	Services Marketing	3 0 3
FIN C491	Special Projects	3

Information Systems

IS C311	Computer Concepts and Software Systems	3 0 3
# IS C313	Object Oriented Programming and Design[1]	3 2 4
IS C321	Program, Data & File Structures	3 0 3
# IS C332	Database Systems and Applications[2]	3 0 3
# IS C341	Software Engineering[2]	3
# IS C342	Structures of Programming Languages[2]	3 0 3
# IS C351	Computer Organization and Architecture[1]	3 2 4
IS C352	Management Information Systems	3 0 3
# IS C362	Operating Systems[1]	3 0 3
# IS C363	Data Structures and Algorithms[1]	3 2 4
IS C411	Information Systems Project	3
IS C415	Data Mining	3 0 3
IS C421	Modelling and Decision Systems	3 0 3
IS C422	Parallel Computing	3 0 3
IS C424	Software for Embedded Systems	3 0 3
IS C431	Educational Software	1 4 3

1 Compulsory Discipline Course normally offered in First Semester.
2 Compulsory Discipline Course normally offered in Second Semester.

IS C442	Advanced Algorithms and Complexity	3 0 3
IS C444	Real Time Systems	3 0 3
IS C446	Data Storage Technologies and Networks	3 0 3
# IS C461	Computer Networks[2]	3 0 3
IS C462	Network Programming	3 0 3
IS C471	Computer Graphics	2 2 3
IS C472	Geographical Information Systems	3 0 3
IS C481	Graphical User Interfaces	3 0 3

Mathematics

# MATH C311	Algebra I[1]	3 0 3
# MATH C312	Algebra II[2]	3 0 3
# MATH C321	Elementary Real Analysis[1]	3 0 3
# MATH C322	Measure and Integration[2]	3 0 3
# MATH C331	Introduction to Topology[1]	3 0 3
# MATH C332	Introduction to Functional Analysis[2]	3 0 3
# MATH C352	Differential Geometry[2]	3 0 3
MATH C353	Statistical Inference and Applications	3 0 3
MATH C411	Complex Analysis	3 0 3
MATH C412	Concepts of Geometry	3 0 3
MATH C413	Topological Groups	3 0 3
MATH C421	Combinatorial Mathematics	3 0 3
MATH C422	Algebraic & Differential Topology	3 0 3
MATH C431	Distribution Theory	3 0 3
MATH C441	Discrete Mathematical Structures	3 0 3
MATH C451	Ordinary Differential Equations	3 0 3
MATH C452	Partial Differential Equations	3 0 3
MATH C461	Integral Equations	3 0 3
MATH C471	Non-Linear Optimisation	3 0 3
MATH C481	Commutative Algebra	3 0 3
MATH C491	Special Projects	3

Manufacturing Engineering

# MF C312	Design of Machine Elements[1]	3 0 3
# MF C313	Kinematics and Dynamics of Machines[1]	3 0 3
# MF C314	Metal Forming and Machining[1]	3 2 4
# MF C315	Casting and Welding[2]	3 2 4
# MF C316	Manufacturing Management[1]	3 0 3
MF C317	Instrumentation and Control	3 0 3
MF C318	Design of Machine Tools	3 0 3
# MF C319	Mechatronics and Automation[2]	3 0 3
MF C321	Mechanical Engineering Drawing	3 0 3
MF C343	Maintenance and Safety	3 0 3
# MF C382	Computer Aided Design[2]	3*
# MF C411	Tool and Fixture Design[2]	3 0 3
MF C412	Automotive Systems	3 0 3
MF C413	Mechanical Vibrations and Acoustics	3 0 3
MF C414	Manufacturing Excellence	3 0 3
MF C415	Noise Engineering	3 0 3
MF C416	Work System Design	3 0 3
MF C417	Internal Combustion Engines	3 0 3
MF C418	Lean Manufacturing	3 0 3
MF C421	Supply Chain Management	4*
MF C432	Computer Aided Manufacturing	3 0 3
MF C441	Quality Control Assurance and Reliability	3 0 3
MF C442	Advances in Materials Science	3 0 3
MF C453	Industrial Relations	3 0 3
MF C472	Precision Engineering	3 0 3
MF C473	Product Design and Development	3 0 3

1 Compulsory Discipline Course normally offered in First Semester.
2 Compulsory Discipline Course normally offered in Second Semester.

MF C474	Product Design and Development Projects	3
MF C481	Project Appraisal	3 0 3
MF C491	Special Projects	3

Mechanical Engineering

# ME C312	Design of Machine Elements[1]	3 0 3
# ME C314	Power Plant Engineering[2]	3 0 3
# ME C331	Transport Phenomena II[1]	3 2 4
# ME C332	Prime Movers and Fluid Machines[2]	3 2 4
# ME C342	Production Techniques[1]	3 2 4
# ME C382	Computer Aided Design[2]	3
# ME C392	Advanced Mechanics of Solids & Kinematics[1]	3 0 3
ME C412	Production Planning & Control	3 0 3
# ME C422	Dynamics of Machines & Vibrations[2]	3 0 3
ME C432	Computer Aided Manufacturing	3 0 3
ME C441	Automotive Vehicles	3 0 3
ME C442	Advances in Materials Science	3 0 3
ME C443	Quality Control, Assurance and Reliability	3 0 3
ME C451	Mechanical Equipment Design	3 0 3
ME C452	Composite Materials & Design	3 0 3
ME C461	Refrigeration and Airconditioning	3 0 3
ME C472	Precision Engineering	3 0 3
ME C481	Project Appraisal	3 0 3
ME C491	Special Projects	3

Pharmacy

# PHA C311	Natural Drugs[1]	2 3 3
# PHA C312	Forensic Pharmacy[2]	3 0 3
# PHA C321	Anatomy Physiology & Hygiene[1]	2 3 3
# PHA C322	Dispensing Pharmacy[1]	2 3 3
# PHA C331	Industrial Pharmacy[1]	2 3 3
# PHA C332	Pharmacology and Toxicology[2]	2 3 3
# PHA C342	Medicinal Chemistry[2]	2 3 3
PHA C411	Physical Pharmacy	2 3 3
PHA C412	Veterinary Pharmacy	3 0 3
PHA C413	Pharmaceutical management & Quality Control	3 0 3
PHA C414	Biopharmaceutics	3 0 3
PHA C415	Pathophysiology	3 0 3
PHA C416	Chemistry of Synthetic Drugs	3 0 3
PHA C417	Pharmacoeconomics	3 0 3
# PHA C421	Pharmaceutical Formulations and Bio-pharmaceutics[2]	2 3 3
PHA C422	Cosmetic Science	2 3 3
PHA C431	Pharmacognosy	2 3 3
PHA C432	Hospital Pharmacy	3 0 3
PHA C441	Biochemical Engineering	3 0 3
PHA C442	Applied Pharmaceutical Chemistry	3 0 3
PHA C461	Phytochemistry	2 3 3
PHA C491	Special Projects	3

Physics

# PHY C311	Electromagnetic Theory I[1]	3 0 3
# PHY C312	Statistical Mechanics[2]	3 0 3
# PHY C321	Quantum Mechanics I[1]	3 0 3
# PHY C322	Solid State Physics[2]	3 0 3
* PHY C332	Methods of Mathematical Physics I[1]	
* PHY C341	Nuclear Physics[2]	3 0 3
* PHY C351	Methods of Experimental Physics	2 3 3
* PHY C352	Atomic & Molecular Spectroscopy[2]	3 0 3
* PHY C353	Optical Physics & Applications	3 0 3
* PHY C362	Particle Physics	3 0 3
PHY C411	Electromagnetic Theory II	3 0 3

1 Compulsory Discipline Course normally offered in First Semester.
2 Compulsory Discipline Course normally offered in Second Semester.

PHY C421	Quantum Mechanics II	3 0 3
PHY C422	Group Theory and Applications	3 0 3
PHY C432	Laser and Applications	3 0 3
PHY C441	Physics Laboratory	0 9 3
PHY C451	Materials Science	3 0 3
PHY C461	Process Analysis Instrumentation	3 0 3
PHY C471	Astrophysics	3 0 3
PHY C491	Special Projects	3

General Studies

It should be noted that there is no clearly defined set of so-called discipline courses in respect of the General Studies programme. The courses drawn from those listed under Humanities, Social sciences and Other courses category and the Science and Applied Sciences category would meet such requirements.

The M.Sc.(Tech.) General Studies programme has also flexibility to offer some skill oriented courses in two different streams, namely Communication and Media Studies and Development Studies. The pool of courses for the two proposed streams for M.Sc.(Tech.) General Studies programme have been identified as shown below:

Pool of Courses for Development Studies

BITS C216	Selected Readings	3 0 3
BITS C217	Environment, Development and Climate Change	3 0 3
BITS C317	Managerial Skills	1 0 1
BITS C319	Negotiation Skills and Techniques	2 0 2
BITS C385	Introduction to Gender Studies	3 0 3
BITS C393	Current Affairs	3 0 3
BITS C397	Techniques in Social Research	3 0 3
BITS C462	Renewable Energy	3 0 3
BITS C484	Introduction to Conflict Management	3 0 3
BITS C487	Global Business Technology and Knowledge Sharing	3 0 3
CDP C211	Agricultural Growth of India	3 0 3
CDP C221	Growth of Social Health in India	3 0 3
CDP C371	Development Economics	3 0 3
ENGG C282	Industrial Engineering Techniques	3 0 3
FIN C411	Project Appraisal	3 0 3
HUM C411	Professional Ethics	3 0 3
IS C472	Geographical Information Systems	3 0 3
MBA C413	Quantitative Methods	4
PHIL C221	Symbolic Logic	3 0 3
POL C212	Modern Political Concepts	3 0 3

Pool of Courses for Communication and Media Studies

BITS C214	Introduction to Mass Communication	3 0 3
BITS C216	Selected Readings	3 0 3
BITS C393	Current Affairs	3 0 3
BITS C394	Mass Media Content and Design	3 0 3
BITS C395	Short Film and Video Production	3 0 3
BITS C396	Reporting and Writing for Media	3 0 3
BITS C398	Creative Multimedia	2 2 3
BITS C486	Product and Brand Management	3 0 3
ENGL C261	Creative Writing	3
ENGL C342	Science Writings	3 0 3

HSS C313	Critical Analysis of Literature and Cinema	3 0 3
HSS C314	Print and Audio Visual Advertising	3 0 3
HUM C342	Graphic Art	3
HUM C411	Professional Ethics	3 0 3
HUM C422	Aesthetics	3 0 3
TA C231	Business Communication	3 0 3
TOC C215	Language Laboratory Practice	0 6 3

Depending on the interest of the students, Clause 1.08 Committee will replace some the existing courses in the chart of M. Sc. (Tech.) General studies with the courses from the concerned pool.

(xi) Practice School I & II or Thesis & Seminar

For each first degree programme, a student has to do Practice School I & II or Thesis & Seminar. Normally a dual degree student will do one degree with Practice School option and another degree with Thesis & Seminar option. Whenever permitted, both degrees may be done with Practice School option or with Thesis & Seminar option.

Note: In addition to the courses listed above there may be remedial course(s) designed by the Dean Instruction from time to time and reported to the Senate.

SEMESTERWISE PATTERNS FOR COMPOSITE DUAL DEGREE PROGRAMMES

The principle by which the composite programme is worked out is described below. All courses and categories of the two programmes that remain after excluding the elective categories, the PS component, the Thesis-Seminar (TS) component, constitute the basic requirement of the composite programme. On this basic requirement is superimposed the smaller of the two elective packages associated with the two concerned programmes as also PS and TS. All these courses are now properly interspersed and resequenced to form the dual degree programme. Thus normally in every dual degree scheme one degree would be with PS and the other with TS.

Semesterwise patterns for composite dual degree programme for Group B to Group A are given in the following pages. It may be seen from these patterns that the system is delicately balanced and any attempt to go outside this would not only upset the system but also result in an ambitious candidate spending more time than what the chart provides.

The semesterwise pattern for composite dual degree programme other than Group B to Group A will be worked out by the Senate appointed Committee as and when required.

Composite Dual Degree Programme (Group B to Group A)
Input Entering in the First Semester

Group B to Engineering

Year	First Semester	Second Semester
I	Same as First Degree Programme	Same as First Degree Programme
II	ES C241 Electrical Sciences I TA C211 Measurement Techniques I TA C252 Computer Programming II PHY C221 Modern Physics (for Phy) MATH C241 Mathematics III ECON C212 Principles of Economics (for Econ) MGTS C211 Principles of Management (for Math, Exptl. Sci.) BIO C211 Biochemistry (for Bio) SOC C211 Dynamics of Social Change (for Econ) ES C221 Mechanics of Solids (for Chem, Math, Phy) BIO C241 Microbiology (for Bio)	ES C242 Structure and Properties of Materials ES C272 Electrical Sciences II TA C222 Measurement Techniques II TA C312 Technical Report Writing CHEM C211 Atomic and Molecular Structure (for Chem) CHEM C232 Chemistry of Organic Compounds (for Chem) MGTS C211 Principles of Management (for Econ) CHE C221 Chemical Process Calculations (for Che) EEE C272 ECE C272 } Circuits & Signals (for EEE, ECE, EI) INSTR C272 ME C211 Applied Thermodynamics (for ME except Chem to ME and Econ to ME) MF C211 Applied Thermodynamics (for MF except Chem to MF and ECON to MF) MATH C222 Discrete Structures for Comp Sci (for CS) CE C212 Transport Phenomena I (for Civil except Chem to Civil) CE C241 Analysis of Structures (for Civil except Bio to Civil and Econ to Civil) ME C212 MF C212 } Transport Phenomena I (for ME, MF) ES C263 Microprocessor Programming & Interfacing (for Bio to CS, Math to CS, Phy to CS) CHE C213 Fluid Flow Operations (for Che except Chem to Che and Econ to Che) ECON C211 Fundamentals of Finance & Accounting (for Econ)
Summer	BITS C221 Practice School I (for PS option only)	
III	First Degree Compulsory Discipline Courses* AAOC C222 Optimization AAOC C311 Data Processing (for Econ. Math) AAOC C221 Graphs and Networks (for Math) BIO C391 Instrumental Methods of Analysis (for Bio) CHEM C391 Instrumental Methods of Analysis (for Chem) PHY C391 Instrumental Methods of Analysis (for Phy) PHY C212 Classical Mechanics (for Phy) ES C221 Mechanics of Solids (for Bio, Econ) Elective 1	First Degree Compulsory Discipline Courses* AAOC C312 Operations Research CE C212 Transport Phenomena I (for Chem to Civil) CE C241 Analysis of Structures (for Bio to Civil and Econ to Civil) ME C211 Applied Thermodynamics (for Chem to ME and Econ to ME) MF C211 Applied Thermodynamics (for Chem to MF and Econ to MF) CHE C213 Fluid Flow Operations (for Chem to Che and Econ to Che) ES C263 Microprocessor Programming & Interfacing (for Chem to CS, Econ to CS) Elective 1
IV	Second Degree Compulsory Discipline Courses* AAOC C321 Control Systems (for B to Che, EEE, EI) AAOC C341 Numerical Analysis (for B to Civil, ME, MF, CS) Electives 2	Second Degree Compulsory Discipline Courses* AAOC C341 Numerical Analysis (for B to Che, EEE, EI) AAOC C321 Control Systems (for B to Civil, ME, MF, CS) Electives 2
V	BITS C413 Practice School II OR BITS C421 Thesis BITS C441 Seminar	BITS C422T Thesis BITS C442T Seminar OR BITS C412 Practice School II

Note: Wherever First Degree Programme is mentioned above, it is as given in Pattern 1.

This is currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

* These are specialized discipline courses to be selected from a pool of courses. Their total number will range from six to nine. Details are given elsewhere in this Part.

Composite Dual Degree Programme (Group B to Group A)
Input Entering in the First Semester

Group B to Pharmacy

Year	First Semester	Second Semester
I	Same as First Degree Programme	Same as First Degree Programme
II	BIO C211 Biological Chemistry ECON C212 Principles of Economics ES C241 Electrical Sciences I PHY C221 Modern Physics (for Phy) MATH C241 Mathematics III TA C211 Measurement Techniques I TA C252 Computer Programming II BIO C241 Microbiology (for Bio) PHA C241 Microbiology (for Chem, Econ, Math, Phy)	ES C242 Structure and Properties of Materials ES C272 Electrical Sciences II CHEM C232 Chemistry of Organic Compounds (for Bio, Chem, Math, Phy) MGTS C211 Principles of Management TA C222 Measurement Techniques II TA C312 Technical Report Writing CHEM C211 Atomic & Molecular Structure (for Chem) SOC C211 Dynamics of Social Change (for Econ) PHA C212 Pharmaceutical Analysis (for Bio, Phy) ECON C211 Fundamentals of Finance & Accounting (for Econ) AAOC C311 Data Processing (for Math)
Summer	BITS C221 Practice School I (for PS option only)	
III	First Degree Compulsory Discipline Courses* AAOC C222 Optimization AAOC C311 Data Processing (for Econ. Math) AAOC C221 Graphs and Networks (for Math) PHY C212 Classical Mechanics (for Phy) PHA C391 Instrumental Methods of Analysis Elective 1	First Degree Compulsory Discipline Courses* AAOC C312 Operation Research AAOC C341 Numerical Analysis (for Math. Exptl.Sc.) PHA C212 Pharmaceutical Analysis (for CHEM, Math, Econ) CHEM C232 Chemistry of Organic Compounds (for Econ)
IV	Second Degree Compulsory Discipline Courses* Electives 3	Second Degree Compulsory Discipline Courses* Electives 2
V	BITS C413 Practice School II OR BITS C421T Thesis BITS C441T Seminar	BITS C422T Thesis BITS C442T Seminar OR BITS C412 Practice School II

Note: Wherever First Degree Programme is mentioned above, it is as given in Pattern 1.

This is currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

* These are specialized discipline courses to be selected from a pool of courses. Their total number will range from six to nine. Details are given elsewhere in this Part.

Composite Dual Degree Programme (Group B to Group A)
Input Entering in the Second Semester

Group B to Engineering

Year	First Semester	Second Semester
I		Same as First Degree Programme
II	Same as First Degree Programme	Same as First Degree Programme
III	Same as First Degree Programme	ECON C211 Fundamentals of Finance & Accounting (for Econ) AAOC C312 Operations Research ES C272 Electrical Sciences II TA C222 Measurement Techniques II CE C212 Transport Phenomena I (for Civil) CE C241 Analysis of Structures (for Civil) ME C212 Transport Phenomena I (for ME) CHE C213 Fluid Flow Operations (for Che) CHE C221 Chemical Process Calculations (for Che) EEE C272 Circuits & signals (for EEE) INSTR C272 Circuits & Signals (for EI) MATH C222 Discrete Structures for Com. Sci. (for CS) ME C211 Applied Thermodynamics (for ME) MF C211 Applied Thermodynamics (for MF) MF C212 Transport Phenomena I (for MF) ES C263 Microprocessor Programming & I Interfacing (for CS, EEE, EI) CHEM C232 Chemistry of Organic Compounds (for Chem) CHEM C211 Atomic & Molecular Structure (for Chem)
Summer	BITS C221 Practice School I (for PS Option only)	
IV	First Degree Compulsory Discipline Courses* ES C221 Mechanics of Solids AAOC C311 Data Processing for (for Econ. , Math) AAOC C221 Graphs and Networks (for Math) BIO C391 Instrumental Methods of Analysis (for Bio.) CHEM C391 Instrumental Methods of Analysis (for Chem.) PHY C391 Instrumental Methods of Analysis (for Phy.) PHY C212 Classical Mechanics (for Phy)	First Degree Compulsory Discipline Courses* AAOC C341 Numerical Analysis (for Math, Exptl. Sc.) Electives 2
V	Second Degree Compulsory Discipline Courses* AAOC C321 Control Systems Electives 2	Second Degree Compulsory Discipline Courses* Electives 2
VI	BITS C413 Practice School II OR BITS C421T Thesis BITS C441T Seminar	BITS C422T Thesis BITS C442T Seminar OR BITS C412 Practice School II

Note: Wherever First Degree Programme is mentioned above, it is as given in Pattern 1.

This is currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

* These are specialized discipline courses to be selected from a pool of courses. Their total number will range from six to nine. Details are given elsewhere in this Part.

Composite Dual Degree Programme (Group B to Group A)
Input Entering in the Second Semester

Group B to Pharmacy

Year	First Semester	Second Semester
I		Same as First Degree Programme
II	Same as First Degree Programme	Same as First Degree Programme
III	AAOC C222 Optimisaton ES C241 Electrical Sciences I TA C211 Measurement Techniques I BIO C241 Microbiology (for Bio) PHA C241 Microbiology (for Chem, Econ, Math, Phy) PHY C221 Modern Physics (for Phy) BIO C211 Biological Chemistry ECON C212 Principles of Economics	AAOC C312 Operations Research ES C272 Electrical Sciences II TA C222 Measurement Techniques II CHEM C232 Chemistry of Organic Compounds (for Bio) CHEM C211 Atomic & Molecular Structure (for Chem) ECON C211 Fundamentals of Finance & Accounting (for Econ) PHA C212 Pharmaceutical Analysis SOC C211 Dynamics of Social Change (for Econ.) Elective 1
Summer	BITS C221 Practice School I (for PS Option Only)	
IV	First Degree Compulsory Discipline Courses* AAOC C221 Graphs and Networks (for Math) AAOC C311 Data processing (for Econ., Math) PHA C391 Instrumental Methods of Analysis PHY C212 Classical Mechanics (for Phy)	First Degree Compulsory Discipline Courses* AAOC C341 Numerical Analysis (for Math, Exptl. Sc.) CHEM C232 Chemistry of Organic Compounds (for Chem, Econ, Math, Phy) Elective 1
V	Second Degree Compulsory Discipline Courses* Electives 2	Second Degree Compulsory Discipline Courses* Electives 2
VI	BITS C413 Practice School II OR BITS C421T Thesis BITS C441T Seminar	BITS C422T Thesis BITS C442T Seminar OR BITS C412 Practice School II

Note: Wherever First Degree Programme is mentioned above, it is as given in Pattern 1.

This is currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

* These are specialized discipline courses to be selected from a pool of courses. Their total number will range from six to nine. Details are given elsewhere in this Part.

HIGHER DEGREE PROGRAMMES

M.E./M.PHARM./M.PHIL./MBA PROGRAMMES

A. Requirements

(i) M.E./M.Pharm./MPH:

Total number of units required – 60 (Minimum) with a breakup as follows:

(a) Dissertation: 15 (Min) – 25 (Max) Units

OR

Practice School : 20 units

(b) Course work : 35 (Min) units

(other than Dissertation/Practice School)

Courses for the course work will be chosen from the list of named and elective courses earmarked for each degree. Total number of courses is nine. In addition to these nine courses all the students are required to do one course on Technical Communication and two courses on Professional Practice. For electives, courses can be drawn from across various disciplines, subject to approval by the Higher Degree Counselling Committee (HDCC).

There is also a flexibility for students of Higher Degree Programmes to register in upto a maximum of one more elective, in addition to the prescribed number of electives. The grade obtained in the additional elective will also be counted towards the CGPA. This additional elective can be from the pool of electives of the concerned degree or courses from other disciplines' named and electives with the permission of HDCC.

(ii) M.Phil.:

Total number of units required - 50 (Minimum) with a breakup as follows:

(a) Dissertation : 12 (Min.) - 25 (Max.) units

OR

Practice School : 20 units

(b) Course work : 25 units (min.)

(other than Dissertation/Practice School)

The courses for course work can be chosen from a list of General/Special courses earmarked for the degree. Wherever there is a need, courses can also be drawn from across the course offerings in various Higher Degree programmes as well as advanced First Degree level, provided the students are adequately prepared for the particular course.

(iii) M.B.A.: The course requirements of the MBA programme are spelt out in terms of courses belonging to different categories in the table below:

Category	No. of Units Required	No. of Courses Required
Named Courses	40-60	15-20
Elective(s)	12-18	4-6
Subtotal	55 (Min)	20 (Min)
PS OR Dissertation	20 16	1
Total	70 (Min)	21 (Min)

Courses for the course work will be chosen from the list of named and elective courses earmarked for the MBA degree.

Dissertation: Normal registration for dissertation is after completion of course work. Normally 16 units of Dissertation will be assigned at the time of this registration. In case of programmes other than MBA, units upto a maximum of 25 may be permitted depending on the total time and work put in by an individual student and the registration in more than 16 units of Dissertation will be normally available only to students who have taken higher degree courses as electives in their first degree programmes or to professionals who have shown competence

in some specialized courses through their professional involvement. Concurrent registration for a nominal 8 units per semester in Dissertation with course work is also permissible for motivated, well-prepared and hardworking students. Provision exists for the Dissertation to be carried out as work-integrated dissertation at recognized off-campus centres or in an organization where the student may get employment, subject to all the stipulations of Academic Regulations.

Practice School: Registration for Practice School is possible only after the completion of all course work. Concurrent registration of other courses with Practice School is not permitted. All clauses of Academic Regulations applicable to first degree PS courses will govern the operation of this Practice School also.

B. Access to Courses

This access is subject to the Academic Regulations and further specific stipulations as follows:

- All general/special courses require the corresponding first degree of BITS or equivalent.
- Approval of the Higher Degree Counselling Committee.

C. General

(i) There will be a Higher Degree Counselling Committee composed of Dean RCD (Convenor), Dean ARCD, Dean ID, Dean PSD, Dean WILPD and the Unit Chief IPC. This Committee is charged with the task of making the semesterwise programmes for various students and monitoring the same. The Committee may co- opt any faculty member of the Institute whenever there is a need to discuss an individual case. This Committee will also draw, from time to time, a list of courses from the Higher Degree programmes from which the students of the Integrated First Degrees can offer the courses as their electives.

(ii) The Dissertation, whether registered for full or partial units, will be awarded a non-letter grade, viz., Excellent, Good, Fair or Poor, at the end of the corresponding semester.

(iii) Ph.D. Qualifying Examination for an eligible candidate will be based on the higher degree courses. Dissertation will not form part of the Qualifying Examination.

(iv) A first degree student can choose upto a maximum of two higher degree courses as electives for his/her first degree from the pool of general/special courses of the corresponding higher degree. When such a student seeks admission to any of the Higher Degree programme of the institute, the student may be given exemption from these courses; however, the student will have to complete the total unit requirements of the higher degree. The minimum units in Dissertation for such a candidate will be increased by the same number of units as exempted from the course work so as to earn the minimum prescribed total units. In such a case, the exempted courses will also form part of the Ph.D. Qualifying Examination when the student appears for the same. HDCC is also empowered to replace the course cleared in first degree by a course from the pool of electives of higher degree on a case by case basis, as an alternative to increasing the dissertation units.

Pattern 1	Semesterwise Pattern for Students Admitted to Higher Degree Programmes in the First Semester								
Year	First Semester				U	Second Semester			U
Biotechnology									
I	BIO	G512	Molecular Mechanism of Gene Expression		5	BIO	G642	Experimental Techniques	5
	BIO	G542	Advanced Cell and Molecular Biology		5	BIO	G641	Cell & Tissue Culture Technology	4
	BIO	G611	Environmental Biotechnology		5	BIO	G643	Plant Biotechnology	5
	BITS	G659	Technical Communication		4	BITS	G620	Professional Practice I	3
					19				17
II	BIO	G513	Microbial & Fermentation Technology		5	BITS	G629T	Dissertation OR	16
	BITS	G621	Professional Practice II		3	BITS	G639	Practice School	20
			Elective		*				
			Elective		*				
					14				16/20
Chemical									
I	BITS	G659	Technical Communication		4	BITS	G620	Professional Practice I	3
	CHE	G541	Process Plant Simulation		4	CHE	G542	Computational Transport Phenomena	5
	CHE	C473	Advanced Process Control		4				
	CHE	G513	Environmental Management Systems		5	CHE	G614	Advanced Heat Transfer	5
						CHE	G641	Reaction Engineering	5
					17				18
II	BITS	G621	Professional Practice II		3	BITS	G629T	Dissertation OR	16
	CHE	G615	Advanced Separation Processes		5	BITS	G639	Practice School	20
			Elective		*				
			Elective		*				
					14				16/20
Chemical – Petroleum Engineering									
I	BITS	G659	Technical Communication		4	BITS	G620	Professional Practice I	3
	CHE	G541	Process Plant Simulation		4	CHE	G542	Computational Transport Phenomena	5
	CHE	C473	Advanced Process Control		4				
	CHE	G616	Petroleum Reservoir Engineering		5	CHE	G617	Petroleum Refinery Engineering	5
						CHE	G618	Petroleum Downstream Processing	5
					17				18
II	BITS	G621	Professional Practice II		3	BITS	G629T	Dissertation OR	16
	CHE	G615	Advanced Separation Processes		5	BITS	G639	Practice School	20
			Elective		*				
			Elective		*				
					14				16/20

* *Minimum 3 Units*

Note: This is the suggested semesterwise pattern by the appropriate Senate appointed committee, subject to change if the situation warrants.

Pattern 1	Semesterwise Pattern for Students Admitted to Higher Degree Programmes in the First Semester								
Year	First Semester			U	Second Semester			U
Civil – Infrastructure Systems								
I	BITS	G659	Technical Communication	4	BITS	G620	Professional Practice I	3
	CE	G515	Fundamentals of Systems Engineering	4	BITS	C494	Environmental Impact Assessment	4
					CE	G529	Construction Project Control Systems	4
	CE	G523	Transportation Systems Planning and Management	4	CE	G520	Infrastructure Planning and Management	4
	CE	G525	Water Resources Planning and Management	4				
				16				15
II	BITS	G621	Professional Practice II	3	BITS	G629T	Dissertation	16
	IS	C472	Geographical Information System	3			OR	
			Elective	*	BITS	G639	Practice School	20
			Elective	*				
				12				16/20
Civil – Structural Engineering								
I	BITS	G659	Technical Communication	4	BITS	G620	Professional Practice I	3
	CE	G551	Dynamics of Structures	4	CE	G552	Advanced Structural mechanics and Stability	4
	CE	G617	Advanced Structural Analysis	4	CE	G553	Theory of Plates and Shells	4
	CE	G619	Finite Element Analysis	5	CE	G615	Earthquake Engineering	4
				17				15
II	BITS	G621	Professional Practice II	3	BITS	G629T	Dissertation	16
	CE	G533	Advanced Composite Materials for Structures	4			OR	
					BITS	G639	Practice School	
			Elective	*				20
			Elective	*				
				13				16/20
Civil – Transportation Engineering								
I	BITS	G659	Technical Communication	4	BITS	G620	Professional Practice I	3
	CE	G523	Transportation Systems Planning and Management	4	CE	G518	Pavement Analysis and Design	4
					CE	G536	Traffic Engineering and Safety	4
	CE	G534	Pavement Material Characterization	4	CE	G537	Transport Economics and Finance	4
					CE	G532	Advanced Soil Mechanics	4
	CE	G535	Highway Geometric Design	4				
	IS	C472	Geographical Information System	3				
				19				19
II	BITS	C621	Professional Practice II	4	BITS	G629T	Dissertation	16
	CE	G524	Urban Mass Transit Planning, Operations and Management	4			OR	
					BITS	G639	Practice School	20
	CE	G538	Project Planning and Management	4				
			Elective	*				
			Elective	*				
				18				16/20

* *Minimum 3 Units*

Note: This is the suggested semesterwise pattern by the appropriate Senate appointed committee, subject to change if the situation warrants.

Pattern 1	Semesterwise Pattern for Students Admitted to Higher Degree Programmes in the First Semester							
Year	First Semester				U	Second Semester				U
Communication Engineering										
I	BITS	G659	Technical Communication		4	BITS	G620	Professional Practice I		3
	EEE	C415	Digital Signal Processing		3	EEE	G591	Optical Communication		5
	EEE	G581	RF and Microwave Engg.		5	EEE	G592	Mobile and Personal Communication		5
	EEE	G612	Coding Theory and Practice		5	EEE	G622	Advanced Digital Communication		5
					17					18
II	BITS	G621	Professional Practice II		3	BITS	G629T	Dissertation		16
	EEE	C472	Satellite Communication		3			OR		
			Elective		*	BITS	G639	Practice School		20
			Elective		*					
					12					16/20
Computer Science										
I	BITS	G659	Technical Communication		4	BITS	G620	Professional Practice I		3
	CS	G551	Advanced Compilation Techniques		5	CS	G513	Network Security		4
	CS	G562	Advanced Architecture and Performance Evaluation		5	CS	G514	Object Oriented Analysis and Design		4
						CS	G553	Reconfigurable Computing		5
	CS	G623	Advanced Operating System		5					
					19					16
II	BITS	G621	Professional Practice II		3	BITS	G629T	Dissertation		16
	EEE	G512	Embedded System Design		4			OR		
			Elective		*	BITS	G639	Practice School		20
			Elective		*					
					13					16/20
Electrical – Power Electronics and Drives										
I	BITS	G659	Technical Communication		4	EEE	G544	Steady state and dynamics of electric motors		5
	EEE	G541	Distribution apparatus and configurations		5	EEE	G545	Control and instrumentation for systems		5
	EEE	G542	Power electronic converters		5					
	EEE	G543	Power device microelectronics and selections		3	EEE	G552	Solid state drives		5
						BITS	G620	Professional Practice I		3
					17					18
II	EEE	G546	Systems simulation lab		4	BITS	G629T	Dissertation		16
	BITS	G621	ofessional Practice II		3			OR		
			ctive		*	BITS	G639	Practice School		20
			Elective		*					
					13					16/20

* *Minimum 3 Units*

Note: This is the suggested semesterwise pattern by the appropriate Senate appointed committee, subject to change if the situation warrants.

Pattern 1				**Semesterwise Pattern for Students Admitted to Higher Degree Programmes in the First Semester**					
Year	First Semester			U	Second Semester			U
Embedded Systems								
I	BITS	G659	Technical Communication	4	BITS	G620	Professional Practice I	3
	BITS	G553	Real Time Systems	5	CS	C424	Software for Embedded Systems	3
	EEE	C415	Digital Signal Processing	3	EEE	G512	Embedded System Design	4
			Elective	*	MEL	G642	VLSI Architectures	4
				15				14
II	BITS	G621	Professional Practice II	3	BITS	G629T	Dissertation	16
	EEE	G626	Hardware Software Co-design	4			OR	
			Elective	*	BITS	G639	Practice School	20
			Elective	*				
				13				16/20
Microelectronics								
I	BITS	G659	Technical Communication	4	BITS	G620	Professional Practice I	3
	MEL	G611	IC Fabrication Technology	5	MEL	G632	Analog IC Design	5
	MEL	G621	VLSI Design	5	MEL	G641	CAD for IC Design	5
	MEL	G631	Physics and Modelling of Microelectronic Devices	5	MEL	G642	VLSI Architectures	4
				19				17
II	BITS	G621	Professional Practice II	3	BITS	G629T	Dissertation	16
			Elective	*			OR	
			Elective	*	BITS	G629T	Practice School	20
			Elective	*				
				12				16/20
Manufacturing Systems Engineering								
I	BITS	G659	Technical Communication	4	BITS	G620	Professional Practice I	3
	EA	C412	Flexible Manufacturing Systems	4	MSE	G511	Mechatronics	5
	ME	C443	Quality Control, Assurance & Reliability	3	MSE	G512	Manufacturing Planning and Control	4
					MSE	G531	Concurrent Engineering	5
	ME	G511	Mechanisms and Robotics	5				
II	BITS	G621	Professional Practice II	3	BITS	G629T	Dissertation	16
	MSE	G521	World-class Manufacturing	5			OR	
			Elective	*	BITS	G639	Practice School	20
			Elective	*				
				14				16/20

* *Minimum 3 Units*

Note: This is the suggested semesterwise pattern by the appropriate Senate appointed committee, subject to change if the situation warrants.

Pattern 1	**Semesterwise Pattern for Students Admitted to Higher Degree Programmes in the First Semester**							
Year	First Semester			U	Second Semester			U
Mechanical Engineering								
I	BITS	G659	Technical Communication	4	BITS	G620	Professional Practice I	3
	ME	C443	Quality Control, Assurance & Reliability	3	ME	G532	Machine Tool Engineering	5
	ME	G511	Mechanisms and Robotics	5	ME	G611	Computer Aided Analysis and Design	5
	ME	G512	Finite Element Methods	5	ME	G631	Heat Transfer	5
				17				18
II	BITS	G621	Professional Practice II	3	BITS	G629T	Dissertation	16
	ME	G641	Theory of Elasticity & Plasticity	5			OR	
			Elective	*	BITS	G639	Practice School	20
			Elective	*				
				14				16/20
Design Engineering								
I	BITS	G659	Technical Communication	4	BITS	G620	Professional Practice I	3
	DE	G611	Dynamics & Vibration	5	DE	G631	Materials Technology & Testing	5
	ME	G511	Mechanisms and Robotics	5	ME	G521	Mechanical System Design	5
	ME	G512	Finite Element Methods	5	ME	G611	Computer Aided Analysis and Design	5
				19				18
II	BITS	G621	Professional Practice II	3	BITS	G629T	Dissertation	16
	DE	G531	Product Design	5			OR	
			Elective	*	BITS	G639	Practice School	20
			Elective	*				
				14				16/20
Pharmacy								
I	BITS	G659	Technical Communication	4	BITS	G620	Professional Practice I	3
	PHA	G532	Quality Assurance & Regulatory Affairs	5	PHA	G611	Advanced Pharmacology	5
	PHA	G612	Pharmacokinetics & Clinical Pharmacy	5	PHA	G621	Advanced Medicinal Chemistry	5
	PHA	G543	Clinical Research	5	PHA	G632	Dosage Form Design	5
				19				18
II	BITS	G621	Professional Practice II	3	BITS	G629T	Dissertation	16
			Elective	5			OR	
			Elective	*	BITS	G639	Practice School	20
			Elective	*				
				14				16/20

* *Minimum 3 Units*

Note: This is the suggested semesterwise pattern by the appropriate Senate appointed committee, subject to change if the situation warrants.

Pattern 1	**Semesterwise Pattern for Students Admitted to Higher Degree Programmes in the First Semester**							
Year	First Semester				U	Second Semester			U
Pharmacy – Pharmaceutics									
I	BITS	G659	Technical Communication		4	BITS	G620	Professional Practice I	3
	PHA	G532	Quality Assurance & Regulatory Affairs		5	PHA	G611	Advanced Pharmacology	5
						PHA	G621	Advanced Medicinal Chemistry	5
	PHA	G543	Clinical Research		5	PHA	G632	Dosage Form Design	5
	PHA	G612	Pharmacokinetics & Clinical Pharmacy		5				
					19				18
II	BITS	G621	Professional Practice II		3	BITS	G629T	Dissertation	16
	PHA	G542	Advanced Physical Pharmaceutics		5			OR	
			Elective		*	BITS	G639	Practice School	20
			Elective		*				
					14				16/20
Pharmacy – Pharmaceutical Chemistry									
I	BITS	G659	Technical Communication		4	BITS	G620	Professional Practice I	3
	PHA	G532	Quality Assurance & Regulatory Affairs		5	PHA	G611	Advanced Pharmacology	5
						PHA	G621	Advanced Medicinal Chemistry	5
	PHA	G543	Clinical Research		5	PHA	G632	Dosage Form Design	5
	PHA	G612	Pharmacokinetics & Clinical Pharmacy		5				
					19				18
II	BITS	G621	Professional Practice II		3	BITS	G629T	Dissertation	16
	PHA	G522	Chemistry of Macromolecules		4			OR	
			Elective		*	BITS	G639	Practice School	20
			Elective		*				
					13				16/20
Software System									
I	BITS	C481	Computer Networks		3	BITS	G620	Professional Practice I	3
	BITS	G659	Technical Communication		4	SS	G515	Data Warehousing	5
	SS	G514	Object Oriented Programming & Design		4	SS	G516	Computer Organization and Software	5
	SS	G562	Software Engineering & Management		5			Systems	
								Elective	*
					16				16
II	BITS	G621	Professional Practice II		3	BITS	G629T	Dissertation	16
	SS	G531	Pervasive Computing		4			OR	
	SS	G653	Software Architecture		5	BITS	G639	Practice School	20
			Elective		*				
					15				16/20

* *Minimum 3 Units*

Note: This is the suggested semesterwise pattern by the appropriate Senate appointed committee, subject to change if the situation warrants.

Pattern 1	Semesterwise Pattern for Students Admitted to Higher Degree Programmes in the First Semester						
Year	First Semester			U	Second Semester			U
Master of Business Administration								
I	MBA	C311	Business Structure & Processes	4	MBA	C416	Corporate Finance & Taxation	4
	MBA	C317	Managerial Skills	1	MBA	C319	Negotiation Skills & Techniques	2
	MBA	C312	Managerial Economics	3	MBA	C418	Marketing	4
	MBA	C411	Organizational Behaviour	4	MBA	C412	Human Resource Management	4
	MBA	C417	Managerial Communication	4	MBA	C419	Production & Operations Management	4
	MBA	C321	Legal and Economic Environment of Business	4	MBA	C471	Management Information Systems	3
	MBA	C413	Quantitative Methods	4	MBA	C421	Supply Chain Management	4
	MBA	C415	Financial & Management Accounting	4				
				28				25
II	MBA	C422	Business and Society	4	BITS	G561	Dissertation	16
	MBA	C423	Business Policy & Strategic Management	4			OR	
					BITS	G560	Practice School	20
	MBA	C424	International Business	3				
			Elective	*				
			Elective	*				
			Elective	*				
			Elective	*				
				27				16/20
Master in Public Health								
I	MPH	G510	Biostatistics & Computers in Public Health	5	MPH	G521	Health Care Management	4
	MPH	G512	Environmental and Occupational Health	4	MPH	G522	Preventive Nutrition & Health Promotion	4
	MPH	G513	Public Health & Diseases	4	MPH	G523	Epidemic & Disaster Management	4
	BITS	G515	Management Principles and Practices	4	MPH	G692	Epidemology	2
					BITS	G620	Professional Practice I	3
	MPH	G515	Communication in Health Care	4	MPH	G613	Health System and Society	2
				21				19
II	BITS	G621	Professional Practice II	3	BITS	G629T	Dissertation	16
	MPH	G531	Health Economics & Financial Management	4			OR	
					BITS	G639	Practice School	20
			Elective	*				
			Elective	*				
			Elective	*				
				16				16/20

* *Minimum 3 Units*

Note: This is the suggested semesterwise pattern by the appropriate Senate appointed committee, subject to change if the situation warrants.

Pattern 1	**Semester-wise Pattern for Students Admitted to M. Phil. Chemistry Programme in First Semester**							
Year	First Semester			U	Second Semester			U
I	BITS	G659	Technical Communication	4	BITS	G620	Professional Practice I	3
	CHEM	G551	Advanced Organic Chemistry	5	CHEM	G552	Advanced Inorganic Chemistry	5
	CHEM	G553	Advanced Physical Chemistry	5	CHEM	G554	Physical Methods in Chemistry	5
	CHEM	G555	Chemistry of Life Processes	4			Elective	3
				18				16
II	BITS	G621	Professional Practice II	3	BITS	G629T	Dissertation	16
			Elective	*			OR	
			Elective	*	BITS	G639	Practice School	20
			Elective	*				
				12				16/20

** Minimum 3 units*

Note: This is a currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

Pattern 2	Semesterwise Pattern for Students Admitted to Higher Degree Programmes in the Second Semester								
Year	First Semester				U	Second Semester			U
Biotechnology									
I						BIO	G642	Experimental Techniques	5
						BIO	G641	Cell & Tissue Culture Technology	4
						BIO	G643	Plant Biotechnology	5
						BITS	G659	Technical Communication	4
									18
II	BIO	G512	Molecular Mechanism of Gene Expression		5	BIO	G542	Advanced Cell and Molecular Biology	5
	BIO	G611	Environmental Biotechnology		5	BITS	G621	Professional Practice II	3
	BIO	G513	Microbial & Fermentation Technology		5			Elective	*
								Elective	*
	BITS	G620	Professional Practice I		3				
					18				14
III	BITS	G629T	Dissertation		16				
			OR						
	BITS	G639	Practice School		20				
					16/20				
Chemical									
I						BITS	G659	Technical Communication	4
						CHE	G542	Computational Transport Phenomena	5
						CHE	C473	Advanced Process Control	4
						CHE	G614	Advanced Heat Transfer	5
									18
II	BITS	G620	Professional Practice I		3	BITS	G621	Professional Practice II	3
	CHE	G541	Process Plant Simulation		4	CHE	G641	Reaction Engineering	4
	CHE	G615	Advanced Separation Processes		5			Elective	*
								Elective	*
	CHE	G513	Environmental Management Systems		5				
					17				13
III	BITS	G629T	Dissertation		16				
			OR						
	BITS	G639	Practice School		20				
					16/20				

* *Minimum 3 Units*

Note: This is the suggested semesterwise pattern by the appropriate Senate appointed committee, subject to change if the situation warrants.

Pattern 2 Semesterwise Pattern for Students Admitted to Higher Degree Programmes in the Second Semester									
Year	First Semester				U	Second Semester			U
Chemical – Petroleum Engineering									
I						BITS	G659	Technical Communication	4
						CHE	G542	Computational Transport Phenomena	5
						CHE	G617	Petroleum Refinery Engineering	5
						CHE	C473	Advanced Process Control	4
									18
II	BITS	G620	Professional Practice I		3	BITS	G621	Professional Practice II	3
	CHE	G541	Process Plant Simulation		4	CHE	G618	Petroleum Downstream Processing	5
	CHE	G615	Advanced Separation Processes		5			Elective	*
								Elective	
	CHE	G616	Petroleum Reservoir Engineering		5				*
					17				14
III	BITS	G629T	Dissertation		16				
			OR						
	BITS	G639	Practice School		20				
					16/20				

* *Minimum 3 Units*

Note: This is the suggested semesterwise pattern by the appropriate Senate appointed committee, subject to change if the situation warrants.

Semesterwise Pattern for Students Admitted to M.E. Civil with specialization in Infrastructure Systems Programme in the Second Semester									
Year	First Semester			U	Second Semester			U
I					BITS	G659	Technical Communication	4
					CE	G529	Construction Project Control Systems	4
					BITS	C494	Environmental Impact assessment	4
					CE	G520	Infrastructure Planning and Management	4
								16
II	BITS	G620	Professional Practice I	3	BITS	G621	Professional Practice II	3
	CE	G515	Fundamentals of Systems Engineering	4	IS	C472	Geographical Information System	3
							Elective	*
	CE	G523	Transportation Systems Planning and Management	4			Elective	*
	CE	G525	Water Resources Planning and Management	4				
				15				12
III	BITS	G629T	Dissertation	16				
			OR					
	BITS	G639	Practice School	20				
				16/20				
Civil – Structural Engineering								
I					BITS	G659	Technical Communication	4
					CE	G552	Advanced Structural Mechanics and Stability	4
					CE	G553	Theory of Plates and Shells	4
					CE	G551	Dynamics of Structures	4
								16
II	BITS	G620	Professional Practice I	3	BITS	G621	Professional Practice II	3
	CE	G533	Advanced Composite Materials for Structures	4	CE	G615	Earthquake Engineering	4
							Elective	*
	CE	G617	Advanced Structural Analysis	4			Elective	*
	CE	G619	Finite Element Analysis	5				
				16				13
III	BITS	G629T	Dissertation	16				
			OR					
	BITS	G639	Practice School	20				
				16/20				

** Minimum 3 units*

Note: This is a currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

Pattern 2	Semesterwise Pattern for Students Admitted to Higher Degree Programmes in the Second Semester									
Year	First Semester				U	Second Semester				U
Communication Engineering										
I						BITS	G659	Technical Communication		4
						EEE	C415	Digital Signal Process		3
						EEE	G592	Mobile and Personal Communication		5
						EEE	G622	Advanced Digital Communication		5
										17
II	BITS	G620	Professional Practice I		3	BITS	G621	Professional Practice II		3
	EEE	C472	Satellite Communication		3	EEE	C591	Optical Communication		5
	EEE	G581	RF and Microwave Engg.		5			Elective		*
	EEE	G612	Coding Theory and Practice		5			Elective		*
					16					14
III	BITS	G629T	Dissertation		16					
			OR							
	BITS	G639	Practice School		20					
					16/20					
Computer Science										
I						BITS	G659	Technical Communication		4
						CS	G513	Network Security		4
						CS	G514	Object Oriented Analysis and Design		4
						CS	G553	Reconfigurable Computing		5
										17
II	BITS	G620	Professional Practice I		3	BITS	G621	Professional Practice II		3
	CS	G551	Advanced Compilation		5	EEE	G512	Embedded System Design		4
			Techniques					Elective		*
	CS	G562	Advanced Architecture and					Elective		*
			Performance Evaluation		5					
	CS	G623	Advanced Operating System		5					
					18					13
III	BITS	G629T	Dissertation		16					
			OR							
	BITS	G639	Practice School		20					
					16/20					
Embedded Systems										
I						BITS	G659	Technical Communication		4
						CS	C424	Software for Embedded System		3
						EEE	C415	Digital Signal Process		3
						EEE	G512	Embedded System Design		4
										14
II	BITS	G620	Professional Practice I		3	BITS	G624	Professional Practice II		3
	BITS	G553	Real Time System		5	MEL	G642	VLSI Architecture		4
	EEE	G626	Hardware Software Co-design		4			Elective		*
			Elective		*			Elective		*
					15					13
III	BITS	G629T	Dissertation		16					
			OR							
	BITS	G639	Practice School		20					
					16/20					

* *Minimum 3 Units*

Note: This is the suggested semesterwise pattern by the appropriate Senate appointed committee, subject to change if the situation warrants.

Pattern 2	Semesterwise Pattern for Students Admitted to Higher Degree Programmes in the Second Semester								
Year	First Semester				U	Second Semester			U
Manufacturing Systems Engineering									
I						BITS	G659	Technical Communication	4
						MSE	G511	Mechatronics	5
						MSE	G512	Manufacturing Planning and Control	4
						MSE	G531	Concurrent Engineering	5
									18
II	BITS	G620		Professional Practice I	3	BITS	G621	Professional Practice II	3
	EA	C412		Flexible Manufacturing Systems	4	MSE	G521	World-class Manufacturing	5
	ME	C443		Quality Control, Assurance & Reliability	3			Elective	*
								Elective	*
	ME	G511		Mechanisms and Robotics	5				
					15				14
III	BITS	G629T		Dissertation	16				
				OR					
	BITS	G639		Practice School	20				
					16/20				
Mechanical Engineering									
I						BITS	G659	Technical Communication	4
						ME	G532	Machine Tool Engineering	5
						ME	G611	Computer Aided Analysis and Design	5
						ME	G631	Heat Transfer	5
									19
II	BITS	G620		Professional Practice I	3	BITS	G621	Professional Practice II	3
	ME	C443		Quality Control, Assurance &		ME	G641	Theory of Elasticity & Plasticity	5
				Reliability	3			Elective	*
	ME	G511		Mechanisms and Robotics	5			Elective	*
	ME	G512		Finite Element Methods	5				
					16				14
III	BITS	G629T		Dissertation	16				
				OR					
	BITS	G639		Practice School	20				
					16/20				
Design Engineering									
I						BITS	G659	Technical Communication	4
						DE	G631	Materials Technology & Testing	5
						ME	G521	Mechanical System Design	5
						ME	G611	Computer Aided Analysis and Design	5
									19
II	BITS	G620		Professional Practice I	3	BITS	G621	Professional Practice II	3
	DE	G611		Dynamics & Vibration	5	DE	G531	Product Design	5
	ME	G511		Mechanisms and Robotics	5			Elective	*
	ME	G512		Finite Element Methods	5			Elective	*
					18				14
III	BITS	G629T		Dissertation	16				
				OR					
	BITS	G639		Practice School	20				
					16/20				

* *Minimum 3 Units*

Note: This is the suggested semesterwise pattern by the appropriate Senate appointed committee, subject to change if the situation warrants.

Pattern 2	Semesterwise Pattern for Students Admitted to Higher Degree Programmes in the Second Semester				
Year	First Semester	U	Second Semester		U
Pharmacy					
I			BITS G659 Technical Communication		4
			PHA G611 Advanced Pharmacology		5
			PHA G621 Advanced Medicinal Chemistry		5
			PHA G632 Dosage Form Design		5
					19
II	BITS G620 Professional Practice I	3	BITS G621 Professional Practice II		3
	PHA G532 Quality Assurance & Regulatory Affairs	5	Elective		5
			Elective		*
	PHA G612 Pharmacokinetics & Clinical Pharmacy	5	Elective		*
	PHA G543 Clinical Research	5			
		18			14
III	BITS G629T Dissertation OR	16			
	BITS G639 Practice School	20			
		16/20			
Pharmacy – Pharmaceutics					
I			BITS G659 Technical Communication		4
			PHA G543 Clinical Research		5
			PHA G621 Advanced Medicinal Chemistry		5
			PHA G632 Dosage Form Design		5
					19
II	BITS G620 Professional Practice I	3	BITS G621 Professional Practice II		3
	PHA G532 Quality Assurance & Regulatory Affairs	5	PHA G611 Advanced Pharmacology		5
			Elective		*
	PHA G612 Pharmacokinetics & Clinical Pharmacy	5	Elective		*
	PHA G542 Advanced Physical Pharmaceutics	5			
		18			14
III	BITS G629T Dissertation OR	16			
	BITS G639 Practice School	20			
		16/20			
Pharmacy – Pharmaceutical Chemistry					
I			BITS G659 Technical Communication		4
			PHA G543 Clinical Research		5
			PHA G621 Advanced Medicinal Chemistry		5
			PHA G632 Dosage Form Design		5
					19
II	BITS G620 Professional Practice I	3	BITS G621 Professional Practice II		3
	PHA G532 Quality Assurance & Regulatory Affairs	5	PHA G611 Advanced Pharmacology		5
			Elective		*
	PHA G612 Pharmacokinetics & Clinical Pharmacy	5	Elective		*
	PHA G522 Chemistry of Macromolecules	4			
		17			14
III	BITS G629T Dissertation or OR	16			
	BITS G639 Practice School	20			
		16/20			

* *Minimum 3 Units*

Note: This is the suggested semesterwise pattern by the appropriate Senate appointed committee, subject to change if the situation warrants.

Pattern 2	Semesterwise Pattern for Students Admitted to Higher Degree Programmes in the Second Semester				
Year	First Semester	U	Second Semester		U
Software System					
I			BITS C481	Computer Networks	3
			BITS G659	Technical Communication	4
			SS G514	Object Oriented Analysis & Design	4
			SS G515	Data Warehousing	5
					16
II	BITS G620	Professional Practice I	3	BITS G621 Professional Practice II	3
	SS G531	Pervasive Computing	4	SS G516 Comp. Organization & Software Systems	5
	SS G653	Software Architecture	5	Elective	*
	SS G562	Software Engineering & Management	5	Elective	*
			17		14
III	BITS G629T	Dissertation	16		
		OR			
	BITS G639	Practice School	20		
			16/20		
Master of Business Administration					
I			MBA C311	Business Structure & Processes	4
			MBA C312	Managerial Economics	3
			MBA C411	Organisational Behaviour	4
			MBA C418	Marketing	4
			MBA C319	Negotiation Skills & Techniques	2
			MBA C412	Human Resource Management	4
				Elective	*
					24
II	MBA C317	Managerial Skills	1	MBA C423 Business Policy & Strategic Management	4
	MBA C417	Managerial Communication	4	MBA C416 Corporate Finance & Taxation	4
	MBA C415	Financial & Management Accounting	4	MBA C419 Production & Operations Management	4
	MBA C413	Quantitative Methods	4	MBA C471 Management Information Systems	3
	MBA C321	Legal and Economic Environment of Business	4	MBA C421 Supply Chain Management	4
				MBA C424 International Business	3
	MBA C422	Business and Society	4	Elective	3
		Elective	*		
		Elective	*		
			27		25
III	BITS G561	Dissertation	16		
		OR			
	BITS G560	Practice School	20		
			16/20		

* *Minimum 3 Units*

Note: This is the suggested semesterwise pattern by the appropriate Senate appointed committee, subject to change if the situation warrants.

Pattern 2	**Semesterwise Pattern for Students Admitted to Higher Degree Programmes in the Second Semester**							
Year	First Semester			U	Second Semester			U
Master in Public Health								
I					MPH	G521	Health Care Management	4
					MPH	G522	Preventive Nutrition & Health Promotion	4
					MPH	G523	Epidemic & Disaster Management	4
					MPH	G692	Epidemology	2
					MPH	G515	Communication in Health Care	4
					MPH	G613	Health System and Society	2
								20
II	MPH	G510	Biostatistics & Computers in Public Health	5	BITS	G621	Professional Practice II	3
	MPH	G512	Environmental and Occupational Health	4	MPH	G531	Health Economics & Financial Management	4
	MPH	G513	Public Health & Diseases	4			Elective	*
	BITS	G515	Management Principles and Practices	4			Elective	*
	BITS	G620	Professional Practice I	3			Elective	*
				20				16
III	BITS	G629T	Dissertation OR	16				
	BITS	G639	Practice School	20				
				16/20				
M.Phil Chemistry								
I					BITS	G659	Technical Communication	4
					CHEM	G552	Advanced Inorganic Chemistry	5
					CHEM	G554	Physical Methods in Chemistry	5
							Elective	3
								17
II	BITS	G620	Professional Practice I	3	BITS	G621	Professional Practice II	3
	CHEM	G551	Advanced Organic Chemistry	5			Elective	*
	CHEM	G553	Advanced Physical Chemistry	5			Elective	*
	CHEM	G555	Chemistry of Life Processes	4			Elective	*
				17				12
III	BITS	G629T	Dissertation OR	16				
	BITS	G639	Practice School	20				
				16/20				

* *Minimum 3 Units*

Note: This is the suggested semesterwise pattern by the appropriate Senate appointed committee, subject to change if the situation warrants.

LIST OF COURSES FOR M.E./M.PHARM./ MBA PROGRAMMES:

Biotechnology

Named Courses

BIO G512	Molecular Mechanism of Gene Expression	5
BIO G513	Microbial & Fermentation Technology	5
BIO G542	Advanced Cell and Molecular Biology	5
BIO G611	Environmental Biotechnology	5
BIO G641	Cell & Tissue Culture Technology	4
BIO G642	Experimental Techniques	5
BIO G643	Plant Biotechnology	5

Elective Courses (any two)

BENG G521	Bioinformatics	5
BIO C417	Biomolecular Modeling	3 0 3
BIO C418	Genetic Engineering Techniques	1 9 4
BIO C421	Enzymology	3 0 3
BIO C441	Biochemical Engineering	3 0 3
BIO C451	Bioprocess Technology	3
BIO C461	Recombinant DNA Technology	3 0 3
BIO G514	Molecular Immunology	5
BIO G515	Stem Cell and Regenerative Biology	3 1 4
BIO G522	Interferon Technology	4
BIO G532	Biostatistics and Biomodelling	4
BIO G612	Human Genetics	5
BIO G631	Membrane and Liposome Technology	4
BIO G632	Transgenic Technology	5
BIO G651	Protein and Enzyme Bioengineering	5
BIO G661	Gene Toxicology	4
BIO G671	Bioconversion Technology	5
BITS C467	Bioethics and Biosafety	3 0 3

Chemical

Named Courses

CHE C473	Advanced Process Control	3 1 4
CHE G513	Environmental Management Systems	5
CHE G541	Process Plant Simulation	4
CHE G542	Computational Transport Phenomena	5
CHE G551	Advanced Separation Technology	5
CHE G614	Advanced Heat Transfer	5
CHE G615	Advanced Separation Processes	3 2 5
CHE G641	Reaction Engineering	5

Elective Courses (any two)

CHE C412	Process Equipment Design	3 0 3
CHE C413	Process Plant Safety	3 0 3
CHE C421	Biochemical Engineering	3 0 3
CHE C422	Combustion Engineering	3 0 3
CHE C441	Process Control	3 0 3
CHE C471	Refrigeration and Air Conditioning	3 0 3
CHE G511	Fluidization Engineering	4
CHE G512	Petroleum Refining & Petrochemicals	4
CHE G514	Evolutionary Computation	5
CHE G521	Chemical Engineering Analysis	4
CHE G522	Polymer Technology	4
CHE G531	Project Engineering	4
CHE G532	Alternate Energy Resources	4
CHE G611	Computer Aided Analysis and Design	5
CHE G617	Petroleum Refinery Engineering	3 2 5
CHE G621	Fluid Dynamics	5
CHE G622	Advanced Chemical Engineering Thermodynamics	5

Chemical with Specialization in Petroleum Engineering

Named Courses

CHE C473	Advanced Process Control	3 1 4
CHE G541	Process Plant Simulation	2 2 4
CHE G542	Computational Transport Phenomena	3 2 5
CHE G615	Advanced Separation Processes	3 2 5
CHE G616	Petroleum Reservoir Engineering	3 2 5
CHE G617	Petroleum Refinery Engineering	3 2 5
CHE G618	Petroleum Downstream Processing	3 2 5

Elective Courses (any two)

CHE C411	Environmental Pollution Control	3 0 3
CHE C412	Process Equipment Design	3 0 3
CHE C413	Process Plant Safety	3 0 3
CHE C421	Biochemical Engineering	3 0 3
CHE C422	Combustion Engineering	3 0 3
CHE C433	Corrosion Engineering	3 0 3
CHE C471	Refrigeration and Air Conditioning	3 0 3
CHE G511	Fluidization Engineering	2 2 4
CHE G513	Environmental Management Systems	5
CHE G514	Evolutionary Computation	5
CHE G521	Chemical Engineering Analysis	2 2 4
CHE G522	Polymer Technology	2 2 4
CHE G531	Project Engineering	2 2 4
CHE G532	Alternate Energy Resources	2 2 4
CHE G611	Computer Aided Analysis and Design	2 3 5
CHE G621	Fluid Dynamics	2 3 5
CHE G622	Advanced Chemical Engineering Thermodynamics	3 2 5
CHE G641	Reaction Engineering	3 2 5
CHE G619	Process Intensification	3 2 5
CHE G620	Energy Integration Analysis	3 2 5

Civil with Specialization in Infrastructure Systems

Named Courses

BITS C494	Environmental Impact Assessment	3 1 4
CE G515	Fundamentals of Systems Engineering	4
CE G520	Infrastructure Planning and Management	4
CE G523	Transportation Systems Planning and Management	4
CE G525	Water Resources Planning and Management	4
CE G529	Construction Project Control Systems	4
IS C472	Geographical Information System	3 0 3

Elective Courses (any two)

BITS C469	Financing Infrastructure Projects	3 0 3
BITS C474	Rural Infrastructure Planning	3 0 3
CE G512	Topics in Environmental Engineering	4
CE G513	Advanced Computational Techniques	4
CE G516	Multicriteria Analysis in Engineering	3 1 4
CE G517	Waste Management Systems	3 1 4
CE G522	Pavement Design, Maintenance and Management	5
CE G524	Urban Mass Transit Planning, Operations and Management	4
CE G526	Systems Approach to Water Resources Modelling	4

CE G527	Construction Management	4
CE G528	Selection of Construction Equipment and Modelling	4
CE G530	Design of Construction Operation	4
CE G531	Environmental Conservation	4
CE G533	Advanced Composite Materials for Structures	4
CE G542	Water Resources and Management	4
CE G610	Computer Aided Analysis & Design in Civil Engineering	5
CE G616	Bridge Engineering	4
CE G618	Design of Multi-Storey Structures	4
CE G619	Finite Element Analysis	5
CHE G518	Environmental Management Systems	3
EA C442	Remote Sensing and Image Processing	3

Civil with Specialization in Structural Engineering

Named Courses

CE G533	Advanced Composite Materials for Structures	4
CE G551	Dynamics of structures	3 1 4
CE G552	Advanced Structural Mechanics and Stability	3 1 4
CE G553	Theory of Plates and Shells	3 1 4
CE G615	Earthquake Engineering	4
CE G617	Advanced Structural Analysis	4
CE G619	Finite Element Analysis	5

Elective Courses (any four)

CE G511	Matrix Method in Civil Engineering	5
CE G513	Advanced Computational Techniques	4
CE G514	Structural Optimization	4
CE G521	Topics in Structural Engineering	5
CE G532	Advanced Soil Mechanics	4
CE G554	Advanced Structural Design	3 1 4
CE G610	Computer Aided Analysis and Design in Civil Engineering	3 2 5
CE G611	Computer Aided Analysis and Design	5
CE G612	Advanced Steel Structures	4
CE G613	Advanced Concrete structures	4
CE G614	Prestressed Concrete Structures	4
CE G616	Bridge Engineering	4
CE G618	Design of multi-story structures	4
CE G620	Advanced Foundation Engineering	4
CE G621	Fluid Dynamics	5
CE G622	Soil-Structure-Interaction	4
CE G623	Ground Improvement techniques	4
CE G631	Selected Topics in Soil Mechanics and Geotechnical Engineering	4
CE G641	Theory of Elasticity & Plasticity	5

Civil with Specialization in Transportation Engineering

Named Courses

CE G518	Pavement Analysis and Design	4
CE G523	Transportation Systems Planning and Management	4
CE G524	Urban Mass Transit Planning, Operations & Management	4
CE G532	Advanced Soil Mechanics	4
CE G534	Pavement Material Characterization	4
CE G535	Highway Geometric Design	4
CE G536	Traffic Engineering and Safety	4

CE G537	Transport Economics and Finance	4
CE G538	Project Planning and Management	4
IS C472	Geographical Information System	3 0 3

Elective Courses (any two)

Pool 1 for elective 1

BITS C494	Environmental Impact Assessment	3 1 4
CE G516	Multi Criteria Analysis in Engineering	4
CE G543	Traffic Flow Theory	4
CE G545	Airport Planning and Design	4
CE G616	Bridge Engineering	4
CE G619	Finite Element Analysis	5

Pool 2 for elective 2

CE G520	Infrastructure Planning and Management	4
CE G528	Selection of Construction Equipment and Modeling	4
CE G546	Highway Construction Practices	4
CE G547	Pavement Failures, Evaluation and Rehabilitation	4
CE G548	Pavement Management Systems	4
CE G549	Rural Road Technology	4

Communication Engineering

Named Courses

EEE C415	Digital Signal Processing	3 0 3
EEE C472	Satellite Communication	3 0 3
EEE G581	RF and Microwave Engg.	5
EEE G591	Optical Communication	5
EEE G592	Mobile and Personal Communication	5
EEE G612	Coding Theory and Practice	5
EEE G622	Advanced Digital Communication	5

Elective Courses (any two)

BITS G553	Real Time Systems	5
BITS G554	Data Compression	3 2 5
CS G553	Reconfigurable Computing	5
CS G555	System Specifications and Modeling	4
EA C415	Introduction to MEMS	4
EA C451	Internetworking Technology	3 0 3
EA C473	Multimedia Computing	3 0 3
EEE C414	Telecom Switching Systems & Networks	3 0 3
EEE G510	RF Microelectronics	5
EEE G512	Embedded System Design	4
EEE G521	Optoelectronic Devices, Circuits and Systems	5
EEE G531	Testable Design and Fault Tolerant Computing	5
EEE G582	Telecom network Management	5
EEE G611	Computer Aided Analysis and Design	5
EEE G613	Advanced Digital Signal Processing	5
EEE G626	Hardware Software Codesign	4
MEL G621	VLSI Design	5
MEL G632	Analog IC Design	5

Computer Science

Named Courses

CS G513	Network Security	4
CS G514	Object Oriented Analysis and Design	4
CS G551	Advanced Compilation Techniques	5
CS G553	Reconfigurable Computing	5
CS G562	Advanced Architecture and Performance Evaluation	5
CS G623	Advanced Operating System	5
EEE G512	Embedded System Design	4

Elective Courses (any two)

BITS C463	Cryptography	3 0 3
BITS C464	Machine Learning	3 0 3
BITS G553	Real Time Systems	5
BITS G554	Data Compression	3 2 5
BITS G624	Computer Based Simulation & Modelling	5
CS C415	Data Mining	3 0 3
CS C422	Parallel Computing	3 0 3
CS C424	Software for Embedded Systems	3 0 3
CS C441	Selected Topics from Computer Science	3
CS C442	Advanced Algorithms & Complexity	3 0 3
CS C446	Data Storages Technologies and Networks	3 0 3
CS C451	Combinatorial Mathematics	3 0 3
CS C453	Discrete Mathematical Structures	3 0 3
CS C461	Computer Networks	3 0 3
CS C471	Computer Graphics	3 0 3
CS G512	Introduction of Authoring Systems	4
CS G515	Queueing System Theory	5
CS G531	Testable Design & Fault Tolerant Computing	5
CS G541	Pervasive Computing	4
CS G554	Distributed Data Systems	3 2 5
CS G611	Distributed Processing Systems	4
CS G612	Fault Tolerant System Design	5
CS G631	Devices, Data Communication and Control	5
CS G632	Application Driven System Design	4
CS G641	Microprocessor Based Systems Design	5
CS G642	Recent Advances in Computing	4
CS G651	Symbolic Computing & Computer Algebra	4
CS G652	Digital Communications and Message Switching	5
CS G653	Software Architecture	5
CS G671	Advanced Computer Graphics	5
EA C451	Internetworking Technologies	3 0 3
EA C473	Multimedia Computing	3 0 3
EEE G582	Telecom Network Management	5
EEE G612	Coding Theory & Practice	5
EEE G626	Hardware Software Codesign	4
EEE G627	Networked Embedded Applications	4
IS C462	Network Programming	3 0 3
MATH G541	Advanced Methods in Discrete Mathematics	5
MATH C412	Concepts of Geometry	3 0 3
MATH C431	Distribution Theory	3 0 3
MATH G531	Number Theory	5
SS G515	Data Warehousing	5

Design Engineering

Named Courses

DE G611	Dynamics & Vibration	5
DE G531	Product Design	5
DE G631	Materials Technology & Testing	5
ME G511	Mechanisms and Robotics	5
ME G512	Finite Element Methods	4
ME G521	Mechanical System Design	5
ME G611	Computer Aided Analysis and Design	5

Elective Courses (any two)

DE G513	Tribology	5
DE G514	Fracture Mechanics	5
DE G521	Instrumentation and Applied Electronics	5
DE G522	Design Projects	5

EA C415	Introduction to MEMS	4
MSE G511	Mechatronics	5
MSE G531	Concurrent Engineering	5
MST G511	Nondestructive Testing Techniques	3 2 5
MST G522	Advanced Composites	5
MST G531	Experimental Stress Analysis Techniques	5

Electrical with specialization in Power Electronics & Drives

Named Courses

EEE G541	Distribution apparatus and configurations	5
EEE G542	Power Electronic Converters	5
EEE G543	Power Device Microelectronics and Selections	3
EEE G544	Steady State and Dynamics of Electric Motors	5
EEE G545	Control and Instrumentation for PE Systems	3
EEE G546	Systems Simulation Lab	4
EEE G552	Solid State Drives	5

Elective Courses (any two)

EEE G553	Utility Applications of Power Electronics	3
EEE G554	Soft Switching Converter Technologies	3
EEE G555	Transformer and Motor Design	3
EEE G556	DSP Based Implementation of Drives	3
EEE G557	Drives for Electric Traction	3

Embedded Systems

Named Courses

BITS G553	Real Time Systems	5
CS C424	Software For Embedded Systems	3 0 3
EEE C415	Digital Signal Processing	3 0 3
EEE G512	Embedded System Design	3 1 4
EEE G626	Hardware Software Co-design	4
MEL G642	VLSI Architectures	2 2 4

Elective Courses (any two)

BITS G554	Data compression	3 2 5
CS G541	Pervasive Computing	4
CS G553	Reconfigurable Computing	5
CS G555	System Specification and Modelling	3 3 4
CS G562	Advanced Architecture and Performance Evaluation	3 2 5
CSG612	Fault tolerant System Design	2 3 5
EEE G592	Mobile and Personal Communication	3 2 5
EEE G613	Advanced Digital Signal Processing	5
EEEG621	Advanced Electronic Circuits	3 2 5
EEE G625	Safety Critical Embedded System Design	4
EEE G627	Networked Embedded Applications	4
INSTR G611	Advanced Control Systems	3 2 5
MEL G626	VLSI Test and Testability	5

Manufacturing Systems Engineering

Named Courses

EA C412	Flexible Manufacturing Systems	3 2 4
ME C443	Quality Control, Assurance & Reliability	3 0 3
ME G511	Mechanisms and Robotics	5
MSE G511	Mechatronics	5
MSE G512	Manufacturing Planning and Control	4
MSE G521	World-class Manufacturing	5
MSE G531	Concurrent Engineering	5

Elective Courses (any two)

BITS C471	Management Information Systems	3 0 3
DE G522	Design Projects	5
DE G531	Product Design	5
DE G631	Materials Technology & Testing	5
EA C415	Introduction to MEMS	4
ITEB G621	Supply Chain Management	4
ME C412	Production Planning & Control	3 0 3
ME C432	Computer Aided Manufacturing	3 0 3
ME C472	Precision Engineering	3 0 3
ME G532	Machine Tool Engineering	5
ME G611	Computer Aided Analysis and Design	5
MGTS C481	Industrial Marketing	3 0 3
MM G522	Total Quality Management	4
MSE G513	Maintenance Engineering	4
MSE G514	Leadership and Managing Change	4

Mechanical Engineering

Named Courses

ME C443	Quality Control, Assurance & Reliability	3 0 3
ME G511	Mechanisms and Robotics	5
ME G512	Finite Element Methods	5
ME G532	Machine Tool Engineering	5
ME G611	Computer Aided Analysis and Design	5
ME G631	Heat Transfer	5
ME G641	Theory of Elasticity & Plasticity	5

Elective Courses (any two)

DE G513	Tribology	5
DE G514	Fracture mechanics	5
DE G522	Digital Projects	5
EA C415	Introduction to MEMS	4
ITEB G621	Supply Chain Management	4
ME C472	Precision Engineering	3 0 3
ME G513	Heating and Cooling of Buildings	5
ME G514	Turbomachinery	5
ME G515	Computational Fluid Dynamics	5
ME G516	Energy Systems Engineering	5
ME G521	Mechanical System Design	5
ME G621	Fluid Dynamics	5
MM G522	Total Quality Management	5
MSE G513	Maintenance Engineering	4
MST G511	Nondestructive Techniques	3 2 5
MST G522	Advanced Composites	5
MST G531	Experimental Stress Analysis Techniques	5

Microelectronics

Named Courses

MEL G611	IC Fabrication Technology	5
MEL G621	VLSI Design	5
MEL G631	Physics and Modelling of Microelectronic Devices	5
MEL G632	Analog IC Design	5
MEL G641	CAD for IC Design	5
MEL G642	VLSI Architectures	4

Elective Courses (any three)

BITS G554	Data Compression	3 2 5
CS G553	Reconfigurable Computing	5
CS G555	System Specifications and Modeling	4
CS G562	Advanced Architecture and Performance Evaluation	3 2 5
CS G612	Fault Tolerant System Design	5
EA C415	Introduction to MEMS	4

EEE C415	Digital Signal Processing	3 0 3
EEE G510	RF Microelectronics	5
EEE G512	Embedded System Design	4
EEE G592	Mobile and Personal Communication	5
EEE G626	Hardware Software Codesign	4
MEL G512	Optoelectronic Devices, Circuits and Systems	5
MEL G531	Testable Design & Fault Tolerant Computing	5
MEL G612	Integrated Electronic System Design	4
MEL G622	Introduction to Artificial Neural Networks	4
MEL G623	Advanced VLSI Design	5
MEL G624	Advanced VLSI Architectures	5
MEL G625	Advanced Analog and Mixed Signal Design	5
MEL G626	VLSI Test and Testability	5

Pharmacy

Named Courses

PHA G532	Quality Assurance & Regulatory Affairs	5
PHA G543	Clinical Research	5
PHA G611	Advanced Pharmacology	5
PHA G612	Pharmacokinetics & Clinical Pharmacy	5
PHA G621	Advanced Medicinal Chemistry	5
PHA G632	Dosage Form Design	5

Elective Courses (any two)

BIO C414	Genetic Engineering	1 6 3
BIO C417	Biomolecular Modeling	3 0 3
BITS C467	Bioethics and Biosafety	3 0 3
PHA G543	Clinical Research	5
PHA G511	Fermentation and Biotechnology	5
PHA G512	Chemistry of Natural Drugs	4
PHA G521	Molecular Biology and Immunology	4
PHA G522	Chemistry of Macromolecules	4
PHA G531	Disinfection and Sterilization	4
PHA G541	Computer Aided Drug Design	5
PHA G542	Advanced Physical Pharmaceutics	3 2 5
PHA G613	Pharmaceutical Biotechnology	5
PHA G614	Clinical Pharmacy & Therapeutics	5
PHA G615	Pharmacy Practice	5
PHA G616	Pharmaceutical Administration and Management	5
PHA G622	Chemistry of Natural Drugs and Macromolecules	5
PHA G642	Lab. Projects	6

M.Pharm. with specialization in Pharmaceutics

Named Courses

PHA G532	Quality Assurance and Regulatory Affairs	3 2 5
PHA G542	Advanced Physical Pharmaceutics	3 2 5
PHA G543	Clinical Research	5
PHA G611	Advanced Pharmacology	2 3 5
PHA G612	Pharmacokinetics & Clinical Pharmacy	2 3 5
PHA G621	Advanced Medicinal Chemistry	2 3 5
PHA G632	Dosage Form Design	2 3 5

Elective Courses (any two)

BITS C467	Bioethics and Biosafety	3 0 3
PHA G614	Clinical Pharmacy & Therapeutics	2 3 5

PHA G616	Pharmaceutical Administration and Management	5
PHA G617	Advanced Drug Delivery Systems	3 2 5

M.Pharm. with specialization in Pharmaceutical Chemistry

Named Courses

PHA G522	Chemistry of Macromolecules	2 2 4
PHA G532	Quality Assurance and Regulatory Affairs	3 2 5
PHA G543	Clinical Research	5
PHA G611	Advanced Pharmacology	2 3 5
PHA G612	Pharmacokinetics & Clinical Pharmacy	2 3 5
PHA G621	Advanced Medicinal Chemistry	2 3 5
PHA G632	Dosage Form Design	2 3 5

Elective Courses (any two)

BITS C467	Bioethics and Biosafety	3 0 3
PHA G512	Chemistry of Natural Drugs	2 2 4
PHA G541	Computer Aided Drug Design	3 2 5
PHA G614	Clinical Pharmacy & Therapeutics	2 3 5
PHA G618	Reterosynthetic Analysis	3 2 5

Software Systems

Named Courses

BITS C481	Computer Networks	3 0 3
SS G514	Object Oriented Analysis and Design	4
SS G515	Data Warehousing	5
SS G516	Computer Organization and Software Systems	5
SS G531	Pervasive Computing	4
SS G562	Software Engineering & Management	5
SS G653	Software Architecture	5

Elective Courses (any two)

BITS C463	Cryptography	3 0 3
BITS C464	Machine Learning	3 0 3
BITS G553	Real Time Systems	5
BITS G554	Data Compression	3 2 5
EA C451	Internetworking Technologies	3 0 3
EA C473	Multimedia Computing	3 0 3
EEE G512	Embedded System Design	4
IS C415	Data Mining	3 0 3
IS C422	Parallel Computing	3 0 3
IS C424	Software for Embedded System	3 0 3
IS C446	Data Storage Technologies & Networks	3 0 3
IS C462	Network Programming	3 0 3
IS C471	Computer Graphics	2 2 3
IS C481	Graphical User Interfaces	3 0 3
ITEB G621	Supply Chain Management	4
SS G512	Object Oriented Programming	4
SS G513	Network Security	4
SS G517	Data Structures and Algorithm Analysis	5
SS G518	Database Design & Application	5
SS G522	Software Development Standards	4
SS G532	Information Theory	4
SS G541	User Interfaces	4
SS G542	Knowledge Management	3
SS G551	Advanced Compilation Techniques	5
SS G552	Software Testing Methodologies	4
SS G554	Distributed Data Systems	3 2 5
SS G624	Computer Based Simulation and Modelling	5
SS G641	Management Information and Decision Support Systems	5

Master of Business Administration

Named Courses

MBA C311	Business Structure and Processes	4
MBA C312	Managerial Economics	3
MBA C317	Managerial Skills	1 0 1
MBA C319	Negotiation Skills and Techniques	2 0 2
MBA C321	Legal and Economic Environment of Business	4*
MBA C411	Organizational Behaviour	4
MBA C412	Human Resource Management	4
MBA C413	Quantitative Methods	4
MBA C414	Technology Management	3 0 3
MBA C415	Financial and Management Accounting	4
MBA C416	Corporate Finance and Taxation	4
MBA C417	Managerial Communication	4
MBA C418	Marketing	4
MBA C419	Production and Operations Management	4
MBA C421	Supply Chain Management	4
MBA C422	Business and Society	4
MBA C423	Business Policy and Strategic Management	4
MBA C424	International Business	4
MBA C471	Management Information Systems	4

Elective Courses

For Engineering & Technology Management

BITS C468	New Venture Creation	3 0 3
BITS C489	Enterprise Resource Planning	3 0 3
BITS C493	Business Analysis and Valuation	3 0 3
EA C475	Financial Engineering	3 0 3
FIN C413	Risk Management and Insurance	3 0 3
MBA C414	Technology Management	3 0 3
MBA C425	R & D Management	3 0 3
MBA C429	Recent Advances in ETM	4
MBA C437	Security Analysis and Portfolio Management	3 0 3
MBA C451	Internetworking Technologies	3 0 3
MBA C454	Project Appraisal	3 0 3
MBA C482	Creating and Leading Entrepreneurial Organization	3 0 3
MBA C483	Marketing Research	3 0 3
MBA G512	Manufacturing Strategy	4
MBA G522	Total Quality Management	4
MBA G523	Project Management	4
MBA G552	Total Productive Maintenance	4
MBA G622	Software Project Management	4

For IT Enabled Services Management

BITS C468	New Venture Creation	3 0 3
BITS C489	Enterprise Resource Planning	3 0 3
BITS C493	Business Analysis and Valuation	3 0 3
EA C474	Retail Management Systems	3 0 3
FIN C413	Risk Management and Insurance	3 0 3
MBA C426	Database Management Systems	4
MBA C427	e-Business and Internet Marketing	4
MBA C428	Internet Security and Cyber-laws	4
MBA C433	Advertising and Sales Promotion	3 0 3
MBA C436	Strategic Financial Management	3 0 3

MBA C437	Security Analysis and Portfolio Management	3 0 3
MBA C451	Internetworking Technologies	3 0 3
MBA C454	Project Appraisal	3 0 3
MBA C482	Creating and Leading Entrepreneurial Organization	3 0 3
MBA C481	Expert Systems	4
MBA C488	Services Management System	3 0 3
MBA G622	Software Project Management	4

Master in Public Health

Named Courses

BITS G515	Management Principles and Practices	4*
MPH G510	Biostatistics & Computers in Public Health	5
MPH G512	Environmental & Occupational Health	4
MPH G513	Public Health & Diseases	4
MPH G515	Communication in Health Care	4
MPH G521	Health Care Management	4
MPH G522	Preventive Nutrition & Health Promotion	4
MPH G523	Epidemic & Disaster Management	4
MPH G531	Health Economics & Financial Management	4
MPH G613	Health Systems and Society	2
MPH G692	Epidemiology	2

Elective Courses (any three)

BITS C467	Bioethics and Biosafety	3 0 3
MPH C431	Accounting & Finance	4
MPH G535	Family & Community Health Measures	3
MPH G537	Law & Ethics in Public Health	3
MPH G538	Telemedicine	3
MPH G539	Inter-sectoral co-ordination	3
	in Health Services	
MPH G540	Role of Voluntary Bodies/NGO's in Public Health	3
MPH G661	Research Methodology I	5
MPH G665	Hospital Operations Management	3
MPH G681	Strategic Management	3

M.Phil. Chemistry

Named Courses

CHEM G551	Advanced Organic Chemistry	5*
CHEM G552	Advanced Inorganic Chemistry	5*
CHEM G553	Advanced Physical Chemistry	5*
CHEM G554	Physical Methods in Chemistry	5*
CHEM G555	Chemistry of Life Processes	5*

Elective Courses (any four)

BIO G513	Microbial and Fermentation Technology	5*
BITS G654	Advanced Instrumentation Techniques	5*
CHEM C412	Photochemistry and Laser Spectroscopy	3 0 3
CHEM C422	Statistical Thermodynamics	3 0 3
CHEM C431	Stereochemistry and Reaction Mechanism	3 0 3
CHEM G513	Advanced Nuclear and Radio Chemistry	5*
CHEM G521	Environmental Chemistry	5*
CHEM G531	Recent Advances in Chemistry	5*
CHEM G541	Chemical Applications of Group Theory	5*
CHEM G556	Catalysis	4*
CHEM G557	Solid Phase Synthesis and Combinatorial Chemistry	4*
CHEM G558	Electronic Structure Theory	5*
CHEM G559	Bioinorganic Chemistry	4*

CHEM G561	Heterocyclic Chemistry	5*
CHEM G562	Solid State Chemistry	4*
CHEM G563	Advanced Statistical Mechanics	5*
EEE C432	Medical Instrumentation	3 0 3
PHA G621	Advanced Medicinal Chemistry	2 3 5

HDCC is empowered to add the following course as a deficiency course on case by case basis if the student is found to be deficient in Mathematics.

CHEM C453	Mathematics for Chemists	4*

* This is the total units and its break-up in terms of lectures and practical/seminars/project may be announced from time to time through the timetable

LIST OF GENERAL/SPECIAL COURSES FOR M.PHIL. PROGRAMMES

BIO G511	Population and Quantitative Genetics	5
BIO G522	Interferon Technology	2 2 4
BIO G541	Neural Network Analysis	5
BIO G551	Membrane Biology	5
BITS G511	Advanced Project	5
BITS G513	Study in Advanced Topics	5
BITS G514	Environmental Health	3 0 3
BITS G644	Development and use of Computer Software	5
BITS G654	Advanced Instrumentation Techniques	5
CHEM G511	Nuclear and Radio Chemistry	5
CHEM G513	Advanced Nuclear and Radiochemistry	5
CHEM G521	Environmental Chemistry	5
CHEM G531	Recent Advances in Chemistry	5
CHEM G541	Chemical Applications of Group Theory	5
CHEM G551	Advanced Organic Chemistry	5
CHEM G552	Advanced Inorganic Chemistry	5
ECON G511	Dynamic Modelling and Control of National Economies	5
ECON G521	Modern Cost Engineering	5
ECON G531	Theory of Macroeconomic Policy	5
ECON G541	Economic Systems Analysis	5
ENGL G511	Growth of the English Language	5
ENGL G512	Language and S & T	5
ENGL G513	Social Impact of S & T	5
ENGL G521	Principles of Language Teaching	5
ENGL G522	Aesthetics and Technology	5
ENGL G531	Applied Linguistics	5
ENGL G541	Interpretation of Literature	5
ENGL G551	Information Technology Lab. I	5
ENGL G561	Information Technology Lab. II	5
ENGL G571	Applied Communication I	5
ENGL G581	Applied Communication II	5
ENGL G591	Project Formulation and Preparation	5
ENGL G611	Twentieth Century English Literature	5
ET G511	Science and Technology Dynamics	5
ET G521	Hi-Tech Management	5
ET G531	Systems Engineering	5
ET G541	Overview of Technology	5
HUM G511	Introduction to Health System	3 0 3

MATH G511	Design and Analysis of Algorithms	5
MATH G512	Selected Topics in Advanced Mathematics for Engineering Situations	5
MATH G521	Applied Functional Analysis	5
MATH G531	Number Theory	5
MATH G541	Advanced Methods in Discrete Mathematics	5
MATH G611	Algebraic Number Theory	5
MATH G612	Riemann Surfaces	5
MATH G621	Fibre Bundles	5
MATH G622	Algebraic Geometry	5
MATH G632	Lie Groups & Lie Algebras	5
MATH G642	Complex Manifolds	5
MGTS G511	Advanced Marketing Theories and Advertising	5
MGTS G521	Business Policy - Structure and Organization	5
MGTS G531	Recent Advances in Organization Behaviour Theory	5
MGTS G541	Management Information and Decision Support Systems	5
MGTS G551	Frontiers in Financial Management	5
MGTS G561	Institutional Finance & Project Appraisal	5
PHY G511	Theoretical Physics	5
PHY G521	Nuclear and Particle Physics	5
PHY G531	Selected Topics in Solid State Physics	5
PHY G541	Physics of Semiconductor Devices	5
SKILL G611	Computer Operation and Software Development I	5
SKILL G612	Computer Operation and Software Development II	5
SKILL G621	Computer Maintenance I	5
SKILL G622	Computer Maintenance II	5
SKILL G631	Professional Communication I	5
SKILL G632	Professional Communication II	5
SKILL G641	Modern Experimental Methods I	5
SKILL G642	Modern Experimental Methods II	5
SKILL G651	Techniques in Development Management I	5
SKILL G652	Techniques in Development Management II	5
SKILL G661	Research Methodology I	5
SKILL G662	Research Methodology II	5

All courses given above are unstructured. Actual structuring will be done from time to time.

COMMON COURSES FOR HIGHER DEGREES

BITS G529	Research Project I	6
BITS G539	Research Project II	6
BITS G619	Professional Practice	4
BITS G620	Professional Practice I	3
BITS G621	Professional Practice II	3
BITS G629T	Dissertation	25 (Max.)
BITS G639	Practice School	20
BITS G649	Reading Course	5
BITS G659	Technical Communication	4

NOTE: Courses with 4 level numbers given above are advanced level electives from the offering of the Integrated First Degree programmes.

COMMON POOL OF ELECTIVES FOR HIGHER DEGREES

BITS G513	Study in Advanced Topics	5
BITS G649	Reading Course	5

NOTE: The courses from this pool will be available as electives to all higher degree students subject to approval from higher degree counseling committee.

Ph.D. PROGRAMME

Structure

1. Course Work

The various categories of courses, for the whole possible range of input of Ph.D. students are described in the Academic Regulations. In most cases, this course work would consist of courses which are required to be completed for a higher degree programme of the Institute. Further, the qualifying examination would also be conducted on the basis of these courses. Departures from these normal situations are described in the Academic Regulations.

2. Ph.D. Qualifying Examination

3. Foreign Language when required

The foreign language will be prescribed as an eligibility requirement for the Ph.D. only when the supervisor and/or the Dean Research & Consultancy have made recommendations for the same justifying its need for the particular topic of research and the literature available and this recommendation has been accepted by the Research Board. Otherwise English or an Indian language, as the case may be, would suffice the requirement of the foreign language.

4. Teaching Practice/Practice Lecture Series

BITS C791T	Teaching Practice I	1
BITS C792T	Teaching Practice II	1

The above two separate and independent courses, to be taken one at a time, are designed and operated to provide cumulative experience for a Ph.D. student in the practice of teaching.

BITS E793T	Practice Lecture Series I	1
BITS E794T	Practice Lecture Series II	1

These two courses are in lieu of the two courses viz. Teaching Practice I and II respectively, and are to be taken one at a time. These are designed and operated to provide cumulative experience for a Ph.D. student in the Practice of teaching in his own professional setting where it is not feasible to operate the teaching practice courses. The student will deliver a predetermined series of technical talks before a professional audience as approved by Dean R&C.

5. Seminar/Independent Study

1. BITS C797T Ph.D. Seminar (Min) 2

While the total minimum number of units is 2, registration is done for one unit in each semester/term until the submission of the thesis.

2. BITS C790T Independent Study (Min) 2

A student may be asked to register in this course in lieu of BITS C797T by Dean, Research & Consultancy if situation so warrants. While the total number of units is 2, registration is done for one unit in each semester/term until the submission of the thesis.

6. Thesis

BITS C799T Ph.D. Thesis (Min) 40

While the total minimum units assigned to this course are 40, the distribution of the units between different semesters/terms would be determined by the Dean, Research & Consultancy.

7. General

The `Doctoral Counselling Committee (DCC)' consisting of (i) Dean, Research & Consultancy Division (Convenor), (ii) Dean, Academic Registration & Counselling Division (iii) Dean, Instruction Division (iv) Dean, Practice School Division (v) Dean, Work Integrated Learning Programmes Division,

and (vi) Two members nominated by the Senate monitors the academic progress of Ph.D. students similar to the monitoring of academic progress of students of integrated First Degree and Higher Degree programmes by the ACB. The decisions of the DCC are reported to the Research Board and the Senate.

A Doctoral Advisory Committee (DAC) is appointed by the Dean, R & C for each candidate admitted to the Ph.D. programme. This committee consists of at least two faculty members from the broad area in which the candidate opts to pursue the Ph.D., besides the Dean, R&C.

Ph.D. Aspirants Scheme for Professionals

This programme enables experienced personnel and professionals working in industries and R&D organisations to work for a Ph.D. degree of the Institute in their respective work environment. This makes it possible for practicing professionals to be offered the same challenges that are traditionally offered to teachers in universities. Candidates, sponsored by their organizations, work for the Ph.D. degree without any dislocation from their work environment on research problems relevant to their organizations.

Admission to this programme is done through what is known as Ph.D. Aspirants Scheme. Ph.D. Aspirants will be first asked to write the qualifying examination. The Ph.D. qualifying examination will always be based on the courses of one of the higher degree programmes of the institute. Whenever a Ph.D. Aspirant already possesses a degree equivalent to a higher degree of the institute, the qualifying examination for him will be based on such a degree. The institute recognizes that there may be professionals who might not possess a degree equivalent to a higher degree of the institute, but has gained knowledge and skills through experience (substantiated by documentary evidence), which could be treated as equivalent to one of the higher degrees of the institute. For convenience of operation, for these cases, the institute has devised a higher degree programme called M.Phil (Applied) with courses that could be used for designing the qualifying examination for such candidates.

A list of courses for M.Phil.(Applied) is given below, from which a minimum number of 8 courses are to be chosen.

M.Phil. (Applied)

BITS E511	Computer Applications I	4
BITS E512	Computer Applications II	4
BITS E521	Technical Communication I	4
BITS E522	Technical Communication II	4
BITS E531	Social, Behavioral & Economic Sciences I	4
BITS E532	Social Behavioral & Economic Sciences II	4
BITS E533	Modern Experimental Techniques-I	4
BITS E534	Modern Experimental Techniques II	4
BITS E535	Management Methods & Techniques I	4
BITS E536	Management Methods & Techniques II	4
BITS E537	Systems Sciences and Engineering I	4
BITS E538	Systems Science and Engineering II	4
BITS E541	Chemical and Life Science I	4
BITS E542	Chemical and Life Science II	4
BITS E543	Instrumentation Engineering I	4
BITS E544	Instrumentation Engineering II	4
BITS E545	Project and Consultancy I	4
BITS E546	Project and Consultancy II	4
BITS E547	Public Administration I	4
BITS E548	Public Administration II	4

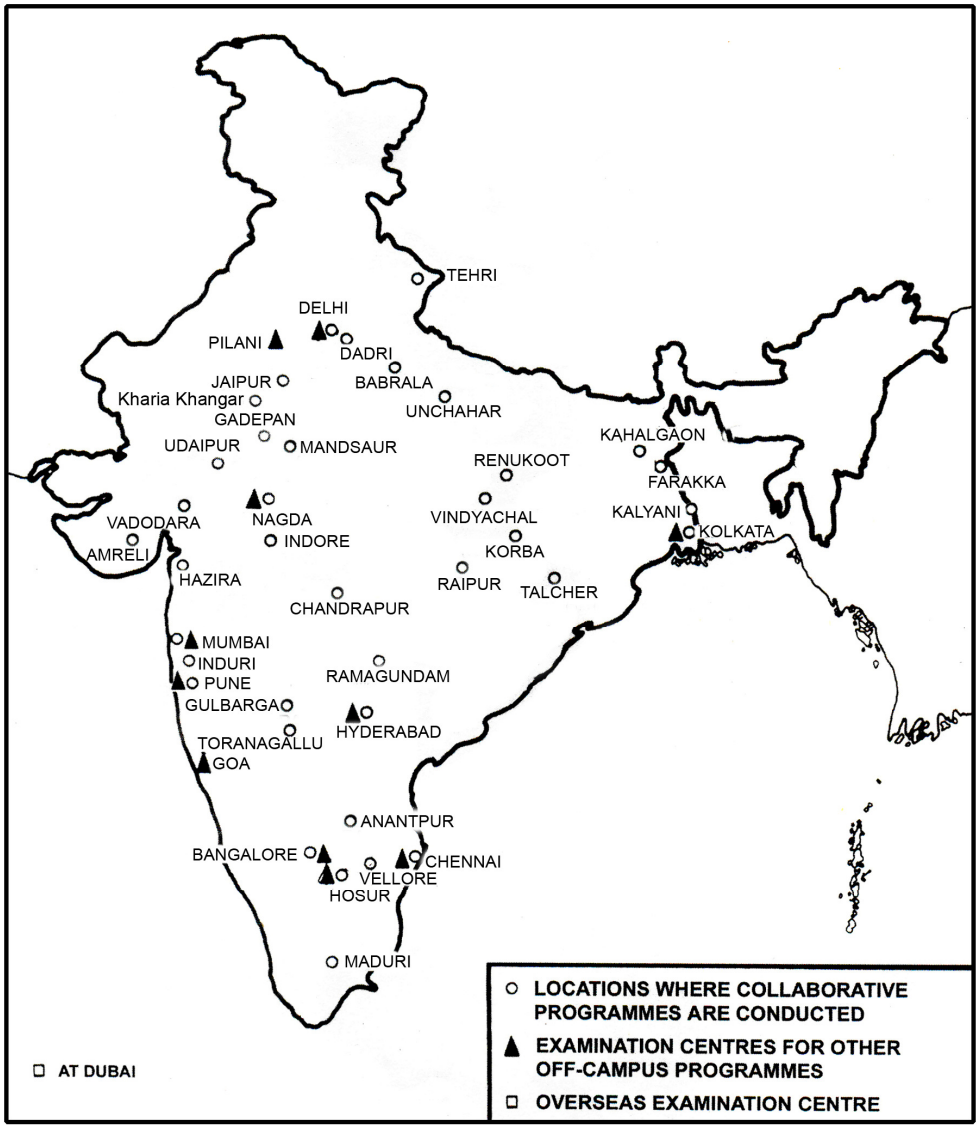
BITS E551	Physical and Mathematical Sciences I	4
BITS E552	Physical and Mathematical Sciences II	4
BITS E561	Use of English for Professional Purposes I	4
BITS E562	Use of English for Professional Purposes II	4
BITS E571	Methods of Planning and Development I	4
BITS E572	Methods of Planning and Development II	4
BITS E573	Study in Advanced Topics I	5
BITS E574	Study in Advanced Topics II	5
BITS E583	Case Studies I	4
BITS E584	Case Studies II	4
BITS E591	Science and Technology Development I	4
BITS E592	Science and Technology Development II	4
BITS E593	Reading Course I	5
BITS E594	Reading Course II	5
BITS E611	Internship I	20
BITS E612	Internship II	20
BITS E661	Research Methodology I	5
BITS E662	Research Methodology II	5

Note: *No direct admission to M.Phil.(Applied) will be done. Courses described above will be used for students admitted to the Ph.D. programmes under the Ph.D. Aspirant Scheme.*

PART V

WORK-INTEGRATED LEARNING PROGRAMMES

MAP OF BITS WORK-INTEGRATED LEARNING & COLLABORATIVE PROGRAMMES 2010-2011



Introduction

Over the past three decades, the educational activities of the Institute have extended beyond the campus. This has been principally due to institutionalized linkages established by the Institute with various industries, R&D organizations, developmental agencies, etc. This activity for all the on-campus programmes is through the Practice School which as an integral component of the academic curriculum takes the classroom for a specified period to a professional location where the students and the faculty along with the industry experts get involved in real-life problems.

Since 1979, the Institute has been participating in the human resources development activities of the industries by evolving several degree programmes by integrating the working environment of the employees with the learning environment required by the Institute. These programmes were first started as M.E. (Collaborative) programmes in 1979. Later, from 1988, the work integrated learning philosophy has been extended to programmes like First Level Diploma in Computer Applications, Footwear Technology, Instrument Servicing & Maintenance, Nautical Sciences, Workshop Technology; M.V.S in Computer Operations & Applications, Footwear Technology, Information Management, Physician Assistant; B.S. in Industrial Management, Engineering & Industrial Technology, Engineering Design, Engineering Technology, Industrial Engineering & Technology, Information Systems, Manufacturing Engineering, Marine Engineering, Nautical Sciences, Nautical Technology, Ophthalmic Assistant, Optometry, Pharmacy Operations, Physician Assistant, Power Engineering, Process Engineering, Technological Operations; M.Sc. (Tech.) Pharmaceutical Chemistry; M.E.(Collaborative) Project Engineering, Industrial Management, Industrial Production; M.S. in Chemical Technology, Computer, Computer Science, Consciousness Studies, Consultancy Management, Design Engineering, e-Business, Educational System Management, Electronic Sciences, Electronics & Control, Embedded Systems, Engineering Management, Habitat Technology, Industrial Production & Management, Life Sciences, Management Systems, Manufacturing Management, Mechanical Systems Design, Medical Laboratory Technology, Microelectronics, Pharmaceutical Operations and Management, Pharmaceutics, Pharmacy Operations, Pharmacy Operations, Physical Sciences, Quality Management, Science & Technology, Science Communication, Software Engineering, Software Systems, Systems & Information, Systems Engineering, Technological Operations, Telecommunications and Software Engineering, Biomedical Sciences; M.Phil. in Cardiac Sciences, Astronomy & Planetarium Sciences, Hospital & Health Systems Management, Mathematics, Optometry, Physician Assistant, Science Communication & Journalism and Off-campus Ph.D.

Description of Programmes

The Institute conducts off-campus degree programmes as a means of continuing education for employed professionals as part of the human resource development programmes of specific organizations at various off-campus centres. The Institute's Senate has authorized the Institute to run the off-campus degree programmes in every degree in which an on-campus degree programme is already run in the Institute. For the conduct of all these programmes, the basic requirement is the participation of the collaborative organization by extending physical and other facilities and by agreeing to integrate their work requirements with the academic requirements of the Institute for the pursuit of the degree programme. A separate division of the Institute operates all these programmes. In all these programmes, emphasis is on self-learning and the pedagogy attempts to incorporate as many modern technologies as desirable. A Schematic depicting Person-centered approach to a Student's Programme of Study as viewed from the Student's standpoint is given in Figure 1 on Page V-2. While every one of these programmes requires collaboration of an organization, some programmes have a highly structured collaboration with planned classroom activities and some programmes may have less structured planning. While a number of degrees are offered through structured collaboration with many collaborating organizations, there are also degrees, which are available in an open manner for a large number of organizations, each of which may sponsor only few students. For all these programmes, faculty/resource persons are drawn from the Institute, the participating organizations as well as experts from other Institutions. The currently operative programmes are given in Table 1 on Page V-3.

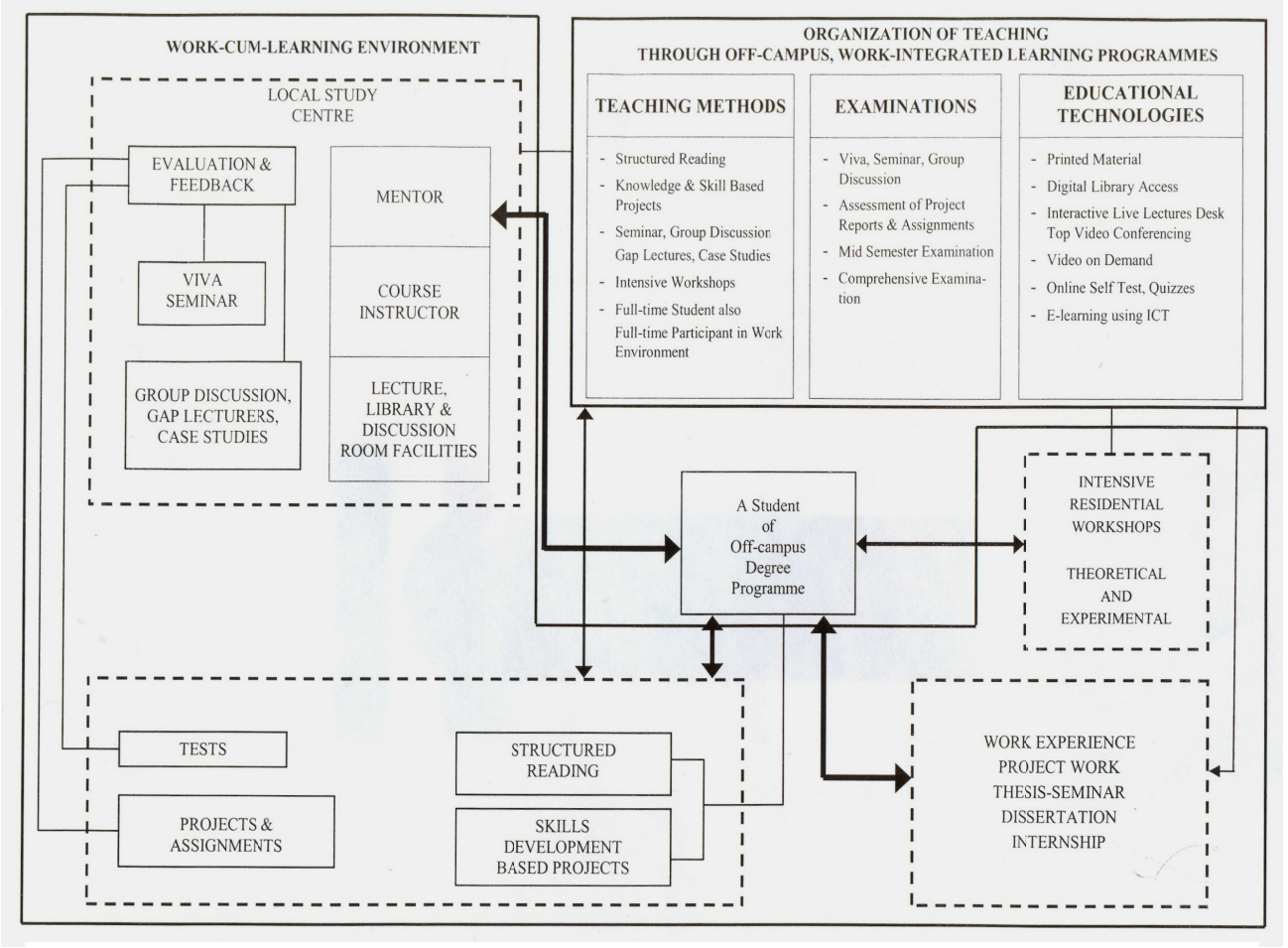


Figure 1: Person-centred Approach in the Work-Integrated Learning Programme

Table 1

Currently Operative Work-Integrated-Learning Programmes at a Glance

Programmes	Collaborating / Sponsoring Organization
Post Graduate Diploma	
1. Office Management	- Designed for employees of BITS, Pilani
First Level Diploma	
1. Nautical Sciences	- Tolani Maritime Institute Mumbai centre
B.S. Programmes	
1. Engineering Design	- L&T eEngineering Solutions, Vadodara
2. Engineering Technology	- Designed for the HRD needs of a diverse spectrum of Engineering Industries
3. Industrial Engineering & Technology	- Ashok Leyland, Chennai & Hosur
4. Information Systems	- Designed for the HRD needs of a diverse spectrum of IT Industries and Wipro Bangalore
5. Manufacturing Engineering	- Bharath Forge, Pune, Texmaco, Kolkata
6. Marine Engineering	- Tolani Maritime Institute, Induri; RL Institute of Nautical Sciences, Madurai
7. Nautical Sciences	- Tolani Maritime Institute Mumbai centre
8. Nautical Technology	- Tolani Maritime Institute, Induri; RL Institute of Nautical Sciences, Madurai
9. Ophthalmic Assistant	- Sankara Nethralaya, Chennai
10. Optometry	- Sankara Nethralaya, Chennai; L V Prasad Eye Institute, Hyderabad
11. Physician Assistant	- Madras Medical Mission, Chennai; Frontier Lifeline, Chennai
12. Power Engineering	- NTPC, NDPL, New Delhi; THDC, Tehri; EPoL, Hazira; Hindalco, Renusagar
13. Process Engineering	- HZL, Udaipur; CFCL, Kota; JSW, Toranagallu; Tata Chemicals, Babrala; Aditya Birla Group; Hindalco Industries Ltd., Renukoot
M.Sc. (Tech.) Programmes	
1. Pharmaceutical Chemistry	- Dr. Reddy's Laboratories, Matrix Laboratories, Hyderabad
M.S. Programmes	
1. Consciousness Studies	- Bhaktivedanta Institute, Mumbai
2. Consultancy Management	- Consultancy Development Centre, New Delhi
3. Educational System Management	- Atomic Energy Education Society, Mumbai
4. Embedded Systems	- Patni Computer Systems Ltd., Mumbai
5. Engineering Management	- Ashok Leyland, Chennai & Hosur; Technip, Chennai
6. Manufacturing Management	- Designed for the HRD needs of a diverse spectrum of Engineering Industries
7. Medical Laboratory Technology	- Sankara Nethralaya, Chennai
8. Microelectronics	- Intel, Texas Instruments, Wipro, Qualcomm, Bangalore
9. Pharmaceutical Operations & Management	- Strides Arcolab Ltd., Bangalore, Dabur Pharma Ltd., Kalyani; Lupin, Mumbai
10. Pharmaceutics	- Dr. Reddy's Laboratories, Hyderabad
11. Quality Management	- Indian Institute of Quality Management, Jaipur
12. Science Communication	National Council of Science Museums, Kolkata
13. Software Engineering	- Wipro Technologies, HP GDIC, Yahoo, SAP Labs, Sabre, Bangalore; CTS, HCL Technologies, Chennai; Mahindra Satyam, Hyderabad; Tech Mahindra, Cybage, Persistent, Pune; Patni, Mumbai
14. Software Systems	- Designed for the HRD requirements of a diverse spectrum of IT Industries
15. Systems Engineering	- Wipro Infotech, Bangalore
16. Telecommunications & Software Engineering	- Tech Mahindra, Pune
M.Phil.	
1. Hospital and Health Systems Management	- CMC&H, Vellore; Bombay Hospital, Mumbai & Indore
2. Optometry	- Sankara Nethralaya, Chennai
3. Physician Assistant	- Madras Medical Mission, Chennai

Note: The Institute looks for the viable number (around 50) of candidates sponsored by an organization or a group of organizations in any centre for a degree programme. Any organization interested in having a dialogue with the Institute for offering any collaborative and innovative programme directed towards the human resource development needs of their industry may write to the Institute. The Institute has an open mind to offer any of the existing programmes or devise any other new programme for their benefit.

Admission Modality

I. The Institute is one of the very few universities in India, which has ventured into off-campus work integrated learning programmes in science and technology areas. In order to maintain the standard as well as rigour required in this area, the Institute could cater only to those inputs, which have the facilities and environment for such a learning process. So the Institute treats these degree programmes as continuing education programmes for employed professionals. Hence admissions are given normally to candidates who are already employed and whose organizations sponsor them in their academic pursuit subject to the candidates having the required academic qualifications. The Institute looks for candidates who have the necessary computer, laboratory and other physical facilities including access to Email and Internet as well as certain intellectual input in terms of guidance by superior / co-officer / professional expert preferably from the workplace of the candidate who will be termed as Mentor, while the candidate is in pursuit of studies. In the case of B.S. Optometry, B.S. Physician Assistant, B.S. Ophthalmic Assistant, M.S. Medical Laboratory Technology, M.Phil. Optometry and M.Phil. Physician Assistant admissions are done also for open candidates. Even in these cases the admitted students will be involved in the work of the collaborative organization almost like an employee and there will be a great emphasis on work experience and in-service training along with the academic pursuit.

II. These degree programmes are work-integrated learning programmes. Hence, for students to get admission to these programmes, they must be engaged in work in the relevant professional areas. The final offer of admission for B.S. Engineering Technology /Information Systems, M.S. Software Systems / Manufacturing Management / Quality Management / Consultancy Management, M.Phil. Hospital & Health Systems Management programmes, would be based on candidate's educational background, academic achievements, work profile, relevant work experience, profile of the employing organization and Mentor's profile.

III. If the number of applications for a particular programme is less than a critical number, that programme may not be offered in that semester.

IV. For some of the off-campus collaborative programmes like B.S. Marine Engineering, B.S. Nautical Technology, B.S. Optometry, B.S. Ophthalmic Assistant and B.S. Physician Assistant; M.S. Medical Laboratory Technology; M.Phil. Optometry and M.Phil. Physician Assistant, a specially designed test and interview may be administered to the candidates for admission. The candidates would be required to attend these tests / interviews at their own expense.

V Certain off-campus collaborative programmes require the students to be present at the off-campus Centre in which they are conducted. For example, the B.S. Optometry is conducted at the off-campus centers in Chennai and Hyderabad; B.S. Ophthalmic Assistant, B.S. Physician Assistant, M.S. Medical Laboratory Technology, M.Phil. Optometry, M.Phil. Physician Assistant are conducted at the off-campus centres in Chennai; B.S. Marine Engineering, B.S. Nautical Technology are conducted at the Off-campus centers in Induri and Madurai.

VI Once the candidate accepts the admission offer and confirms registration, any request for deferment of admission to a subsequent semester cannot be entertained. The candidate can only withdraw from the registered semester.

Fees Structure

The fees schedule applicable for all programmes is as follows:

Admission Fees : Rs. 15,000/-

Each Semester Fees: Rs. 30,000/-

A candidate who has been offered admission will have to pay Rs. 45,000/- (Admission fees and Semester fees for the Starting Semester of the programme) immediately on receiving the Admit Offer Letter. Any candidate who desires to discontinue from the programme after confirmation of admission & registration for the courses specified in the admit offer letter will forfeit the total amount of fees paid.

Certain fully residential programmes like B.S. Marine Engineering where hostel and other facilities are provided, there will be additional fees prescribed which will be communicated at the time of admission.

Note 1: Additional facilities such as access to digital library, if provided, may be charged extra in addition to the above fee.

Note 2: For the examination centre at Dubai, in addition to the semester fees, for each semester there will be an examination centre fees of 1000 UAE Dirhams or equivalent per semester out of which 500 UAE Dirhams is to be paid at the time of appearing in Mid-semester examinations at Dubai Centre for that semester and the remaining 500 UAE Dirhams is to be paid at the time of appearing in comprehensive examinations at Dubai centre for that semester.

Educational Process

The education in the off-campus work integrated learning programmes is characterized by person-centered approach where the rigour and standards are maintained on par with Institute's system of education on-campus. These programmes judiciously combine the flexibility and ingenuity of the off-campus educational system with the regular features of the on campus education system. Also, the learning and evaluation process draws upon the successful and established methodologies followed by the Institute.

The off-campus work integrated learning environment of a student consists of two broad-based facets:

1. Academic Environment created by Pilani-based and off-campus centre based Instructors who are BITS faculty drawn from different disciplines;
2. Student's own Work Environment from which assignments, projects, seminars etc., may emerge to integrate theory and practice. A (locally-based) Mentor imparts structured guidance and conducts certain evaluation components (see Role of Mentor' below);

Central to the educational philosophy of the Institute being the dialectical link between theory and practice, the student's own work environment provides an ideal ground where theory could be meaningfully combined with practice through Assignments, Case Studies, Laboratory-Oriented Projects, Work Experience, In-service Training, Internship, Thesis-Seminar, Project Work and Dissertation. These evaluation components and courses search for evidence of self-study, time planning, conceptual understanding and application of the concepts in a real-life situation, self-reliant articulation, enthusiasm for, awareness of and participation in new pedagogy. One of the distinctive features of this system is the complete formalization of pursuit of education at the work-learning environment. An organization creates a work learning environment by providing academic sponsorship for the candidates as well as infrastructural facilities such as place for conducting formal classes / mentor interactions / examination apart from library, computer and laboratory access. The work learning environment form a strict requirement in order to infuse a strong component of teacher-student contact through course instructors as well as Mentor (a senior officer of the student's own organization). Thus work-learning environment

is a very important component of the person-centered learning process. There is in the design, a clear arrangement of periodic personal discussion in the work-learning environment with the students so that their progress is directly monitored by planned interaction. Further, the students at the work-learning environment receive help from mentors. Throughout the student's learning process, which is conducted in his own work place, through systematic self-study, and self-learning process, the student remains continually in contact with the course instructors for any clarifications. Thus the operation is an imaginative combination of the contact hours and tutoring of the on-campus system with the student-centered self-study feature of the off-campus system and an organizational and pedagogic commitment of the collaborating organizations. The student is at once, a full-time student as well as full-time employee.

Work-Integrated Learning: For each course offered by the Institute, there would be an Instructor, who is a BITS faculty, drawn from the relevant discipline. He is charged with the responsibility of the conduct of that course. This will be in terms of preparing question papers, evaluation of answer papers and answering student's queries. He will also prepare instruction manuals, question bank, supplementary notes, etc. wherever required in order to strengthen the course.

For each course, there will be a handout, which will spell out the plan of study and evaluation scheme, apart from other details. The evaluation schedule is also announced in the beginning of the semester itself. All details pertaining to the operation of the course including study plan are shared with the students through this document.

The BITS, Pilani model of cooperative education has a structured method of integrating education with practical work experience, faculty-student interaction as well as mentor-employer involvement. Further, the BITS model of education deploys ICT both in synchronous and asynchronous modes. Synchronous instruction through Internet based desktop video conferencing enables effective interaction between students and faculty. Asynchronous instruction, including on-demand lectures and electronic mail through list servers, is more flexible as it accommodates multiple learning levels and schedules. In addition, intensive residential contact classes are held for various programmes at the Institute campus as well as at the locations of various organizations. Thus, the BITS, Pilani model emphasizes on acquisition of knowledge and skills through mediated information and instruction, encompassing all technologies, in the work-integrated learning environment.

The Role of a Mentor: A Mentor is a senior officer of the student-employee who has been nominated by his employing organization or is a person in a senior position willing to undertake and discharge the academic responsibilities on his own volition. It is expected of the Mentor to possess adequate qualifications to guide the student. Typically for the B.S. programmes mentor is expected to have minimum educational qualification of the level of Integrated First Degree of BITS or its equivalent such as B.E. / BITS B.S. / B.Tech. / M.Sc. / A.M.I.E. etc. and for the M.S. /M.Phil. programmes of the level of Higher Degree of BITS or its equivalent such as M.E. / M.S. / M.Tech. / M.Phil. / M.D. etc.

The Mentors would assist the course instructors in terms of the following:

a) Achieving the set of academic objectives specified by the instructors;

b) Verifying if a student is indeed adhering to the plan of study given in the handout;

c) Monitoring involvement of the student in self-study, time planning, understanding of concepts and their use, developing self-reliant articulation, awareness of and enthusiasm for new pedagogy, responsibility to meet deadlines, develops familiarity with the library, etc.

d) Conducting certain evaluation components like Seminar, Assignment, Project, Case Study, etc.

Additional features include:

(a) Course Materials (Printed notes and standard textbooks) developed/identified especially for the work-integrated learning situation.

(b) ***It is the responsibility of each student to acquire textbooks and other reference materials recommended for each course.***

(c) Curricula designed on S&T approach for modernizing the workbench by purposeful acquisition of scientific methods and modern skills.

(d) Residential Terms for intensive contact classes (where required) conducted at BITS, Pilani or at its off-campus centres or at the collaborating organizations. The requirements of these Terms would include the following:

- Gap Lectures
- Field, Library and Laboratory work
- Projects
- Tutorials
- Informal discussions
- Seminars
- Social activities.

Evaluation Methodology

Evaluation for a given course is internal and continuous and has the following features:

- Assignments, Projects, Case-studies, spread over a semester for making the course relevant and meaningful to the work learning environment of the students;
- Written examinations - one at the mid-semester point and another comprehensive exam at the end of semester. These examinations are conducted at specified off-campus centres of BITS in a centralized manner under the supervision of BITS faculty.
- For BS Engineering Technology, BS Information Systems, MS Software Systems, MS Manufacturing Management, MS Quality Management, MS Consultancy Management, M.Phil. Hospital & Health Systems Management; the Institute presently has examination centre arrangements at Bangalore, Chennai, Delhi, Goa, Hosur, Hyderabad, Kolkata, Mumbai, Nagda, Pilani, Pune in India and Dubai in UAE.
- Strict adherence to the evaluation schedule as announced through the course handout at the start of the semester.
- The Institute follows continuous system of internal evaluation and letter grades A, B, C, D, E carrying grade points 10, 8, 6, 4, 2 respectively are awarded for all courses other than Dissertation / Thesis-Seminar / Project Work for which only non-letter grades namely EXCELLENT, GOOD, FAIR, POOR are awarded. If a student does not offer adequate opportunity for evaluation in a course, reports such as RRA (Require to Register Again) may be awarded.
- The final grading in a course is done by tabulating in descending order (equivalently a histogram) the total marks of all students in a particular course. The performance of the course will be analysed in terms of average, highest and lowest marks and dividing lines between various clusters. Gaps between clusters and the nature of clusters will guide drawing the dividing lines between various grades. In a normal class of large size, the C-band will usually include the average mark. This is not a hard and fast rule and exceptions may arise in cases of small classes or a skewed histogram etc.
- The Cumulative Grade Point Average (CGPA) on a 10 Scale basis is used to describe the overall performance of a student in all courses for which LETTER GRADES are awarded.

$$CGPA = \frac{U_1G_1 + U_2G_2 + U_3G_3 + ... + U_nG_n}{U_1 + U_2 + U_3 + ... + U_n}$$

Where U_1, U_2, U_3, … U_n denote units associated with the courses taken by the student and G_1, G_2,G_3,… G_n denote grade points of the letter grades awarded in the respective courses. Non-Letter grades do not go into computation of CGPA.

- In the case of Integrated First Degree programmes the final division for the degree is decided on the basis of CGPA and there are three classifications, namely Distinction (CGPA 9.00 or more), First Division (CGPA 7.00 or more but less than 9.00) and Second Division (CGPA 4.50 or more but less than 7.00). However, no division will be awarded in diploma, higher degrees and Ph.D. programmes.
- Subject to fulfilling the Academic Regulations of the Institute, the student will be issued at the end of each semester a grade sheet and at the end of the programme a Transcript and Provisional Certificate followed by the Final Degree Certificate. The grade sheet / transcript – provisional certificate will be withheld when a student has not paid his dues or when there is a pending case of breach of discipline or a case of unfair means against him.
- The minimum academic requirements for the M.S. programme stipulate that a student obtains a CGPA of 5.50 and no E grade in any course. Similarly for the B.S. programmes, student should obtain a CGPA of 4.50 and no E grade in any course. Students who fail to meet the minimum academic requirements are placed under the purview of Academic Monitoring Board (AMB), which monitors their progress, and gives guidance so that they are properly rehabilitated at the earliest.
- The Institute's Academic Regulations must be consulted for additional details.

Some Stipulations

(a) While the students who are admitted to on-campus degree programmes may be permitted to transfer to off-campus degree programmes, the reverse is normally not possible since the admission modalities for the two degrees are not the same. However, all off-campus degrees are equivalent to the corresponding degree of on-campus and for admissions to the Institute for any higher degree programmes the off-campus degrees will not be distinguished from on-campus degrees.

(b) In any examination, as far as possible, the direct interactive process of the evaluation would be made at a place nearest to the working place of the candidates. Wherever there is not adequate number of candidates, the Institute will be free to demand that all candidates come to Campus or other Off-Campus centers for this purpose.

(c) In case of organization specific collaborative programmes, a student who is admitted to the Institute because of sponsorship from an organization will cease to be a student if he discontinues employment from the organization. In case of other programmes, the student may be allowed to continue if the new organization in which he is employed agrees to sponsor him for the degree and if the work integrated learning environment is relevant to the degree programme. However, if the person becomes unemployed he may not be continued because of the requirement of work integrated learning environment for the degree, which may no longer be available to the student.

(d) Any student admitted to a programme may be allowed to transfer to another programme provided he is eligible for the same and is supported by his work environment and sponsorship of his employer.

(e) Since every student admitted to off-campus degree programme is treated as a full-time student and a full time employee, it is essential that such a student be not enrolled for any degree or diploma programme, part-time or otherwise, in any other university. If it is found that a student is admitted/ registered in some other university for degree programme, then his admission/ registration will be cancelled.

Operating Definitions of Certain Key Terms

1. A course is a component of knowledge, which serves as the irreducible minimum building block in the curriculum or syllabus.
2. A programme of studies is a set of courses constituting the requirements of a degree.
3. A regular student is one who is enrolled for a degree.
4. A collaborating organization is an organization that helps the Institute in setting up the necessary facilities and in the running of classes and laboratories for all students. Such an organization may simultaneously be also a sponsoring organization.
5. A sponsoring organization is an organization, which fulfills one or more of the following features:
   a) the organization is the employer of the student and pays fully / partly the fees/dues of the student and also provides facilities required for the learning process.
   b) the organization is an employer of the student but does not pay the fees/dues of the student. Nonetheless the organization agrees to encourage and actively participate in the special nature of the educational process for the mutual benefit of the organization and the employee.
6. An Associate Student is one who is allowed to register in any of the courses offered in each semester with an ultimate goal of obtaining a diploma/degree or without any such ambition. The treatment of these students will be different from that of the casual students in that these students will be registered on credit and not on audit basis and may be admitted for a degree or a diploma, if situation so warrants. Further, admission procedure and the fee structure may also differ in contrast to the casual students. Presently the Institute considers only sponsored candidates from structured collaborative programmes for admission as Associate Student.

Duration: This may vary from programme to programme depending upon the input qualification, experience requirements, nature as well as the need of the collaborating organizations including the viability and feasibility of course offerings. The Semesterwise pattern given in the following pages indicate the currently operational details for various programmes, which are subject to change if the situation warrants.

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B.S. Industrial Engineering & Technology (Ashok Leyland, Chennai & Hosur)	V-15
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B.S. Information Systems (Wipro, Bangalore)	V-17
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B.S. Manufacturing Engineering (Texmaco, Kolkata)	V-18
B.S. Marine Engineering (TMI, Induri and RLINS, Madurai)	V-19
B.S. Nautical Sciences (TMI-DLC, Mumbai)	V-20
B.S. Nautical Technology (TMI, Induri and RLINS, Madurai)	V-21
B.S. Ophthalmic Assistant (Sankara Nethralaya, Chennai)	V-22
B.S. Optometry (Sankara Nethalaya, Chennai)	V-23
B.S. Optometry (LVPEI, Hyderabad)	V-24
B.S. Physician Assistant (MMM, Chennai)	V-25
B.S. Physician Assistant (FL, Chennai)	V-26
B.S. Power Engineering (NTPC, NDPL, New Delhi; THDC, Tehri; EPoL, Hazira; Hindalco, Renusagar)	V-27
B.S. Process Engineering (Aditya Birla Group Cement Business)	V-28
B.S. Process Engineering (CFCL, Kota)	V-28
B.S. Process Engineering (Hindalco Industries, Renukoot)	V-29
B.S. Process Engineering (HZL, Udaipur)	V-29
B.S. Process Engineering (JSW Steel, Toranagallu)	V-30
B.S. Process Engineering (Tata Chemicals, Babrala)	V-30
M.Sc. (Tech.) Pharmaceutical Chemistry (DRL, Hyderabad)	V-31
M.Sc. (Tech.) Pharmaceutical Chemistry (Matrix Laboratories, Hyderabad)	V-31
M.S. Consciousness Studies (BVI, Mumbai)	V-32
M.S. Consultancy Management (CDC, Delhi)	V-33
M.S. Educational System Management (Atomic Energy Education Society, Mumbai)	V-33
M.S. Embedded Systems (Patni Computer Systems, Mumbai)	V-34
M.S. Engineering Management (Ashok Leyland, Chennai & Hosur)	V-34
M.S. Engineering Management (Technip, Chennai)	V-35
M.S. Manufacturing Management	V-36
M.S. Medical Laboratory Technology (Sankara Nethralaya, Chennai)	V-37
M.S. Microelectronics (Intel, Texas Instruments, Wipro, Qualcomm, Bangalore)	V-38

Programme	Page No.
M.S. Pharmaceutical Operations and Management (Dabur Pharma, Kalyani)	V-39
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M.S. Pharmaceutical Operations and Management (SAL, Bangalore)	V-40
M.S. Pharmaceutics (DRL, Hyderabad)	V-40
M.S. Quality Management (IIQM, Jaipur)	V-41
M.S. Science Communication (NCSM, Kolkata)	V-41
M.S. Software Engineering (CTS, Chennai)	V-42
M.S. Software Engineering (Cybage, Pune)	V-42
M.S. Software Engineering (HCL, Chennai)	V-43
M.S. Software Engineering (HP GDIC, Bangalore)	V-43
M.S. Software Engineering (Patni, Mumbai)	V-44
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M.S. Software Engineering (4 year)(SAP Labs India, Bangalore)	V-46
M.S. Software Engineering (2 year)(SAP Labs India, Bangalore)	V-46
M.S. Software Engineering (Satyam, Hyderabad)	V-47
M.S. Software Engineering (Tech Mahindra, Pune)	V-47
M.S. Software Engineering (Wipro Technologies, Patni, Mumbai)	V-48
M.S. Software Engineering (Yahoo!, Bangalore)	V-48
M.S. Software Systems	V-49,50
M.S. Systems Engineering (Wipro Infotech, Bangalore)	V-51
M.S. Telecommunication and Software Engineering (Tech Mahindra, Pune)	V-52
M.Phil. Hospital and Health Systems Management (CMC&H, Vellore; Bombay Hospital, Mumbai & Indore)	V-52
M.Phil. Optometry (Sankara Nethralaya, Chennai)	V-53
M.Phil. Physician Assistant (ICVD, Chennai)	V-53

Post Graduate Diploma in Office Management

Type of Input: Sponsored Employees with B.A. / B.Sc. / B.Com or its equivalent

Duration Normally Two Semesters

Special Feature: This programme is specially designed programme for Human Resource Development of employees of BITS Pilani

Year	First Semester		U	Second Semester		U
I	DOM ZC211	Functional English	3	DOM ZC212	Business Communication	3
	DOM ZC221	Computer Skills and Communication Aids	4	DOM ZC222	Materials Management and Accounting	4
	DOM ZC231	Principles and Practice of Office Management	4	DOM ZC232	Basic Management Skills	4
		Elective	5		Elective	5
		Total	16		Total	16

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

Pool of Elective courses		
DOM ZC241	University Operations	5
DOM ZC242	Hospitality and Events Management	5
DOM ZC252	Housekeeping Operations	5
DOM ZC262	Management Personnel Management Operations	5

First Level Diploma in Nautical Sciences

Type of Input: Pass in 10+2 from the Central Board or its equivalent with Mathematics, Physics and Chemistry followed by 3-4 Months Pre-Sea Training at an institution recognized by DG Shipping and employed by a shipping company.

Duration Normally Three Semesters

Special Feature: This programme is conducted in collaboration with Tolani Maritime Institute Mumbai Centre.

Year	Semester A		U	Semester B		U
I	NS ZC111	Navigation I	5	NS ZC112	Navigation II	5
	NS ZC121	Cargo Handling & Stowage I	3	NS ZC122	Cargo Handling & Stowage II	3
	NS ZC131	Controlling the Operation of Ship I	3	NS ZC132	Controlling the Operation of Ship II	3
	NS ZC141	Merchant Shipping I	2	NS ZC142	Merchant Shipping II	2
	NS ZC151	Cadet Record Book I	2	NS ZC152	Cadet Record Book II	2
		Total	15		Total	15
	Semester C		U			
II	NS ZC211	Navigation III	5			
	NS ZC221	Cargo Handling & Stowage III	3			
	NS ZC231	Controlling the Operation of Ship III	3			
	NS ZC241	Merchant Shipping III	2			
	NS ZC251	Cadet Record Book III	2			
		Total	15			

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

B. S. Engineering Design (L&T, Vadodara)

Type of Input & Duration: Sponsored employees of L&T eEngineering Solutions, Vadodara with Technical Diploma / B.Sc. or its equivalent for a six semesters programme.

Special Feature: This is a specially designed programme for the Human Resource Development needs of L&T eEngineering Solutions, Vadodara.

Year	First Semester		U	Second Semester		U
I	EDLT ZC211	Electrical & Electronics Technology	3	EDLT ZC212	Engineering Mechanics	3
	EDLT ZC221	Engineering Mathematics I	3	EDLT ZC222	Engineering Mathematics II	3
	EDLT ZC231	Principles of Management	3	EDLT ZC232	Engineering Materials	3
	EDLT ZC241	Technical Report Writing	3	EDLT ZC242	Fluid Mechanics and Machines	3
		Total	12		Total	12
II	EDLT ZC311	Manufacturing Process	3	EDLT ZC312	Computer Programming	3
	EDLT ZC321	Mechanics of Solids	3	EDLT ZC322	Kinematics & Dynamics of Machines	3
	EDLT ZC331	Optimization	3	EDLT ZC332	Mechanical Engineering Design I	3
	EDLT ZC341	Thermal Engineering I	3	EDLT ZC342	Thermal Engineering II	3
		Total	12		Total	12
III	EDLT ZC411	Computer Aided Design	3	EDLT ZC423T	Project Work	20
	EDLT ZC421	Instrumentation & Control	3			
	EDLT ZC431	Mechanical Engineering Design II	3			
		Elective	3			
		Total	12		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

Pool of Elective courses		
EDLT ZC441	Automotive Vehicles	3
EDLT ZC451	Product Design and Development	3

B. S. Engineering Technology

Type of Input: Employed persons in Engineering Industries with minimum 2 years work experience and a Technical Diploma / B.Sc. or its equivalent with adequate background in Mathematics. Employer consent with suitable mentor availability will be additional requirements.

Duration Normally Six Semesters

Special Feature: This is a specially designed Work-Integrated Learning Programme for catering to the Human Resource Development requirements of diverse spectrum of Engineering Industries.

Semesterwise pattern for students admitted in the First Semester of the Academic Session

Year	First Semester		U	Second Semester		U
I	MGTS ZC211	Principles of Management	3	TA ZC142	Computer Programming	3
	TA ZC312	Technical Report Writing	3	MATH ZC232	Engineering Mathematics II	3
	MATH ZC161	Engineering Mathematics I	3	ES ZC261	Digital Electronics and Microprocessors	3
	ENGG ZC111	Electrical & Electronics Technology	3	AAOC ZC111	Probability and Statistics	3
		Total	12		Total	12
II	ENGG ZC241	Mechanical Technology	3	ET ZC342	Materials Management	3
	TA ZC232	Engineering Measurements	3	ET ZC362	Environmental Pollution Control	3
	ENGG ZC232	Engineering Materials	3	ET ZC412	Production Planning & Control	3
	AAOC ZC222	Optimization	3	ENGG ZC242	Maintenance & Safety	3
		Total	12		Total	12
III	ET ZC432	Quality Control, Assurance & Reliability	3	BITS ZC423T	Project Work	20
	ET ZC341	Instrumentation & Control	3			
	ET ZC414	Project Appraisal	3			
	BITS ZC471	Management Information Systems	3			
		Total	12		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

Semesterwise pattern for students admitted in the Second Semester of the Academic Session

Year	First Semester		U	Second Semester		U
I				MGTS ZC211	Principles of Management	3
				TA ZC312	Technical Report Writing	3
				MATH ZC161	Engineering Mathematics I	3
				ENGG ZC111	Electrical & Electronics Technology	3
					Total	12
II	TA ZC142	Computer Programming	3	ENGG ZC241	Mechanical Technology	3
	MATH ZC232	Engineering Mathematics II	3	TA ZC232	Engineering Measurements	3
	ES ZC261	Digital Electronics and Microprocessors	3	ENGG ZC232	Engineering Materials	3
	AAOC ZC111	Probability and Statistics	3	AAOC ZC222	Optimization	3
		Total	12		Total	12
III	ET ZC342	Materials Management	3	ET ZC432	Quality Control, Assurance & Reliability	3
	ET ZC362	Environmental Pollution Control	3			
	ET ZC412	Production Planning & Control	3	ET ZC341	Instrumentation & Control	3
	ENGG ZC242	Maintenance & Safety	3	ET ZC414	Project Appraisal	3
				BITS ZC471	Management Information Systems	3
		Total	12		Total	12
IV	BITS ZC423T	Project Work	20			
		Total	20			

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

BS Industrial Engineering & Technology (Ashok Leyland, Chennai & Hosur)

Type of Input: Sponsored employees of Ashok Leyland, Chennai and Hosur with Technical Diploma / B.Sc. or its equivalent.

Duration Normally Six Semesters

Special Feature: This is a specially designed programme for the Human Resource Development needs of Ashok Leyland, Chennai and Hosur.

Year	First Semester		U	Second Semester		U
I	IETAL ZC211	Engineering Mathematics-I	3	IETAL ZC251	Mechanical Technology	3
	IETAL ZC221	Computer Programming	3	IETAL ZC212	Engineering Mathematics-II	3
	IETAL ZC231	Principles of Management	3	IETAL ZC222	Engineering Materials	3
	IETAL ZC241	Technical Report Writing	3	IETAL ZC232	Engineering Measurements and Techniques	3
		Total	12		Total	12
II	IETAL ZC242	Manufacturing Process	3	IETAL ZC331	Production Planning & Control	3
	IETAL ZC252	Production and Operations Management	3	IETAL ZC341	Mechatronics	3
	IETAL ZC311	Automobile Technology – I	3	IETAL ZC351	Industrial Engineering	3
	IETAL ZC321	Quality Assurance and Reliability	3	IETAL ZC312	Automobile Technology-II	3
		Total	12		Total	12
III	IETAL ZC322	Materials Management	3	IETAL ZC423T	Project Work	20
	IETAL ZC332	Operations Research	3			
	IETAL ZC342	Machine Design	3			
	IETAL ZC352	Maintenance Engineering and Safety	3			
		Total	12		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

B. S. Information Systems

Type of Input: Employed persons in Information Technology industry with minimum 2 years work experience and a Technical Diploma / B.Sc. or its equivalent with adequate background in Mathematics. Employer consent with suitable mentor availability will be additional requirements.

Duration Normally Six Semesters

Special Feature: This is a specially designed Work-Integrated Learning Programme for catering to the Human Resource Development requirements of diverse spectrum of IT Industries.

Semesterwise pattern for students admitted in the First Semester of the Academic Session

Year	First Semester		U	Second Semester		U
I	MGTS ZC211	Principles of Management	3	TA ZC142	Computer Programming	3
	TA ZC312	Technical Report Writing	3	MATH ZC232	Engineering Mathematics II	3
	MATH ZC161	Engineering Mathematics I	3	ES ZC261	Digital Electronics and Microprocessors	3
	ENGG ZC111	Electrical & Electronics Technology	3	AAOC ZC111	Probability and Statistics	3
		Total	12		Total	12
II	AAOC ZC221	Graphs & Networks	3	BITS ZC461	Software Engineering	3
	BITS ZC411	Object Oriented Programming	3	IS ZC351	Computer Organization and Architecture	3
	BITS ZC471	Management Information Systems	3	IS ZC361	Data Structures and Algorithms	3
	AAOC ZC222	Optimization	3	MATH ZC222	Discrete Structures for Computer Science	3
		Total	12		Total	12
III	IS ZC362	Operating Systems	3	BITS ZC423T	Project Work	20
	IS ZC342	Structures of Programming Languages	3			
	IS ZC332	Database Systems & Applications	3			
	BITS ZC481	Computer Networks	3			
		Total	12		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

Semesterwise pattern for students admitted in the Second Semester of the Academic Session

Year	First Semester		U	Second Semester		U
I				MGTS ZC211	Principles of Management	3
				TA ZC312	Technical Report Writing	3
				MATH ZC161	Engineering Mathematics I	3
				ENGG ZC111	Electrical & Electronics Technology	3
					Total	12
II	TA ZC142	Computer Programming	3	AAOC ZC221	Graphs & Networks	3
	MATH ZC232	Engineering Mathematics II	3	BITS ZC411	Object Oriented Programming	3
	ES ZC261	Digital Electronics and Microprocessors	3	BITS ZC471	Management Information Systems	3
	AAOC ZC111	Probability and Statistics	3	AAOC ZC222	Optimization	3
		Total	12		Total	12
III	BITS ZC461	Software Engineering	3	IS ZC362	Operating Systems	3
	IS ZC351	Computer Organization and Architecture	3	IS ZC342	Structures of Programming Languages	3
	IS ZC361	Data Structures and Algorithms	3	IS ZC332	Database Systems & Applications	3
	MATH ZC222	Discrete Structures for Computer Science	3	BITS ZC481	Computer Networks	3
		Total	12		Total	12
IV	BITS ZC423T	Project Work	20			
		Total	20			

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

B. S. Information Systems (Wipro, Bangalore)

Type of Input & Duration: Sponsored employees (with adequate work experience) with a Technical Diploma / B.Sc. or its equivalent with adequate background in Mathematics, for a six semester programme.

Special Feature: This is a specially designed Programme for the Human Resource Development needs of Wipro, Bangalore.

Year	First Semester		U	Second Semester		U
I	SEWP ZC211	Mathematics I	3	SEWP ZC212	Mathematics II	3
	SEWP ZC221	Structured Programming	3	SEWP ZC222	Advanced Programming Techniques	3
	SEWP ZC241	Principles of Management	3	SEWP ZC213	Probability & Statistics	3
	SEWP ZC261	Digital Electronics & Microprocessors	3	SEWP ZC252	Discrete Structures for Computer Science	3
		Total	12		Total	12
II	SEWP ZC413	Computer Organization & Architecture	3	SEWP ZC421	Computer Networks	3
	SEWP ZC415	Data Structures & Algorithms	3	SEWP ZC422	Operating Systems	3
	SEWP ZC461	Software Engineering	3	SEWP ZC322	Database Management Systems	3
	SEWP ZC432	Object Oriented Programming	3	SEWP ZC362	Programming Languages & Compiler Construction	3
		Total	12		Total	12
III	SEWP ZC312	Technical Report Writing	3	SEWP ZC423T	Project work	20
	SEWP ZC471	Management Information Systems	3			
	SEWP ZC473	Multimedia Computing	3			
	SEWP ZC446	Data Storage Technologies and Networks	3			
		Total	12		Total	20

Note : This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

BS Manufacturing Engineering (Bharat Forge, Pune)

Type of Input: Sponsored employees of Bharat Forge Ltd., Pune with Technical Diploma / B.Sc. or its equivalent.

Duration Normally Six Semesters

Special Feature: This is a specially designed programme for the Human Resource Development needs of Bharat Forge Ltd., Pune.

Year	First Semester		U	Second Semester		U
I	MEBF ZC211	Engineering Mathematics-I	3	MEBF ZC251	Mechanical Technology	3
	MEBF ZC221	Computer Programming	3	MEBF ZC212	Engineering Mathematics-II	3
	MEBF ZC231	Principles of Management	3	MEBF ZC222	Engineering Materials	3
	MEBF ZC241	Technical Report Writing	3	MEBF ZC232	Engineering Measurements and Techniques	3
		Total	12		Total	12
II	MEBF ZC242	Manufacturing Process	3	MEBF ZC331	Production Planning & Control	3
	MEBF ZC252	Production and Operations Management	3	MEBF ZC341	Mechatronics	3
				MEBF ZC351	Industrial Engineering	3
	MEBF ZC311	Automobile Technology –I	3	MEBF ZC312	Automobile Technology-II	3
	MEBF ZC321	Quality Assurance and Reliability	3			
		Total	12		Total	12
III	MEBF ZC322	Materials Management	3	MEBF ZC423T	Project Work	20
	MEBF ZC332	Operations Research	3			
	MEBF ZC342	Machine Design	3			
	MEBF ZC352	Maintenance Engineering and Safety	3			
		Total	12		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

BS Manufacturing Engineering (Texmaco, Kolkata)

Type of Input: Sponsored employees of Texmaco Kolkata with Technical Diploma / B.Sc. or its equivalent.

Duration Normally Six Semesters

Special Feature: This is a specially designed programme for Human Resource Development needs of Texmaco Ltd Kolkata.

Year	First Semester		U	Second Semester		U
I	METX ZC211	Engineering Mathematics-I	3	METX ZC251	Mechanical Technology	3
	METX ZC221	Computer Programming	3	METX ZC212	Engineering Mathematics-II	3
	METX ZC231	Principles of Management	3	METX ZC241	Technical Report Writing	3
	METX ZC222	Engineering Materials	3	METX ZC232	Engineering Measurements and Techniques	3
		Total	12		Total	12
II	METX ZC242	Manufacturing Process	3	METX ZC331	Production Planning & Control	3
	METX ZC252	Production and Operations Management	3	METX ZC341	Mechatronics	3
	METX ZC311	Computer Aided Design	3	METX ZC351	Industrial Engineering	3
	METX ZC321	Quality Assurance and Reliability	3	METX ZC312	Foundry Engineering	3
		Total	12		Total	12
III	METX ZC322	Materials Management	3	METX ZC423T	Project Work	20
	METX ZC332	Operations Research	3			
	METX ZC342	Machine Design	3			
	METX ZC352	Maintenance Engineering and Safety	3			
		Total	12		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

B.S. Marine Engineering (TMI, Induri / RLINS, Madurai)

Type of Input: 10+2 from Central / State Board or its equivalent with Physics, Chemistry and Mathematics along with adequate proficiency in English. Short-listed candidates will be required to take an entrance examination and interview at their own expense at Induri / Madurai for getting admission

Duration Normally Eight Semesters

Special Feature: This is specially designed 4-year integrated programme with classes and laboratory work conducted entirely at Tolani Maritime Institute (TMI), Induri, Pune – 410 517 and at R.L. Institute of Nautical Sciences (RLINS), Madurai – 625 022.

Year	First Semester		U	Second Semester		U
I	ME** ZC111	English Language Skills	2	ME** ZC112	Thermodynamics	3
	ME** ZC121	Engineering Mathematics I	3	ME** ZC122	Engineering Mathematics II	3
	ME** ZC131	Applied Mechanics I	3	ME** ZC132	Applied Mechanics II	3
	ME** ZC141	Geometrical Drawing	2	ME** ZC142	Engineering Drawing	2
	ME** ZC151	Workshop Technology	4	ME** ZC152	Workshop Practice I	2
	ME** ZC161	Applied Electricity	4	ME** ZC162	Electrical Measurements	2
	ME** ZC171	Maritime Geography	2	ME** ZC172	Strength of Materials	3
	ME** ZC181	Introduction to Computers	3	ME** ZC182	Computer Applications	3
				ME** ZC192	Social Studies	2
		Total	23		Total	23
II	ME** ZC213	Electronics I	2	ME** ZC211	Probability & Statistics	3
	ME** ZC223	Engineering Materials	3	ME** ZC214	Electronics II	2
	ME** ZC233	Marine Machinery Drawing	3	ME** ZC222	Marine Boilers & Steam Engineering	3
	ME** ZC261	Hydraulics	3	ME** ZC224	Internal Combustion Engines	3
	ME** ZC271	Applied Thermodynamics	3	ME** ZC231	Fuels & Lubricants	2
	ME** ZC281	Workshop Practice II	2	ME** ZC242	Seamanship & Survival at Sea	2
	ME** ZC282	Electrical Machines	3	ME** ZC272	Mechanics of Materials	3
	ME** ZC291	Ship Structure & Construction	3	ME** ZC361	Alternators & Motors	2
				ME** ZC372	Ship Fire Prevention & Control	3
		Total	22		Total	23
III	ME** ZC311	Marine Auxiliary Machines I	2	ME** ZC312	Marine Auxiliary Machines II	2
	ME** ZC313	Naval Architecture	3	ME** ZC314	Advanced Naval Architecture	3
	ME** ZC323	Marine Electro Technology	2	ME** ZC324	Advanced Marine Electro Technology	2
	ME** ZC333	Machine Design	3	ME** ZC334	Marine Machinery Design	3
	ME** ZC371	Mechanics of Machines	3	ME** ZC342	Marine Environmental Protection	2
	ME** ZC381	Pumps of Pumping Systems	2	ME** ZC352	Technical Report Writing	3
	ME** ZC382	Refrigeration & Air Conditioning	3	ME** ZC362	Dynamics of Vibrations	2
	ME** ZC391	Marine Internal Combustion Engines	3	ME** ZC431	Marine Control Engineering	4
		Total	21		Total	21
IV	ME** ZC351	Principles of Management	3	ME** ZC412	Internship	20
	ME** ZC421	Ship Operation & Management	3			
	ME** ZC441	International Conventions & IMO	3			
	ME** ZC471	Operations Research	3			
	ME** ZC492	Power Plant Operation & Watchkeeping	3			
		Elective				
		Elective				
		Total	-		Total	20

Note 1: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

Note 2: For the course numbers in the above chart, the symbol ****** can be substituted by **TI** for TMI and **RI** for RLINS.

Pool of other Courses*		
Course No.	**Course Title**	**U**
ME** ZC413	Oceanography	3
ME** ZC423	Emergency Management & Damage Control	3
ME** ZC433	Quality Management	3
ME** ZC443	CAD/CAM	3
ME** ZC453	Project	3
ME** ZC463	Maritime Law	3
ME** ZC473	Switchgear & Protection	3
ME** ZC481	Marine Cost Engineering	2
ME** ZC491	Organizational Behaviour	3

* Any course from this pool may be used to substitute a course from the Semesterwise pattern, if the situation warrants.

B.S. Nautical Sciences

Input & Duration: 8 Semesters for Employed Persons in Merchant Navy in the Deck Department with 10+2 with MPC and 3 months Pre-Sea Training from DG Shipping Approved Institutions. 5 Semesters for Sea serving personnel holding First Level Diploma in Nautical Sciences of BITS, Pilani or its equivalent and sponsored by employing shipping company.

Special Features: The programme incorporates 18 months of Sea Service as Nautical Cadet to be completed in the first three semesters in addition to 12 months of Sea Service as a Navigational Watch Keeping Officer to be completed in the remaining five semesters.

Year	Semester A		U	Semester B		U
I	NS ZC111	Navigation I	5	NS ZC112	Navigation II	5
	NS ZC121	Cargo Handling & Stowage I	3	NS ZC122	Cargo Handling & Stowage II	3
	NS ZC131	Controlling the Operation of Ship I	3	NS ZC132	Controlling the Operation of Ship II	3
	NS ZC141	Merchant Shipping I	2	NS ZC142	Merchant Shipping II	2
	NS ZC151	Cadet Record Book I	2	NS ZC152	Cadet Record Book II	2
		Total	15		Total	15
II	Semester C			Semester D		
	NS ZC211	Navigation III	5	NS ZC212	Navigation IV	4
	NS ZC221	Cargo Handling & Stowage III	3	NS ZC222	Cargo Handling & Stowage IV	4
	NS ZC231	Controlling the Operation of Ship III	3	NS ZC232	Controlling the Operation of Ship IV	4
	NS ZC241	Merchant Shipping III	2	NS ZC242	Marine Powerplant I	4
	NS ZC251	Cadet Record Book III	2	NS ZC252	Communication Skills	1
				NS ZC262	Maritime Legislation I	3
		Total	15		Total	20
III	Semester E			Semester F		
	NS ZC311	Navigation V	4	NS ZC312	Navigation VI	4
	NS ZC321	Cargo Handling & Stowage V	4	NS ZC322	Cargo Handling & Stowage VI	4
	NS ZC331	Controlling the Operation of Ship V	4	NS ZC332	Controlling the Operation of Ship VI	4
	NS ZC341	Marine Powerplant II	4	NS ZC342	Marine Powerplant III	4
	NS ZC351	Technical Report Writing	3	NS ZC352	Principles of Management	3
	NS ZC361	Maritime Legislation II	3	NS ZC362	Maritime Legislation III	3
		Total	22		Total	22
IV	Semester G			Semester H		
	NS ZC411	Mathematical Techniques for Nautical Sciences	4	NS ZC412	Project Work	20
		Any four of the following Six				
	NS ZC421	Quality & Safety Management	4			
	NS ZC431	Basic Maritime Human Resource Management	4			
	NS ZC441	Basic Maritime Financial Management	4			
	NS ZC451	Basic Ship Operation	4			
	NS ZC461	Management				
		Basic Commercial Shipping	4			
	NS ZC471	Management	4			
		Basic Risk Management				
		Total	20			

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

B.S. Nautical Technology

Type of Input: 10+2 from Central / State Board or its equivalent with Physics, Chemistry and Mathematics along with adequate proficiency in English. Short-listed candidates will be required to take a Written Test and Interview at their own expense at Induri / Madurai for getting admission.

Duration Normally Eight Semesters

Special Feature: This is specially designed 4-year integrated programme with classes and laboratory work conducted entirely at Tolani Maritime Institute (TMI), Induri, Pune – 410 517, and at R.L. Institute of Nautical Sciences (RLINS), Madurai – 625 022.

Year	First Semester		U	Second Semester		U
I	NT** ZC111	English Language Skills	2	NT** ZC112	Workshop Practical	2
	NT** ZC121	Engineering Mathematics –I	3	NT** ZC122	Engineering Mathematics – II	3
	NT** ZC131	Applied Mechanics –I	3	NT** ZC132	Applied Mechanics-II	3
	NT** ZC141	Geometrical Drawing	2	NT** ZC242	Seamanship & Survival at Sea	2
	NT** ZC151	Workshop Technology	4	NT** ZC152	Nautical Physics	2
	NT** ZC161	Applied Electricity	4	NT** ZC162	General Cargo Handling & Stowage	3
	NT** ZC171	Maritime Geography	2	NT** ZC172	Strength of Materials	3
	NT** ZC181	Introduction to Computers	3	NT** ZC182	Computer Applications	3
				NT** ZC192	Social studies	2
		Total	23		Total	23
II	NT** ZC213	Electronics – I	2	NT** ZC211	Probability & Statistics	3
	NT** ZC221	Chart Work – I	3	NT** ZC212	Celestial Navigation – I	3
	NT** ZC223	Engineering Materials	3	NT** ZC214	Electronics –II	2
	NT** ZC231	Collision Prevention	2	NT** ZC222	Chart Work – II	3
	NT** ZC241	Marine Signalling	3	NT** ZC232	Bridge Equipment & Watchkeeping – I	3
	NT** ZC251	Principles of Navigation	3	NT** ZC242	Hazardous Cargo Handling & Stowage – I	3
	NT** ZC261	Hydraulics	3	NT** ZC252	Meteoroloy – I	3
	NT** ZC291	Ship Structure & Construction	3	NT** ZC372	Ship Fire Prevention & Control	3
		Total	22		Total	23
III	NT** ZC311	Celestial Navigation – II	3	NT** ZC312	Chart Work – III	3
	NT** ZC313	Naval Architecture	3	NT** ZC322	Marine Machinery systems	3
	NT** ZC321	Meteorology – II	3	NT** ZC332	Hazardous Cargo Handling & Stowage – II	3
	NT** ZC331	Ship Routine & Maintenance	2	NT** ZC342	Marine Environment protection	2
	NTTIZC341	Bridge Equipment & Watchkeeping - II	3	NT** ZC351	Principles of Management	3
	NT** ZC421	Ship Operation & Management	3	NT** ZC352	Technical Report Writing	3
	NT** ZC441	International conventions & IMO	3	NT** ZC362	Ship Manoeuvring & Emergencies	3
	NT** ZC471	Operations Research	3	NT** ZC372	Advanced Ship Construction & Stability	3
		Total	23		Total	23
IV	NT** ZC442	Internship – I	20	NT** ZC443	Internship –II	20
		Total	20		Total	20

Note 1: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

Note 2: For the course numbers in the above chart, the symbol ****** can be substituted by **TI** for TMI and **RI** for RLINS.

B.S. Ophthalmic Assistant

Type of Input: 10+2 from Central / State Board or its equivalent with Physics, Chemistry & Mathematics / Biology along with adequate proficiency in English. Short-listed candidates will be required to take a Written Test and Interview at their own expense for getting admission.

Duration Normally Eight Semesters

Special Feature: This is a specially designed four-year integrated programme with classes and laboratory work conducted entirely at Sankara Nethralaya Medical Research Foundation (MRF), 18, College Road, Nungambakam, Chennai – 600 006.

Year	First Semester		U	Second Semester		U
I	OASN ZC111	Functional English & Communication	3	OASN ZC112	Ocular Anatomy	2
	OASN ZC121	Human Anatomy	2	OASN ZC122	Ocular Physiology	3
	OASN ZC131	Human Physiology	2	OASN ZC132	Pharmacology	2
	OASN ZC141	Basic Mathematics	3	OASN ZC142	Microbiology	2
	OASN ZC151	Introduction to Computers	3	OASN ZC152	Pathology	2
	OASN ZC161	Principles of Management	3	OASN ZC162	Biological Chemistry	3
	OASN ZC171	Scientific Measurements	3	OASN ZC172	Nutrition & Dietetics	4
	OASN ZC181	Hospital Procedures	1	OASN ZC182	Molecular Genetics	3
		Total	20		Total	21
II	OASN ZC211	Ocular Diseases -I	3	OASN ZC212	Ocular Diseases -II	3
	OASN ZC221	Inservice Training -I	6	OASN ZC222	Inservice Training – II	6
	OASN ZC231	Medical & Nursing Records	3	OASN ZC232	Community Health Care	7
	OASN ZC241	Introduction to General Medicine & Surgery	4	OASN ZC242	Public Relations	1
				OASN ZC252	Geriatric Health Care	3
	OASN ZC251	Pediatric Health Care	3			
		Total	19		Total	20
III	OASN ZC311	Principles of Emergency Patient Care	4	OASN ZC312	Ophthalmic Operation Theatre Management	5
	OASN ZC321	Inservice Training -III	6			
	OASN ZC331	Technical Report Writing	3	OASN ZC322	Ophthalmic Surgical Instrumentation	5
	OASN ZC341	Introduction to Ophthalmic Out Patient Care	5	OASN ZC332	Ophthalmic Anesthesia	4
				OASN ZC342	Ophthalmic Surgical Procedures	6
		Total	18		Total	20
IV	OASN ZC411	Internship - I	20	OASN ZC412	Internship - II	20
		Total	20		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

B.S. Optometry (Sankara Nethralaya)

Type of Input: 10+2 from Central / State Board or its equivalent with Physics, Chemistry & Mathematics / Biology along with adequate proficiency in English. Short-listed candidates will be required to take a Written Test and Interview at their own expense for getting admission.

Duration Normally Eight Semesters

Special Feature: This is a specially designed four-year integrated programme with classes and laboratory work conducted entirely at Sankara Nethralaya Medical Research Foundation (MRF), 18, College Road, Nungambakam, Chennai – 600 006.

Year	First Semester		U	Second Semester		U
I	OPTO ZC111	Functional English & Communication	3	OPTO ZC131	Physical Optics	4
	OPTO ZC211	Computer Programming	3	OPTO ZC142	Ocular Anatomy	2
	OPTO ZC141	Basic Biochemistry I	3	OPTO ZC152	Ocular Physiology	3
	OPTO ZC151	General Anatomy	2	OPTO ZC162	Basic Biochemistry II	3
	OPTO ZC161	General Physiology	5	OPTO ZC121	Mathematics I	2
	OPTO ZC112	Basic Accountancy	2	OPTO ZC182	Principles of Lighting	1
	OPTO ZC172	Nutrition	1	OPTO ZC122	Public Relations	1
	OPTO ZC133	Hospital Procedures	1	OPTO ZC171	Geometric Optics I	4
		Total	20		Total	20
II	OPTO ZC192	Mathematics II	2	OPTO ZC132	Pharmacology	2
	OPTO ZC221	Optometric Optics I	3	OPTO ZC212	Medical Psychology	1
	OPTO ZC231	Optometric Instruments	3	OPTO ZC222	Pathology & Microbiology	3
	OPTO ZC241	Clinical Exam of Visual System	2	OPTO ZC232	Optometric Optics II	3
	OPTO ZC251	Ocular Diseases I	3	OPTO ZC242	Ocular Diseases II	3
	OPTO ZC261	Visual Optics I	2	OPTO ZC252	Visual Optics II	3
	OPTO ZC123	Geometric Optics II	3	OPTO ZC272	Clinics II	5
	OPTO ZC281	Clinics I	4			
		Total	22		Total	20
III	OPTO ZC282	Dispensing Optics	3	OPTO ZC312	Binocular Vision II	1
	OPTO ZC311	Binocular Vision I	1	OPTO ZC322	Law & Optometry	1
	OPTO ZC323	Contact Lens I	1	OPTO ZC324	Contact Lens II	1
	OPTO ZC331	Systemic Disease	1	OPTO ZC332	Public Health & Community Optometry	1
	OPTO ZC341	Glaucoma	1			
	OPTO ZC371	Clinics & Special Clinics I	8	OPTO ZC342	Pediatric Optometry	1
	OPTO ZC381	Low Vision Aids	1	OPTO ZC352	Occupational Optometry	2
	OPTO ZC421	Epidemiology	3	OPTO ZC372	Clinics & Special Clinics II	8
	OPTO ZC431	Biostatistics	3	OPTO ZC382	Geriatric Optometry	1
				OPTO ZC422	Project	5
		Total	22		Total	21
IV	OPTO ZC411	Internship I	20	OPTO ZC412	Internship II	20
		Total	20		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants. Students with marginal deficiency in Mathematics or Biology would be additionally required to register in OPTO ZC181 Remedial Mathematics (2 units) or OPTO ZC191 Remedial Biology (2 units) in the first year first semester.

B.S. Optometry (LVPEI)

Type of Input: 10+2 from Central / State Board or its equivalent with Physics, Chemistry & Mathematics / Biology along with adequate proficiency in English. Short-listed candidates will be required to take a Written Test and Interview at their own expense for getting admission.

Duration Normally Eight Semesters

Special Feature: This is a specially designed four year integrated programme with classes and laboratory work conducted entirely at Bausch & Lomb School of Optometry, L.V. Prasad Eye Institute (LVPEI), Kismatpur Campus, Rajendra Nagar, Hyderabad – 500 030.

Year	First Semester	U	Second Semester	U
I	OPLVP ZC111 Introductory Optometry	2	OPLVP ZC112 General Anatomy	2
	OPLVP ZC121 Ocular Anatomy	2	OPLVP ZC122 General Physiology	5
	OPLVP ZC131 Ocular Physiology	3	OPLVP ZC132 Pharmacology	2
	OPLVP ZC141 Physical Optics	4	OPLVP ZC142 Basic Biochemistry II	3
	OPLVP ZC151 Basic Biochemistry I	3	OPLVP ZC152 Pathology & Microbiology	3
	OPLVP ZC161 Functional English and Communication	3	OPLVP ZC171 Mathematics I	2
	OPLVP ZC181 Geometric Optics I	4	OPLVP ZC172 Geometric Optics II	3
			OPLVP ZC272 Computer Programming	3
			OPLVP ZC192 Visual Optics I	2
	Total	21	Total	25
II	OPLVP ZC162 Mathematics II	2	OPLVP ZC212 Dispensing Optics	3
	OPLVP ZC211 Low Vision Aids	1	OPLVP ZC222 Optometric Optics II	3
	OPLVP ZC221 Optometric Optics I	3	OPLVP ZC232 Nutrition	1
	OPLVP ZC231 Optometric Instruments	3	OPLVP ZC242 Ocular Diseases II	3
	OPLVP ZC241 Clinical Examination of Visual Systems	2	OPLVP ZC252 Contact Lens I	1
	OPLVP ZC251 Clinics I	4	OPLVP ZC262 Binocular Vision I	1
	OPLVP ZC261 Visual Optics II	3	OPLVP ZC282 Clinics II	5
	OPLVP ZC271 Ocular Diseases I	3	OPLVP ZC312 Geriatric Optometry	1
	OPLVP ZC281 Public Health and Community Optometry	1		
		22		18
III	OPLVP ZC311 Biostatistics	3	OPLVP ZC182 Hospital Procedures	1
	OPLVP ZC321 Systemic Disease	1	OPLVP ZC322 Pediatric Optometry	1
	OPLVP ZC331 Epidemiology	3	OPLVP ZC332 Principles of Lighting	1
	OPLVP ZC341 Clinics & Special Clinics I	8	OPLVP ZC342 Medical Psychology	1
	OPLVP ZC351 Contact Lens II	1	OPLVP ZC352 Occupational Optometry	2
	OPLVP ZC361 Binocular Vision II	1	OPLVP ZC362 Law and Optometry	1
	OPLVP ZC371 Basic Accountancy	2	OPLVP ZC372 Clinics and Special Clinics II	8
	OPLVP ZC381 Public Relations	1	OPLVP ZC382 Project	5
	Total	20	Total	20
IV	OPLVP ZC411 Internship I	20	OPLVP ZC412 Internship II	20
	Total	20	Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants. Student with marginal deficiency in Mathematics or Biology would be additionally required to register in OPLVP ZC113 Remedial Mathematics (2 units) or OPLVP ZC114 Remedial Biology (2 units) in the first year first semester.

B.S. Physician Assistant (MMM)

Type of Input: 10+2 from Central / State Board or its equivalent with Physics, Chemistry & Mathematics / Biology along with adequate proficiency in English. Short-listed candidates will be required to take a Written Test and Interview at their own expense for getting admission.

Duration Normally Eight Semesters

Special Feature: This is a specially designed four year integrated programme with classes and laboratory work conducted entirely at Madras Medical Mission (MMM)-BITS Training Centre, 4A, Dr. J. Jayalalitha Nagar, Mogappair East, Chennai - 600 037.

Year	First Semester		U	Second Semester		U
I	PAT ZC121	Mathematics I	3	PAT ZC122	Mathematics II	3
	PAT ZC131	Introduction to Computers	3	PAT ZC132	Scientific Measurements	3
	PAT ZC141	Biological Chemistry	3	PAT ZC142	Nutrition & Dietetics	4
	PAT ZC151	General Anatomy	3	PAT ZC152	Clinical Biochemistry	5
	PAT ZC161	General Physiology	3	PAT ZC162	Pediatrics & Geriatrics	2
	PAT ZC171	Cell Biology	3			
		Total	18		Total	17
II	PAT ZC251	Principles of Management	3	PAT ZC212	Introduction to Surgery	2
	PAT ZC231	Microbiology	3	PAT ZC222	Introduction to Medicine	2
	PAT ZC262	Introduction to Psychology	3	PAT ZC282	Molecular Genetics	3
	PAT ZC261	Technical Report Writing	3	PAT ZC382	Data Processing	3
	PAT ZC411	Inservice Training - I	10	PAT ZC412	Inservice Training - II	10
		Total	22		Total	20
III	PAT ZC311	Cardiology & Cardiac Surgery.	4	PAT ZC332	Principles of Emergency Medicine	1
	PAT ZC381	Anesthesiology	1	PAT ZC342	Medical Instrumentation	2
	PAT ZC341	Cardiac Nursing	2	PAT ZC312	Advances in Cardiology	2
	PAT ZC423	Pharmacology & Toxicity	3	PAT ZC322	Advances in Cardiac Surgery	2
	PAT ZC431	Biostatistics	3	PAT ZC482	Management Information Systems	3
	PAT ZC421	Inservice Training - III	10	PAT ZC422	Inservice Training - IV	10
		Total	23		Total	20
IV	PAT ZC442	Internship - I	20	PAT ZC443	Internship - II	20
		Total	20		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

B.S. Physician Assistant (FL)

Type of Input: 10+2 from Central / State Board or its equivalent with Physics, Chemistry & Mathematics / Biology along with adequate proficiency in English. Short-listed candidates will be required to take a Written Test and Interview at their own expense for getting admission.

Duration Normally Eight Semesters

Special Feature: This is a specially designed four year integrated programme with classes and laboratory work conducted entirely at Frontier Lifeline (FL) – Dr K M Cherian Heart Foundation & International Centre for Biomedical Sciences and Technology, #932, TVS Avenue, Jeevan Bheema Nagar, Mogappair, Chennai – 600 101.

Year	First Semester		U	Second Semester		U
I	PATFL ZC121	Mathematics I	3	PATFL ZC122	Mathematics II	3
	PATFL ZC131	Introduction to Computers	3	PATFL ZC132	Scientific Measurements	3
	PATFL ZC141	Biological Chemistry	3	PATFL ZC142	Nutrition & Dietetics	4
	PATFL ZC151	General Anatomy	3	PATFL ZC152	Clinical Biochemistry	5
	PATFL ZC161	General Physiology	3	PATFL ZC162	Pediatrics & Geriatrics	2
	PATFL ZC171	Cell Biology	3			
		Total	18		Total	17
II	PATFL ZC251	Principles of Management	3	PATFL ZC212	Introduction to Surgery	2
	PATFL ZC231	Microbiology	3	PATFL ZC222	Introduction to Medicine	2
	PATFL ZC262	Introduction to Psychology	3	PATFL ZC282	Molecular Genetics	3
	PATFL ZC261	Technical Report Writing	3	PATFL ZC382	Data Processing	3
	PATFL ZC411	Inservice Training - I	10	PATFL ZC412	Inservice Training - II	10
		Total	22		Total	20
III	PATFL ZC311	Cardiology & Cardiac Surgery	4	PATFL ZC332	Principles of Emergency Medicine	1
	PATFL ZC381	Anesthesiology	1	PATFL ZC342	Medical Instrumentation	2
	PATFL ZC341	Cardiac Nursing	2	PATFL ZC312	Advances in Cardiology	2
	PATFL ZC423	Pharmacology & Toxicity	3	PATFL ZC322	Advances in Cardiac Surgery	2
	PATFL ZC431	Biostatistics	3	PATFL ZC482	Management Information Systems	3
	PATFL ZC421	Inservice Training - III	10	PATFL ZC422	Inservice Training - IV	10
		Total	23		Total	20
IV	PATFL ZC442	Internship - I	20	PATFL ZC443	Internship - II	20
		Total	20		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

B.S. Power Engineering

Type of Input: Sponsored employees with Technical Diploma/ B.Sc. or its equivalent.

Duration Normally Six Semesters

Special Feature: This is a specially designed programme for Human Resource Development needs of NTPC, NDPL, New Delhi; THDC, Tehri; EPoL, Hazira; Hindalco, Renusagar.

Year	First Semester		U	Second Semester		U
I	POWNT ZC211	Computer Programming	3	POWNT ZC212	Engineering Mathematics II	3
	POWNT ZC221	Engineering Mathematics I	3	POWNT ZC222	Electronics & Microprocessor	3
	POWNT ZC231	Thermodynamics	3	POWNT ZC232	Principles of Management	3
	POWNT ZC251	Electrical Technology	3	POWNT ZC242	Engineering Measurements	3
		Total	12		Total	12
II	POWNT ZC311	Prime Movers & Fluid Machines	3	POWNT ZC312	Quality Control, Assurance and Reliability	3
	POWNT ZC321	Technical Report Writing	3			
	POWNT ZC322	Power Generation	3	POWNT ZC332	Energy Management	3
	POWNT ZC331	Instrumentation & Control	3	POWNT ZC342	Power Systems Engineering I	3
				POWNT ZC481	Plant Layout & Design	3
		Total	12		Total	12
III	POWNT ZC411	Environmental Pollution Control	3	POWNT ZC423T	Project Work	20
	POWNT ZC421	Essentials of Project Management	3			
	POWNT ZC431	Maintenance & Safety	3			
	POWNT ZC441	Power Systems Engineering II	3			
		Total	12		Total	20

Note 1: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

Pool of other Courses*		
Course No.	**Course Title**	**U**
POWNT ZC412	Power System Operation and Control	3
POWNT ZC422	Power System Drawing and Design	3
POWNT ZC451	Alternative Energy Sources	3
POWNT ZC461	Power Plant Engineering	3
POWNT ZC471	Power Electronics & Drives	3

* Any course from this pool may be used to substitute a course from the Semesterwise pattern, if the situation warrants.

B.S. Process Engineering (Cement units of Aditya Birla Group)

Type of Input: Sponsored employees of Aditya Birla Group with Technical Diploma or its equivalent

Duration Normally Six Semesters

Special Feature: This is a specially designed programme for the Human Resource Development needs of Aditya Birla Group.

Year	First Semester		U	Second Semester		U
I	PEAB ZC121	Electrical & Electronics Engineering	3	PEAB ZC111	Computer Programming	3
	PEAB ZC131	Engineering Mathematics- I	3	PEAB ZC212	Engineering Mathematics – II	3
	PEAB ZC221	Principles of Management	3	PEAB ZC222	Fluid Mechanics	3
	PEAB ZC313	Technical Report Writing	3	PEAB ZC232	Engineering Materials	3
		Total	12		Total	12
II	PEAB ZC311	Chemical Engineering Thermodynamics	3	PEAB ZC322	Kinetics & Reactor Design	3
	PEAB ZC321	Chemical Process Calculations	3	PEAB ZC352	Energy Management	3
	PEAB ZC341	Heat Transfer	3	PEAB ZC412	Process Equipment Design	3
	PEAB ZC351	Mass Transfer	3	PEAB ZC441	Process Control & Instrumentation	3
		Total	12		Total	12
III	PEAB ZC314	Power Plant Engineering	3	PEAB ZC423T	Project Work	20
	PEAB ZC331	Quality Control Assurance & Reliability	3			
	PEAB ZC382	Cement Technology	3			
	PEAB ZC413	Process Plant Safety and Environment	3			
		Total	12		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

B.S. Process Engineering (CFCL, Kota)

Type of Input: Sponsored employees of Chambal Fertilizers and Chemicals Ltd., Kota with Technical Diploma / B.Sc. or its equivalent.

Duration Normally Six Semesters

Special Feature: This is a specially designed programme for the Human Resource Development needs of CFCL, Kota.

Year	First Semester		U	Second Semester		U
I	PECF ZC131	Engineering Mathematics I	3	PECF ZC111	Computer Programming	3
	PECF ZC121	Electrical & Electronics Engineering	3	PECF ZC212	Engineering Mathematics II	3
	PECF ZC313	Technical Report Writing	3	PECF ZC222	Fluid Mechanics	3
	PECF ZC221	Principles of Management	3	PECF ZC232	Engineering Materials	3
		Total	12		Total	12
II	PECF ZC311	Chemical Engineering Thermodynamics	3	PECF ZC322	Kinetics & Reactor Design	3
	PECF ZC321	Chemical Process Calculations	3	PECF ZC352	Energy Management	3
	PECF ZC341	Heat Transfer	3	PECF ZC412	Process Equipment Design	3
	PECF ZC351	Mass Transfer	3	PECF ZC441	Process Control & Instrumentation	3
		Total	12		Total	12
III	PECF ZC314	Power Plant Engineering	3	PECF ZC423T	Project Work	20
	PECF ZC331	Quality Control, Assurance & Reliability	3			
	PECF ZC382	Fertilizer Technology	3			
	PECF ZC413	Process Plant Safety and Environment	3			
		Total	12		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

B.S. Process Engineering (Hindalco, Renukoot)

Type of Input: Sponsored employees of Hindalco Industries Ltd., Renukoot with Technical Diploma or its equivalent

Duration Normally Six Semesters

Special Feature: This is a specially designed programme for the Human Resource Development needs of Hindalco Industries Ltd., Renukoot.

Year	First Semester		U	Second Semester		U
I	PEHR ZC121	Electrical & Electronics Engineering	3	PEHR ZC111	Computer Programming	3
	PEHR ZC131	Engineering Mathematics- I	3	PEHR ZC212	Engineering Mathematics – II	3
	PEHR ZC221	Principles of Management	3	PEHR ZC222	Fluid Mechanics	3
	PEHR ZC313	Technical Report Writing	3	PEHR ZC232	Engineering Materials	3
		Total	12		Total	12
II	PEHR ZC311	Chemical Engineering Thermodynamics	3	PEHR ZC322	Kinetics & Reactor Design	3
	PEHR ZC321	Chemical Process Calculations	3	PEHR ZC352	Energy Management	3
	PEHR ZC341	Heat Transfer	3	PEHR ZC412	Process Equipment Design	3
	PEHR ZC351	Mass Transfer	3	PEHR ZC441	Process Control & Instrumentation	3
		Total	12		Total	12
III	PEHR ZC314	Power Plant Engineering	3	PEHR ZC423T	Project Work	20
	PEHR ZC331	Quality Control Assurance & Reliability	3			
	PEHR ZC383	Extractive Metallurgy	3			
	PEHR ZC413	Process Plant Safety and Environment	3			
		Total	12		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

B.S. Process Engineering (HZL, Udaipur)

Type of Input: Sponsored employees of Hindustan Zinc Ltd., Udaipur with Technical Diploma / B.Sc. or its equivalent

Duration: Normally Six Semesters

Special Feature: This is a specially designed programme for the Human Resource Development needs of HZL, Udaipur.

Year	First Semester		U	Second Semester		U
I	PEHZ ZC131	Engineering Mathematics I	3	PEHZ ZC111	Computer Programming	3
	PEHZ ZC121	Electrical & Electronics Engineering	3	PEHZ ZC212	Engineering Mathematics II	3
	PEHZ ZC313	Technical Report Writing	3	PEHZ ZC222	Fluid Mechanics	3
	PEHZ ZC221	Principles of Management	3	PEHZ ZC232	Engineering Materials	3
		Total	12		Total	12
II	PEHZ ZC311	Chemical Engineering Thermodynamics	3	PEHZ ZC322	Kinetics & Reactor Design	3
	PEHZ ZC321	Chemical Process Calculations	3	PEHZ ZC352	Energy Management	3
	PEHZ ZC341	Heat Transfer	3	PEHZ ZC412	Process Equipment Design	3
	PEHZ ZC351	Mass Transfer	3	PEHZ ZC441	Process Control & Instrumentation	3
		Total	12		Total	12
III	PEHZ ZC314	Power Plant Engineering	3	PEHZ ZC423T	Project Work	20
	PEHZ ZC331	Quality Control, Assurance & Reliability	3			
	PEHZ ZC383	Extractive Metallurgy	3			
	PEHZ ZC413	Process Plant Safety and Environment	3			
		Total	12		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

B.S. Process Engineering (JSW Steel, Toranagallu)

Type of Input: Sponsored employees of JSW Steel Ltd. with Technical Diploma or its equivalent

Duration: Normally 6-Semesters.

Special Feature: This is a specially designed programme for Human Resource Development needs of JSW Steel Ltd, Toranagallu.

Year	First Semester		U	Second Semester		U
I	PEJS ZC121	Electrical & Electronics Engineering	3	PEJS ZC111	Computer Programming	3
	PEJS ZC131	Engineering Mathematics- I	3	PEJS ZC212	Engineering Mathematics – II	3
	PEJS ZC221	Principles of Management	3	PEJS ZC232	Engineering Materials	3
	PEJS ZC313	Technical Report Writing	3	PEJS ZC242	Thermodynamics & Kinetics	3
		Total	12			12
II	PEJS ZC252	Mineral Beneficiations and Agglomeration	3	PEJS ZC312	Steel Making & Casting	3
	PEJS ZC262	Iron Making	3	PEJS ZC332	Testing of Materials	3
	PEJS ZC272	Furnace Technology	3	PEJS ZC352	Energy Management	3
	PEJS ZC442	Advances in Materials Science	3	PEJS ZC441	Process Control & Instrumentation	3
		Total	12		Total	12
III	PEJS ZC331	Quality Control Assurance & Reliability	3	PEJS ZC423T	Project Work	20
	PEJS ZC362	Steel Processing	3			
	PEJS ZC413	Process Plant Safety and Environment	3			
	PEJS ZC414	Project Appraisal	3			
		Total	12		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

B.S. Process Engineering (TCL, Babrala)

Type of Input: Sponsored employees of TCL, Babrala with Technical Diploma / B.Sc. or its equivalent

Duration: Normally 6-Semesters.

Special Feature: This is a specially designed programme for Human Resource Development needs of Tata Chemicals Ltd., Babrala

Year	First Semester		U	Second Semester		U
I	PETC ZC131	Engineering Mathematics I	3	PETC ZC111	Computer Programming	3
	PETC ZC121	Electrical & Electronics Engineering	3	PETC ZC212	Engineering Mathematics II	3
	PETC ZC313	Technical Report Writing	3	PETC ZC222	Fluid Mechanics	3
	PETC ZC221	Principles of Management	3	PETC ZC232	Engineering Materials	3
		Total	12			12
II	PETC ZC311	Chemical Engineering Thermodynamics	3	PETC ZC322	Kinetics & Reactor Design	3
	PETC ZC321	Chemical Process Calculations	3	PETC ZC352	Energy Management	3
	PETC ZC341	Heat Transfer	3	PETC ZC412	Process Equipment Design	3
	PETC ZC351	Mass Transfer	3	PETC ZC441	Process Control & Instrumentation	3
		Total	12		Total	12
III	PETC ZC314	Power Plant Engineering	3	PETC ZC423T	Project Work	20
	PETC ZC331	Quality Control, Assurance & Reliability	3			
	PETC ZC382	Fertilizer Technology	3			
	PETC ZC413	Process Plant Safety and Environment	3			
		Total	12		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.Sc. (Tech.) Pharmaceutical Chemistry (DRL, Hyderabad)

Type of Input Sponsored employees of DRL, Hyderabad with B.Sc. in Experimental Sciences.

Duration Normally Six Semesters

Special Feature This is a specially designed programme for Human Resource Development needs of Dr. Reddy's Laboratories Limited, Hyderabad.

Year	First Semester		U	Second Semester		U
I	PCRL ZC111	Mathematics- I	3	PCRL ZC112	Mathematics – II	3
	PCRL ZC122	Physical Chemistry	3	PCRL ZC121	Organic Chemistry	3
	PCRL ZC131	Principles of Management	3	PCRL ZC132	Computer Programming	3
	PCRL ZC141	Inorganic Chemistry	3	PCRL ZC142	Measurement Techniques	3
		Total	12		Total	12
II	PCRL ZC211	Instrumental Methods of Analysis	4	PCRL ZC212	Synthetic Organic Chemistry	3
	PCRL ZC221	Structure & Reactivity of Organic Compounds	3	PCRL ZC222	Stereo Chemistry and Reaction Mechanisms	3
	PCRL ZC232	Pharmaceutical Process Technology	3	PCRL ZC242	Environmental Pollution Control	3
	PCRL ZC251	Organo-Metallic Chemistry	3	PCRL ZC252	Analytical Method Development	3
		Total	13		Total	12
III	PCRL ZC311	Technical Report Writing	3	PCRL ZC423T	Project Work	20
	PCRL ZC321	Medicinal Chemistry	3			
	PCRL ZC341	Pharmaceutical Quality Control & Regulatory Affairs	3			
	PCRL ZC351	Structure Elucidation	3			
		Total	12		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.Sc.(Tech.) Pharmaceutical Chemistry (Matrix Laboratories, Hyderabad)

Type of Input Sponsored employees of Matrix Laboratories, Hyderabad with B.Sc. in Experimental Sciences.

Duration Normally 6-Semesters.

Special Feature This is a specially designed programme for Human Resource Development needs of Matrix Laboratories Ltd, Hyderabad.

Year	First Semester		U	Second Semester		U
I	PCML ZC111	Mathematics- I	3	PCML ZC112	Mathematics – II	3
	PCML ZC122	Physical Chemistry	3	PCML ZC121	Organic Chemistry	3
	PCML ZC131	Principles of Management	3	PCML ZC132	Computer Programming	3
	PCML ZC141	Inorganic Chemistry	3	PCML ZC142	Measurement Techniques	3
Total			12			12
II	PCML ZC211	Instrumental Methods of Analysis	4	PCML ZC212	Synthetic Organic Chemistry	3
	PCML ZC221	Structure & Reactivity of Organic Compounds	3	PCML ZC222	Stereo Chemistry and Reaction Mechanisms	3
	PCML ZC232	Pharmaceutical Process Technology	3	PCML ZC242	Environmental Pollution Control	3
	PCML ZC251	Organo-Metallic Chemistry	3	PCML ZC252	Analytical Method Development	3
Total			13	Total		12
III	PCML ZC311	Technical Report Writing	3	PCML ZC423T	Project Work	20
	PCML ZC321	Medicinal Chemistry	3			
	PCML ZC341	Pharmaceutical Quality Control & Regulatory Affairs	3			
	PCML ZC351	Structure Elucidation	3			
Total			12	Total		20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Consciousness Studies

Type of Input: Integrated First Degree of BITS or its equivalent.

Duration Normally Four Semesters

Special Feature: This programme is specially designed for being conducted for eligible candidates in collaboration with Bhakthivedanta Institute, Mumbai. Structured classes would be held in Mumbai regularly.

Year	First Semester		U	Second Semester		U
I	CONS ZG511	Philosophy and Consciousness	4	CONS ZG512	Philosophy and Consciousness – Advanced Topics	4
	CONS ZG656	Technical Writing	4			
	CONS ZG573	Study in Advanced Topics I	5	CONS ZG551	Artificial Intelligence and Consciousness	4
		Elective	4	CONS ZG574	Study in Advanced Topics II	5
				CONS ZG541	Biology and Consciousness	4
		Total	17		Total	17
II	CONS ZG542	Consciousness Studies – Advanced Topics	4	CONS ZG629T	Dissertation	20
	CONS ZG572	Matter and Consciousness in Bhagavata Sankhya	4			
	CONS ZG591	Selected Topics in Consciousness Studies	4			
		Elective	4			
		Total	16		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

Pool of other Courses		
Course No.	**Course Title**	**U**
CONS ZG531	Physics and Consciousness	4
CONS ZG532	Neuroscience and Consciousness	4
CONS ZG552	Foundations of Physics	4
CONS ZG561	Vedanta and Consciousness	4
CONS ZG562	Physics and Consciousness – Advanced Topics	4
CONS ZG571	Mind, Body, Medicine-Current Trends	4
CONS ZG581	Medicine and Consciousness – Advanced Topics	4
CONS ZG582	Psychology and Consciousness	4

* Any course from this pool may be used to substitute a course from the Semesterwise pattern, if the situation warrants.

M.S. Consultancy Management

Type of Input: Employed professionals working in consulting and business organizations, with an Integrated First Degree of BITS or its equivalent.

Duration Normally Four Semesters

Special Feature: This is a specially designed Work-Integrated Learning programme for eligible candidates conducted in collaboration with Consultancy Development Centre (CDC) New Delhi. The programme would have mandatory Intensive Contact Sessions of two weeks duration each in both the semesters of the first year of the programme, to be held tentatively at Ahmedabad / Bangalore / Chennai / Delhi / Hyderabad / Kolkata / Mumbai / Pune.

Year	First Semester		U	Second Semester		U
I	CM ZG511	Consultancy Practice	4	CM ZG542	Knowledge Management	3
	CM ZG513	Financial Management	4	CM ZC483	Marketing Research	3
	CM ZG515	Quantitative Methods	4	CM ZG561	Management of Technology	4
	CM ZC473	International Business	3	CM ZG619	Professional Practice	4
		Total	15		Total	14
II	CM ZC471	Management Information Systems	3	CM ZG629T	Dissertation	20
	CM ZG523	Project Management	4			
	CM ZG532	Total Quality Management	4			
	CM ZG611	Strategic Management & Business Policy	4			
		Total	15		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Educational System Management (AEES, Mumbai)

Type of Input: Sponsored employees of the Atomic Energy Education Society, Mumbai with Integrated first degree of BITS or its equivalent.

Duration: Normally Four Semesters

Special Feature: This is a specially designed programme for Human Resource Development needs of the Atomic Energy Education Society, Mumbai.

Year	First Semester		U	Second Semester		U
I	ESM ZG511	Organisational Behaviour	4	ESM ZG512	Management Information Systems	3
	ESM ZG521	Professional Ethics	3	ESM ZG522	Human Resource Management	4
	ESM ZG531	Overview of Management Concepts	4	ESM ZG532	Total Quality Management	4
	ESM ZG541	Technical Communication	4	ESM ZG542	Introduction to Accounting and Finance	4
		Total	15		Total	15
II	ESM ZG611	Research Methodology	5	ESM ZG629T	Dissertation	20
	ESM ZG621	Educational Technology and Instructional Design	4			
	ESM ZG631	Counselling	4			
	ESM ZG641	International Challenges and Response in Education	4			
		Total	17		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Embedded Systems (Patni, Mumbai)

Type of Input: Sponsored employees (with adequate relevant work experience) with an Integrated First Degree of BITS in Electrical & Electronic or Electronics & Instrumentation or Computer Science or its equivalent.

Duration: Normally Four Semesters

Special Feature: This is a specially designed programme for Human Resource Development needs of Patni Computer Systems Ltd., Mumbai.

Year	First Semester		U	Second Semester		U
I	ESPC ZC421	Computer Networks	3	ESPC ZC424	Software for Embedded Systems	3
	ESPC ZG512	Embedded System Design	4	ESPC ZG520	Wireless & Mobile Communication	5
	ESPC ZG553	Real-Time Systems	5	ESPC ZG641	Hardware Software Co-Design	4
	ESPC ZG573	Digital Signal Processing	3	ESPC ZG651	Networked Embedded Applications	4
		Total	15		Total	16
II	ESPC ZC446	Data Storage Technologies & Networks	3	ESPC ZG629T	Dissertation	20
	ESPC ZG513	Network Security	4			
	ESPC ZG531	Pervasive Computing	4			
	ESPC ZG612	Fault Tolerant System Design	5			
		Total	16		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Engineering Management (Ashok Leyland, Chennai & Hosur)

Type of Input: Sponsored employees of Ashok Leyland, Chennai with First Degree of BITS or its equivalent.

Duration: Normally 4-Semesters.

Special Feature: This is a specially designed programme for Human Resource Development needs of Ashok Leyland, Chennai & Hosur.

Year	First Semester		U	Second Semester		U
I	EMAL ZG643	Maintenance Engineering & Safety	4	EMAL ZG632	Materials Management	4
	EMAL ZG612	Methods & Techniques of Systems Engineering	5	EMAL ZG511	Overview of E-Commerce	3
				EMAL ZG532	Quality Assurance & Reliability	5
	EMAL ZG614	Management Concepts & HRM	5	EMAL ZG631	Product Systems Management	5
	EMAL ZC432	Introduction to Accounting & Finance	4			
		Total	18		Total	17
II	EMAL ZC481	Industrial Marketing	3	EMAL ZG629T	Dissertation	20
	EMAL ZC411	Issues in Technology	3			
	EMAL ZG659	Technical Communication	4			
	EMAL ZG641	Management Information & Decision Support Systems	5			
		Total	15		Total	20

Note: This is currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Engineering Management (Technip, Chennai)

Type of Input: Sponsored employees of Technip India, Chennai with First Degree of BITS or its equivalent.

Duration: Normally 4-Semesters.

Special Feature: This is a specially designed programme for Human Resource Development needs of Technip India, Chennai.

Year	First Semester		U	Second Semester		U
I	EMTP ZG659	Technical Communication	4	EMTP ZG532	Quality Assurance & Reliability	5
	EMTP ZG614	Management Concepts & HRM	5	EMTP ZG523	Project Management	4
	EMTP ZG511	Design Engineering I	4	EMTP ZG512	Design Engineering II	4
	EMTP ZC432	Introduction to Accounting & Finance	4	EMTP ZG612	Methods & Techniques of Systems Engineering	5
		Total	17		Total	18
II	EMTP ZG541	Process Plant Simulation	4	EMTP ZG629T	Dissertation	20
	EMTP ZG641	Management Information & Decision Support Systems	5			
	EMTP ZG533	Environmental Management System	5			
	EMTP ZC312	Managerial Economics	3			
		Total	17		Total	20

Note: This is currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Manufacturing Management

Type of Input: Employed professionals in manufacturing industries with minimum 1 year experience and holding an Integrated First Degree of BITS or its equivalent with adequate background in Mathematics. Employer consent with suitable mentor availability will be additional requirements.

Duration Normally Four Semesters

Special Feature: This is a specially designed Work-Integrated Learning programme for catering to the Human Resource Development requirements of diverse spectrum of manufacturing industries.

Semesterwise pattern for students admitted in the First Semester of the academic session

Year	First Semester		U	Second Semester		U
I	MM ZG511	Manufacturing Organization & Management	5	MM ZC441	Human Resource Management	4
	MM ZG521	Financial Management	4	MM ZG621	Supply Chain Management	4
	MM ZG541	Product Design	5	MM ZG542	Just-in-Time Manufacturing	4
	MM ZG522	Total Quality Management	4	EA ZC412	Flexible Manufacturing Systems	4
		Total	18		Total	16
II	MM ZG411	Marketing	4	BITS ZG629T	Dissertation	20
	MM ZG523	Project Management	4			
	MM ZG611	Strategic Management & Business Policy	4			
	BITS ZG659	Technical Communication	4			
		Total	16		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

Semesterwise pattern for students admitted in the Second Semester of the academic session

Year	First Semester		U	Second Semester		U
I				MM ZC441	Human Resource Management	4
				MM ZG621	Supply Chain Management	4
				MM ZG542	Just-in-Time Manufacturing	4
				EA ZC412	Flexible Manufacturing Systems	4
					Total	16
II	MM ZG511	Manufacturing Organization & Management	5	MM ZG411	Marketing	4
	MM ZG521	Financial Management	4	MM ZG523	Project Management	4
	MM ZG541	Product Design	5	MM ZG611	Strategic Management & Business Policy	4
	MM ZG522	Total Quality Management	4	BITS ZG659	Technical Communication	4
		Total	18		Total	16
III	BITS ZG629T	Dissertation	20			
		Total	20			

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Medical Laboratory Technology

Type of Input: B.Sc. in Experimental Sciences with adequate exposure to Biology and Chemistry. Short-listed candidc be required to take a Written Test and Interview at their own expense for getting admission.

Duration Normally Six Semesters

Special Feature: This is a specially designed three-year higher degree programme with classes and laboratory work conducted entirely at Sankara Nethralaya Medical Research Foundation (MRF), 18, College Road, Nungambakam, Chennai – 600 006.

Year	First Semester		U	Second Semester		U
I	MLTSN ZG511	Human Anatomy & Physiology	2	MLTSN ZG512	Enzymology and Metabolism in Health	3
	MLTSN ZG521	Bio-organic & Bio-physical Chemistry	3	MLTSN ZG522	Human Genetics	2
	MLTSN ZG531	Heamopoitic Systems & Basic Heamotologic Techniques	2	MLTSN ZG532	Disorders of RBCs & Haemoglobin	2
	MLTSN ZG541	General Microbiology	3	MLTSN ZG542	Clinical Immunology	3
	MLTSN ZG551	Computers & Information Systems	3	MLTSN ZG552	Clinical Pathology	2
	MLTSN ZG561	Instrumentation in Medical Laboratory Technology	3			
		Total	16		Total	12
II	MLTSN ZG611	Food & Nutrition in Health	4	MLTSN ZG612	Clinical Biochemistry	4
	MLTSN ZG621	Molecular Biology	3	MLTSN ZG622	Histopathological Techniques	3
	MLTSN ZG631	Disorders of Leucocytes, Haemostasis & Coagulation	2	MLTSN ZG632	Diagnostic Microbiology	4
	MLTSN ZG641	Medical Microbiology	4	MLTSN ZG659	Technical Communication	4
	MLTSN ZG651	Epidemiology & Biostatistics	2	MLTSN ZG562	Blood Banking	2
		Total	15		Total	17
III	MLTSN ZG633T	Internship I	15	MLTSN ZG634T	Internship II	15
		Total	15		Total	15

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Microelectronics

Type of Input & Duration :

- Sponsored employees (with adequate work experience in Microelectronics area) with a Technical Diploma in Engineering or its equivalent for a Eight Semester programme
- Sponsored employees (with adequate work experience in Microelectronics area) with a First Degree of BITS or its equivalent for a Four Semester programme

Special Feature: This is a specially designed programme to meet the Human Resource Development requirements of collaborating organizations at Bangalore such as Intel, Texas Instruments, Wipro and Qualcomm. Structured classes would be held in Bangalore regularly.

Year	First Semester		U	Second Semester		U
I	MELTI ZC231	Circuit Theory	3	MELTI ZC381	Electronic Devices	3
	MELTI ZC112	Electricity & Magnetism	3	MELTI ZC212	Mathematics II	3
	MELTI ZC211	Mathematics I	3	MELTI ZC321	Control Systems	3
	MELTI ZC252	Electronics	3	MELTI ZC241	Principles of Management	3
		Total	12		Total	12
II	MELTI ZC391	Digital Electronics	4	MELTI ZC382	Communication Systems	3
	MELTI ZC364	Analog Electronics	4	MELTI ZG659	Technical Communication	4
	MELTI ZC471	Electronic Measurements	3	MELTI ZC372	Circuits & Signals	3
	MELTI ZC251	Mathematics III	3	MELTI ZC411	Microprocessors	3
		Total	14		Total	13
III	MELTI ZG573	Digital Signal Processing	3	MELTI ZG621	VLSI Design	5
	MELTI ZG512	Embedded System Design	4	MELTI ZG632	Analog IC Design	5
	MELTI ZG511	Design & Analysis of Algorithms	5	MELTI ZG641	CAD for IC Design	5
	MELTI ZG631	Physics & Modelling of Micro-Electronic Devices	5	MELTI ZG611	IC Fabrication Technology	5
		Total	17		Total	20
IV	MELTI ZG642	VLSI Architecture	4	MELTI ZG629T	Dissertation	20
	MELTI ZG531	Testability for VLSI	5			
	MELTI ZG625	Advanced Analog and Mixed Signal Design	5			
	MELTI ZG651	Hardware Software Co-Design	4			
		Total	18		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Pharmaceutical Operations and Management (Dabur Pharma, Kalyani)

Type of Input: Sponsored employees of Dabur Pharma Ltd., Kalyani with Integrated first degree of BITS in Chemistry or Chemical Engineering or Pharmacy or equivalent.

Duration: Normally Four Semesters

Special Feature: This is a specially designed programme for Human Resource Development needs of Dabur Pharma Ltd., Kalyani.

Year	First Semester		U	Second Semester		U
I	POMDP ZG531	Manufacturing Organization and Management	5	POMDP ZG522	Quality Assurance and Regulatory Affairs	5
	POMDP ZC471	Management Information Systems	3	POMDP ZG515	Pharmaceutical Administration and Management	5
	POMDP ZG511	Pharmaceutical Process Technology-I	4	POMDP ZC431	Stereo Chemistry and Reaction Mechanisms	3
	POMDP ZC411	Organizational Behaviour	4	POMDP ZG512	Pharmaceutical Process Technology-II	3
		Total	16		Total	16
II	POMDP ZC413	Process Plant Safety and Environment	3	POMDP ZG629T	Dissertation	20
	POMDP ZC417	Managerial Communication	4			
	POMDP ZG523	Total Quality Management	4			
	POMDP ZG541	Modern Analytical Techniques	4			
		Total	15		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Pharmaceutical Operations and Management (Lupin Ltd., Mumbai)

Type of Input: Sponsored employees of Lupin Ltd., Mumbai with Integrated first degree of BITS in Chemistry or Chemical Engineering or Pharmacy or equivalent.

Duration: Normally Four Semesters

Special Feature: This is a specially designed programme for Human Resource Development needs of Lupin Ltd., Mumbai.

Year	First Semester		U	Second Semester		U
I	POMLM ZC441	Human Resource Management	4	POMLM ZC473	International Business	3
	POMLM ZC471	Management Information Systems	3	POMLM ZG515	Pharmaceutical Administration & Management	5
	POMLM ZG523	Project Management	4	POMLM ZG522	Quality Assurance & Regulatory Affairs	5
	POMLM ZG641	Technical Communication	4	POMLM ZG611	Advanced Pharmacology	5
		Total	15		Total	18
II	POMLM ZG525	Pharmaceutical Process Development & Scale-up	4	POMLM ZG629T	Dissertation	20
	POMLM ZG532	Supply Chain Management	4			
	POMLM ZG534	Advanced Pharmaceutical Technology	5			
	POMLM ZG535	Pharmacoeconomics	3			
		Total	16		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Pharmaceutical Operations and Management (SAL, Bangalore)

Type of Input : Sponsored employees with Integrated first degree of BITS in Pharmacy or its equivalent.

Duration Normally Four Semesters

Special Feature: This is a specially designed programme for the Human Resource Development needs of Strides Arcolab Ltd., Bangalore.

Year	First Semester		U	Second Semester		U
I	POMSA ZG511	Disinfection and Sterilisation	4	POMSA ZG512	Dosage Form Design	5
	POMSA ZG521	Statistical Process Control	5	POMSA ZG522	Quality Assurance & Regulatory Affairs	5
	POMSA ZG531	Manufacturing Organization and Management	5	POMSA ZG532	Supply Chain Management	4
	POMSA ZG541	Modern Analytical Techniques	4	POMSA ZG542	Production and Operations Management	4
		Total	18		Total	18
II	POMSA ZG611	Advanced Pharmacology	5	POMSA ZG629T	Dissertation	20
	POMSA ZC471	Management Information Systems	3			
	POMSA ZG631	TQM Tools and Techniques	5			
	POMSA ZG641	Technical Communication	4			
		Total	17		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Pharmaceutics (DRL, Hyderabad)

Type of Input: Sponsored employees of DRL, Hyderabad with B.Pharm. or equivalent.

Duration: Normally 4-Semesters.

Special Feature: This is a specially designed programme for Human Resource Development needs of DRL, Hyderabad.

Year	First Semester		U	Second Semester		U
I	PHRL ZG511	Advanced Physical Pharmaceutics	5	PHRL ZG513	Application of Statistics and Computers in Pharmacy	5
	PHRL ZG521	Advanced Pharmaceutical Analysis	5	PHRL ZG523	Pharmacokinetics & Clinical Pharmacy	5
	PHRL ZG512	Technical Communication	4	PHRL ZG514	Quality Assurance & Regulatory Affairs	5
	PHRL ZG522	Biopharmaceutics	3	PHRL ZG524	Dosage Form Design	5
		Total	17		Total	20
II	PHRL ZG534	Advanced Pharmaceutical Technology	5	PHRL ZG629T	Dissertation	20
	PHRL ZG515	Pharmaceutical Administration and Management	5			
	PHRL ZG525	Pharmaceutical Process Development & Scale-up	4			
	PHRL ZG535	Pharmacoeconomics	3			
		Total	17		Total	20

Note: This is currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

Pool of other courses*

Course No.	Course Title	Units
PHRL ZG545	Clinical Pharmacy & Therapeutics	5

* Any course from this pool may be used to substitute a course from the semesterwise pattern, if the situation warrants.

M.S. Quality Management

Type of Input: Employed professionals working in quality and related services, with an Integrated First Degree of BITS or its equivalent.

Duration Normally Four Semesters

Special Feature: This is a specially designed Work-Integrated Learning programme for eligible candidates conducted in collaboration with Indian Institute of Quality Management, Jaipur. The programme would have mandatory Intensive Contact Sessions of two weeks duration each in both the semesters of the first year of the programme, to be held tentatively at Bangalore / Chennai / Jaipur / Pune.

Year	First Semester		U	Second Semester		U
I	QMJ ZG511	TQM-Core Concepts	5	QMJ ZG541	TQM Tools & Techniques	5
	QMJ ZG521	Quality Management System	5	QMJ ZG522	Quality through Measurement System	5
	QMJ ZG531	Statistical Process Control	5	QMJ ZG532	Environmental Management System	5
	QMJ ZG512	Human Resource Management & Organizational Learning	5	QMJ ZG658	Technical Communication	4
		Total	20		Total	19
II	QMJ ZC411	Marketing	4	QMJ ZG629T	Dissertation	20
	QMJ ZG523	Project Management	4			
	QMJ ZG611	Strategic Management and Business Policy	4			
	QMJ ZG621	Supply Chain Management	4			
		Total	16		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Science Communication

Type of Input: First Degree of BITS or its equivalent

Duration: Normally Four Semesters

Special Feature: This is a specially designed programme for Human Resource Development needs of National Council of Science Museums (NCSM), Kolkata and other associated organizations

Year	First Semester		U	Second Semester		U
I	NCSM ZG511	History of Science & Technology	4	NCSM ZG522	Exhibits & Presentation	3
	NCSM ZG521	Concepts in Science Communication	3	NCSM ZG532	Science Communication & IT	4
	NCSM ZG531	Technical Communication	4	NCSM ZG542	Professional Skills & Techniques- II	4
	NCSM ZG541	Professional Skills & Techniques- I	4	NCSM ZG611	Museum Management & Operations	4
			15			15
II	NCSM ZG512	Museum Planning & Organization	4	NCSM ZG629T	Dissertation	20
	NCSM ZG621	Science Learning in Non Formal Settings	4			
	NCSM ZG631	Science & Society	3			
	NCSM ZG641	Professional Skills & Techniques- III	4			
			15			20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Software Engineering (CTS)

Type of Input & Duration :

- Sponsored employees (with adequate work experience) with a B.Sc. Degree or its equivalent with adequate preparation in Mathematics & Physics, for an Eight Semester programme
- Sponsored employees (with adequate work experience) with Integrated First Degree of BITS or its equivalent, for a Four Semester programme

Special Feature: This is a specially designed programme for Human Resource Development needs of Cognizant Technology Solutions, Chennai.

Year	First Semester		U	Second Semester		U
I	SECT ZC271	Mathematics I	3	SECT ZC272	Mathematics II	3
	SECT ZC221	Structured Programming	3	SECT ZC222	Advanced Programming Techniques	3
	SECT ZC241	Principles of Management	3	SECT ZC213	Probability & Statistics	3
	SECT ZC261	Digital Electronics & Microprocessors	3	SECT ZC252	Discrete Structures for Computer Science	3
		Total	12		Total	12
II	SECT ZC413	Computer Organization & Architecture	3	SECT ZC421	Computer Networks	3
	SECT ZC415	Data Structures & Algorithms	3	SECT ZC362	Programming Languages & Compiler Construction	3
	SECT ZC461	Software Engineering	3	SECT ZC322	Database Management Systems	3
	SECT ZC432	Object Oriented Programming	3	SECT ZC422	Operating Systems	3
		Total	12		Total	12
III	SECT ZG659	Technical Communication	4	SECT ZG651	Software Architectures	5
	SECT ZG512	Object Oriented Analysis & Design	4	SECT ZG652	Software Maintenance Management	4
	SECT ZG511	Design & Analysis of Algorithms	5	SECT ZG552	Software Testing Methodologies	4
	EBCT ZG511	Overview of e-Business	3	SECT ZG641	Management Information & Decision Support Systems	5
		Total	16		Total	18
IV	SECT ZG661	Software Quality Management	4	SECT ZG629T	Dissertation	20
	SECT ZG517	Usability Engineering	5			
	SECT ZG622	Software Project Management	4			
	SECT ZG513	Network Security	4			
		Total	17		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Software Engineering (Cybage India Ltd., Pune)

Type of Input: Sponsored employees of Cybage India Ltd., Pune with Integrated First Degree of BITS or its equivalent.

Duration Normally Four Semesters

Special Feature: This is a specially designed programme for the Human Resource Development needs of Cybage India Ltd., Pune

Year	First Semester		U	Second Semester		U
I	SECY ZG512	Object Oriented Analysis and Design	4	SECY ZC451	Internetworking Technologies	3
	SECY ZG517	Data Structures and Algorithm Analysis	5	SECY ZG514	Data Warehousing	5
	SECY ZG518	Database Design and Applications	5	SECY ZG651	Software Architectures	5
	SECY ZG562	Software Engineering & Management	5	SECY ZG661	Software Quality Management	4
		Total	19		Total	17
II	SECY ZC351	Organizational Behaviour	3	SECY ZG629T	Dissertation	20
	SECY ZG513	Network Security	4			
	SECY ZG531	Pervasive Computing	4			
	SECY ZG623	Advanced Operating Systems	5			
		Total	16		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Software Engineering (HCL Chennai)

Type of Input: Sponsored employees of HCL Technologies, Chennai with Integrated First Degree of BITS or its equivalent.

Duration Normally Four Semesters

Special Feature: This is a specially designed programme for the Human Resource Development needs of HCL Technologies, Chennai

Year	First Semester		U	Second Semester		U
I	SEHT ZC421	Computer Networks	3	SEHT ZC462	Network Programming	3
	SEHT ZG516	Computer Organization & Software Systems	5	SEHT ZG512	Object Oriented Analysis & Design	4
	SEHT ZG517	Data Structures & Algorithm Analysis	5	SEHT ZG623	Advanced Operating Systems	5
	SEHT ZG562	Software Engineering & Management	5	SEHT ZG520	Wireless & Mobile Communication	
					or	5
				SEHT ZG518	Database Design & Applications	
		Total	18		Total	17
II	SEHT ZG552	Software Testing Methodologies	4	SEHT ZG629T	Dissertation	20
	SEHT ZG573	Digital Signal Processing				
		or	3			
	SEHT ZC451	Internetworking Technologies				
	SEHT ZG591	Optical Communication				
		or	5			
	SEHT ZG514	Data Warehousing				
	SEHT ZG513	Network Security	4			
		or				
	SEHT ZG651	Software Architectures	5			
		Total	16/17		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Software Engineering (HP GDIC, Bangalore)

Type of Input Sponsored employees of HP GDIC, Bangalore with Integrated first degree of BITS or its equivalent.

Duration Normally Four Semesters

Special Feature This is a specially designed programme for Human Resource Development needs of HP GDIC, Bangalore.

Year	First Semester		U	Second Semester		U
I	SEHP ZC421	Computer Networks	3	SEHP ZC451	Internetworking Technologies	3
	SEHP ZG512	Object Oriented Analysis and Design	4	SEHP ZG518	Database Design & Applications	5
	SEHP ZG517	Data Structures & Algorithm Analysis	5	SEHP ZG623	Advanced Operating Systems	5
	SEHP ZG562	Software Engineering & Management	5	SEHP ZG651	Software Architectures	5
		Total	17		Total	18
II	SEHP ZG513	Network Security	4	SEHP ZG629T	Dissertation	20
	SEHP ZG514	Data Warehousing	5			
	SEHP ZG552	Software Testing Methodologies	4			
	SEHP ZG622	Software Project Management	4			
		Total	17		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Software Engineering (Patni)

Type of Input: Sponsored employees of Patni Computer Systems with Integrated First Degree of BITS or its equivalent.

Duration: Normally Four Semesters

Special Feature: This is a specially designed programme for Human Resource Development needs of Patni Computer Systems Ltd, Mumbai

Year	First Semester		U	Second Semester		U
I	SEPC ZC421	Computer Networks	3	SEPC ZC462	Network Programming	3
	SEPC ZG512	Object Oriented Analysis and Design	4	SEPC ZG514	Data Warehousing	5
	SEPC ZG517	Data Structures and Algorithm Analysis	5	SEPC ZG623	Advanced Operating Systems	5
	SEPC ZG518	Database Design and Applications	5	SEPC ZG651	Software Architectures	5
		Total	17		Total	18
II	SEPC ZC451	Internetworking Technologies	3	SEPC ZG629T	Dissertation	20
	SEPC ZG513	Network Security	4			
	SEPC ZG552	Software Testing Methodologies	4			
	SEPC ZG562	Software Engineering and Management	5			
		Total	16		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Software Engineering (Persistent)

Type of Input: Sponsored employees of Persistent Systems Pvt. Ltd., Pune with Integrated first degree of BITS or its equivalent.

Duration Normally Four Semesters

Special Feature: This is a specially designed programme for Human Resource Development needs of Persistent Systems Pvt. Ltd., Pune.

Year	First Semester		U	Second Semester		U
I	SEPS ZG512	Object Oriented Analysis and Design	4	SEPS ZG651	Software Architectures	5
	SEPS ZG517	Data Structures and Algorithm Analysis	5	SEPS ZC451	Internetworking Technologies	3
	SEPS ZG518	Database Design and Applications	5	SEPS ZG514	Data Warehousing	5
	SEPS ZG562	Software Engineering & Management	5	SEPS ZG552	Software Testing Methodologies	4
		Total	19		Total	17
II	SEPS ZC462	Network Programming	3	SEPS ZG629T	Dissertation	20
	SEPS ZG623	Advanced Operating Systems	5			
	SEPS ZG513	Network Security	4			
	SEPS ZG531	Pervasive Computing	4			
		Total	16		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Software Engineering (Sabre Travel Technologies, Bangalore)

Type of Input Sponsored employees of Sabre Travel Technologies, Bangalore with First Degree of BITS or its equivalent and adequate, relevant work experience.

Duration Normally 4-Semesters.

Special Feature: This is a specially designed programme for Human Resource Development needs of Sabre Travel Technologies, Bangalore.

Year	First Semester		U	Second Semester		U
I	SEST ZC421	Computer Networks	3	SEST ZC473	Multimedia Computing	3
	SEST ZG516	Computer Organization & Software Systems	5	SEST ZG512	Object Oriented Analysis and Design	4
	SEST ZG517	Data Structures and Algorithm Analysis	5	SEST ZG514	Network Security	4
	SEST ZG518	Database Design and Applications	5	SEST ZG652	Software Maintenance Management	4
		Total	18		Total	15
IV	SEST ZC425	Data Mining	3	SEST ZG629T	Dissertation	20
	SEST ZG531	Pervasive Computing	4			
	SEST ZG651	Software Architectures	5			
	SEST ZG661	Software Quality Management	4			
		Total	16		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Software Engineering (SAP Labs India, Bangalore)

Type of Input & Duration : Sponsored employees (with adequate work experience) with a B.Sc. Degree or its equivalent with adequate preparation in Mathematics & Physics, for an Eight Semester programme

Special Feature: This is a specially designed programme for Human Resource Development needs of SAP Labs India, Bangalore.

Year	First Semester		U	Second Semester		U
I	SESAP ZC211	Mathematics I	3	SESAP ZC212	Mathematics II	3
	SESAP ZC221	Structured Programming	3	SESAP ZC222	Advanced Programming Techniques	3
	SESAP ZC241	Principles of Management	3	SESAP ZC213	Probability & Statistics	3
	SESAP ZC261	Digital Electronics & Microprocessors	3	SESAP ZC252	Discrete Structures for Computer Science	3
		Total	12		Total	12
II	SESAP ZC413	Computer Organization & Architecture	3	SESAP ZC421	Computer Networks	3
	SESAP ZC415	Data Structures & Algorithms	3	SESAP ZC362	Programming Languages & Compiler Construction	3
	SESAP ZC461	Software Engineering	3	SESAP ZC322	Database Management Systems	3
	SESAP ZC432	Object Oriented Programming	3	SESAP ZC422	Operating Systems	3
		Total	12		Total	12
III	SESAP ZC462	Network Programming	3	SESAP ZC451	Internetworking Technologies	3
	SESAP ZG511	Design & Analysis of Algorithms	5	SESAP ZG514	Data Warehousing	5
	SESAP ZG512	Object Oriented Analysis & Design	4	SESAP ZG552	Software Testing Methodologies	4
	SESAP ZG659	Technical Communication	4	SESAP ZG651	Software Architectures	5
		Total	16		Total	17
IV	SESAP ZC425	Data Mining	3	SESAP ZG629T	Dissertation	20
	SESAP ZG513	Network Security	4			
	SESAP ZG622	Software Project Management	4			
	SESAP ZG661	Software Quality Management	4			
		Total	15		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Software Engineering (SAP Labs India, Bangalore)

Type of Input Sponsored employees of Sap Labs, Bangalore with First Degree of BITS or its equivalent and adequate, relevant work experience.

Duration Normally 4-Semesters.

Special Feature: This is a specially designed programme for Human Resource Development needs of Sap Labs India, Bangalore.

Year	First Semester		U	Second Semester		U
III	SESAP ZC462	Network Programming	3	SESAP ZC451	Internetworking Technologies	3
	SESAP ZG511	Design & Analysis of Algorithms	5	SESAP ZG514	Data Warehousing	5
	SESAP ZG512	Object Oriented Analysis & Design	4	SESAP ZG552	Software Testing Methodologies	4
	SESAP ZG659	Technical Communication	4	SESAP ZG651	Software Architectures	5
		Total	16		Total	17
IV	SESAP ZC425	Data Mining	3	SESAP ZG629T	Dissertation	20
	SESAP ZG513	Network Security	4			
	SESAP ZG622	Software Project Management	4			
	SESAP ZG661	Software Quality Management	4			
		Total	15		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Software Engineering (Satyam)

Type of Input: Sponsored employees of Satyam Computer Services with Integrated First Degree of BITS or its equivalent.

Duration Normally Four Semesters

Special Feature: This is a specially designed programme for the Human Resource Development needs of Satyam Computer Services, Hyderabad

Year	First Semester		U	Second Semester		U
I	SESL ZC421	Computer Networks	3	SESL ZC462	Network Programming	3
	SESL ZG512	Object Oriented Analysis and Design	4	SESL ZC473	Multimedia Computing	3
	SESL ZG517	Data Structures & Algorithms Analysis	5	SESL ZG513	Network Security	4
	SESL ZG562	Software Engineering & Management	5	SESL ZG518	Data Base Design and Applications	5
		Total	17		Total	15
II	SESL ZG514	Data Warehousing	5	SESL ZG629T	Dissertation	20
	SESL ZG531	Pervasive Computing	4			
	SESL ZG552	Software Testing Methodologies	4			
	SESL ZG651	Software Architectures	5			
		Total	18		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Software Engineering (Tech Mahindra, Pune)

Type of Input & Duration : Sponsored employees (with adequate work experience) with a B.Sc. Degree or its equivalent with adequate preparation in Mathematics & Physics, for an Eight Semester programme

Special Feature: This is a specially designed programme for Human Resource Development needs of Tech Mahindra, Pune.

Year	First Semester		U	Second Semester		U
I	SEMB ZC211	Mathematics I	3	SEMB ZC212	Mathematics –II	3
	SEMB ZC223	Advanced Programming Techniques	3	SEMB ZC461	Software Engineering	3
	SEMB ZC241	Principles of Management	3	SEMB ZC213	Probability and Statistics	3
	SEMB ZC261	Digital Electronics & Microprocessors	3	SEMB ZC252	Discrete Structures for Computer Science	3
		Total	12		Total	12
II	SEMB ZC413	Computer Organization and Architecture	3	SEMB ZC421	Computer Networks	3
	SEMB ZC415	Data Structure and Algorithms	3	SEMB ZG659	Technical Communication	4
	SEMB ZC432	Object Oriented Programming	3	SEMB ZC351	Organizational Behaviour	3
	SEMB ZC322	Database Management Systems	3	SEMB ZC422	Operating Systems	3
		Total	12		Total	12
III	SEMB ZG651	Software Architectures	5	SEMB ZG514	Data Warehousing	5
	SEMB ZG512	Object Oriented Analysis and Design	4	SEMB ZG513	Network Security	4
	SEMB ZG511	Design and Analysis of Algorithms	5	SEMB ZG582	Telecom Network Management	5
	SEMB ZC473	Multimedia Computing	3	SEMB ZC462	Network programming	3
		Total	17		Total	17
IV	SEMB ZG661	Software Quality Management	4	SEMB ZG629T	Dissertation	20
	SEMB ZG552	Software Testing Methodologies	4			
	SEMB ZG622	Software Project Management	4			
	SEMB ZC451	Internetworking Technologies	3			
		Total	15		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Software Engineering (Wipro, Patni)

Type of Input & Duration : Sponsored employees (with adequate work experience) with a B.Sc. Degree or its equivalent with adequate preparation in Mathematics & Physics, for an Eight Semester programme

Special Feature: This is a specially designed programme for Human Resource Development needs of Wipro Technologies, Bangalore and Patni Computer Systems, Mumbai.

Year	First Semester		U	Second Semester		U
I	SE* ZC211	Mathematics I	3	SE* ZC212	Mathematics II	3
	SE* ZC221	Structured Programming	3	SE* ZC222	Advanced Programming Techniques	3
	SE* ZC241	Principles of Management	3	SE* ZC213	Probability & Statistics	3
	SE* ZC261	Digital Electronics & Microprocessors	3	SE* ZC252	Discrete Structures for Computer Science	3
		Total	12		Total	12
II	SE* ZC413	Computer Organization & Architecture	3	SE* ZC421	Computer Networks	3
	SE* ZC415	Data Structures & Algorithms	3	SE* ZC362	Programming Languages & Compiler Construction	3
	SE* ZC461	Software Engineering	3	SE* ZC322	Database Management Systems	3
	SE* ZC432	Object Oriented Programming	3	SE* ZC422	Operating Systems	3
		Total	12		Total	12
III	SE* ZG659	Technical Communication	4	SE* ZG651	Software Architectures	5
	SE* ZG512	Object Oriented Analysis & Design	4	SE* ZG661	Software Quality Management	4
	SE* ZG511	Design & Analysis of Algorithms	5	SE* ZC473	Multimedia Computing	3
	SE* ZC462	Network Programming	3	SE* ZC451	Internetworking Technologies	3
		Total	16		Total	15
IV	SE* ZG514	Data Warehousing	5	SE* ZG629T	Dissertation	20
	SE* ZG552	Software Testing Methodologies	4			
	SE* ZG622	Software Project Management	4			
	SE* ZG513	Network Security	4			
		Total	17		Total	20

Note 1: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

Note 2: For the course number in the above chart the symbol ***** can be substituted by **WP** for Wipro, and **PC** for Patni.

M.S. Software Engineering (Yahoo!, Bangalore)

Type of Input Sponsored employees of Yahoo! Software Development India Private Limited, Bangalore with First Degree of BITS or its equivalent and adequate, relevant work experience.

Duration Normally 4-Semesters.

Special Feature: This is a specially designed programme for Human Resource Development needs of Yahoo! Software Development India Private Limited, Bangalore.

Year	First Semester		U	Second Semester		U
I	SEYI ZC421	Computer Networks	3	SEYI ZC473	Multimedia Computing	3
	SEYI ZG516	Computer Organization & Software Systems	5	SEYI ZG512	Object Oriented Analysis and Design	4
	SEYI ZG517	Data Structures and Algorithm Analysis	5	SEYI ZG513	Network Security	4
	SEYI ZG518	Database Design and Applications	5	SEYI ZG652	Software Maintenance Management	4
		Total	18		Total	15
IV	SEYI ZC425	Data Mining	3	SEYI ZG629T	Dissertation	20
	SEYI ZG531	Pervasive Computing	4			
	SEYI ZG651	Software Architectures	5			
	SEYI ZG661	Software Quality Management	4			
		Total	16		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Software Systems

Type of Input: Employed professionals in information technology industries with minimum 1 year experience and holding an Integrated First Degree of BITS or its equivalent with adequate background in Mathematics. Employer consent with suitable mentor availability will be additional requirements.

Duration Normally Four Semesters

Special Feature: This is a specially designed Work-Integrated Learning Programme for catering to the Human Resource Development requirements of a diverse spectrum of information technology industries.

Semesterwise pattern for students admitted in the First Semester of the academic session

Year	First Semester		U	Second Semester		U
I	BITS ZC481	Computer Networks		EA ZC473	Multimedia Computing	
		Or	3		Or	3
	IS ZC462	Network Programming		IS ZC424	Software for Embedded Systems	
	SS ZG514	Object Oriented Analysis & Design		SS ZG513	Network Security	
		Or	4		Or	4
	SS ZG531	Pervasive Computing		EEE ZG512	Embedded System Design	
	SS ZG562	Software Engineering & Management		SS ZG516	Computer Organization & Software Systems	
		Or	5		Or	5
	SS ZG515	Data Warehousing		CS ZG623	Advanced Operating Systems	
	IS ZC361	Data Structures & Algorithms		IS ZC332	Database Systems & Applications	
		Or	3		Or	3
	EA ZC451	Internetworking Technologies		IS ZC415	Data Mining	
		Total	15		Total	12
II	SS ZG653	Software Architectures		BITS ZG629T	Dissertation	20
		Or	5			
	BITS ZG553	Real Time Systems				
	SS ZG514	Object Oriented Analysis & Design				
		Or	4			
	SS ZG531	Pervasive Computing				
	SS ZG562	Software Engineering & Management				
		Or	5			
	SS ZG515	Data Warehousing				
	BITS ZG659	Technical Communication	4			
		Total	18		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Software Systems

Type of Input: Employed professionals in information technology industries with an Integrated First Degree of BITS or its equivalent with adequate background in Mathematics. Employer consent with suitable mentor availability will be additional requirements.

Duration Normally Four Semesters

Special Feature: This is a specially designed Work-Integrated Learning Programme for catering to the Human Resource Development requirements of diverse spectrum of information technology industries.

Semesterwise pattern for students admitted in the Second Semester of the academic session

Year	First Semester		U	Second Semester		U
I				BITS ZC481	Computer Networks	
					Or	3
				IS ZC462	Network Programming	
				SS ZG514	Object Oriented Analysis & Design	4
				SS ZG516	Computer Organization & Software Systems	
					Or	5
				CS ZG623	Advanced Operating Systems	
				IS ZC332	Database Systems & Applications	
					Or	3
				IS ZC415	Data Mining	
					Total	15
II	SS ZG653	Software Architectures		EA ZC473	Multimedia Computing	
		Or	5		Or	3
	BITS ZG553	Real Time Systems		IS ZC424	Software for Embedded Systems	
	SS ZG531	Pervasive Computing	4	SS ZG513	Network Security	
	SS ZG562	Software Engineering & Management			Or	4
		Or	5	EEE ZG512	Embedded System Design	
	SS ZG515	Data Warehousing		SS ZG562	Software Engineering & Management	
	IS ZC361	Data Structures & Algorithms			Or	5
		Or	3	SS ZG515	Data Warehousing	
	EA ZC451	Internetworking Technologies		BITS ZG659	Technical Communication	4
		Total	17		Total	16
III	BITS ZG629T	Dissertation	20			
		Total	20			

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Systems Engineering (Wipro Infotech, Bangalore)

Type of Input & Duration Sponsored employees (with adequate work experience) with a B.Sc. Degree or its equivalent with adequate preparation in Mathematics & Physics, for an Eight-Semester programme

Special Feature This is a specially designed programme for Human Resource Development needs of Wipro Infotech, Bangalore.

Year	First Semester		U	Second Semester		U
I	SEWI ZC211	Mathematics I	3	SEWI ZC212	Mathematics II	3
	SEWI ZC221	Structured Programming	3	SEWI ZC213	Probability & Statistics	3
	SEWI ZC241	Principles of Management	3	SEWI ZC222	Advanced Programming Techniques	3
	SEWI ZC261	Digital Electronics & Microprocessors	3	SEWI ZC252	Discrete Structures for Computer Science	3
		Total	12		Total	12
II	SEWI ZC413	Computer Organization & Architecture	3	SEWI ZC421	Computer Networks	3
	SEWI ZC415	Data Structures & Algorithms	3	SEWI ZC362	Programming Languages & Compiler Construction	3
	SEWI ZC461	Software Engineering	3	SEWI ZC322	Database Management Systems	3
	SEWI ZC432	Object Oriented Programming	3	SEWI ZC422	Operating Systems	3
		Total	12		Total	12
III	SEWI ZG659	Technical Communication	4	SEWI ZG531	Pervasive Computing	4
	SEWI ZG520	Wireless & Mobile Communication	5	SEWI ZG661	Software Quality Management	4
	SEWI ZG512	Object Oriented Analysis & Design	4	SEWI ZG553	Real Time Systems	5
	SEWI ZC462	Network Programming	3	SEWI ZC451	Internetworking Technologies	3
		Total	16		Total	16
IV	SEWI ZG582	Telecom Network Management	5	SEWI ZG629T	Dissertation	20
	SEWI ZG514	Data Warehousing	5			
	SEWI ZG622	Software Project Management	4			
	SEWI ZG513	Network Security	4			
		Total	18		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.S. Telecommunications and Software Engineering (Tech Mahindra)

Type of Input: Sponsored employees (with adequate work experience in Telecommunications area) with Integrated First Degree of BITS or its equivalent.

Duration Normally Four Semesters

Special Feature: This is a specially designed programme for Human Resource Development needs of Tech Mahindra, Pune.

Year	First Semester		U	Second Semester		U
I	SEMB ZG659	Technical Communication	4	SEMB ZG651	Software Architectures	5
	SEMB ZG512	Object Oriented Analysis & Design	4	SEMB ZC452	Mobile Telecom Networks	3
	SEMB ZG516	Embedded System Design	4	SEMB ZC473	Multimedia Computing	3
	SEMB ZC421	Computer Networks	3	SEMB ZC482	Satellite Communication	3
		Total	15		Total	14
II	SEMB ZG582	Telecom Network Management	5	SEMB ZG629T	Dissertation	20
	SEMB ZG591	Optical Communication	5			
	SEMB ZG514	Data Warehousing	5			
	SEMB ZG513	Network Security	4			
		Total	19		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.Phil. Hospital & Health Systems Management

Type of Input: Employed professionals in the healthcare industry, having an M.B.B.S. degree or any Integrated First Degree of BITS or its equivalent, with at least one year post-qualification work experience and sponsored by their employers.

Duration: Normally Four Semesters

Special Feature: This programme is conducted in collaboration with Christian Medical College, Vellore and Bombay Hospital, Mumbai. Contact classes for four weeks are held at Vellore / Mumbai / Indore during the first semester, and at Pilani, during the second semester. The viva-voce for dissertation in the final semester would be held at BITS, Pilani.

Year	First Semester		U	Second Semester		U
I	HHSM ZG631	Introduction to Health Systems & Environmental Health	4	HHSM ZG514	Health Care Marketing & Strategic Management	4
	HHSM ZG665	Hospital Operations Management	3	HHSM ZG515	Quantitative Methods	3
	HHSM ZG513	Biostatistics & Epidemiology	4	HHSM ZG516	Epidemic & Disaster Management	4
	HHSM ZG531	Health Economics & Financial Management	4	HHSM ZG517	Health Care Management	4
		Total	15		Total	15
II	HHSM ZG518	Total Quality Management	4	HHSM ZG629T	Dissertation	20
	HHSM ZC471	Management Information Systems	3			
	HHSM ZC417	Managerial Communication	4			
	HHSM ZG519	Project Management	4			
		Total	15		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

M.Phil. Optometry

Type of Input: B.S. Optometry of BITS or its equivalent. Short-listed candidates will be required to take a Written Test and Interview at their own expense for getting admission.

Duration: Normally four semesters

Special Feature: This is a specially designed two-year higher degree programme with classes and laboratory work conducted entirely at Elite School of Optometry, MRF (Medical Research Foundation), 8, GST Road, St. Thomas Mount, Chennai - 600 016.

Year	First Semester		U	Second Semester		U
I	OPTO ZG642	Computers & Information Systems	3	OPTO ZG659	Technical Communication	4
	OPTO ZG623	Research Methodology I	3	OPTO ZG663	Research Methodology II	3
	OPTO ZG511	Special Clinics I	4	OPTO ZG512	Special Clinics II	4
		Elective I	4		Elective II	4
		Total	14		Total	15
II	OPTO ZG613	Ophthalmic Photography	3	OPTO ZG629T	Dissertation	20
	OPTO ZG681	Medical Records	3			
	OPTO ZG513	Special Clinics III	4			
	OPTO ZG644	Recent Advances in Optometry	4			
		Total	14	Total		20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

Pool of Elective Pairs		
Course No.	**Course Title**	**U**
OPTO ZG673	Clinical Optometry I	4
OPTO ZG683	Clinical Optometry II	4
OPTO ZG631	Advanced Glaucoma I	4
OPTO ZG682	Advanced Glaucoma II	4
OPTO ZG612	Advanced Contact Lens I	4
OPTO ZG611	Advanced Contact Lens II	4

M.Phil. Physician Assistant

Type of Input: B.S. Physician Assistant of BITS or its equivalent.

Duration Normally Four Semesters

Special Feature: This programme is specially designed for being conducted for eligible candidates in collaboration with Madras Medical Mission (MMM)-BITS Training Centre, Institute of Cardio-Vascular Diseases, 4A, Dr. J. Jayalalitha Nagar, Mogappair East, Chennai - 600 050. Structured classes would be held in Chennai regularly.

Year	First Semester		U	Second Semester		U
I	PAT ZG521	Immunology	5	PAT ZG522	Selected Topics in Cardiac Science-I	5
	PAT ZG531	Hospital Operations Management	3	PAT ZG532	Critical Care Medicine and Trauma	2
	PAT ZG541	Introduction to Health System and Environmental Health	4	PAT ZG542	Biostatistics and Decision Analysis	4
				PAT ZG552	Reproductive Medicine	3
	PAT ZG551	Clinical Pathology	2			
		Total	14		Total	14
II	PAT ZG661	Selected Topics in Cardiac Sciences-II	5	PAT ZG629T	Dissertation	20
	PAT ZG671	Advanced in Practice of Physician Assistantship	4			
	PAT ZG681	Membrane and Liposome Technology	4			
	PAT ZG691	Molecular Medicine	3			
		Total	16		Total	20

Note: This is the currently operative pattern as approved by the Senate-appointed committee, subject to change if the situation warrants.

PART VI

COURSE DESCRIPTIONS
(On-Campus)

LEGEND

The numbers that appear at the end of each course title like 3 0 3, 0 9 3, 2 3 3 etc. indicate the lecture hours per week, the practical/seminar/project hours per week and the number of units in that order. Wherever a single number (with or without*) appears, it indicates only total units and its break up in terms of lectures and practicals/seminar/project may be announced from time to time through the timetable whenever it is needed.

This part gives a detailed description of all the courses.

Offering of courses: The academic calendar consists of two regular semesters. The summer term is not part of the academic calendar except where specifically stated. The offering of courses shall always depend on the normal unfolding of these courses for regular students who should be able to negotiate all the courses required as compulsory or electives as they proceed within the stated number of years in the programme. Very often any departure from this practice is subject to the overall facilities available. It will be invariably taxing of facilities to help the largest number of students when possible. For instance, same course is offered in both the semesters where only one is necessary, in the pattern described above. Depending upon the need and the facilities, Dean Instruction decides the courses that will be offered in any particular semester and this information will be made available through a course-wise timetable at the beginning of every semester.

It will be clear from the above discussion that a student who wishes to exercise his choice of electives can do so only through courses available in the timetable and not courses which are mentioned in the bulletin. Nonetheless, students can easily guess, on the basis of previous timetables, which courses are likely to be offered in what semester and make an advance planning to the extent it is possible. Similarly, a student who has backlog will find that he is already out of phase with the pattern that has been described earlier and therefore has to work out a strategy for himself by which he reduces fouling up as much as it is possible for him to do so.

While registration in a particular course or set of courses is governed by Academic Regulations, for easy reference the following general guidelines together with specific points are listed.

1. The Dean, Instruction may introduce or withdraw courses in categories which are taken on the basis of electives or options.
2. Registration in any course can be made only with the prior permission of the Dean, ARC.
3. Although the detailed break-up of the units in terms of hours for lecture and practical classes are presented without designating tutorial hours, every student will be required to attend these tutorial classes as and when required by the Dean, Instruction.
4. In the structure of a programme a block of courses follow in a particular sequence semester after semester. The mere fact that no specific restriction has been put does not permit unwarranted jumbling of this sequence. This sequence is presented in semesterwise pattern for each programme.
5. The list of courses to be followed invariably have numbers attached to each course. These numbers generally determine the level at which the course is to be normally registered. However on the same plane there are courses which are specially designed for group C programmes and are not available to students of groups A&B programmes. Appropriate sections of the Bulletin may be consulted.
6. Sometimes a particular course has a prerequisite condition which has to be fulfilled before one can register in that course, or has to be waived with the consent of the Dean, Instruction.
7. For registration in certain specific courses like Specialized Discipline Courses, Higher Degree Courses, apart from the prerequisite, there will also be requirement of prior preparation. Academic regulations must be consulted for this.
8. For students registered in courses of Off-Campus Work Integrated Learning and Collaborative Programmes corresponding instructions have been detailed in PART V.

Note: The items mentioned above are not exhaustive. For precise rules reference should be made to Academic Regulations.

Course Description for all On-campus Programmes

Analysis & Application Oriented Courses

AAOC C111 Probability and Statistics 3 0 3

Probability spaces; conditional probability and independence; random variables and probability distributions; marginal and conditional distributions; independent random variables; mathematical expectation; mean and variance; binomial, Poisson and normal distributions; sum of independent random variables; law of large numbers; central limit theorem (without proof); sampling distribution and test for mean using normal and student's t-distribution; test of hypothesis; correlation and linear regression.

AAOC C221 Graphs and Networks 3 0 3

Basic concepts of graphs and digraphs behind electrical communication and other networks behind social, economic and empirical structures; connectivity, reachability and vulnerability; trees, tournaments and matroids; planarity; routing and matching problems; representations; various algorithms; applications.

AAOC C222 Optimization 3 0 3

Prerequisite: MATH C191 and MATH C192

Introduction to optimization; linear programming; simplex methods; duality and sensitivity analysis; transportation model and its variants; integer linear programming nonlinear programming; multi-objective optimization; evolutionary computation techniques.

AAOC C311 Data Processing 3 0 3

Prerequisite: TA C162

Introduction to Data Processing; Files and File Structures; Indexing Techniques; Sorting, Searching and Merging Techniques; Introduction to Database Management Systems; Design of Information Systems; Emerging trends in Data Processing.

AAOC C312 Operations Research 3 0 3

Prerequisite: AAOC C111

Introduction to operations research; dynamic programming; network models - including CPM and PERT; probability distributions; inventory models; queuing systems; decision making - under certainty, risk, and uncertainty; game theory; simulation techniques, systems reliability.

AAOC C321 Control Systems 3 0 3

Prerequisites: (ES C241 or ENGG C111) and (MATH C191)

Mathematical models of physical systems, feedback characteristics of control systems, control system components, time response analysis, stability, frequency response, state-space analysis, compensation.

AAOC C322 Systems 3 0 3

Prerequisite: ES C241 or ENGG C111

Systems and systems approach; signals and systems; modelling of physical systems and modelling of nonphysical systems; continuous and discrete systems; time domain analysis; systems stability.

AAOC C341 Numerical Analysis 3 0 3

Prerequisite : MATH C191 and MATH C192

Solution of non-linear algebraic equation; interpolation and approximation; numerical differentiation and quadrature; solution of ordinary differential equations; systems of linear equations; matrix inversion; eigenvalue and eigenvector problems; round off and conditioning.

Bioengineering

BENG C411 Anatomy, Physiology and Hygiene 2 3 3

Course description is same as given under PHA C321.

BENG G511 Biomaterials 3 2 5

Introduction to biomaterials, structure and characterizations of materials, metallic implant materials, ceramic implant materials,

polymeric implant materials, composites as biomaterials, structure property relationship, tissue response to implants, certain aspects of different kinds of prostheses.

BENG G512 Biomechanics 3 2 5

Introduction to biomechanics, kinematics, kinetics, anthropometry, muscle and joint biomechanics, electromyography, synthesis of human movement, muscle mechanics, kinesiology, biomechanics in sports.

BENG G521 Bioinformatics 3 2 5

General search methods, means-ends analysis, problem reduction, goal tree, optimal search, dynamic programming principle, minimax procedure, alpha-beta pruning. Stastical preliminaries, sampling and sampling distribution, estimation, hypothes's testing. Scoring systems and comparison of two sequences. Global multiple alignment. Construction of polygenetic trees. Search in biological database, pattern discovery in set of sequences. Sequences and structure of macromolecules. Transcription and translation.

BENG G522 Biotransport Processes 3 2 5

Introduction to basic principles of fluid mechanics and of energy and mass transport, with emphasis on applications to living systems. Mass, momentum and energy conservation, mass diffusion, convection and diffusion. Modelling of momentum, energy and mass transport processes in physiological systems. Boundary layer, Penetration, and compartment models; interphase transport. Applications to respiratory, circulatory and other systems.

BENG G531 Telemetry 3 2 5

Major components and concerns of telemetry systems, including : sensors, signal conditioning and calibration, analogue-to-digital conversion, frame and packet construction, time and position determination, multiplexing, modulators, power amplifiers, channel distortion, link budgets, communication link reliability.

BENG G532 Biomedical Imaging 3 2 5

The physics and engineering of the data acquistion, mathematics of the image reconstruction. Multi-dimensional linear systems, x-ray radiography, radioisotopes, ultrasound imaging, computed tomography, nuclear medicine, nuclear magnetic resonance (NMR) imaging, magnetic resonance imaging (MRI), volumetric rendering, confocal computed tomography (CT) in radiological sciences and confocal fluorescence microscopy in the biological sciences.

BENG G591 Selected Topics in Bioengineering 3 2 5

Course description for the above course is to be developed.

Biological Sciences

BIO C111 General Biology 3 0 3

Living systems and their properties; major biological compounds; basic physiological processes; introduction to genetics; environment and evolution.

BIO C211 Biological Chemistry 3 0 3

Chemistry and functions of constituents of cells and tissues; introduction to enzymes; metabolism of carbohydrates, lipids, aminoacids; nucleic acids and protein synthesis; vitamins and hormones.

BIO C231 Biology Project Laboratory 3*

The course includes projects involving laboratory investigation or laboratory development in Biology. The course is normally available to students of second or higher level. The course must coterminate with a project report.

BIO C241 Microbiology 2 3 3

Introduction and classification of microbes; structure and physiology of microbial cell; infection and immunity; host parasite relationship; microbiology of milk, air, water and food; physical and chemical methods of controlling microbes; experiments for isolation,

cultivation, physiological and biochemical characterization of microbes.

BIO C312 Developmental Biology 3 0 3

Scope and problems in developmental processes in biology, role of different animal and plant models, cell division and differentiation, cell interaction, genetic control of morphogenesis in vertebrate and invertebrates, tissue specific gene expression, organogenesis, germ cells and fertilization, apoptosis, genomic imprinting, sex determination, regeneration, teratology, post embryonic development, aging and senescence.

BIO C321 Cell Biology 3 0 3

Fundamental processes of life at cellular and sub-cellular levels, cell environments, membrane transport, cell movements, division and control mechanisms.

BIO C322 Ecology 3 0 3

Ecosystem productivity and trophism; environmental complex; limiting factors; population and community; ecological regulation; biogeographic regions; applied ecology.

BIO C331 Biophysics 3 0 3

A study of molecules and their interaction forces; bioenergetics and physical techniques as applied to biological phenomena.

BIO C332 Genetics 3 0 3

Facts and theories of heredity, their relation to the present state of biological theory in general; elements of population genetics; genetics and species concept.

BIO C342 General Physiology 3 0 3

Basic functional processes in plants and animals; nutrition, photosynthesis, circulation, respiration, excretion, reproduction, hormonal mechanisms and irritability.

BIO C352 Cell and Tissue Culture Technology 3 0 3

Theories and practices on *in vitro* techniques for plants and animals, development of normal and tumor cell lines, somatic hybridization, monoclonal antibody production, hairy root cultures, secondary metabolite production, scale-up strategies for large scale production of biomass.

BIO C391 Instrumental Methods of Analysis 4

Principles, configuration, applications of instruments like mass spectrophotometer, NMR, UV, IR, X-ray apparatus, atomic spectrophotometer, gas chromatography, liquid scintillation spectrophotometer, laser device, high voltage electrophoresis, ultracentrifuge, DTA, TGA, etc.

The course is specially designed for students in the first degree majoring in experimental sciences and would require groups of students to work with the above instruments in order to appreciate the potentiality of such modern instrumental methods of analysis.

BIO C411 Laboratory 0 9 3

Specially designed for M.Sc. (Hons). Biological Sciences; cannot be taken by others under any circumstances.

This laboratory course is designed only for M.Sc.(Hons) Biological Sciences students and aims to expose the students to and build competence in selected techniques of modern biology.

BIO C412 Introduction to Bioinformatics 3 0 3

Introduction to genomics and proteomics, Human genome and other sequencing projects; Biological database and data mining; Similarity search and sequence alignment; Protein structure prediction and structure analysis; Use of software package in bioinformatics.

BIO C413 Molecular Biology of Cell 3 0 3

Introduction of eukaryotic cell cycle, genetic regulation of cell cycle and differential gene expression during developmental process. In addition, the postulated functions of hitherto accepted non-essential DNA and the functioning of higher eukaryotic genes with unex-

pected structures in eukaryotic genomes would also be covered.

BIO C416 Immunology 3 0 3

Introduction to immune system, cell mediated and humoral immunity, allergy, mechanisms of hypersensitivity reactions, immunity to infectious diseases, immune mechanisms involved in cancer and transplantation immunology.

BIO C417 Biomolecular Modelling 3 0 3

Biomolecular Conformation, Structural genomics and proteomics, protein folding, Forecefield, Simulation, Conformational analysis, ab initio structure prediction, comparative modeling, lattice models, usage of modeling packages.

BIO C418 Genetic Engineering Techniques 1 9 4

Experiments on the common molecular biology techniques used in gene manipulation in bacteria and plants; gene cloning procedure in bacteria – from isolation of plasmids to screening of recombinant clones; polymerase chain reaction (PCR) and its applications; gene and protein expression analysis; DNA sequencing; Agrobacterium-mediated gene transfer in plants and introduction to plant cell culture techniques; Use of software for molecular biology.

BIO C419 Molecular Evolution 3 0 3

Introduction of evolution of macromolecules, reconstruction of evolutionary history of genes and organisms, evolutionary adaptation to temperature, water solute adaptation, dynamics of genes in populations, rates and pattern of nucleotide substitution, evolution of gene duplication and domain shuffling, concreted evolution of multigene family, genome organization and evolution, roles of mutation and selection in molecular evolution.

BIO C421 Enzymology 3 0 3

Prerequisite : BIO C211

Enzyme nomenclature and classification; isolation and purification; structures; kinetics; regulation of enzymatic reactions; evaluation of enzymes and other proteins.

BIO C431 Reproductive Physiology 3 0 3

Prerequisite: BIO C211

Study of sexual cycles; biochemistry of fertilisation; control of ovarian functions; gonadotropins; pheromones and mammalian reproduction.

BIO C441 Biochemical Engineering 3 0 3

Principles of Chemical Engineering applied to Bioprocesses; Kinetic Models for growth, substrate utilization and product formation; Biological reaction kinetics and applied enzyme catalysis; immobilized biocatalysts; Bioreactor Design and Operation; Fermentation, Upstream & Downstream processing; Novel Bioreactor Configurations; Transport phenomena in Bioprocesses; Instrumentation and control; Bioprocess Optimization and Scale up; Industrial Protein Purification Techniques; Commercial Enzymes & Biopharmaceuticals; Bioprocess Patenting, Economics & Feasibility Studies.

BIO C451 Bioprocess Technology 3*

Bioprocess Principles; Kinetics of Biomass production, substrate utilization and product formation; Kinetics of enzyme catalyzed reactions and applied enzyme catalysis; Fermentation process parameters and controls, Upstream & Downstream processing; Bioreactor Design & Operation; Transport processes in Bioreactors; Novel Bioreactor Configurations; Immobilized biocatalysts; Bioconversion; Protein Purification; Industrial applications of Bioprocesses; Bioprocess Patenting & Economics.

BIO C461 Recombinant DNA Technology 3 0 3

The course deals with theoretical aspects of recombinant DNA manipulation. Emphasis will be placed on procedures to create chemeric molecules using examples from actual experimental work. Vector designing, poly-

merase chain reaction, invitro mutagenesis and cloning in prokaryotic and eukaryotic vectors will be covered.

BIO C491 Special Projects 3

This is an unstructured open-ended course where under the overall supervision of an instructor-in-charge, batches of students will be attached to different instructors. Each batch will work on a specific time-bound project which is of basic or peripheral concern of his discipline. Each student must submit a project report as a culmination of his endeavour and investigation. The instructor- in-charge will determine the choice of the project and also whether or not the project report is to be submitted jointly by a group or individually by a student. The course will aim to evaluate student's actual ability to use the fundamentals of knowledge and to meet new unknown situations as demonstrated by the students' interaction with the instructors and instructor-in- charge and aggregated in the project report. The instructor-in- charge may assign specific hours for formal brain-storming sessions.

BIO G511 Population and Quantitative Genetics 5

Gene pool, allele frequency, genotype frequency, Hardy-Weinberg equilibrium & its complications, non-random breeding, genetic drift, genetic load, gene flow, selection, intensity of selection pressure, inbreeding & artificial selection, natural selection & polymorphism, neutral theory & evolution speciation.

BIO G512 Molecular Mechanism of Gene Expression 3 2 5

Prokaryotic and eukaryotic genomes and their topology: DNA - protein interactions; RNA transcription and transcriptional control; DNA replication; transcription in yeast; RNA processing; translation; mechanism of gene expression in pro and eukaryotes.

BIO G513 Microbial and Fermentation Technology 5

Metabolic Stoichiometry- energetics, fundamentals of microbes and their morphology, Stoichiometry of cell growth and product formation, fermentation kinetics, phases of growth in batch culture, continuous culture and fed-batch cultures, kinetics of cell growth, product formation and substrate utilization-substrate and product inhibition kinetics, enzyme technology. Industrial Biotechnology- strain selection and improvement, media formulation and sterilization strategies, industrial applications, fermentation and product recovery, preparation of alcohols, antibiotics, organic acids, enzymes, bakery and dairy products, biopharmaceuticals, vaccine production.

BIO G514 Molecular Immunology 5

This course will deal extensively with topics like molecular basis of T and B cell antigen recognition and activation. Immunity to microbes and diseases caused by humoral and cell mediated immune responses will be covered and emphasis placed on congenital and acquired immunodeficiencies. Advanced topics like antibody engineering will be discussed with the help of review articles.

BIO G515 Stem Cell and Regenerative Biology 3 1 4

Introduction to stem cells and regenerative biology; embryonic stem cells, adult stem cells, manipulation of stem cells for replacing cells in diseased tissues; transplantation of embryonic and adult stem cells, replacing congenitally defective organs and damaged organs, tissue engineering, biodegradable and biocompatible materials, nano-devices, and regulatory perspectives.

BIO G522 Interferon Technology 2 2 4

Characterization, Functional activity, broad pleiotropic agents, antiviral, anti-angiogenic,

antitumor, anti-proliferative, immunomodulatory effect, specific receptor binding, mechanisms, sequencing, classification, Dosage formulation Therapeutic study, side effects, molecular manipulation and activity profile.

BIO G532 Biostatistics and Biomodelling 2 2 4

Probability analysis variables in biology; standard deviation and standard errors; correlation and correlation coefficient; regression analysis; significance test; chi-square and goodness of fit; applications of computers in statistics; handling of software on enzyme kinetics and protein sequence analysis; computer analysis of nucleic acid structure.

BIO G541 Neural Network Analysis 5

Basic concepts, Characteristics of nerve cells and neurons, Definition of artificial neurons, Algorithms, network topology and functions, Neural network application for learning, expert systems, knowledge representation, speech recognitions and synthesis, visual perception and pattern recognition and language processing: Emphasis will be on a comparative study with biological systems.

BIO G542 Advanced Cell and Molecular Biology 5

Eukaryotic cell cycle: restriction point, G1 phase progression, role of cyclins, cancer cell cycles; growth factors and their interaction with receptors: PDGF, EGF, VEGF, FGF, TGF; stress responses: mechanisms molecular biology with special reference to hypoxia; extracelular matrix and adhesion molecules; cytokines: sources, molecular structure, targets and mechanisms of action; apoptosis, caspases and necrosis.

BIO G551 Membrane Biology 5

Concepts of biological membrane, Membrane constituents phospholipids, glycolipids and cholesterol; Membrane bilayers, amphipathic molecules, Self-assembly process; Membrane proteins, lateral and transverse diffusion, fluid mosaic model, Membrane permeability; Organization and dynamics of membrane, Signal transduction, role of carbohydrate components of membrane, Red-cell membrane proteins, Tools and techniques in membrane study: electron microscope, X-ray study, autoradiography and spectrometry. Immune response, Surface properties, Kinetics of membrane-bound processes.

BIO G611 Environmental Biotechnology 5

Applications of biotechnology to the management of environmental problems, role of biotechnology in increasing plant and animal production through biological insecticides, herbicide resistance, mineral cycling, conservation of genetic resources and biological nitrogen-fixation. Use of biotechnological processes in pollution control, bioremediation of toxicants, treatment of domestic and industrial waste will be emphasized. Ethical issues related with the release of genetically modified organisms would also be covered.

BIO G612 Human Genetics 3 2 5

Epigenetic and Chromosomal Control of Gene Expression**:** DNA methylation, Genomic imprinting and mammalian development. DNA damage & repair: Damage control during replication and mitosis, Genome stability and checkpoint control, Disorders related to aberrant DNA repair. Molecular genetics of inherited disorders. Cancer genetics: Genetic analysis of various cancers, tumor suppressor genes, metabolic polymorphisms and cancer susceptibility. Genomics & Proteomics: Human genome project and its applications in Gene therapy, novel drug design approaches.

BIO G631 Membrane and Liposome Technology 2 2 4

Membrane structure and biogenesis: techniques for the study of membrane structure and properties; model of membranes; molecular transport mechanisms; techniques of artificial membrane productions; liposomes - structure and characteristics; carrier mechanisms for targeting therapeutic agents; industrial applications of liposomes.

BIO G632 Transgenic Technology 3 2 5

Transgenic techniques as replacements of traditional breeding practices; understanding faulty gene pool; development of commercial and economically viable tissue culture and their genetic improvement through r-DNA strategies; development of recombinant transplants for improved genomic system.

BIO G641 Cell & Tissue Culture Technology 2 2 4

Plant and animal cell culture from various organism; types of cell lines; development and maintenance of cell lines; tissue culture for viral growth, hybridization and gene manipulation; hybridoma technology and protoplast fusion.

BIO G642 Experimental Techniques 5

Specially designed laboratory course which aims to impart training in selected range of techniques such as, salt fractionation, dialysis, PAGE with discontinuous buffer solution, Western Blotting, Ion-exchange chromatography and Gel filtration, Genomic DNA extraction from Human Blood, bacteria, purification of DNA and analysis, polymerase chain reaction, single, double and partial restriction digestion, construction of genomic DNA library, Southern Blotting, Karyotyping, short term lymphocyte culture, RNA extraction and quantification.

BIO G643 Plant Biotechnology 3 2 5

Commercially important plant parts and compounds; invitro living industries, plant cell, protoplast and germ plasm culture, maintenance and application; in vitro industrial production of secondary metabolites, pharmaceutical products, enzymes and food proteins; strategies for industrial production of antibodies through crop farming.

BIO G651 Protein and Enzyme Bioengineering 3 2 5

Sources, isolation, purification and storage of protein and/or enzymes; kinetics of enzyme catalyzed reactions; biocatalyst reaction engineering; techniques of production and recovery of enzymes; protein and enzyme modification; clinical and industrial applications of free and immobilized enzymes.

BIO G661 Gene Toxicology 2 2 4

Origin and fundamentals of Gene Toxicity; genotoxic effects in plants and mammalian systems; screening and measurements of genetoxicants; techniques in gene toxicology and their application to human, agricultural and environmental monitoring.

BIO G671 Bioconversion Technology 3 2 5

Waste and by-product utilization; down stream processing; biogas production; principles of biodegradation process parameters; bioreactor design and operation; exploitation of waste streams enzyme-based bioconversions of high value products.

Biotechnology

BIOT C216 Introductory Molecular Biology 3 0 3

Basic aspects of molecular biology, DNA replication, transcription, translation and control mechanisms of protein synthesis. DNA-protein interactions, post transcriptional modifications, regulation of gene expression, DNA repair. Current advances.

BIOT C332 Genetics 3 0 3

Course description is same as given as under BIO C332.

BIOT C336 Cell Physiology 3 0 3

Fundamentals of structure and functioning of cells and organelles; cytoskeleton, cellular membrane, ultrastructural studies of bacterial, plant and animal cells and viruses; cellular homeostasis, respiration, bioenergetics, carbon and nitrogen fixation. Synthesis of biomolecules and homeostasis.

BIOT C337Industrial Microbiology and Bioprocess Engineering 2 3 4

Principles and application of fermentation technology with respect to production of value added biotechnological products and strategies of improving production; develop-

ment of biological processes associated with raw materials preparation to product recovery, relevant to industries as diverse as medical, food and environmental protection.

BIOT C338 Introduction to Environmental Biotechnology 3 0 3

Industrial processes, incorporating design and monitoring of waste treatment technologies; microbial removal and degradation of organics pollutants, phytoremediation of soil and water contaminated with toxic metals and radionuclides, wetlands as treatment processes, biofilms, biofilters for vapor-phase wastes, and composting; biosensors in environmental analysis, molecular biology applications in environmental engineering and genetic engineering of organisms for bioremediation.

BIOT C339 Biophysical Chemistry 3 0 3

Course description is same as given as under CHEM C341.

BIOT C343 Genomics 3 0 3

Introduction to the field of genomics, structure of the human genome, and the strategies that are used to map and sequence the genome, how genomic sequence information is utilized for pharmacogenomics, drug discovery and diagnostics; post-genomics technologies such as bioinformatics, functional genomics and comparative genomics.

BIOT C344 Proteomics 3 0 3

Introduction to proteome, significance and analysis of post-translational modification of proteins, protein-protein interaction; functions of all protein in light of the standard prokaryotic and eukaryotic models; methods of proteomic research, proteome analysis, resolution and identification of proteins.

BIOT C345 Immunotechnology 3 0 3

Biotechnological aspects of immunological mechanisms, hybridoma technology and production of monoclonal antibodies, antibody engineering using genetic manipulations, alternatives to hybridoma technology for monoclonal antibodies, designing and building of mAb genes, primary and secondary libraries for antibody genes including production of humanized antibodies; monoclonal antibodies in diagnosis, therapy of allergic diseases, vaccine production, abzyme, purification, quantification and cytogenetic analysis.

BIOT C346 Experiments in Biotechnology 0 9 3

Advanced molecular biology techniques such as genomic DNA isolation, plasmid DNA, single, double & partial digestion, construction of genomic DNA library, PCR, polymorphism in studies, southern blotting, RNA isolation, Real Time PCR, protein expression and analysis and immuno-histochemical techniques.

BIOT C413 Molecular Biology of Cell 3 0 3

Course description is same as given as under BIO C413.

BIOT C416 Immunology 3 0 3

Course description is same as given as under BIO C416.

BIOT C417 Biomolecular Modeling 3 0 3

Course description is same as given as under BIO C417.

BIOT C418 Genetic Engineering Techniques 1 9 4

Course description is same as under BIO C418.

BIOT C461 Recombinant DNA Technology 3 0 3

Course description is same as given as under BIO C461.

BIOT C491 Special Projects 3

Course description is same as given as under BIO C491.

BITS

BITS C211 Introduction to IPR 1

Importance & relevance of IPR's in the globalised era; legislation covering IPR's in India; patents, copyrights, trademarks, industrial de-

signs, trade secrets, geographical indications; procedures for filing IPR's in India, WTO, TRIPS agreement and their relevance to agriculture, industry education and service sector and others.

BITS C212 Introduction to Human Rights 1

Relevance of human rights education in India: evolution of human rights and duties, human rights: international norms, human rights and duties in India, redressal mechanisms for human rights violations, deprivation of human rights: core issues; women and human rights and duties, good governance, science and technology and human rights.

BITS C213 Introduction to Environmental Studies 1

Ecosystems, evolution and biodiversity; impact of population and economic growth on the environment; sustainable development and use of resources such as water, food, and energy; environmental quality – waste management, air and water pollution, hazards such as global warming, ozone layer depletion, acid rain, and nuclear accidents; sustaining environmental quality – economic, social, political and ethical issues.

BITS C214 Introduction to Mass Communication 3 0 3

Mass communication: an overview, history of media and media plan, cinema, radio, television, theatre, advertising, audience and media, public relations, writing for media, new information technology: software revolution, internet, social media, video conferencing.

BITS C216 Selected Readings 3 0 3

The course is intended to nurture the students' critical thinking and to enhance their skills at information gathering and expressing. Selected readings from books in the areas of History, Science & Technology, Culture, Literature, Art, Philosophy, Psychology, Religion, Development Concepts and Trends etc. will be assigned to the students. A set of books will be identified in at least two broad areas for study and analysis.

This course is designed only for students of M.Sc.(Tech.) General Studies Programme.

BITS C217 Environment, Development and Climate Change 3 0 3

Specific topics on environment, development and climate change; regional, national and international climate debates; review of international climate negotiations such as Kyoto, Copenhagen and other declarations; environment problems: causes, sustainability and policies; population, resources and sustainability; population dynamics, capacity and conservation; food security, poverty, impact and global solutions; energy resources: renewable, wind, oil, natural gas, nuclear energy; growth, technology and greenhouse gas emissions, carbon credit; regional impacts of climate change and adaptation strategies; techniques in modeling; water resources and pollution: monsoon, drought, rainwater harvesting, traditional practices in water conservation; case studies.

BITS C221 Practice School I 5
BITS C231 Practice School I 5
BITS C241 Practice School I 5

All the above courses are run during the summer term only. The operation of all these three courses will be identical in nature. However, BITS C221 will be a required course for all integrated First Degree students with Practice School option. This course is also a prerequisite for BITS C412 Practice School II. BITS C231 may be available only to those students who have successfully cleared BITS C221 and BITS C241 is available only to those students who have successfully completed BITS C231. Thus BITS C231 and BITS C241 can be taken only as electives and are available only to highly motivated students if facilities are available after satisfying the needs of students who have to compulsorily register in BITS C221.

BITS C224 Corporate Taxation 3 0 3

Corporation tax; assessing income from business; receipts less deductions: actual business expenses, scientific research; insur-

ance premium, bonus, etc., interest, bad debts and other expenses for business; amortization of certain expenses, capital expenditure, allowances, carry forward losses and allowances; income from other heads, interest, dividends house property, deductions from gross total income, total income, taxable income, capital gains, mode of computation and deduction, personal income tax laws and provisions.

BITS C313 Lab Oriented Projects 3

BITS C314 Lab Oriented Projects 3

These courses include projects involving laboratory investigation or laboratory development in the students' discipline or interdisciplinary areas. These courses are normally available to students in third or higher levels. These courses must coterminate with project reports.

BITS C317 Managerial Skills 1 0 1

The role of manager, team building and goal setting, basics of supervision, leadership, decision making, negotiation skills and techniques, how managers communicate, how to interview, process of induction, training and development, delegation, how to appraise employees, how to manage time, use of committees, how to handle meetings, how to handle complaints.

BITS C318 Workshop on Film Production 1*

Introduction and Concept of Film-making, Script Writing, Screenplay, Equipment and Facilities, Film Shooting, Sound Recording, Dubbing and Voice Over, Film Editing, Finishing.

BITS C319 Negotiation Skills and Techniques 2 0 2

Overview, Negotiation styles, Negotiation process, Tactics in Negotiation, Handling conflicts in negotiation, Best Alternative to a Negotiated Agreement, Communication - Key to Effective Negotiating, Non-verbal communication in Negotiations, Emotions: dealing with others and ourselves, International negotiations, Cross Cultural Issues in Negotiations, Power in negotiation, Workplace Negotiations, Turning Negotiation into a Corporate Capability, Do's and Don'ts of Negotiations, Negotiating over the telephone/ Electronic media, Ethics in negotiation, Negotiation-Exercise.

BITS C321 Legal and Economic Environment of Business 4*

Indian contracts act, sale of goods act, negotiable instruments act, companies act, corporate tax laws, consumer protection and unfair trade practices act, FEMA, Industrial policy, macroeconomic environment, fiscal and monetary policy, overview of Indian economy, economic indicators.

BITS C323 Study Oriented Project 3

BITS C324 Study Oriented Project 3

These courses include projects which are oriented towards readings from published literature or books about new frontiers of development or analysis of available data base. These courses are normally available to students in third or higher levels. These courses must coterminate with project reports.

BITS C331 Computer Projects 3

BITS C335 Computer Projects 3

Prerequisite: Prior preparation for one's own CDC or for CDC of first degree for dual degree students.

These courses are intended to impart practical training to the students in the areas of computer software and hardware through specifically assigned one-semester projects. The projects would be person-oriented, individually supervised by a project guide and demand attainments of different dimensions and complexity depending on the student's earlier background and the objectives of the projects.

BITS C332 Culture and Significance of Modern Mathematics 3 0 3

Prerequisite: Prior preparation for one's own CDC or for CDC of first degree for dual degree students

This course intends to give a guided tour of mathematics of the 20th century. Topics will

be treated not for coverage of content but for giving the culture, excitement, flavour and relevance of modern branches of mathematics like topology, algebra, geometry, homology homotopy, undecidable problems, non-euclidean geometries, functional analysis, discrete areas of mathematics etc. The topics will be dealt with, in an expository manner with an attempt to show that mathematics is a challenging series of abstractions of concrete situation. Students may be required to do projects in one or more areas touched upon in class. The treatment will assume the mathematics already built in the core BITS courses of mathematics. The standard of treatment will be as in Bell's Development of mathematics, Courant and Robbins "What is Mathematics?"

BITS C333 Projects on Organisational Aspects 3

BITS C334 Projects on Organisational Aspects 3

These courses involve projects related to thrust areas where students are expected to get involved with planning, organisation and execution of new ideas and concepts. These courses are normally available to students in third or higher levels. These courses must coterminate with project reports.

BITS C341 Selected Computer Languages 3*

Prerequisite: TA C252

This course aims at inculcating programming and problem-solving skills using one or more of the higher level languages like C++, LISP and 4GLs; The choice of languages and the treatment may vary from semester to semester depending on various factors like emerging technologies and feedback from the industry.

BITS C342 Object Oriented Programming 3 0 3

Prerequisite: TA C162

Object orientation concepts and principles: abstraction, encapsulation, modularity, inheritance, and polymorphism; classes and objects; static and dynamic binding; class utilities; metaclasses; object oriented software engineering; programming and problem-solving using one or more of the popular object-oriented programming languages like C++ or Java.

BITS C364 Human-Computer Interaction 3 0 3

Principles of human-computer interaction; Evaluation of user interfaces; Usability engineering; Task analysis, user-centered design, and prototyping; Conceptual models and metaphors; Software design rationale; Design of windows, menus, and commands. Voice and natural language I/O; Response time and feedback; Color, icons, and sound; Internationalization and localization; User interface architectures and APIs.

BITS C372 Data Communications and Networks 3 0 3

Communication Concepts; Data and Voice Communications; Hardware Systems and Configurations; Network Topologies and Design Aspects; Protocols; Networking Software; Local Area Networks; Network Security and Management; Emerging Trends in Communications.

BITS C381 TIC Projects 3

BITS C383 TIC Projects 3

These courses provide an avenue for first degree students who are normally in third year or in a higher class, to earn a letter grade credit for doing projects under the Technology Innovation Centre. These projects are sponsored by the industries which come to the Institute under the scheme for participating in Technology Innovation Centre. The projects are also supervised and monitored by the personnel from industry who visit as Associate Faculty. These courses are unstructured and would require all the rigor which the industry would demand.

BITS C382 Reading Course 3

BITS C385 Introduction to Gender Studies 3 0 3

Introduction to gender studies, Sociological theories about gender, Women's access to

education, interest, access and role in science and technology from gender perspective, Gender bias, work place, women and employment opportunities, Women and Politics, women in *Panchayati Raj* Institutions, women and family, women and violence, dowry, women and law, women's movements, feminism, women and human rights, women and media, gender equity-policy issues, women and development.

BITS C386 Quantum Information and Computation 3 0 3

History and scope, introduction to quantum information, quantum bits (qubits), quantum parallelism, teleportation etc. Basic ideas of quantum systems, two-state systems, evolution of states, superposition, entanglement, quantum measurement, decoherence. Basic ideas of computation theories and models, computational resources, complexity. Quantum Gates: single qubit, multiple qubit gates, controlled gates, universal gates, measurement. Quantum algorithms, Deutsch', Shor's and Grover's Algorithms, quantum circuits. Quantum Fourier Transform and applications, Quantum Search Algorithm. Physical Implementation of quantum computation. Compression and transmission of quantum information, quantum noise, error-correction, coding and cryptography, complexity, fault-tolerant computation.

BITS C393 Current Affairs 3 0 3

Introduction, importance and scope; domains: political, social, religious, scientific, developmental, etc.; categories: controversial, non controversial, neutral; sources of information: newspapers, magazines, posters, pamphlets, manifestoes, etc.; reading skills: skimming, scanning, extensive and intensive reading; understanding, interpreting and analysing news, events and information; forming, balancing and expressing opinion.

BITS C394 Mass Media Content and Design 3 0 3

Types of Corporate Communication documents; Importance of corporate communication documents for stakeholders; Data collection for documents- Sources, types, methods; Analyzing and Organizing the content – preparing the drafts; Design Concepts; Design Technologies – Overview; Specific Design tools – Dreamweaver, Macromedia Director, Adobe Premier, Photoshop, Flash; Integrating Content and Design.

BITS C395 Short Film and Video Production 3 0 3

Introduction; communication media formats like audio, film, video, audio recording and editing; image composting; script writing : screenplay; equipment: video cameras, film cameras, the lens, the camera; the film stock: negatives, prints, aspect ratio, grain, gauge, speed, colour contrast, tone; handling the camera; image technology, sound technology; basic filming techniques: lights and lighting, shooting, sound recording, sound track, dubbing, voice over; visual effects, editing: familiarization with editing software, mixing and looping; Final production.

BITS C396 Reporting and Writing for Media 3 0 3

Reporters and their functions; What makes news; Analysing the components; Getting the information and putting it together; Organizing a news story; Building colour into news stories; Fighting the formula story ; Writing Leads; Message molecules (Vocabulary, grammar, Spelling), Human Interest and Depth Report; Finding and using news sources; Basics of ethics in Journalism.

BITS C397 Techniques in Social Research 3 0 3

Principles of social research, research process, stages of social research, choosing the research problem, objectivity and subjectivity in social research, ethics in social research, ethical codes of practice, confidentiality and anonymity, privacy, Effects of Value in social research, constructing social explanations, descriptive studies, explanatory studies, designing a social research proposal, quantitative research, survey, sampling, SPSS, various statistical tests, qualitative research,

observation: participant and non-participant, issues in conducting qualitative research studies, case studies of socio-economic, political, health, gender and developmental issues, interview as social interaction, ethnographic research, field study, hypothesis testing, analysis of data, report preparation and documentation, factors limiting application of social research, evaluation research and development of social indicators.

BITS C398 Creative Multimedia 2 2 3

Imaginative and creative communication skills, interactive multimedia applications incorporating various aspects of rich media; digital screen design, typography, non linear editing, animation techniques, sound design and editing, testing and managing multimedia products, post production techniques.

BITS C412 Practice School II 20
BITS C413 Practice School II 20

The above two courses will be operated identically with stipulated prior preparation conditions as per the Academic Regulations. BITS C412 is a required course for all students with practice school option either for a single degree or for one of the degrees under dual degree scheme. BITS C413 has been created as a required course if a dual degree student is allowed a practice school option for a second degree after he has completed a practice school option for one degree.

BITS C432 Entrepreneurship 3 0 3

Meant for senior students who are close to completing their graduation requirements Small scale industry; growth and structure of Indian economy; identification of specific industry and product; market evaluation; description of the manufacturing processes; machinery and equipment requirements; building and site requirements; recurring cost; management; human relationship; product distribution; finance management and accounting; projects; system design of a small scale industry.

BITS C421T Thesis 15
BITS C441T Seminar 1

BITS C422T Thesis 15
BITS C442T Seminar 1

The above two pairs of courses BITS C422T and BITS C442T and BITS C421T and BITS C441T will be operated identically with stipulated prior preparation conditions as per the Academic Regulations. BITS C422T and BITS C442T are required courses for all students with Theses and Seminar option either for a single degree of for one of the degrees under dual degree scheme. BITS C421T and BITS C441T have been created as required courses if a dual degree student is permitted Thesis and Seminar option for a second degree after he has completed Thesis and Seminar option for one degree.

BITS C452T Independent Study 1

BITS C461 Software Engineering 3*

Prerequisite: TA C252

Software engineering concepts and methodology; formal requirements specification; estimation; software project planning; detailed design; techniques of design; productivity; documentation; programming languages styles, code review; tool, integration and validation; software quality assurance; software maintenance; metrics, automated tools in software engineering.

BITS C462 Renewable Energy 3 0 3

Introduction of renewable energy, advantages, potential, status of development, broad details of different renewable energy systems such as solar, wind, biomass, microhydel, geothermal etc; Renewable energy development policy, Renewable energy industries, international co-operation, HRD and career growth opportunities, consultancy areas and future thrust areas in renewable energy development.

BITS C463 Cryptography 3 0 3

Objectives of cryptography; ciphers – block and stream; mathematical foundations – modular arithmetic, finite fields, discrete loga-

rithm, primality algorithms; RSA; digital signatures; interactive proofs; zero–knowledge proofs; probabilistic algorithms; pseudo-randomness.

BITS C464 Machine Learning 3 0 3

Neural networks; neuro-computing theory and applications, knowledge representation; computational learning theory; statistical/probabilistic methods, genetic algorithms; inductive/analytic/reinforcement learning and bayesian networks; selected topics such as alpha-beta pruning in game trees, computer models of mathematical reasoning, natural language understanding and philosophical implications.

BITS C467 Bioethics and Biosafety 3 0 3

Introduction to the need and issues governing biosafety, legal, ethical and social implications of human gene manipulation, guidelines for research in transgenic organisms and plants, socio-economic impacts of biotechnological experiments, GLP and MGP and CPCSEA guidelines, patent processing, ethics in stem cell research, animal cloning and organ transplants, environmental pollution-hazards and control, public education and participation in biosafety.

BITS C468 New Venture Creation 3 0 3

Entrepreneurship as career option, idea to opportunity – market analysis and segmentation, presenting a pitch deck, building the startup team, competition analysis, lean startups, product development, intellectual property, sales and marketing, business models, financing, launching a business, growth and exit strategy, social entrepreneurship, business plan presentation skills.

BITS C469 Financing Infrastructure Projects 3 0 3

Investment decisions in infrastructural projects: benefit cost analysis, measurement problems, indirect estimation methods of benefits; Cost of capital: private and public money, different schools of thought on social capital- cases; Multiple projects and constraints: linear and integer programming models, goal programming formulation; Financing infrastructure projects: venture capital, sources of capital–private and public participation, modes of cooperation such as BOOT and BOT national and international sources, international agencies, borrowing terms and conditionalities; Public policy issues, leasing and mortgaging, evaluation issues, infrastructural mutual funds, valuation aspects; Real options, value of option for delay, abandonment and vacant land – judgmental assessment of options; post review and administrative issues in project management, international (cross country) projects, implementation issues.

BITS C471 Management Information Systems 3 0 3

Introduction to Information Systems; Concepts of management, concepts of information, systems concepts; Information Systems and Organizations; decision making process; database systems; data communications; planning, designing, developing and implementing information systems; quality assurance and evaluation of information systems; future developments and their organizational and social implications; decision support system and expert systems.

BITS C472 e-Business 3 0 3

e-business evolution & opportunities; categories of e-business; e-business models; network infrastructure & web based tools for e-business; e-business risks & risks management; network security and firewall; cryptography and authentication; billing/payment systems; regulatory environment of e-business; ERP/SCM/CRM and web based marketing; business intelligence & intelligent systems; data warehousing and data mining; implementing e-business systems & change management. Case studies and projects in e-business areas; emerging e-business scenarios.

BITS C473 Nonlinear dynamics and Chaos 3 0 3

Chaos – definitions, characteristics, and measures; Examples of chaotic systems; Nonlinear dynamics and chaos – state space, Poincare sections, Iterated maps, Period-doubling; Quasi-periodicity, Intermittency, fractals; computer simulations of chaotic systems; Selected topics and applications of chaos theory; Examples will be drawn from different disciplines in science, engineering, and social sciences.

BITS C474 Rural Infrastructure Planning 3 0 3

Local level government structure; planning methodology and budgeting; regional economics; link of rural infrastructure with poverty alleviation and employment creation; sustainable livelihood approach; participatory planning; Integrated Rural Accessibility Planning (IRAP): need based approach, planning objectives, access needs, questionnaire preparation and data collection, quantification of accessibility, identification of problems and their prioritization, identification, screening and ranking of projects, selection of project and its location, action plan for implementation; Introduction to software such as: HDM (Highway Development and Management System) and RED (Road Economic Decision Model) etc.

BITS C481 Computer Networks 3 0 3

Introduction, history and development of computer networks; Reference models; Physical Layer: theoretical basis, transmission media, types of transmission; MAC sub-layer: local area networks, FDDI; Data Link Layer: Sliding Window protocols, design aspects; Network Layer: routing algorithms, congestion control algorithms, internetworking: Transport Layer: Integrated Services Digital Network (ISDN). Asynchronous Transfer Mode (ATM) - reference models, service classes, switch design, LAN emulation; Application Layer protocols.

BITS C482 Creating and Leading Entrepreneurial Organizations 3 0 3

Fundamentals of entrepreneurship; elements of leadership; identifying business opportunities; market study and research; business plans; finance, issues in raising finance; venture capitalist evaluation of business plans, technical aspects for the project, corporate strategies for growth; legal aspect to entrepreneurship, people skills, marketing and branding; creativity and communication.

BITS C483 Indian Wisdom for Modern Management 3 0 3

The blind management; the identity crisis – family business; the mistaken judgment; the management of man, mind, methods, and materials; the management methods for man management; the management methods for mind (individual); the management methods for mind (total); the basic quality of an efficient manager; the commonsense factor of an efficient manager, clarity about goals and priority fixations; duty-oriented life style vs. right-oriented life style; inner equipoise leading to inner strength; a portrait of a balance manager; secrets of a Karmayogi; the cardinal principles supporting excellence in life.

BITS C484 Introduction to Conflict Management 3 0 3

Characteristics and dynamics of conflict, reasons for conflict; the value of conflict in social change; the different approaches to addressing and managing conflict; Examining the history and impacts of a conflict; exploring stakeholder power and relationship; assessment of options to address conflict; tools for determining the best strategy; incentive sand methods in getting stakeholders to collaborate; active listening; skills in mediation and facilitation; roles of mediator and facilitator in conflict management; dealing with emotions and difficult situations; planning and preparing for negotiations; improving negotiation skills; joint problem solving approaches; building agreements; building conflict management mechanisms and consensus-building strategies.

BITS C485 Marketing Audit 3 0 3

Prerequisite: FIN C431/MGTS C322

The marketing process, marketing planning, the customer audit, the product audit, the service business, the competitive climate, setting objectives and strategies, advertising and sales promotion, the buying process, the sales plan, sales force management, the pricing plan, the distribution plan, marketing information and forecasting, implementing marketing plan, diagnosing problems in marketing.

BITS C486 Product and Brand Management 3 0 3

Scope of product Policy Decisions; Product-Market strategy; Product Life Cycle and Strategy; Managing Product Deletion; Product Associations; Branding including aspects of brand name selection; Brand Equity and its utilization for marketing decision making; Brand Extension: use for brand names for launching new products; New product development process; Idea Generation and Screening; Concept Development and Evaluation; Product Design and Testing; Market planning; Testing the market plan; Marketing research process; Adoption and Diffusion of products; Organizing for new and existing product.

BITS C487 Global Business, Technology and Knowledge Sharing 3 0 3

Changing corporate landscape, New knowledge industries, networking and interdependence, Technology: a fundamental driving force, WTO. Global Business Environment, Intellectual Property Rights (IPR), FDI, trends in India and comparison with China. Technology import and export, Technology transfer and adaptation. Need for technology intermediation, newly emerging techno-business opportunities, technology forecasting, technology assessment, technical actions. The role of small and medium enterprise's and the changing roles of enterprises. Leadership for the inter-networked business, Employment and Jobs, access and equity, quality of life, global knowledge innovation infrastructure.

BITS C488 Services Management System 3 0 3

Understanding Services, the Service Sector today, Designing the Service Enterprise, Technological Issues, Structuring Service Operations, Processes Management, Staffing for Services, Functions of Services Management System, Client Relationships, Measuring and Reporting Services.

BITS C489 Enterprise Resource Planning 3 0 3

Introduction to ERP; Re-engineering and ERP systems; ERP planning, design, and implementation; ERP systems – sales and marketing; ERP systems – accounting and finance; ERP systems – production and materials management; ERP systems – human resources; Managing and ERP project; Supply chain management and e-Market place.

BITS C493 Business Analysis and Valuation 3 0 3

Theory of finance, value maximization, stakeholder theory, and corporate objective function: value creation – ways and means, business analysis: The techniques of strategy and competitive analysis, value chain analysis for competitive advantages, business valuation – approaches and methods, the dark side of valuation: strategic investment decisions.

BITS C494 Environmental Impact Assessment 3 1 4

Environment and global problems; Framing Environmental issues; effects of infrastructure development on environment; prediction and assessment of environmental impacts of infrastructure projects: technical and procedural aspects, guidelines and legal aspects of environmental protection, impacts on air, water, soil and noise environment, valuation, strategic assessment, mathematical modeling for environmental processes; social impact assessment (SIA), dislocation/disruption impact of Infrastructure projects; Life Cycle Assessments (LCA) and risk analysis methodologies; mitigation of environmental impacts; case studies; environmental management plan (EMP), national and international certification and guidelines including ISO.

BITS G515 Management Principles and Practices 4*

Management concepts and functions; Decision process; Marketing variables, analysis and research; Services marketing; Financial transactions and statements; Financial planning and control; Manpower planning and development; Personnel appraisal, General administration.

BITS C790T Independent study 2
BITS C791T Teaching Practice I 1
BITS C792T Teaching Practice II 1
BITS C797T Ph.D. Seminar 2
BITS C799T Ph.D. Thesis 40 (Max)

The registration in this course will be for a minimum of 10 units in any semester.

BITS E511 Computer Applications I 4
BITS E512 Computer Applications II 4

This is a package of two courses in sequence, the second reinforcing the content of the first in scope or depth. Each one ends with a project report. These two courses would aim at training student in skills of computer applications through examples as well as through requirement of project work. In the process, the courses are expected to create an awareness in the student's mind of computer usage in his own work setting.

Recognizing that input to the programme is unlikely to be in a narrow band, it is visualized that students for these courses will come with different levels of computer competence in their previous training, formal or informal. Understandably, these courses will therefore aim to take that background for each student and come out with admissible and acceptable outputs in the areas of computer application.

BITS E521 Technical Communication I 4
BITS E522 Technical Communication II 4

This is a package of two courses in sequence, the second reinforcing the content of the first in scope or depth. Each one ends with a project report. These two courses will attempt, through examples and through project-work, to build up improved communication skills with the present technology as well as exposure to new communication technology for the student in the broad areas of his own professional orientation and aptitude.

BITS E531 Social, Behavioral and Economic Sciences I 4
BITS E532 Social, Behavioural and Economic Sciences II 4

This is a package of two courses in sequence, the second reinforcing the content of the first in scope or depth. Each one ends with a project report. These two courses will deal with methods and techniques through which social, behavioral and economic situations under professional settings are focussed, analyzed and used for application conditions. Various aspects thus covered would be organizational behavior, group dynamics, personnel, legal functions, government and business, managerial economics, finance, accounting and budgeting, corporate planning, project appraisals, etc. While course No. I will aim at an integrated exposure (in the context) through examples as well as through requirement of project work as drawn against the student's professional backdrop, course No. II will consist of a deeper investigation undertaken by the student in relation to the above vis-a-vis a defined problem-solving situation.

BITS E533 Modern Experimental Techniques I 4
BITS E534 Modern Experimental Techniques II 4

This is a package of two courses in sequence, the second reinforcing the content of the first in scope or depth. Each one ends with a project report. These courses will deal with modern experimental techniques and measurement techniques. Students will be encouraged to use instrumental methods of analysis dealing with advanced analytical instruments in conducting their experimental work.

BITS E535 Management Methods and Techniques I 4

BITS E536 Management Methods and Techniques II 4

This is a package of two courses in sequence the second reinforcing the content of the first in scope or depth. Each one ends with a project report. These two courses will attempt through examples and through requirement of project work, to bring to the attention of the student certain basic management concepts which are manifest in the professional setting in which the student functions. Various concepts thus covered will be planning, organizing, directing and control, production, marketing, etc. While course No. I will aim at providing an integrated exposure in the above context, course No. II will require student to undertake deeper investigation(s) in the context against well-defined situation(s).

BITS E537 Systems Science and Engineering I 4

BITS E538 Systems Science and Engineering II 4

This is a package of two courses in sequence, the second reinforcing the content of the first in scope or depth. Each one ends with a project report. The attempt through these courses would be to create an awareness in the student's mind of the systems approach the aspects of micro as well as macro design in the setting of his own professional operation through examples as well as through requirement of project report(s). Thus, these courses would introduce students to methods and techniques from areas of information processing, systems analysis, systems planning and operation and systems optimization. While course No. I will introduce the student to an integrated view of the above methods and techniques constituting elements of systems science, course No. II will require him to carry out an intense investigation in the context against a defined professional situation identified in terms of his own work setting.

BITS E541 Chemical and Life Science I 4

BITS E542 Chemical and Life Science II 4

This is a package of two courses in sequence, the second reinforcing the content of the first in scope or depth. Each one ends with a project report. These two courses, will cover areas of Modern Biology together with Structural Chemistry and expose students to recent developments in organic and biochemistry and to certain extent developments in molecular biology. Some part of the training and exposure will deal with modern experimental techniques and measurement techniques.

BITS E543 Instrumentation Engineering I 4

BITS E544 Instrumentation Engineering II 4

This is a package of two courses in sequence, the second reinforcing the content of the first in scope or depth. Each one ends with a project report. These two courses will attempt through short and long projects to bring to the student's attention certain basic design and implementation concepts relating to instrumentation for better plant efficiency and modern engineering operations. The aspects, which would thus be covered, would pertain to planning and executing modernization of instrumentation in defined situations.

BITS E545 Projects and Consultancy I 4

BITS E546 Projects and Consultancy II 4

This is a package of two courses in sequence, the second reinforcing the content of the first in scope or depth. Each one ends with a project report. These courses would attempt to give the experience to the students in handling various types of projects and get involved in the process of consultancy. The work will encompass all factors starting with organizing the details and the scope of the project, planning of manpower and other resources, financial estimates, etc. which are to be matched with Institutional goals. The student will go through the experience of various stages of implementation of the projects including the drafting of its final report. While the course No. I will introduce the student to individual components of project/consultancy work, course No. II will

aim to integrate the above knowledge for the fulfillment of ultimate objectives.

BITS E547 Public Administration I 4

BITS E548 Public Administration II 4

This is a package of two courses in sequence, the second reinforcing the contents of the first in scope or depth. Each one ends with a project report. These courses will introduce the students to the various aspects in which an administrator plays a vital role, whether it is personnel policies or financial administration or an implementation of law and this will be done through participation in a work associated with these aspects. Further, the student learns the role of an administrator in a society where planning, management and social aspirations have to be finally achieved with or without the help of a legislative/statutory solution.

Thus, the student has to involve himself in situations where decision making, coordination and supervision of various functions are the issues in an organization. While course No. I will provide the students the elements of administrative methodologies, course No. II will require him to pursue a deeper investigation in the context against defined situation(s) consistent with his professional background.

BITS E551 Physical and Mathematical Sciences I 4

BITS E552 Physical and Mathematical Sciences II 4

This is a package of two courses in sequence, the second reinforcing the content of the first in scope or depth. Each one ends with a project report. These will be analysis-oriented courses, where one has to draw heavily upon background of physics and modern mathematics. Some part of the training and exposure will deal with modern experimental and measurement techniques.

BITS E561 Use of English for Professional Purposes I 4

BITS E562 Use of English for Professional Purposes II 4

This is a package of two courses in sequence, the second reinforcing the content of the first in scope or depth. Each one ends with a project report. These courses will revolve around professional involvement of a student in the skill areas of handling English language and communication as defined in terms of technological, professional, scientific and social science situations. This package is specially designed for students who apply their training in English language in the above-defined situations to the production of technical outputs along with a group of technologists.

BITS E571 Methods of Planning and Development I 4

BITS E572 Methods of Planning and Development II 4

This is a package of two courses in sequence, the second reinforcing the content of the first in scope or depth. Each one ends with a project report. These courses would attempt to introduce the student to planning and development methods in terms of development definitions, strategies of development, mobilization of internal and external inputs for development, planning methods, factors affecting statutory administrative and financial decisions, project implementation, etc. The student, depending on his professional setting would be expected to study the above aspects of planning and development in situations of R&D, production, maintenance, social science, university development, planning & implementing new institutions and organizations, etc. While course No. I will provide the student an integrated understanding of planning and development methods, Course No. II will require him to pursue a deeper investigation in the context against defined situation(s) consistent with his professional background.

BITS E573 Study in Advanced Topics - I 5

BITS E574 Study in Advanced Topics-II 5

In these courses students will be assigned study work in advanced areas of professional interest. Each student will work under the

overall supervision and guidance of a faculty member and will in the end submit a project report encompassing critical review of the material studied. The organization and evaluation of the course would be achieved through seminars, group discussions, project report etc. The course will be conducted by the team of teachers who provide guidance for study work.

BITS E583 Case Studies I 4

BITS E584 Case Studies II 4

This is a package of two courses in sequence, the second reinforcing the content of the first in scope or depth. Each one ends with a project report. These courses using case methods of education, will introduce students to issues relating to modern technology application(s) as drawn from broad spectrum of activities. Consistent with the professional background of the student and his operational setting, these activities would be identified in terms of process plants, engineering and design organization, pharmaceutical units, science centres, R&D activities, social & service sectors, university environment; etc. Various Technological issues thus covered would range from Techno-Economic Decision to Design, Commissioning & Production to operations & Maintenance to Resource Management to Planning of Management Information System etc. While Course No. I will introduce the student to an integrated view on decision making in respect of complete cycle mentioned above, course No. II will require him to pursue a deeper investigation in the context against a defined industrial behavioral social problem.

BITS E591 Science and Technology Development I 4

BITS E592 Science and Technology Development II 4

This is a package of two courses in sequence, the second reinforcing the content of the first in scope or depth. Each one ends with a project report. These two courses will deal with issues relating to science and technology development. Towards this end, the method of teaching will heavily draw upon the examples as well as the requirement of project work consistent with the student's professional background. Thus, depending on the professional setting, the courses will cover various aspects of science and technology development in respect of science policy, R&D management, technology forecasting, science communication, science centres, rise of technological order, etc. While course No. I will aim at providing an integrated exposure to the student in the above context, course No. II will end up with analysis of a specific science and technology application situation for development.

BITS E593 Reading Course I 5

BITS E594 Reading Course II 5

BITS E611 Internship I 20

BITS E612 Internship II 20

Each of these courses will span a period of five and half months. Consistent with the student's Professional background and operational setting, the student will be required to carry out work-oriented projects. In their operation these courses will imitate internship under M.E.(Collaborative) programme, thus enabling the student to play the role of an understudy.

BITS E661 Research Methodology – I 5

BITS E662T Research Methodology – II 5

These two courses, to be offered in two consecutive semesters, are designed to impart training in methodology of research such as analysis of research problems, mathematical and statistical analysis of data, computer simulation methods, experimental techniques etc. The actual contents of these course will depend upon the needs and research goals of a particular student. A project report has to be submitted by each student at the end of each course.

The organization and evaluation of these courses would be achieved through seminars, group discussions, project reports etc. The courses will be conducted by a team of teachers.

BITS E793T Practice Lecture Series I 1

BITS E794T Practice Lecture Series II 1

BITS G511 Advanced Project 5

This course is designed to permit treatment of an advanced area in a discipline or interdisciplinary pursuit to meet the objectives of acquisition of additional competence by the student and also development of new areas of study or lab. The course will be characterized by minimum formal contact and maximum self- study under immediate supervision by the teacher.

BITS G512 Object Oriented Programming 2 2 4

Basics of object oriented programming: objects, classes, instances; inheritance; polymorphism; operator overloading; static and dynamic binding; smalltalk, C++, cases from other object oriented languages like Ada, Loop, Flavors, Objective-C, etc.; object oriented software engineering.

BITS G513 Study in Advanced Topics 5

In this course students will be assigned study work in advanced areas of professional interest. Each student will work under the overall supervision and guidance of a faculty member and will in the end submit a project report encompassing critical review of the material studied.

The organisation and evaluation of the course would be achieved through seminars, group discussions, project report etc. The course will be conducted by the team of teachers who provide guidance for study work.

BITS G514 Environmental Health 3 0 3

Environmental Health and its importance, water pollution, air pollution, automobile pollution, pollution due to chemicals used in agricultural sector, handling and disposal of domestic and industrial refuse, incineration of waste materials, techniques for studying, monitoring and controlling pollution, effect on health, vector control, effect of high frequency electromagnetic radiation, nuclear radiation, hazardous wastes, occupational health.

BITS G521 Fourth Generation Languages and Applications 1 3 4

Nature of 4GLs; application generators; RDBMS and 4GLs; SQL based 4GLs; 4GLs and development of information systems and decision support systems; other types of 4GLs; case studies.

BITS G522 Software Development Standards 1 3 4

Standards and their role in software development; Institutions involved in formulating and promoting standards; operating environment standards; POSIX; software design standards; diagramming standards; coding standards; language design, code generation and usage standards; software portability and standards; standards in software development tools; standards in compilers and interpreters; open systems; OSI; user interface standards.

BITS G529 Research Project I 6

BITS G539 Research Project II 6

This is a package of two courses dealing with an advanced pursuit in terms of a study project or a lab project in assigned areas of professional interest. Each student will work under the overall supervision and guidance of an assigned teacher. The second course may be a continuation of the task engaged in the first course; or the two courses may be independent of each other. Each course must end with a well-defined project report outlining all the investigative efforts and conclusions.

BITS G541 User Interfaces 1 3 4

Emerging importance of user interfaces; user interface management systems; designing UIMS toolkits; hardware and OS aids in user interface development; human & psychological factors in user interface design; theories, principles and guidelines; emerging interaction styles; menu selection systems, command

languages, direct manipulation; interaction device; hypertext; standards in user interface design and implementation; case studies from Domain Dialog; Apple's user interface; Open Look; OSF/Motif.

BITS G553 Real Time Systems 5

Real time software, Real time operating systems-scheduling, virtual memory issues and file systems, real time data bases, fault tolerance and exception handling techniques, reliability evaluation, data structures and algorithms for real time/embedded systems, programming languages, compilers and run time environment for real time/embedded systems, real time system design, real time communication and security, real time constraints and multi processing and distributed systems.

BITS G554 Data Compression 3 2 5

Introduction: the need for data compression. Information theory and data compression; Entropy, Relative entropy and mutual information. Fano's inquality. Types of information sources, and source extension. Asymptotic equipartition property and data compression. Entropy rates of stochastic processes. Kraft inequality, Prefix codes, Huffman codes and Arithmetic coding. Quantization and Rate distortion theory. Lossy image compression techniques based on DCT, VQ and Fractals. Introduction to wavelets: continuous and discrete wavelet transforms. Filter banks and wavelets. Frames and tight frames. Wavelet packets. Wavelet based signal processing. Joint source and channel coding.

BITS G560 Practice School 20

BITS G561T Dissertation 25 (Max)

BITS G612 Methods and Techniques of Systems Engineering 2 3 5

This course would cover various systems engineering methods and techniques in the context of their application to the design, implementation and operation of large, humanly-contrived soft systems. The techniques would be chosen from amongst linear programming, integer programming, queuing theory, inventory control, simulation, maintenance models sampling techniques, forecasting techniques, decision models, network scheduling methods etc. These would be applied in the context of resource planning, facility location, manpower planning, financial management, decision-making, maintenance issues, construction and operation scheduling; planning research issues; social assessment of technology; issues of technology-economy nexus etc.

BITS G613 Systems Analysis for Large Systems 2 3 5

System thinking and approach; concepts of systems with special reference to large, humanly-contrived soft systems; review of mathematical techniques and principles of economics and management required for systems engineering of such systems; modelling and systems engineering methodology for large soft systems.

BITS G619 Professional Practice 4

This course will aim to achieve a professional development of the student in the context of the overall goal of his/her programme. Depending upon the profession, this course will be conducted in terms of actual participation in professional activities such as teaching, laboratory organization, course development, organizational development, R&D work, design, production, data organization, data preparation or management of institutions/ hospitals/voluntary organizations, etc. The course will also deal with communication aspects such as teaching a course, presenting a paper in the seminar/conference, articulating ideas and concepts to professional audience/customers, etc. This course will also deal with the laws and ethics concerned with the profession of an individual.

BITS G620 Professional Practice I 3

BITS G621 Professional Practice II 3

These two courses, to be offered in two consecutive semesters, are designed to train the students towards acquiring competence in teaching as well as in research methodologies. The course will be conducted in terms of

actual participation in professional activities such as teaching, laboratory organization, course development, R & D work, etc. Each student will be assigned under a faculty member to work on specified projects, and to assist the faculty in teaching and research activities. The student will be required to present a number of seminars in a group in a structured manner.

BITS G624 Computer Based Simulation and Modelling 2 3 5

Discrete event simulation on computers; Systems simulation & simulation languages; GASP & GPSS; Continuous simulation - languages and modelling techniques; Forrester's models; case studies.

BITS G629T Dissertation 25 (Max)

This is a required component for all higher degree students except for those who opt and are selected for practice school programme. The unit requirements will vary from 12 to 25 units. It may be registered for one full semester (12 to 25 units) after completing all courses or may be registered for varied units (4 to 10 units) along with other courses.

BITS G639 Practice School 20

A higher degree student if permitted can register in this course in lieu of Dissertation only after the completion of all course work. Concurrent registration of other courses with this course is not permitted. All clauses of Academic Regulations applicable to First Degree Practice School courses will govern the operation of this course.

BITS G641 Management Information and Decision Support Systems 2 3 5

Data & information; characteristics of information; components of management information systems; information flows; design and maintenance of management information systems; decision support systems.

BITS G644 Development and Use of Computer Software 5

Concepts and operations of processors; concept, capabilities and types of software; review and case studies of computer applications. Principles and use of standard software packages. Principles of software creation: processing concepts, flowcharting and algorithms, programming constructs, programming languages, program development sequence. Concepts of data and information: files and databases, logical data storage structures. Information Systems: need, significance, concepts, their Analysis, Design and Implementation. Software Engineering: software life cycle, with special reference to software planning, software requirements and software maintenance. The course would terminate with a term paper on a specialised area of the development and use of computer software.

BITS G649 Reading Course 5

BITS G651 Project Formulation and Preparation 2 3 5

This course is designed to inculcate principles of technical documentation as required within S&T organisations. Through this course, students are expected to acquire familiarity with several of the following: Proposals, feasibility reports, formal project reports, short reports, memos, negotiations, contracts, etc. In the process principles of project formulation and evaluation, such as technical considerations; performance specifications; preliminary block diagrams, types and analysis of contracts; cost estimation concepts, work breakdown structure; project data preparation, scheduling facilities etc., would be introduced. The course would invariably include the preparation of a detailed report embodying as many of the above concepts as appropriate.

BITS G654 Advanced Instrumentation Techniques 5

Generalised approach to measuring systems; performance characteristics of instruments; primary sensing elements and transducers; analog and digital signal conditioning operations; microprocessors in in-

strumentation; applied process control instrumentation; General purpose and analytical instruments covering spectroscopic, separation, atomic absorption instruments UV-VIS-IR,GLC, HPLC, etc; Instrumentation practices in typical R&D laboratories; instrumentation case studies covering selection, quality assurance, system design, etc; Hands on experience in operation of sophisticated instrumentation systems.

BITS G659 Technical Communication 4

Role and importance of communication; effectiveness in oral and written communication; technical reports; technical proposals; technical descriptions; definitions and classifications; business correspondence; précis writing; memorandum; notices, agenda and minutes; oral communication related to meetings, seminars, conferences, group discussions, etc.; use of modern communication aids.

BITS N101T Physical Fitness, Health and Wellness 0 1 1

Basic Exercise - warm-up and warm-down exercise, Calisthenics and its importance, Cardio-respiratory or endurance exercises - various forms of endurance exercise, exercise with intensity and duration for physical wellness; strength training exercise; various strength exercises and their importance, free hand weight training; flexibility exercise and wellness and relaxation exercise including stretching & yoga. This course can be taken only on audit.

Courses on Development Process

CDP C211 Agricultural Growth of India 3 0 3

Planning and policy problems-agricultural policy in India since independence, planning for agriculture, growth and inequality in agriculture; production modes and Institutions-technical relations in agriculture, farm mechanisation; agricultural labour market, land reforms and the changing agrarian structure; resources for production-fertilizer in India's agricultural development, motive power and energy use in agriculture, education and agricultural growth, technological change, extension, and innovation - new technology, problems & potentialities, dry farming technology, integrated rural development; role of agriculture looking ahead - India's crop output trends, past and present; forecasting agricultural production.

CDP C212 Industrial Growth of India 3 0 3

Concept and problems of industrialization; industrialization in developing countries; industrial growth and planning in India since 1947, emerging industrial structure in India; problems and prospects of some industries namely: steel, foundry, iron ore, aluminium, machine tool industry, cement, chemicals petrochemicals, fertilizer, oil industry, coal industry, power generation, textile, handloom, jute, sugar, vanaspati, plantations, paper, rubber, drug and pharmaceuticals; issues bearing on industrial growth in the 1980s.

CDP C221 Growth of Social Health in India 3 0 3

Planning and development of public health in India; public health administration at centre and in the states; environmental sanitation; prerequisites of healthy life-water, air and ventilation, food and housing; family planning and population control; school health, rural sanitation; sanitation of camps, fairs and festivals; social security and health services; comprehensive health care; social medicine, health education, health statistics and statistical methods.

CDP C231 Transport and Communication 3 0 3

Review of transport development in India, transport under the five year plans, growth of transport, trends in traffic, imbalances in the transport system, a new evidence on traffic flow; machinery for coordination of transport policy at the centre and state levels; transport planning and data base; transport research training; railways; road development; road transport; urban transport; air transport;

coastal shipping; inland water transport; ports and harbours; ropeways and pipelines.

CDP C313 Security Analysis & Portfolio Management 3 0 3

Introduction to investment and securities; profile of financial assets; new issue market or primary market, initial public offerings (IPO); secondary market; framework of risk & return; fundamental analysis- economy, industry; company analysis; stock evaluation models; multiple holding period and multiple growth rate; bond analysis and bond management strategies; technical analysis; efficient market theory; portfolio management; Markowitz model; Sharpe's Single Index model; capital asset pricing model; financial derivatives-options & futures.

CDP C323 Functions and Working of Stock Exchanges 3 0 3

Stock exchanges in India: regulations governing formation and working; trading and settlement procedures; review of the working of stock exchanges in India. National stock market system; OTCEI; listing requirements. requirements for membership of stock exchange; responsibilities of stock brokers in regard to contracts and accounts, duties and responsibilities to stock exchange, public and members interset; securities contracts act, bylaws and regulations; SEBI guidelines; trading in stock exchanges; insider trading: SEBI guidelines; dealings in debentures; rating of debentures; trading in government securities; potential for trading in derivatives.

CDP C332 Contemporary India 3 0 3

Topics will include some or all of the following: economic process; contemporary Indian planning and industry; political processes; Contemporary Indian political scene and Indian administration : India and the contemporary world; social processes: contemporary Indian educational scene; religion and caste system; Indian science; Indian women; cultural processes; contemporary Indian art, music, dance, theatre, cinema and literature.

CDP C364 Industrial Relations 3 0 3

Introduction to human resources management; planning and organising human resources; leadership and motivation; job satisfaction and morale; employee communication; audit and control; procurement of personnel; performance appraisal; human resource development; wage and salary administration; job change; discipline; labour welfare; trade unions and collective bargaining; industrial disputes; worker participation in management.

CDP C371 Development Economics 3 0 3

Concept of development; statistical foundation of decisions; nutrition, disease and climate as influences on growth; critical importance of population; importance of agriculture, international trade and industry; cost-benefit analysis and planning process.

Civil Engineering

CE C212 Transport Phenomena I 3 0 3

Concepts and definitions, Fluid pressure and measurement, Hydrostatics, Buoyancy, Fundamentals of fluid flow, equations of motion and energy equation, impulse momentum equation, applications, flow through pipes, Laminar flow, Dimensional analysis.

CE C241 Analysis of Structures 3 0 3

Determinacy and indeterminacy, work and energy principles, fixed beams, continuous beams, frames and trusses, slope deflection and moment distribution methods, maxwell's reciprocal theorems, rolling loads and influence lines, Muller Breslau's principles, arches, multistory frames, stiffness and flexibility methods, introduction to plastic theory.

CE C322 Construction Planning and Technology 3 0 3

Development of model-based planning; control and reviewing Civil Engineering construction; network based methodology; cost- duration studies and resources allocation, case

studies, major construction problems; principal building system as affected by environmental, legal, material and industrial constraints; interrelationships among the components of the systems; fundamental systems of enclosure-load distribution and environmental control; assembly line process.

CE C342 Water and Waste Water Treatment 3 2 4

Water supply and waste water systems; capacity requirements; analysis of water and waste water; treatment requirements; unit operations and processes of treatment, design of treatment units; disposal waste water and sludge; design of sewers and water distribution networks; rural sanitation, effluent repurification and reuse.

CE C361 Soil Mechanics and Foundation Engineering 3 2 4

Origin and classification of soils; physico-chemical properties; effective stress concept; steady state flow-Darcy's law, permeability; one-dimensional consolidation; shear strength under different drainage conditions, Mohr-Coulomb theory; slope stability; earth pressures; stress distribution in soils; bearing capacity; shear failure and settlement; design of footings; pile foundations, group of piles; well foundations; machine foundations; foundations on black cotton soil; soil stabilization.

CE C371 Hydraulics and Fluid Mechanics 3 2 4

Turbulent flow through conduits; lift and drag; pipe networks; boundary layer theory; open channel flow; uniform and varied flow; hydraulic jump; elements of sediment transport; introduction to hydrology and hydrological cycle; elements of meteorology; precipitation; mean depth of rainfall over area; evaporation, transpiration and evapotranspiration; interception and infiltration; run off and factors affecting run- off; unit hydrograph; methods of determination of run-off.

CE C381 Design of Steel Structures 3 0 3

Structural steels loads and stresses, design of tension, compression and flexural members of steel; riveted, bolted and welded connections, trusses, gantry girders, beam columns, plate girder, column bases and footings. Industrial buildings, Plastic designs.

CE C383 Design of Concrete Structures 3 2 4

Materials for concrete, design of concrete mix, design philosophies, singly and doubly reinforced beams, flanged beams, shear and development length, slabs, columns, footings and walls, foundations, water tanks, introduction to prestressed concrete, yield line theory.

CE C391 Transportation Engineering 3 2 4

Basic characteristics of transportation systems, social factors and strategic consideration; demand forecasting and economic analysis; planning and design of transport facilities; design standards-geometric design of highways railways and airports; design of highway and airport pavements; flexible and rigid pavement; materials and tests; design of grades and grade separated intersections; traffic accidents; traffic management.

CE C392 Geodesy 3 2 4

Field measurements and mapping; theory of measurements and error analysis; astronomical observation; triangulation; photogrammetry; laying out works.

CE C412 Disaster Management 3 0 3

Definitions, types of hazards, natural and man-made disasters, impact, causes and effects, damages, coping mechanism and relief assistance, disaster continuum, preparedness, prevention, mitigation, warning and management, vulnerability assessment, rehabilitation and reconstruction after disasters, pre disaster planning for earthquakes, cyclones, floods, draught and famine, disaster resistant constructions, non-structural and structural mitigation measures, guiding principles of mitigation, education and training for disasters, disaster case studies, computer use in disaster scenario development.

CE C414 Introduction to Environmental Engineering 3 0 3

Environmental pollution; essentials of solid waste management; environmental noise pollution and its control; water quality significance; air quality management; industrial site selection criteria – environmental impact assessment-case studies-computer applications.

CE C415 Design of prestressed Concrete Structures 3 0 3

Introduction to basic concepts of prestressing; prestressing systems; analysis of prestress & bending stress; losses in prestress; deflection; design for flexure, shear and torsion; transfer of prestress; composite construction of prestresses and in situ concrete; load balancing technique, statically indeterminate structures; introduction to optimum design.

CE C416 Computer Application in Civil Engineering 3 2 4

Programming techniques, review of programming languages useful to civil engineering works, structural analysis concepts, modeling of problems, relation between elements and systems, programming with and flexibility and stiffness matrix displacement plain stress/strain problems, eigen value problems, programming for pre and post processor, civil engineering computer projects.

CE C417 Applications of Artificial Intelligence in Civil Engineering 3 0 3

Genetic algorithm and its applications in problem solving and optimization; neural network and its application in functional mapping, flood forecasting, remote sensing; fuzzy logic and its application in decision making, clustering and linear programming.

CE C418 Introduction to Water Resources Engineering 3 0 3

Introduction to hydrology, Methods of Irrigation, Water requirement of crops and Estimation methods, Detailed analysis of runoff and Hydrograph, Ground water hydrology, definitions, Discharge computations for confined and unconfined aquifers, pumping tests, Reservoir planning, types of reservoirs, Selection of site, mass curve, life of reservoir, Cost aspects, Flood routing, Introduction to dams, Systems analysis techniques in planning and practical applications.

CE C419 Geotechnical Earthquake Engineering and Machine Foundation 3 0 3

Seismic hazard, Engineering seismology, Wave propagation, Dynamic Soil Properties, Dynamic bearing capacity, Seismic design of foundation, Seismic slope stability, Dynamic earth pressure, Seismic design of retaining structure, Liquefaction, Design of machine foundation, Soil improvement techniques, Seismic design codes.

CE C422 Design of Bridge Structures 3 0 3

Investigations for bridges, types of bridges and loading standards, selection of bridge, analysis and design of bridges, pier and abutments, different types of bridge foundations.

CE C432 Structural Dynamics 3 0 3

Free and forced vibrations, single and multi-degree systems, continuous systems, response of various systems to different excitations, damping; numerical evaluation of dynamic response, frequency domain analysis, mode superposition, direct integration for dynamic response.

CE C441 Design of Water Resources Systems 3 0 3

Aspects of water resources system planning; storage dams; estimation of flood; flood routing through reservoir; spillways; weirs on permeable foundation; canal masonry works; ground water exploration; well hydraulics, construction and development; pumping tests under boundary conditions.

CE C461 Refrigeration and Air Conditioning 3 0 3

Principles, thermodynamic analysis, load estimates and design of various refrigeration and air conditioning systems for comfort and

industrial applications. Theoretical or experimental investigation of refrigeration and air-conditioning problems.

CE C471 Introduction to Finite Element Methods 3 0 3

Element properties; Isoparametric elements; Finite element method; analysis of framed structures; plane stress and plane strain axi-symmetric and 3D analysis; analysis of plate bending, shell finite element. Application of FEM in Civil Engineering & Mechanical Engineering, FEM programming.

CE C491 Special Projects 3

Course description is same as given under BIO C491.

CE G511 Matrix Methods in Civil Engineering 2 3 5

Matrix techniques; basic equations of solid mechanics; variational methods; finite difference and finite element methods; applications to structural mechanics, soil and rock mechanics, fluid mechanics, and hydraulic structures.

CE G512 Topics in Environmental Engineering 2 2 4

Collection and disposal of solid wastes; air pollution and control; stream sanitation; rural water supply and sanitation.

CE G513 Advanced Computational Techniques 4

Interpolation, Polynomial Interpolation, Lagrange, Newton's Interpolation, Numerical integration, Wilson θ Method, Newmark's Method, Gauss and Hermitian Quadrature, Quadrature rules for multiple integrals, Large system of linear simultaneous equations, Direct and iterative algorithms based on Gauss elimination, Gauss Seidel method and symmetric banded equations, storage schemes – skyline, band solver, frontal solver, Cholesky decomposition, Non-linear system of equations, Eigen value problems, Forward iteration, Inverse iteration, Jacobi, Given's method, Transformation of generalized Eigen value problem to standard form, Vector iteration method, Initial and boundary value problems, Solution of first and second order differential equations using Euler, modified Euler, and Runge-Kutta methods, Finite difference operators.

CE G514 Structural Optimization 4

Introduction, Engineering Optimization Problems, Optimal problem formulation, Single-variable optimization algorithms, Bracketing methods, Region Elimination methods, Gradient-based methods, Multivariable optimization algorithms, Evolutionary optimization methods, Simplex Search method, Hooke-Jeeves pattern search method, Powell's conjugate direction method, Cauchy's method, Newton's method, Conjugate Gradient method, Constrained Optimization algorithms, Kuhun-Tucker conditions, Transformation methods, Direct search for constrained minimization, Feasible Direction Method, Specialized algorithms, Integer Programming, Geometric Programming, Nontraditional optimization Algorithms, Genetic algorithms, Simulated Annealing, Structural Optimization, Methods of optimal design of structural elements, minimum weight design of truss members, optimum reinforced design of R.C. C. Slabs and beams, Optimization to the design of structures such as multi-storey buildings, water tank, shell roofs, folded plates.

CE G515 Fundamentals of Systems Engineering 4

Linear Programming, Queuing Theory, Inventory Control, Simulation, Maintenance models sampling techniques, Forecasting techniques, Decision models, Network scheduling, application to Resources planning, financial Management, facility location, decision making Maintenance issues, construction & operational issues for Civil Engg. System

CE G516 Multicriteria Analysis in Engineering Management 4

Introduction, Conventional optimization, Multi-objective Optimization, Fuzzy logic and its extensions, in multi-objective optimization, Multicriterion Decision Making, Deterministic analysis, Stochastic analysis, Fuzzy analysis,

Classification problems, Hybrid approaches in Decision Making, Genetic Algorithms, Artificial Intelligence, Artifical Neural networks, Practical applications in Engineering.

CE G517 Waste Management Systems 4

Introduction, Wastewater and Solid Wastes, Collection and Transportation, Waste Disposal Systems, Land Treatment, Wastewater Management Methods, Wetland and Aquatic Treatment, Landfilling, Incineration, Energy from Wastes, Recycling, Composting, Reduction, Reuse and Recovery, Risk management, Case studies.

CE G518 Pavement Analysis and Design 3 1 4

Types of pavements, flexible, rigid and semi-rigid; components of pavement structure; stresses and strains in flexible and rigid pavements: layered systems, visco-elastic solutions; stresses and deflections in rigid pavements; computer programmes for analysis of stresses and deflections in rigid pavements; traffic loadings, load equivalency factors, traffic projections and analysis; material characterization as input to pavement design; flexible pavement design and rigid pavement design using IRC, AASHTO, PCA methods; design of overlays; pavement deterioration, pavement performance and use of HDM-4; pavement drainage design.

CE G520 Infrastructure Planning and Management 3 1 4

The goals and perspectives of planning; forecasting and design of alternatives; plan testing: economic, financial and environmental evaluation; the challenges of managing infrastructure; Information management and decision support system; Concepts of total quality management; Economics: life-cycle analysis and maintenance, Rehabilitation and Reconstruction (M.R & R) programming; Infrastructure management system (IMS) development and implementation; Rural Infrastructure Planning.

CE G521 Topics in Structural Engineering 2 3 5

Introduction to structural optimization, application to simple structures such as trusses, and simple frames; Theory of plates and its applications in Civil Engineering; folded plate design; theory and design of shell structures specifically with application in structures covering large area.

CE G522 Pavement Design, Maintenance and Management 3 2 5

Materials for road construction: specifications and tests on binder, aggregate and soil; Asphalt mix design; Pavement structure; Stresses in flexible and rigid pavements; Design of flexible and rigid pavements; Pavement Management System (PMS) implementation and operation; Data base requirements; Road condition surveys; Data management; Pavement condition analysis; Determination of maintenance and rehabilitation needs at network level; Panel inspection; Prioritization and optimization; Budgets, programmes and plans of action.

CE G523 Transportation Systems Planning and Management 3 1 4

System and environment; sequential transportation systems planning: trip generation, trip distribution, modal split and traffic assignment. Transportation Systems Management (TSM) actions: traffic management techniques for improving vehicular flow, preferential treatment for high occupancy modes, demand management technique for reduced traffic demand, staggered hours, vehicle restrictions; planning for pedestrians, parking planning; Methods of accident data collection and analysis.

CE G524 Urban Mass Transit Planning, Operations and Management 3 1 4

Modes of public transportation and application pf each to urban travel needs; Comparison of transit modes and selection of technology and transit service; Estimating demand in transit planning studies and functional design of transit routes; Terminal design; Management and operation of transit systems, Model for operational management;

Fleet and crew management; Terminal management; Fiscal management.

CE G525 Water Resources Planning and Management 3 1 4

Introduction; Quantitative and qualitative assessment of water resources; Engineering principles applied to the management of water resources; Hydrographic and project surveys; Watershed management; Measurement techniques in water resources engineering; Gains of water resources planning to the society; Water economics; Computer utilization areas; Project discussions; Laboratory experiments.

CE G526 Systems Approach to Water Resources Modeling 3 1 4

Introduction to system analysis; Water management models: types and significance; Fundamentals of model development; Model solution techniques (computational methods) such as computer aided optimization, simulation, statistical analysis and reliability considerations; Model calibration and verification; Modeling of water quality subsystems and water quantity subsystems in various water bodies and its methods of analysis.

CE G527 Construction Management 3 1 4

Industry profile, parties involved, contracts, bonds, bidding, changes, pre-planning, construction management approach and partnering; Planning and scheduling, net-work based scheduling systems (CPM), Resource management, Network acceleration, PERT probabilistic approach.

CE G528 Selection of Construction Equipment and Modeling 3 1 4

Selection and application of construction and earth moving equipment; Productivity analysis of equipment operations; mathematical models for construction operations; Quality issues in construction process modeling.

CE G529 Construction Project Control Systems 3 1 4

Concepts, planning and organization; bar charts and schedule networks; CPM computer software, Resource management; Optimal project duration; Project estimates; Budgeting and cash flow; Project control; PERT and line of balance; Project simulation; Materials management and information systems; Claims; Corrective actions; Total quality management; Equipment economics; Nature of design projects: (1) design of project scheduling networks, (2) design of construction operations, (3) development of project breakdown structure, and (4) development of project cash flow design.

CE G530 Design of Construction Operations 3 1 4

Techniques for the design and analysis of construction operations to maximize productivity and minimize resource idleness; Queuing theory, line of balance, simulation, probabilistic and statistical methods applied to construction; An actual construction operation will be modeled and analyzed as part of the course in the context of a term project.

CE G531 Environmental Conservation 2 2 4

Environmental management; impact of development schemes; essentials of an environmental policy and an environmental act; environmental issues and priorities, ecological effects of current development process; energy resources and water resources planning; Economics of pollution control; National conservation strategy; Organisations dealing with environmental conservations.

CE G532 Advanced Soil Mechanics 2 2 4

Modern concept of soil structure and its application in explaining its behaviour; effects of seepage on equilibrium of ideal soil; mechanics of drainage; theories of elastic subgrade reaction; theories of semi infinite elastic soils; vibration problems.

CE G533 Advanced Composite Materials for Structures 3 1 4

Introduction and History of FRP, Overview of Composite materials, Physical and Mechani-

cal Properties and Test methods, Design of RC Structures reinforced with FRP Bars, Flexural Strengthening of RC Beams, Shear Strengthening of Beams, Flexural Strengthening of Slabs, Strengthening of Axially and Eccentrically Loaded Columns, Seismic Retrofit of Columns.

CE G534 Pavement Material Characterization 3 1 4

Soils: Origin, properties of soils, tests on soils; aggregates: origin, classification, requirements, properties, importance of aggregate gradation; bituminous materials: origin, preparation, properties and tests, criterion for selection of different binders, modified binders; bituminous emulsions and cutbacks: preparation, characteristics, uses and tests; bitumen mix design: marshall method and superpave procedure; mechanical properties of bituminous mixes: resilient modulus, dynamic modulus, visco-elastic and fatigue characteristics. cement concrete pavement materials: requirements and design of mix for CC pavement, IRC and IS specifications and tests, joint filler and sealer materials.

CE G535 Highway Geometric Design 3 1 4

Highway functional classification; route layout and selection, design controls and criteria: turning paths, driver performance, traffic characteristics; highway capacity; access control; safety; environment; Elements of design: sight distance, horizontal alignment, transition curves, super elevation and side friction; vertical alignment: - grades, crest and sag curves; highway cross-sectional elements and their design; at-grade Inter-sections – sight distance consideration and principles of design, canalization, mini roundabouts, layout of roundabouts, inter-changes: major and minor interchanges, entrance and exit ramps, acceleration and deceleration lanes, bicycle and pedestrian facility design; parking layout and design; terminal layout and design.

CE G536 Traffic Engineering and Safety 3 1 4

Road users and their characteristics; traffic studies- volume, speed, origin-destination (O-D) and delay studies; analysis and interpretations of traffic studies; traffic forecasting; capacity and level of service analysis; traffic characteristics at un-signalized and signalized intersections; design of signalized intersections, capacity and LOS of signalized intersections, actuated signal control, signal coordination; traffic controls: signs, markings, street furniture; traffic regulations; parking studies; nature of traffic problems and their solutions; traffic safety: accidents- data collection and analysis; causes and prevention.

CE G537 Transportation Economics and Finance 3 1 4

Need for economic evaluation; concept of total transport cost; fixed and variable costs, elasticity of demand, marginal costs; value of travel time, accident costs; methods of economic evaluation; taxation in road transport, user charges: fees and tolls; highway legislation; investment policies and pricing, issues in financing and subsidy policy, public private partnership (PPP) options in transport sector: BOT, BOOT, BOLT; feasibility studies, identification and sharing of risks in PPP projects, operation and management agreements.

CE G538 Project Planning and Management 3 1 4

Foundations of project management: project life cycle, environment, selection, proposal, scope, ToR standardization; work break down structure; network scheduling: critical path method (CPM), programme evaluation and review technique (PERT), planning and scheduling of activity networks; resource planning: allocation, schedule compression, precedence diagram, generalized activity network; estimation of project cost, earned value analysis, monitoring project progress; quality assurance; contract administration and management; mechanization and advanced process control; quality audit; milestones, bonus and penalties; dispute resolution; capacity building and skill development.

CE G542 Water Resources and Management 2 2 4

Water resources system for different utilization; theory and analytical methods for minimum cost and optimum development; analysis and design of multi-purpose water resources system; engineering and economic principles applied to the management of water resources.

CE G543 Traffic Flow Theory 3 1 4

Traffic flow elements: speed, volume and density and their relationships; time-space diagrams, controlled access concept, freeway concept, system performances, measures of effectiveness; mathematical modeling; probabilistic & stochastic models of traffic flow process, discrete and continuous modeling: headways, gaps and gap acceptance; macroscopic models; car-following model; queuing models; fundamentals & development of queuing processes; traffic simulation; intelligent transportation systems (ITS).

CE G545 Airport Planning and Design 3 1 4

Air Transport-structure and organization; forecasting air travel demand: trend forecasts and analytical methods; air freight demand; airport system; characteristics of the aircraft; airport planning: site selection, layout plan, orientation and length of runway; airport capacity and configuration; geometric design of runway, taxiway and aprons; passenger terminal function, passenger and baggage flow, design concepts, analysis of flow through terminals, parking configurations and apron facilities; air cargo facilities-flow through cargo terminals, airport lighting; airport drainage; pavement design; airport access problem; environmental impact of airports.

CE G546 Highway Construction Practices 3 1 4

Road planning and reconnaissance; right of way selection; fixing of alignment; road construction techniques: construction staking, clearing and grubbing of the road construction area; subgrade construction: excavation and filling, compaction, preparation of sub grade, quality control tests as per MORTH specifications; granular subbase and base course construction: gravel courses, WBM, WMM, stabilized soil subbases, use of geotextiles and geo-grids; construction of bituminous layers; concrete pavement construction; field quality control ; road making machinery.

CE G547 Pavement Failures, Evaluation and Rehabilitation 3 1 4

Pavement deterioration, distress and different types of failures, pavement surface condition deterioration such as slipperiness, unevenness, rutting, cracking; pot holes, etc., causes, effects, methods of measurement and treatment, use of modern equipment for pavement surface condition measurements, Analysis of data, interpretation. Structural deterioration of pavements: causes, effects, methods of treatment. Structural evaluation of flexible pavements by rebound deflection method, analysis of data, design of overlay, use of FWD and other methods for evaluation of flexible and rigid pavements and their application. Evaluation of new pavement materials, model studies, pavement testing under controlled conditions, accelerated testing and evaluation methods, Test track studies. Instrumentation for pavement testing.

CE G548 Pavement Management Systems 3 1 4

Components of pavement management systems, pavement maintenance measures; pavement performance evaluation: general concepts, serviceability, pavement distress survey systems, performance evaluation and data collection using different equipment; evaluation of pavement distress modeling and safety; pavement performance prediction: concepts, modeling techniques, structural condition deterioration models, mechanistic and empirical models, HDM-IV models, comparison of different deterioration models, functional and structural condition deterioration models; ranking and optimization methodologies: Recent developments, economic optimization of pavement maintenance and rehabilitation.

CE G549 Rural Road Technology 3 1 4

Network planning, accessibility and mobility; road alignment and survey; geometric design: cross-sectional elements, sight distance, horizontal and vertical alignments; road materials and use of marginal materials; pavement design, drainage, culverts and small bridges; construction and specifications; quality control in construction; pavement failures; maintenance; preparation of detailed project report (DPR); community participation in planning, design, construction and management.

CE G551 Dynamics of structures 3 1 4

Free and forced Vibration Analysis of SDOF system, Response to general dynamic loadings, Numerical evaluation of dynamic response, Effect of damping; Free and forced vibration of undamped and damped multi degree of freedom systems; Modeling for multi degree of freedom systems; Equation of motions, Evaluation of natural frequencies and mode shapes, orthogonality conditions, Modal analysis and modal combination rules, Numerical evaluation of dynamic response for multi degree of freedom, time history analysis; support excited vibration, analysis of non-linear systems, Free and forced vibration analysis of continuous systems, Random vibrations, Stochastic response; Vibration isolation, vibration absorber and tuned mass damper; Evaluation of wind, blast, wave loading and other dynamic forces on structure; Modeling and dynamic analysis of buildings, bridges, water tank, liquid storage tanks, stack like structure, machine foundations etc.

CE G552 Advanced Structural Mechanics and Stability 3 1 4

Analysis of stress and strain in three dimension domain, deviatoric stress and strain; stress and strain invariants, compatibility conditions, equilibrium equations; stress-strain relations for anisotropic, orthotropic and isotropic elastic materials; yield criterion; plastic potential and flow rules. Problems on plane stress and plain strain conditions, Airy stress function; Axi-symmetric problems; torsion of prismatic bars, circular and non-circular sections; thin-walled sections, membrane and sand-heap analogies, concept of stability of structures and examples of instability. Stability of structures with one and two degree of freedom, buckling of columns; beam-columns and simple frames, lateral torsion buckling of beams; and introduction to postbuckling of plates.

CE G553 Theory of Plates and Shells 3 1 4

Analysis procedure and the basic theory of plates and shells; Different kinds of plates such as rectangular, circular, and elliptical; Different kinds of shell structures such as shell of revolution: spherical shells, cylindrical shells and special shell structures; Principles and applications of bending of plates, membrane theory, bending of shells, and stability of plates and shells; Kirchoff theory, Reissner-Mindlin-Naghadi type theories, rectangular plates-solution by double Fourier series, membrane theory of shells, and case study on plates and shells using numerical tools.

CE G554 Advanced Structural Design 3 1 4

Practical design problems on analysis and design of multistoried and industrial buildings, chimney, retaining wall, water tank, towers, etc using both the steel and concrete materials. Modeling of structures subjected to various load (DL, LL, WL, EQ etc.) combinations, structural analysis, design, and detailing of specific advanced concrete and steel structures.

CE G610 Computer Aided Analysis and Design in Civil Engineering 3 2 5

Computer languages; CAD, graphics; database management system; knowledge base expert system; development of preprocessor and post processor with graphic interface; analysis and design, optimization techniques, genetic algorithms, software development for analysis and design, interfacing.

CE G611 Computer Aided Analysis and Design 2 3 5

The course aims at developing complete self reliance in solving analysis & design problems

of engineering with the aid of computers. It stresses upon the use of more powerful tools including system planning, simulation and modelling. The student will take up a design project and will work independently on the project guided by the instructor or resource person as and when required. The effort must culminate with a CAAD program and a project report.

CE G612 Advanced steel Structures 3 1 4

Steel properties; high strength steels, structural behaviour, analysis and design; loads and environmental effects; load and resistant factor design (LRFD); column and beams; connections; member under combined loads; bracing requirements; composite members; plastic analysis and design; tall steel buildings, detailing in steel structures.

CE G613 Advanced concrete Structures 3 1 4

Materials; high strength concrete, flexure analysis and design; shear and diagonal tension; bond and anchorage; serviceability; torsion; columns; joints; indeterminate beams and frames; yield line analysis; strip method for slabs; composite construction; footing and foundations; concrete building system; concrete tall buildings, detailing in concrete structures.

CEG614 Prestressed Concrete Structures 3 1 4

Effect of prestressing; source of prestress, prestressing steel; concrete for construction; elastic flexure analysis, flexural strength; partial prestressing; flexural design based on concrete stress limits; tension profile; flexural design based on load balancing; losses due to prestress; shear diagonal tension and web reinforcement; bond stress, transfer and development length, anchorage zone design, deflections.

CE G615 Earthquake Engineering 3 1 4

Single and multi degree freedom system; seismic risk, causes and effects of earthquakes; seismicity, determination of site characteristics; design earthquakes; earthquake resistant design philosophy; seismic response; earthquake resistant design of structures; detailing for earthquake resistance in concrete and steel structures.

CE G616 Bridge Engineering 3 1 4

Purpose of bridge; classification of bridges; characteristics of each bridge; loads stresses and combinations; design of RC bridges; design of non-composite and composite bridges; prestressed bridge; continuous spans, box girders, long span bridges; substructure design for bridges.

CE G617 Advanced Structural Analysis 3 1 4

Flexibility Method; stiffness method; beam curved in plan; two dimensional and three dimensional analysis of structures; shear deformations, shear wall analysis; interactive software development for analysis of structures.

CE G618 Design of Multi-Storey Structures 3 1 4

Loads and stresses; building frames; framing systems, bracing of multistorey building frames; diaphragms; shear walls and cover; tube structure, approximate analysis and preliminary design; frame analysis; design loading, wind effects and response, earthquake response of structures.

CE G619 Finite element analysis 3 2 5

Fundamentals of Finite Element Method (FEM); basic formulations of FEM; assembly of elements, solution techniques; 2D and 3D problems; review of the isoparametric elements; thin and thick plate elements; introduction to shell formulations; use of newly developed elements; mixed finite element method; material and geometric nonlinear problems; application of FEM to civil engineering problems, programming FEM.

CE G620 Advanced Foundation Engineering 3 1 4

Types of foundations, capacity and settlement of foundations, soil properties, design considerations, discrete method for analysis, design of shallow and deep foundations, fail-

ure in foundations, remedial measures, case studies of foundations.

CE G621 Fluid Dynamics 2 3 5

Mechanics of turbulent flow; semi-empirical expressions; statistical concepts; stability theory; flow of non-Newtonian fluids; stationary and moving shock waves; Prandtl-Mayer expressions; two and three dimensional subsonic and supersonic flow; methods of characteristics; small perturbation theory and similarity rules.

CE G622 Soil-Structure-Interaction 3 1 4

Importance of soil-structure interaction, basic theories, types of interaction problems, numerical modelling, experimental and field investigations, prediction of failure mechanism, economic considerations.

CE G623 Ground Improvement Techniques 3 1 4

Requirements for ground improvement, various techniques of improvement, water table lowering, ground freezing, electro-osmosis, compaction, tamping, use of explosives, vibratory probes, thermal treatment, addition of lime, cement and bitumen, gravel and sand columns, preloading techniques, reinforced earth, soil replacement techniques.

CE G631 Selected Topics in Soil Mechanics and Geotechnical Engineering 1 3 4

Formation of soil & soil deposits, subsurface exploration, collapsible soils identification treatment & design consideration, review of casting expansion models in soil, treatment of weak soil, numerical modelling, fracture propagation & fracture energy, fluid infiltered materials, modern trends.

CE G641 Theory of Elasticity and Plasticity 2 3 5

Basic equations of theory of elasticity; elementary elasticity problems in two and three dimensions; theories of plastic flow; problems in plastic flow of ideally plastic and strain hardening materials; theory of metal forming processes.

Chemical Engineering

CHE C213 Fluid Flow Operations 3 0 3

Fundamental concepts; fluid statics; integral and differential analyses for fluid motion; dimensional analysis; internal and external fluid flow; fluid machinery; flow through packed bed; agitation; introduction to compressible flow.

CHE C221 Chemical Process Calculations 3 0 3

Properties of gases, liquids and solids; material and energy balances; elementary process analysis involving phase equilibria and chemical reactions; recycling and unsteady state processes; combustion calculations and typical industrial applications.

CHE C311 Chemical Engineering Thermodynamics 3 0 3

Development and applications of the combined first and second laws; relations between state properties; chemical equilibria in reacting and nonreacting systems; statistical concepts, and brief exposure to irreversible thermodynamics; extensive problem assignments throughout.

CHE C312 Kinetics and Reactor Design 3 0 3

Kinetics of homogeneous, heterogeneous reactions; ideal reactors, nonideal flow; selectivity; analysis and design of chemical reactors.

CHE C322 Chemical Process Technology 3 0 3

Process synthesis concepts for flow sheet generation; selected technologies for chemicals from inorganic chemical industries, natural product industries, synthetic organic chemical industries, polymerization industries, etc.

CHE C332 Process Design Decisions 3 0 3

Strategic design decisions in process synthesis & analysis; cost models; profitability measures & analysis; depreciation; engineering economics; hierarchy of levels of design decision making; batch vs. continuous; input-output

structure of flow sheet; recycle structure of flow sheet; general structure of separation systems; energy integration analysis; pinch technology; cost diagrams & screening of process alternatives; preliminary process optimization; process retrofitting; case studies.

CHE C351 Heat Transfer Operations 3 3 4

Steady and unsteady state heat conduction; forced and natural convection; radiation; condensation and boiling heat transfer; evaporation; heat exchanger; associated laboratory.

CHE C361 Mass Transfer Operations 3 0 3

Introduction to molecular diffusion and mass transfer coefficients; interphase mass transfer; design of absorption, distillation, extraction and leaching processes.

CHE C411 Environmental Pollution Control 3 0 3

Air & water pollutants; sampling and analysis; control methods for air & water pollutants; modeling of different control techniques; advanced wastewater treatment processes; solid waste management, noise pollution; case studies; associated laboratory.

CHE C412 Process Equipment Design 3 0 3

Application of principles of Chem. Engg. to the selection and design of equipment for Chemical industries; design, cost estimation and selection of process equipment; piping, pressure vessels, heat exchangers, distillation columns etc. Use of computer software packages in the design; plant safety practices; use of codes.

CHE C413 Process Plant Safety 3 0 3

Role of safety in society. Engineering aspects of process plant safety. Chemical hazards and worker safety. Hazardous properties of chemicals. Safety aspects in site selection and plant layout. Design and inspection of pressure vessels. Storage, handling and transportation of hazardous chemicals. Risk assessment methods. Toxic release, fire and explosions. Boiling liquid expanding vapor explosions. Safety audit. Emergency planning and disaster management. Case studies.

CHE C414 Transport Phenomena 3 0 3

Prerequisite : CHE C213, CHE C351, CHE C361

Analogy for momentum, heat and mass transport; shell balance approach for analysis of individual and simultaneous momentum, heat and mass transport; hydrodynamic and thermal boundary layers; velocity, temperature and concentration distributions in turbulent flow; interphase transport for isothermal and non-isothermal systems.

CHE C421 Biochemical Engineering 3 0 3

Course description is same as given under BIO C441.

CHE C422 Combustion Engineering 3 0 3

Fundamentals; theory of combustion and its application to problems of design and operation of equipment for efficient use of fuel; burning of coal in boilers and furnaces; radiation from fires, fly ash and fusion; ignition and flame propagation in fires; industrial explosion and fire hazards; study of design and construction of furnaces.

CHE C431 Selected Chemical Engineering Operations 3 3 4

Chemical engineering operations such as size reduction, mechanical separation, filtration, crystallization, drying, adsorption, membrane separation processes etc; associated laboratory.

CHE C432 Computer Aided Process Plant Design 3 0 3

Introduction to chemical engineering, process plant and methodology for computer aided process design, and analysis. It further undertakes computer aided design of process equipment viz. distillation column, absorption column, heat exchanger, evaporator, condenser, pressure vessel, piping, etc; and plant safety practices. The course contains a project work on computer aided design of the specific plant or equipment.

CHE C433 Corrosion Engineering 3 0 3

(Prerequisite: ES C242)

Corrosion principles: electrochemical aspects, environmental effects, metallurgical & other aspects; various forms of corrosion. Materials: metals and alloys, non-metallics (polymers and ceramics). Corrosion prevention: materials selection, alternation of environment, design, cathodic and anodic protection, coatings.

(This course is introduced as SDC category of B.E. (Hons.) Chemical Engineering Programme).

CHE C441 Process Control 3 0 3

Prerequisite: AAOC C321

Dynamic modeling and simulation of momentum, energy and mass transfer and reacting systems; analysis of the dynamic behaviour of lumped and distributed parameter systems; analysis and design of simple feed back and advanced control systems; design of control systems with multiple input and multiple output; introduction to computer control.

CHE C471 Refrigeration and Air Conditioning 3 0 3

Course description is same as given under CE C461.

CHE C473 Advanced Process Control 3 1 4

(Prerequisite: CHE C441 Process Control or INSTR C451 Process Control)

Process identification and adaptive control; Model predictive control structures; Model-based control structures; State estimation; Synthesis of control systems-some case studies; Intelligent control.

CHE C491 Special Projects 3

Course description is same as given under BIO C491.

CHE G511 Fluidisation Engineering 2 2 4

Fundamentals, industrial applications; study, design and operation of fluidisation units.

CHE G512 Petroleum Refining and Petro-Chemicals 2 2 4

Origin, formation and composition of petroleum; history and development of refining; refinery products and test methods; classification and evaluation of oil stocks, fractionation of petroleum; thermal and catalytic processes; properties & production of petrochemicals.

CHE G513 Environmental Management Systems 5

Introduction to air & water pollutants & solid wastes; sampling & analysis techniques; impact of these on environment; national & international regulations; ISO series; conventional & non-conventional energy resources; life cycle analysis; environmental audit; sustainable developments; case studies.

CHE G514 Evolutionary Computation 5

Non-traditional optimization techniques; population based search algorithms; evolutionary strategies; evolutionary programming; simulated annealing; genetic algorithms; differential evolution; different strategies of differential evolution; Memetic algorithms; scatter search; ant colony optimization; self-organizing migrating algorithm; other emerging hybrid evolutionary computation techniques; engineering applications involving highly non-linear processes with many constraints and multi-objective optimization problems.

CHE G521 Chemical Engineering Analysis 2 2 4

Mathematical analysis of chemical engineering problems; introduction to modelling and simulation techniques in the analysis of systems; emphasis on applying mathematical techniques to real Chemical Engineering processes and on physical and mathematical interpretation of results; use of computer software for analysis and solution of mass and energy balances problems for complex processes.

CHE G522 Polymer Technology 2 2 4

Polymerisation techniques; classification of polymers; mechanism and kinetics of forma-

tion of polymers; different techniques for determination of different types of molecular weights; polymer structure; definition and measurement of glass transition and crystalline melting temperatures; viscoelasticity and rubber elasticity behaviour; degradation and stability; polymer processing; rheology and applications. The course will terminate with several design projects on real life problems.

CHE G531 Project Engineering 2 2 4

Project feasibility studies and report; Project appraisal; Project solution and evaluation; Project planning; Economic decision making; Project preparation and management.

CHE G532 Alternate Energy Resources 2 2 4

The scope and present day technology in utilization of solar energy, wind power, tidal power, geothermal power, M.H.D. and fuel cells.

CHE G541 Process Plant Simulation 2 2 4

Computer aided analysis of chemical process systems; classification and development of mathematical models to various chemical engineering systems; decomposition of networks; tearing algorithms; numerical methods for convergence promotion and solving chemical engineering problems; traditional & non-traditional optimization techniques; specific purpose simulation; dynamic process plant simulation; case study problems using professional software packages.

CHE G542 Computational Transport Phenomena 3 2 5

Concepts; partial differential equations: types, boundary conditions, finite difference scheme, error analysis, grid generation, stability criteria; conduction and convection : two-dimensional steady state problem, methods for solving coupled algebraic equations, finite element method; fluid flow : governing equations, various approach of simulation (stream-vorticity, primitive variable), staggered grid, similarity solution, Newton-Raphson method, explicit and implicit formulation; solution of Navier-Stokes equations : solution of full and parabolized equations, unsteady flow, MAC, SIMPLE algorithm, RNS method; Mass Transfer : dynamic model, mass transfer with simultaneous convection and diffusion, transient multicomponent diffusion; short projects on development of codes for various real life problems involving transport processes.

CHE G551 Advanced Separation Technology 3 2 5

A brief overview of the existing separation technologies such as adsorption-based separation, membrane separation, cryogenic separation, and biotechnology-based separation. Recent advancements on the above areas and the new concepts such as simulated moving bed adsorption, thermally coupled pressure swing adsorption, reactive distillation, bio-filtration, supercritical fluid extraction etc. This course will terminate with several design projects on real life problems.

CHE G611 Computer Aided Analysis and Design 2 3 5

Course description is same as given under CE G611.

CHE G613 Advanced Mass Transfer 5

Use of stage and differential contact concepts in design of mass transfer equipment; methods of determining and interpretation of rate data; multicomponent distillation, absorption and extraction.

CHE G614 Advanced Heat Transfer 5

Heat conduction with unsteady boundary conditions; recent advances in natural and forced convection; condensation and boiling phenomena; heat transfer in high speed flows; liquid metal heat transfer, radioactive metal heat-transfer between surfaces in absorbing media; complex problems involving simultaneous conduction, convection and radiation.

CHE G615 Advanced Separation Processes 3 2 5

Shortcut and rigorous methods of conventional separation processes such as multicomponent distillation, absorption, stripping and extraction; Azeotropic and Extractive dis-

tillation; adsorption based separation, simulated moving bed adsorption, thermally coupled pressure swing adsorption; cryogenic separation, gas liquefaction; membrane based separation, pervaporation, liquid membrane; biotechnology based separation, modeling approach, design considerations, biofiltration; reactive distillation; super critical fluid extraction.

CHE G616 Petroleum Reservoir Engineering 3 2 5

Origin and composition of petroleum; Geographic distribution of oil; Petroleum geology; Exploration, drilling and recovery; Drilling methods and drilling fluids; Lubricants and spotting fluids; Corrosion control; Analytical and test methods; Enhanced oil recovery; Injection fluids; Polymer and caustic flooding; Use of surfactants; Improvement of oil displacement efficiency; Environmental and economic aspects.

CHE G617 Petroleum Refinery Engineering 3 2 5

History and development of refining; Indian petroleum industry; Composition of petroleum, laboratory tests, refinery products; Classification, characterization and evaluation of crude oil; Trends of petroleum products; Atmospheric and vacuum distillation; Design of crude distillation column; Catalytic cracking; Hydrotreating and Hydrocracking; Catalytic reforming; Delayed coking and visbreaking; Furnace design; Isomerization, alkylation and polymerization; Lube oil manufacturing; Energy conservation in petroleum refineries; Environmental aspects of refining.

CHE G618 Petroleum Downstream Processing 3 2 5

Petrochemical feedstock; Pyrolysis of Naptha and light hydrocarbons; First generation petrochemicals: Ethylene, Propylene, Butylenes, Acetylene, Butadienes, Chloroprene, cyclohexane, BTX, Polymethyl Benzenes; Second generation petrochemicals: synthesis gas, methanol, ethanol, ethylene oxide, propylene oxide, acetone, allyl alcohol, glycerol, acrylonitrile, Acrylic acid and derivatives, phenol, aniline, nylon monomers, polyester monomers, styrene and other monomers; Third generation petrochemicals: plastics, rubbers, fibres, resins, detergents, pesticides, dyes, protein, explosives, petroleum coke and carbon black; Catalysts in petroleum refining and petrochemicals processes; Transportation of dangerous goods; Health and safety in petrochemical industries; Pollution and toxicity; Future of petrochemicals.

CHE G619 Process Intensification 3 2 5

A brief review of the process intensification (PI), includes philosophy and principles of PI; equipments and methods for PI; few examples of their application on the commercial scale, such as multifunctional reactors, hybrid processes, monolithic reactors, high gravity reactors etc., industrial practice of PI- methodology and applications; PI by process synthesis; PI by plant safety. This course will terminate with several design projects on real life problems.

CHE G620 Energy Integration Analysis 3 2 5

Importance and scope of application of Energy Integration; Pinch technology tools, targeting, design, synthesis and optimization of heat exchanger networks (HEN); Interfacing HEN synthesis with heat exchanger design, Retrofitting, energy integration of distillation and evaporation processes, mathematical programming approach, Artificial intelligence based approaches.

CHE G621 Fluid Dynamics 2 3 5

Course description is same as given under CE G621.

CHE G622 Advanced Chemical Engineering Thermodynamics 3 2 5

Review of fundamental principles; statistical foundations; thermodynamic properties of pure substances and mixtures, their estimation and correlation; stability and equilibrium criteria for homogeneous and heterogeneous systems; thermodynamics of irreversible processes.

CHE G631 Heat Transfer **2 3 5**

Heat conduction with unsteady boundary conditions; recent advances in natural and forced convection; condensation and boiling phenomena; heat transfer in high speed flows; liquid metal heat transfer, radioactive metal heat-transfer between surfaces in absorbing media; complex problems involving simultaneous conduction, convection and radiation.

CHE G641 Reaction Engineering **3 2 5**

Design of multi-phase reactors; analyses of gas-liquid and gas-liquid-solid reactions; intrinsic kinetics of catalytic reactions; residence time distribution models for micro-and macro-mixing; mathematical models for gas-liquid-solid reactors; laboratory reactors; dynamics and design of various multi-phase reactors such as trickle bed reactors, bubble column reactors, segmented-bed reactors, slurry reactors, spouted bed reactors, pulsating reactors, fluidized bed reactors, etc.; optimization of chemical reactors.

Chemistry

CHEM C141 Chemistry I **3 0 3**

This is the first of a sequence of two courses aimed at providing an integrated overview of chemistry. Topics to be discussed will include: nuclear chemistry: electronic structure of atoms; molecular structure and chemical bonding; chemical thermodynamics; phase and chemical equilibrium; electrochemistry; chemical kinetics.

CHEM C142 Chemistry II **3 0 3**

Pre-requisite: CHEM C141

Representative topics from inorganic and organic chemistry will be discussed to expose the student to the logic and systematics of these areas, keeping in view the general principles introduced in the first course. Topics will include: stereoisomerism; important classes of organic reactions such as nucleophilic aliphatic substitution, elimination, electrophilic addition, free radical addition; organic synthesis; chemistry of selected main group elements; coordination chemistry.

CHEM C211 Atomic and Molecular Structure **3 0 3**

Elements of quantum theory; the Schrodinger equation; some exactly solvable models; angular momentum; hydrogen-like atoms; approximation methods; electronic structure of many-electron atoms; molecules-Valence Bond and molecular orbital theories; semi-empirical treatments-huckel theory; molecular spectroscopy.

CHEM C212 Colloid and Surface Chemistry **3 0 3**

Surface phenomena; intermolecular forces relevant to colloidal systems; forces in colloidal systems; experimental and theoretical studies of the structure, dynamics and phase transitions in micelles, membranes, monolayers, bilayers, vesicles and related systems; technical applications.

CHEM C221 General Chemistry **3 0 3**

Atomic structure; chemical bonding; gaseous, liquid and solid states; thermodynamics: phase and chemical equilibrium; electrochemistry; chemical kinetics; organic compounds: functional groups, structure and isomerism; stereochemistry; organic reactions: substitution, addition and elimination; chemistry of some representative elements; nucleus and radioactivity.

CHEM C222 Modern Analytical Chemistry **3 0 3**

Data handling and analysis; sample preparation; unit operations; volumetric and gravimetric analysis; oxidation-reduction and complexometric titrations; electroanalytical methods: potentiometry, ion selective electrodes, conductometry, polarography; separation techniques: chromatography, solvent extraction; introduction to spectroscopic methods; radiochemical methods; specific applications to problems in air and water quality analysis, toxic and trace metal estimation in biological and environmental samples.

CHEM C231 Chemistry Project Laboratory 3*

The course includes projects involving laboratory investigation or laboratory development in chemistry. The course is normally available to students of second or higher level. The course must coterminate with a project report.

CHEM C232 Chemistry of Organic Compounds 3 0 3

Electrophilic and nucleophilic aromatic substitution; nucleophilic additions to carbonyl compounds, aldol and related condensations; amines, malonic ester and acetoacetic ester synthesis; carbohydrates; orbital symmetry and chemical reactions; heterocyclic compounds.

CHEM C311 Chemical Kinetics 3 0 3

Discussion of reaction rate theory, kinetics and mechanism of various types of reactions, effect of temperature on reaction rates, energy of activation, theories of reaction rates and photochemistry.

CHEM C312 Chemistry of Nontransitional Elements 3 0 3

Basic principles of inorganic chemistry; abnormal and general properties; methods of preparation; industrial uses of derivatives of non-transitional elements.

CHEM C321 Chemical Thermodynamics 3 0 3

Review of classical thermodynamics and an introduction to statistical mechanics with applications to chemical systems.

CHEM C322 Quantum Chemistry 3 0 3

Review of the postulates of quantum mechanics and some exactly solvable potential problems; angular momentum; variation method; stationary state and time dependent perturbation theory; atomic structure: antisymmetry, determinantal wave functions, SCF method, coupling of angular momenta, spectra; symmetry: point groups, representations, direct product, projection operators; molecules – Born-Oppenheimer approximation, molecular Hartree Fock calculations, VB and MO theories: ab initio and semi empirical methods; symmetry and molecular spectra.

CHEM C331 Structure and Reactivity of Organic Compounds 3 0 3

Structure & reactivity; oxidation and reduction, aliphatic nucleophilic substitution; aromatic substitution reactions; eliminations, addition to carbon heteromultiple bonds and rearrangements; stereo chemistry of cyclic compounds.

CHEM C332 Synthetic Organic Chemistry 3 0 3

Retrosynthetic analysis, synthetic strategies, protecting groups, carbon-carbon bond forming reactions, functional group disconnection, carbon-carbon bond disconnection, ring annelation, multistep synthesis, synthetic equivalents, asymmetric synthesis.

CHEM C341 Biophysical Chemistry 3 0 3

The principles governing the molecular shapes,
structures, structural transitions and dynamics in some important classes of biomolecules and biomolecular aggregates will be discussed. The topics will include: structure, conformational analysis, conformational transitions and equilibria in proteins and nucleic acids; protein folding; lipids - monolayers, bilayers and micelles; lipid-protein interactions in membranes.

CHEM C342 Coordination Chemistry 3 0 3

Crystal field, ligand field and molecular orbital theories; chemistry of transitional metals; organometallic compounds; lanthanides and actinides.

CHEM C351 Computational Chemistry 3 3 4

Selected problems in computational chemistry from diverse areas such as chemical kinetics and dynamics, quantum mechanics, electronic structure of molecules, spectroscopy, molecular mechanics and conformational analysis, thermodynamics, and structure and properties of condensed phases will be discussed. The problems chosen will illustrate the application of various mathematical and numerical methods such as those

used in the solution of systems of algebraic equations, differential equations, and minimization of multidimensional functions, Fourier transform and Monte Carlo methods.

CHEM C352 Bonding in Inorganic Compounds
3 0 3

Point groups and molecular symmetry; uses of point group symmetry; ionic bonding; covalent bonding; valence bond and molecular orbital theories of simple compounds; electronegativity; VSEPR model; fluxional molecules; ionic and covalent solids; band theory; dipole related forces; hydrogen bonding; coordination compounds: VB, crystal field and MO theories, electronic spectra and magnetic properties.

CHEM C361 Polymer Chemistry 3 0 3

Types of polymers; structures of polymers; molecular weight and molecular weight distributions; kinetics and mechanisms of major classes of polymerization reactions such as step growth, radical, ionic, heterogeneous, and copolymerization methods; polymer solutions- solubility, lattice model and the Flory-Huggins theory, solution viscosity; bulk properties- thermal and mechanical properties such as the melting and glass transitions, rubber elasticity, and viscous flow; polymerization reactions used in industry.

CHEM C362 Chemistry of Inorganic Compounds 3 0 3

Periodicity; periodic anomalies; p orbitals in pi bonding; d orbitals in non-metal chemistry: similarities and contrasts within a group, e.g., C-Si, N-P; chemistry of boron hydrides, aluminosilicates; hydrogen; acid-base concepts; hard and soft acids and bases; chemistry in aqueous and nonaqueous media; halogens and noble gases; coordination chemistry: different coordination numbers, chelation, isometrism and reactivity; chemistry of metals; introduction to bioinorganic and organometallic chemistry.

CHEM C391 Instrumental Methods of Analysis 4

Principles and practice of modern instrumental methods of chemical analysis. Emphasis on spectroscopic techniques such as UV-Visible, infrared, NMR (^{1}H, ^{13}C and other elements, NOE, correlation spectroscopies), ESR, atomic absorption and emission, photoelectron, Mossbauer, and fluorescence. Other topics will include mass spectrometry, separation techniques, light scattering, electroanalytical methods, thermal analysis, and diffraction methods.

CHEM C411 Chemical Experimentation 0 9 3

Specially designed for M.Sc. (Hons.) Chemistry; cannot be taken by others under any circumstances.

This laboratory course is designed only for M.Sc. (Hons.) Chemistry students in order to develop competence in selected techniques of modern analytical chemistry.

CHEM C412 Photochemistry and Laser Spectroscopy 3 0 3

Photochemical events : absorption, fluorescence and phosphorescence; Jablonski diagrams; physical properties of molecules after photoexcitation; photochemical tools and techniques : spectrophotometers, fluorescence decay time measurement and analysis, flash photolysis; fundamental properties of laser light; principles of laser operation ; description of some specific laser systems : Helium-Neon, Argon ion, CO_2, Nd-YAG and ultrafast Titanium : Sapphire lasers.

CHEM C421 Theoretical Inorganic Chemistry 3 0 3

Stereochemistry of inorganic compounds; acids and bases; nonaqueous solvents; chemistry of the elements of the first period.

CHEM C422 Statistical Thermodynamics 3 0 3

Review of classical thermodynamics, principles of statistical thermodynamics, ensemble averages; Boltzmann distribution; partition functions and thermodynamic quantities; ideal gases and crystals; thermodynamic properties from spectroscopic and structural data; dense gases and the second virial

coefficient; statistical mechanics of solutions; Bose-Einstein and Fermi-Dirac statistics.

CHEM C431 Stereochemistry and Reaction Mechanisms 3 0 3

Relative and absolute configuration; stereochemistry of organic compounds including those containing nitrogen atoms, allenes, and biphenyls; stereochemical implications of various organic reactions; conformational analysis of cyclohexanes and substituted cyclohexanes; mechanism of addition, elimination and substitution reactions.

CHEM C441 Biochemical Engineering 3 0 3

Course description is same as given under BIO C441.

CHEM C451 Physical Pharmacy 2 3 3

This course is designed to make the students conversant with the applications of physicochemical principles to the study of the drug stability behaviour of drug powers and of other pharmaceutical systems; it includes the discussion of drug degradation, micromeritics, rheology and interactions of drugs.

CHEM C453 Mathematics for Chemists 4

This course is meant for higher degree students of chemistry having no mathematics in their first degree curriculum. The following topics will be covered along with suitable examples in chemistry or other physical sciences. Functions and graphs; Polynomials; Rational Functions; Binomial Theorem; Trigonometric Functions; Complex numbers; Limits and Continuity; Differentiation; Matrices and Linear Equations; Three dimensional geometry; Vectors and Vector Products; Integration; Logarithms and Exponentials; Differential Equations; Sequences and Series; Simple Numerical Methods; Probability and Statistics; Regression Analysis.

CHEM C461 Nuclear and Radiochemistry 3 0 3

Nuclear and radiochemistry; transuranic elements; nucleus; nuclear reactions and radiation chemistry.

CHEM C491 Special Projects 3

Course description is same as given under BIO C491.

CHEM G511 Nuclear and Radio Chemistry 5

Course description for the above course to be developed.

CHEM G513 Advanced Nuclear and Radiochemistry 5

Nuclear stability, binding energy, properties of nucleons; Nuclear models (Shell Model, Liquid drop model), Radioactive decay characteristics, decay kinetics, α, β and γ decay, nuclear reactions, types, radiative capture, reaction cross section, theory of fission; Nuclear reactors – classification, Reactor power, Breeder reactors, Nuclear reactors in India, Reprocessing of spent fuel, Nuclear waste management (HLW, LLW and ILW); Detection and measurement of activity, GM counters, Gamma counters, Liquid Scintillation counting; Application of radioactivity, Szilard Chalmers reaction, Isotope dilution analysis, Neutron activation analysis, Diagnostic and therapeutic applications of radionucleides, interaction of radiation with matter.

CHEM G521 Environmental Chemistry 5

Energy-flows and supplies, fossil fuels, nuclear energy, nuclear waste disposal, renewable energy, industrial ecology, green chemistry, ozone chemistry, effect of SO_x, NO_x as pollutants, reformulated gasoline, water pollution and treatment, organochlorine and organophosphate pesticides, eco-system effects, Toxic chemicals – Effect of dioxins, polychlorinated biphenyls (PCBs) and species of metals such as lead, mercury, cadmium etc.

CHEM G531 Recent Advances in Chemistry 5

The course is aimed at providing an overview of recent developments in selected areas of chemistry. Topics to be covered may be drawn from: modern theories of structure, bonding and reactivity, spectroscopy, chemical dynamics, phase transitions, surface phenomena, solid state materials, and synthetic and mechanistic organic and inorganic

chemistry, or such other topics as may emerge in the development of the subject.

CHEM G541 Chemical Applications of Group Theory 5

Groups, subgroups and classes : definitions and theorems; molecular symmetry and symmetry groups; representation of groups; character tables; wave functions as bases for irreducible representations; direct product; symmetry adapted linear combinations; symmetry in molecular orbital theory; hybrid orbitals; molecular orbitals of metal sandwich compounds; ligand field theory; molecular vibrations; space groups.

CHEM G551 Advanced Organic Chemistry 5

Recent advances in aromatic electrophilic and nucleophilic substitution reactions and nucleophilic addition reactions; oxidation and reduction; enolates in organic synthesis; retro synthetic analysis; multiple step synthesis; protecting groups.

CHEM G552 Advanced Inorganic Chemistry 5

Advanced coordination chemistry, reactions, kinetics and mechanism; advanced organometalic chemistry, bonding models in inorganic chemistry, inorganic chains, rings, cages and clusters; group theory and its applications to crystal field theory, molecular orbital theory and spectroscopy (electronic and vibrational); inorganic chemistry in biological systems.

CHEM G553 Advanced Physical Chemistry 5

Equilibrium: The laws of Thermodynamics, applications to phase equilibrium, reaction equilibrium, and electrochemistry; Structure: Principles and techniques of quantum mechanics, applications to atomic and molecular structure and spectroscopy, statistical thermodynamics, molecular interactions, macromolecules, solid state; Dynamics: Molecular motion in gases and liquids, reaction rate laws, mechanisms and rate theories of complex reactions, molecular reaction dynamics, surface processes, electron transfer dynamics.

CHEM G554 Physical Methods in Chemistry 5

Advanced spectroscopic and non-spectroscopic techniques used in chemistry; Topics will include electronic absorption spectroscopy of organic and inorganic compounds, ORD, CD; vibrational rotational spectroscopy symmetry aspects; Dynamic and Fourier transform NMR, NOE, Multipulse methods, Two-Dimensional NMR; EPR; NQR; Mossbauer spectroscopy; Magnetism; Ionization Methods: Mass spectrometry, Ion Cyclotron Resonance; Photoelectron Spectroscopy; Microscopic techniques: TEM, STM, AFM; EXAFS, XANES; X-ray Crystallography.

CHEM G555 Chemistry of Life Processes 4

Synthesis and structures of biopolymers such as proteins and nucleic acids; nucleic acid replication, transcription and translation; lipids and biomembranes; transport across membranes; neurotransmission; enzyme and enzyme inhibitors; citric acid cycle, pentose phosphate pathway and nucleic acid metabolisms; photosynthesis; electron transport systems in respiration and oxidative phosphorylation.

CHEM G556 Catalysis 4

A comprehensive survey of the catalytic processes along with the fundamental aspects of the catalyst design and evaluation; several classes of heterogeneous industrial catalysts; their preparation, characterization and applications, recent developments in catalysis, application of nanomaterials in catalysis.

CHEM G557 Solid Phase Synthesis and Combinatorial Chemistry 4

A comprehensive understanding of solid phase synthesis and combinatorial chemistry, basic principles of solid phase organic synthesis; solid phase organic synthesis strategies; introduction to combinatorial chemistry; analytical techniques in combinatorial chemistry; applications of the combinatorial approach in chemistry, drug development and biotechnology.

CHEM G558 Electronic Structure Theory 5

Advanced methods in theoretical and computational chemistry based on Quantum Mechanics: Review of mathematical background, N-Dimension complex vector spaces, linear variational problem, many electron wave functions and operators, operators and matrix elements; Ab-initio methods: Hartree-Fock (H-F), Configuration Interaction (CI), Many Body Perturbation Theory (MBPT); Density Functional Theory: Thomas-Fermi model, Hohenberg-Kohn theorems, derivation of Kohn-Sham equations; Development and use of software for such models.

CHEM G559 Bioinorganic Chemistry 4

Fundamentals of inorganic biochemistry; essential and non-essential elements in biosystems, metalloproteins and metalloenzymes; role of metal ions in oxygen carriers, synthetic oxygen carriers, bioinorganic chips and biosensors; fixation of dinitrogen, environmental bioinorganic chemistry; transport and storage of metal ions *in vivo*, metal complexes as probes of structure and reactivity with metal substitution; fundamentals of toxicity and detoxification, chelating agents and metal chelates as medicines, nuclear medicines.

CHEM G561 Heterocyclic Chemistry 5

The fundamental structural characteristics; synthesis and reactions of various heterocycles with nitrogen, oxygen and sulphur heteroatom in the ring; heterocyles such as pyrrole, thiophene, furan, imidazole, thiazole, oxazole, indole, benzofuran, pyridine and quinoline; advanced synthesis and reaction mechanism of heterocyclic compound.

CHEM G562 Solid State Chemistry 4

Basics of solid state chemistry, comprehensive survey of different synthesis techniques, properties and their structural-property relationship of solid materials; introduction to special nanomaterials, ceramics, polymers, biopolymers and nanocomposites; thermal and mechanical properties of nanomaterials; nanocomposites in hydrophobic applications; recent advances in material science and technology.

CHEM G563 Advanced Statistical Mechanics 5

Review of ensembles, fluctuations, Boltzmann statistics, quantum statistics, ideal gases and chemical equilibrium; imperfect gases; distribution function theories and perturbation theories of classical liquids; electrolyte solutions; kinetic theory of gases; continuum mechanics; Boltzmann equation; transport processes in gases and Brownian motion; introduction to time-correlation function formalism.

Chinese

CHI N101T Beginning Chinese 3 0 3

Basic grammar; sentence construction; vocabulary building; conversations; dialogues; listening; translation of simple passages.

Computer Science

CS C311 Data Structures 3 0 3

Basic concepts of data, linear lists, strings, arrays and orthogonal lists; representation of trees and graphs; storage systems and structures; symbol table and searching techniques, sorting techniques; data structures in programming languages; data management systems.

CS C313 Object Oriented Programming and Design 3 2 4

Object oriented concepts and design, abstraction, architecture and design patterns, GUI programming and frameworks, design of object oriented solutions using UML, design for concurrency, implementation of solutions using object oriented languages like C++ or Java; Language level mapping and realization of object oriented constructs, realization and performance issues versus abstraction and usability.

CS C321 Computers and Programming 3 2 4

Computer structures; instruction execution, addressing techniques; computer system organization, micro-programming and interpre-

ters; symbolic coding; programme segmentation and linkage; laboratory work as several computer projects to illustrate basic machine structure and programming techniques.

CS C332 Systems Programming 3 0 3

Prerequisite: CS C311 & CS C321 & (CS C391 or EEE C391 or INSTR C391)

Batch processing Systems programs; operating characteristics and limitations; parallel processing of I/O and interrupt handling, multiprogramming; multiprocessing systems; design of system modules and interfaces; other selected topics.

CS C342 Advanced Computer Organization 3 0 3

Prerequisite: CS C391 or EEE C391 or INSTR C391

Memories and memory module design; sample CPU design - instruction set, addressing modes, instruction formats, instruction fetching and execution; instruction and execution cycles, timing, realization and documentation; floating point arithmetic operations, FPAU design; I/O devices and interrupt processing; special topics such as microprogramming & bus structures, simple design examples.

CS C351 Theory of Computation 3 0 3

Finite automata and regular languages – equivalences, closure properties. context free languages & push-down automata – equivalences, closure properties, concepts in parsing; turing machines; computability & decidability – universal turing machine, recursive functions, church-turing hypothesis; complexity classes – P, NP, reducibility and NP-completeness.

CS C352 Data Base Systems 3 0 3

Introduction to data bases and management; data files and structures; hierarchical, relational, network models; distributed data bases; query processing and query optimization, query languages; concepts of security and protection; case study of a data base system.

CS C362 Programming Languages & Compiler Construction 3 0 3

Overview of programming languages concepts and constructs, programming paradigms; Introduction to compiler process, phases and passes, bootstrapping of compilers; Formal languages, grammars and abstract machines; Lexical analysis, regular expressions and finite automata; Context-free grammar and push-down automata; Recursive-descent, LL and LR parsers; Semantic analysis, attribute grammar, type checking, intermediate representation; Runtime environments; Code optimization and code generation.

CS C363 Data Structures and Algorithms 3 2 4

Introduction to software design principles, modularity, abstract data types, data structures and algorithms; Analysis of algorithms; Linear data structures – stacks, arrays, lists, queues and linked representations; Pre-fix, in-fix and post-fix expressions; Recursion; Set operations; Hashing and hash functions; Binary and other trees, traversal algorithms, Huffman codes; Search trees, priority queues, heaps and balanced trees; Sorting techniques; Graphs and digraphs; Algorithmic design techniques; Data structures for external storage, multi-way search and B-trees; Implementation techniques for different data structures including trees, graphs and search structures; Performance evaluation of data structures and algorithms; Implementation issues in large data structures.

CS C372 Operating Systems 3 0 3

Introduction to operating systems; Various approaches to design of operating systems; Overview of hardware support for operating systems; Process management: process synchronization and mutual exclusion, interprocess communication, process scheduling; CPU scheduling approaches; Memory management: paging, segmentation, virtual memory, page replacement algorithms; File systems: design and implementation of file systems; Input/Output systems; device controllers and device drivers; Security and pro-

tection; Case studies on design and implementation of operating system modules.

CS C391 Digital Electronics and Computer Organisation 3 3 4

Number systems and machine representation, Boolean algebra, combinational and sychronous sequential circuits, logic minimisation, programmable logic devices, state table and state diagrams, digital integrated circuits, asynchronous circuits, arithmetic operations and algorithms, introduction to computer organisation and architecture, speed considerations, memory organisation, I/O design, implementation issues. The course will also consist of laboratory practice.

CS C414 Telecommunication Switching Systems and Networks 3 0 3

Intoduction, electromechanical switching, pulse dialing and DTMF dialing, stored program control, space division switching, speech digitization and transmission, time division switching, fundamentals of traffic engineering, telephone networks, signaling, data networks, layered architecture and protocols, LANs, packet switching networks, TCP/IP, ISDN, ATM networks.

CS C415 Data Mining 3 0 3

Data Mining – introduction, fundamental concepts; motivation and applications; role of data warehousing in data mining; challenges and issues in data mining; Knowledge Discovery in Databases (KDD); role of data mining in KDD; algorithms for data mining; tasks like decision-tree construction, finding association rules, sequencing, classification, and clustering; applications of neural networks and machine learning for tasks of classification and clustering.

CS C422 Parallel Computing 3 0 3

Introduction to parallel computing; Models of parallel computers; Interconnection networks, basic communication operations; Introduction to parallel algorithms; Parallel programming paradigms; issues in implementing algorithms on parallel computers; Parallel programming with message passing interface; Performance analysis; Scalability analysis; Basic design techniques for parallel algorithms; Parallel algorithms for selected topics like sorting, searching and merging, matrix algebra, graphs, discrete optimization problems and computational geometry.

CS C424 Software for Embedded System 3 0 3

Real-time and embedded system; software issues in embedded system; software development process; requirements analysis: use Cases, identification and analysis of use cases, use case diagrams; design: architectural design, design patterns and detailed design; implementation: languages, compilers, runtime environments and operating systems for embedded software; testing: methodologies, tests cases.

CS C441 Selected Topics from Computer Science 3

This course is primarily intended to introduce the students of computer science to topics, either in recent advances or of special interest. Topics may be taken from one or more of the areas like artificial intelligence, theory of computing, networking and distributed processing, digital control, information theory, super computers, special purpose architectures and language processors.

The course will be unstructured and operationally polarized depending upon the interests and pursuits of the professional in the discipline. Actual structuring will be announced from time to time.

CS C442 Advanced Algorithms and Complexity 3 0 3

Randomized algorithms (Las Vegas & Monte Carlo); basic tools from probability theory and probabilistic analysis required in algorithmic applications: game theoretic techniques; occupancy problems & tail inequalities; data structures for randomized algorithms: skip list & hash tables; randomized geometric & linear programming algorithms: convex hull, duality

& diameter of a set; randomized graph algorithms: all-pairs shortest paths & minimum spanning trees; optimization problems: simplex algorithm & duality; primal-dual algorithm for shortest paths; NP-Completeness; the Classes P & NP, NP – hard problems, approximation algorithms.

CS C444 Real–Time Systems 3 0 3

Introduction to real-time systems, clock synchronization, task assignment and scheduling, programming language with real-time support, ADA, real-time communication protocols, real-time databases, fault tolerant techniques, reliability evaluation methods; case studies in real-time operating systems, simulation of real-time systems, embedded system programming.

CS C446 Data Storage Technologies and Networks 3 0 3

Storage Media and Technologies – Magnetic, Optical and Semiconductor media, techniques for read/write operations, issues and limitations. Usage and Access – Positioning in the memory hierarchy, Hardware and Software Design for access, Performance issues. Large Storages – Hard Disks, Networked Attached Storage, Scalability issues, Networking issues. Storage Architecture. - Storage Partitioning, Storage System Design, Caching, Legacy Systems. Storage Area Networks – Hardware and Software Components, Storage Clusters/Grids. Storage QoS – Performance, Reliability, and Security issues**.**

CS C451 Combinatorial Mathematics 3 0 3

Advanced theory of permutations and combinations; elementary counting functions; theory of partitions; theorems on choice including Ramsey's theorem; the mobius function; permutation groups; Polya's theorem and Debrauijn's generalisation; graphical enumeration problems.

CS C453 Discrete Mathematical Structures 3 0 3

One or more of the interrelated topics will be covered from the following: graphs, designs, codes, shift register sequences, groups, fields, Boolean algebras, analysis of algorithms, Fast Fourier Transform etc. providing a fertile ground for interaction between mathematics and modern areas of computer science. The selection of the topics will depend upon the circumstance and current interest of faculty.

CS C461 Computer Networks 3 0 3

(Prerequisite: CS C372 Conc.)

Evolution of communication and computer networks, protocol layering, network reference models, multiple access protocols, local area networks, packet and circuit switching, switching fabrics, network performance analysis and simulation techniques; addressing, routing, flow and congestion control, IP protocol; Broadband Integrated Services Digital Network (B-ISDN); Asynchronous Transfer Mode (ATM) reference models; network interoperability, traffic management and quality of service in integrated network protocol design and implementation strategies.

CS C471 Computer Graphics 2 2 3

Generation of dots, lines, arcs and polygons; color graphics, shades and levels; image transformation, windowing and clipping; 2-D and 3-D graphics; data structures, algorithms and optimization methods; case studies using GKS, CORE, etc; graphic languages and compilers.

CS C481 Graphical User Interfaces 3 0 3

Concept of an User Interface; User Interface Management Systems; Interaction Styles; Event-driven programming; graphical user interface components and examples; emphasis will be on programming in GUI environments like MS Windows.

CS C491 Special Projects 3

Course description is same as given under BIO C491.

CS G511 Design and Analysis of Algorithms 3 2 5

Design techniques such as divide-and-conquer, recursion, backtracking, branch-and-bound, simulation; Analysis in terms of average level and worst level efficiency; Relationship to appropriate data structures; Illustrations dealing with problems in computer science, graph theory and mathematics; Computational complexity and bounds; NP-hard and NP-complete problems.

CS G512 Introduction to Authoring Systems 2 2 4

Characteristics and principles of expert systems; construction and transfer of expertise; meta-knowledge; tools and formalisms for expert systems; application through programs in prolog; state of art characteristics and principles of authoring systems; implementation techniques.

CS G513 Network Security 3 1 4

This course examines issues related to network and information security. Topics include security concepts, security attacks and risks, security architectures, security policy management, security mechanisms, cryptography algorithms, security standards, security system interoperation and case studies of the current major security systems.

CS G514 Object Oriented Analysis and Design 2 2 4

Object orientation concepts, theories and principles; fundamental concepts of the object model: classes, objects, methods and messages, encapsulation and inheritance, interface and implementation, reuse and extension of classes, inheritance and polymorphism; process of object-oriented requirements specification, analysis and design; notations for object-oriented analysis and design; case studies and applications using some object oriented programming languages.

CS G515 Queueing Systems Theory 5

Resource sharing issues and theory of queueing systems; Review of Markov chains and baby queueing theory; Method of stages. M/Er/1. Er/M/1. Bulk arrival and bulk service systems. Series-parallel stages. Fundamentals of open and closed queueing networks. Intermediate queueing theory: M/G/1; G/M/m. Collective marks. Advanced queueing theory: G/G/1; Lindley integral equation; spectral solution. Inequalities, bounds, approximations.

CS G521 Object Oriented Programming 2 2 4

Course description is same as given under BITS G512.

CS G531 Testable Design & Fault Tolerant Computing 3 2 5

Fault: types, modelling and simulation; testing methodologies, coverage, economics and quality; test vector generation: design for testability, built-in self tests; fault tolerant computing; fault tolerant software.

CS G541 Pervasive Computing 4*

Select application architectures; hardware aspects; human-machine interfacing; device technology: hardware, operating system issues; software aspects, java; device connectivity issues and protocols; security issues; device management issues and mechanisms; role of web; wap devices and architectures; voice-enabling techniques; PDAs and their operating systems; web application architectures; architectural issues and choices; smart card-based authentication mechanisms; applications; issues and mechanisms in WAP-enabling; access architectures; wearable computing architectures.

CS G551 Advanced Compilation Techniques 5

Generic Code Optimization Techniques - loop optimization, inlining, and other transformations. Impact of architectures on code generation and optimization: RISC architectures, VLIW architectures, special-purpose architectures. Architecture-specific code optimizations – register allocation, instruction scheduling. Code Optimizations under real-time / embedded constraints - cacheless / diskless memory models, bounded time res-

ponses. Garbage Collection Techniques. Virtual Machines and Just-in-Time Compilation techniques - HotSpot-like optimizations. Implementation of exception handling, concurrency, and generic jumps (like call/cc).

CS G553 Reconfigurable Computing 5

Overview of Programmable Logics. FPGA fabric architectures. Logic Elements and Switch Networks. Design and Synthesis of Combinational and Sequential Elements. Placement and Routing. Pipelining and other Design Methodologies. Fine-grained and Coarse-Grained FPGAs. Static and Dynamic Reconfiguration. Partitioning. Hardware/Software Portioning and Partial Evaluation. Systolic Architectures.

CS G554 Distributed Data Systems 3 2 5

Distributed File Systems - File System Models; Replication and Synchronization - Caching; Failure & Recovery; File System Security. Distributed Databases - Distributed Data Sources and Updates; Database Connectivity; Concurrency Control and Distribution mechanism; Distributed indexing schemes. Database security. Data on the Web - Web as a distributed data repository. Data Collection and Use Crawlers, Search Engines, and Indexing Schemes. Information Retrieval Techniques. Data Exchange - Hierarchical Data Models, XML, and query languages. Semi-structured / Unstructured data -querying and synchronization.

Pervasive Data - Data distribution and access for non-computing devices, small computing devices, embedded computing devices and sensory devices.

CS G555 System Specifications & Modelling 3 3 4

Requirement analysis, specification formalisms, system modeling issues, system modeling languages, Hardware Specification and verification languages, EDA tools and its applications.

CS G562 Advanced Architecture and Performance Evaluation 3 2 5

Introduction to advanced architectures; parallel processing; pipelining and vector processing; array processing; SIMD computers and processor enhancement; performance evaluation methods, statistics and discrete math applications; modelling for evaluation of virtual memory; time sharing environments.

CS G611 Distributed Processing Systems 2 2 4

Concepts of distributed processing, networkable architectures, inter process and processor communication algorithms, process migration and porting techniques etc.

CS G612 Fault Tolerant System Design 2 3 5

Principles of fault tolerant systems, redundancy, parallel and shared resources, spatial systems, configurations, design aspects etc.

CS G622 Local Area Networks: Design and Implementation 2 3 5

Introduction to Local Networks; carrier sense networks; shared memory and device systems; protocol and token passing techniques & algorithms; security and integrity problems; algorithms and implementation; and selected current topics.

CS G623 Advanced Operating Systems 3 2 5

Overview of advanced operating systems: motivation for their design, and various types of advanced operating systems; Distributed operating systems: architecture of distributed systems, theoretical foundation of distributed systems, deadlock detection/resolution, aggrement protocols, file systems, distributed shared memory, scheduling, fault tolerance and recovery; Multiprocessor operating systems: multiprocessor system architectures, multiprocessor operating system design issues, thereads, process synchronization, process scheduling and memory management; Data base operating systems: introduction, concurrency control: theoretical and algorithmic aspects; Case Study: Amoeba and Mach.

CS G631 Devices, Data Communications and Control 2 3 5

Principles of operations of I/O devices; device handlers; master- slave control & controllers; Intelligent mode of operation; device handlers; most popular data communication methods; synchronisation and handshaking; design of controllers for selected devices.

CS G632 Application Driven System Design 0 4 4

General principles of application driven systems, examples from space and high speed digital imaging systems, Bandwidth considerations, design aspects etc.

CS G641 Microprocessor-Based Systems Design 2 3 5

Small systems organisation; bus architectures; building blocks around a microprocessor; memory techniques; RAM disks; paged memory modules; communications and data transfers; monitors and operating systems; engineering applications of microprocessors as device controllers; concept of local and central control.

CS G642 Recent Advances in Computing 2 2 4

Introduction to transputing and transputers, minimization algorithms, design aspects. Neural networks modelling, simulation and design. Optical computing and recent advances.

CS G651 Symbolic Computing & Computer Algebra 2 2 4

Course description of above course is to be developed.

CS G652 Digital Communications and Message Switching 3 2 5

Signals & transmission types; noise; coding & decoding; modulation techniques; filters; time and frequency multiplexing; message switching; protocols; packet switching systems; remote networks; satellite linking communications.

CS G653 Software Architectures 3 2 5

Systems engineering and software architectures; Hatley-Pirbhai architectural template; architecture flow diagrams; requirements engineering and software architecture; architectural design processes; design post-processing; real-time architectures; architectural design patterns; software architecture and maintenance management; object oriented architectures; client-server architectures; forward engineering for object oriented and client-server architectures; emerging software architectures.

CS G671 Advanced Computer Graphics 3 2 5

Overview of computer graphics and graphic devices; two dimensional & three dimensional curve representations, rotations and transformations; surfaces, generation, representation, rotation and transformations; modelling techniques; concepts in geometric design.

Design Engineering

DE G511 Advanced Methods in Applied A Mathematics **5**

Suitable topics from amongst the following: linear algebra; vector analysis; numerical methods to solve different types of equations; approximate numerical solutions of ordinary and partial differential equations; integral transform; linear and nonlinear optimization techniques; mathematical programming; mathematical modelling; calculus of variations; random variates and statistical techniques; decision models and analysis.

DE G512 Finite Element Analysis **5**

Element properties, Isoparametric elements, Finite element methods and analysis, Applications in design including continuum mechanics, Dynamic systems, Heat conduction and Electrical potentials, etc. will be taken up.

DE G513 Tribiology **5**

Introduction, lubricants and lubrication, surface texture, bearing materials, fundamentals of viscous flow, reynolds equation and applications, thrust bearings, journal bearings, squeeze-film bearings, hydrostatic bearings, gas bearings, dry and starved bearings, selecting bearing type and size, principles and operating limits, friction, wear and lubrication.

DE G514 Fracture Mechanics **5**

Introduction, energy release rate, stress intensity factor and complex cases, anelastic deformation at the crack tip, elastic plastic analysis through J-integral, crack tip opening displacement, test methods, fatigue failure, numerical analysis, mixed mode crack initiation and growth.

DE G521 Instrumentation and Applied Electronics **5**

Generalized instrumentation system for measurement and control; performance characteristics of instruments; analytical techniques - time and frequency domain analysis, Laplace and Fourier transform techniques; sensors and transducers; Feedback measurement system, ynalmg and digital signal conditioning and conversion techniques, telemetry techniques, improvement of signal-to-noise ratio, statistical instrumentation techniques; transducers interfacing; computer control instrumentation, electronic bench instruments, etc.

DE G522 Design Projects **5**

Practice in engineering design through projects emphasizing creative solutions to engineering design problem. Illustrative case studies of design will be taken up. The course will be conducted through selected group/individual projects.

DE G531 Product Design **5**

Introduction to creative design; user research and requirements analysis, product specifications, Computer Aided Design; standardization, variety reduction, preferred numbers and other techniques; modular design; design economics, cost analysis, cost reduction and value analysis techniques, design for production; human factors in design: anthropometric, ergonomic, psychological, physiological considerations in design decision making; legal factors, engineering ethics and society.

DE G532 Quality Assurance & Reliability **5**

Quality planning and control, economics of quality control, Specifications, tolerances and process capability studies, total quality control concepts in quality circles, quality incentives. Fundamental concepts of reliability engineering, Failure analysis, Reliability versus quality control, Systems reliability evaluation, reliability allocation, maintainability, and designing for reliability. Illustrative examples of design ensuring reliability to be taken up.

DE G611 Dynamics & Vibrations **5**

Steady and transient Vibration of single and multi degree freedom systems. Systems with distributed mass and elasticity. Non-linear and self-excited vibrations, structural damping,

Random vibrations, vibration analysis, vibra-

tion control - reduction, isolation and vibration absorbers.

DE G621 Digital & Microprocessor Based Systems 5

Digital system design using combinational and sequential circuits; processor architecture, assembly programming and system design using peripheral devices such as PPI, Interrupt controller, DMA controller, etc. Microcontroller architecture and typical applications; concept of bus based system design and PC based system design.

DE G631 Materials Technology & Testing 5

Study of characteristics and technology of metals, plastics, rubbers, ceramics, polymers, composites, optical fibres and other modern engineering materials and their application with particular reference to Railways. Destructive and non-destructive testing techniques and their applications in Railways.

Emerging Area

EA C342 Computer Aided Design 3*

Computer Aided Drafting and tools for graphics; mathematical tools; convergence criteria; design tools like modelling, simulation, spread sheets and use of specialised packages etc.; students will be required to do projects, specialised works for which a pool of guides will be drawn from several disciplines.

EA C412 Flexible Manufacturing Systems 3 2 4

Introduction CAD/CAM systems, overview of FMS, system hardware and general functions, material handling system, work holding systems, cutting tools and tool management, physical planning of system, software structure functions and description, cleaning and automated inspection, communications and computer networks for manufacturing, quantification of flexibility, human factors in manufacturing, FMS and CIM in action (case studies), justification of FMS, modelling for design, planning and operation of FMS.

EA C413 Intelligent Manufacturing Systems 3 0 3

Introduction of manufacturing systems and intelligent manufacturing systems, intelligent systems architecture: design techniques, knowledge-based systems, artificial neural networks, fuzzy systems, genetic algorithms in process planning, scheduling, fault diagnosis, automated assembly, manufacturing feature identification, visionbased inspection, process monitoring & control.

EA C414 Introduction to Bioinformatics 3 0 3

Course description is same as given under BIO C412.

EA C415 Introduction to MEMS 4*

Overview, history and industry perspective; working principles; mechanics and dynamics, thermofluid engineering; scaling law; microactuators, microsensors and microelectromechanical systems; microsystem design, modeling and simulation; materials; packaging; microfabrication: bulk, surface, LIGA etc; micromanufacturing; microfludidics; microrobotics; case studies.

EA C416 Introduction to Nanoscience 3 0 3

Introduction; nanoscience in nature; fundamental science behind nanomaterials; synthesis and properties of nanomaterials; tools to study the properties, size and shape determinations, application of nanomaterials in science, engineering and biomedical field; future trends.

EA C422 Fibre Optics and Optoelectronics 3*

Theory of optical fibres; image transmission by fibres; technology of fibre production; fibre testing; characterization of optical fibres; detectors and sources for fibre optic systems; active fibres; applications of optical fibres; optoelectronic devices and applications.

EA C441 Robotics 3*

The objective of this course is to make the students familiar with Robotics, the main components of kinematics, sensors, transmission and drives, control systems, intelligence

and vision, geometric modelling and reasoning, assembly planning, grasping, collision avoidance, mobile robots, force strategies, uncertainty analysis, and representation of visual world.

EA C442 Remote Sensing and Image Processing 3*

Introduction to remote sensing; types of sensors; earth resource sensors; Landsat; IRS; SPOT; microwave remote sensing; SAR; SLAR; thermal infrared remote sensing; data analysis; image processing; smoothing; filtering; image averaging; enhancement techniques; transforms; FFT; PCA; segmentation; gradient operators; pattern recognition; ML classifier; minimum distance classifier; other classifiers; ISODATA clustering; feature selection; divergence; canonical analysis; recent developments in remote sensing; LIDAR; imaging spectroscopy etc.

EA C443 Image Processing 3 0 3

Introduction to Image Processing and Imaging systems, Image sampling, Transforms, Enhancement and Restoration, Coding and Communications, Image Compression, Image understanding, Neural network and PR Approaches.

EA C451 Internetworking Technologies 3 0 3

Introduction to internetworking concepts; the internet architecture; goals and key issues related to internetworking technologies; design aspects; HTTP and other relevant protocols; agent technology and tools relevant to the internet; techniques of data compression; voice, video, and interactive video-on-demand over the internet; multimedia operating systems and their impact; multimedia networking; mobile computing; internet security; case studies.

EA C452 Mobile Telecommunication Networks 3 0 3

Fundamentals of mobile telecommunications, with an overview of first generation (analog) systems and more detailed coverage of second generation (digital) technologies; technology basics including descriptions of wireless network elements, spectrum allocation, frequency re-use, characteristics of the transmission medium; over the-air (OTA) interface characteristics; capacity, coverage, speech coding, channel coding and modulation techniques of TDMA and CDMA technologies; network characteristics; architecture, signaling, element management of IS-41 and GSM networks; call processing; call setup and release, handoff, roaming, advanced services; mobile data communications; circuit and packet switched data services, third generation (wideband data) mobile communications system requirements/architecture.

EA C461 Artificial Intelligence 3*

The object of this course is to give an introduction to the problems and techniques of A.I. along with the applications of A.I. techniques to the fields like natural language understanding, image processing, game theory and problem solving. The course also aims at understanding its implementation using LISP and PROLOG languages.

EA C462 Superconductivity Theory and Applications 3 0 3

Phenomenological theory involving concepts of critical temperature, critical current; Meissner effect, London equation, GL theory, BCS theory, superconductors in magnetic field, high Tc superconductors, Josephson junction; superconducting devices SQUIDS, uses in biomagnetic fields, Josephson arrays for submillimeter source; LSI technology and circuits.

EA C463 Neural Networks and Applications 3 0 3

Introduction to neural networks and fuzzy systems' neural dynamics; activations and signals; activation models; unsupervised and suprvised learning rules and their domain of applications; architectures of neural systems; adaptive fuzzy and neural control systems

and their comparison; case studies on fuzzy and neural control systems.

EA C471 Pattern Recognition 3*

The object of this course is to study the principles and available techniques for the analysis and design of pattern recognition system, introduction to pattern classification by distance functions, and likelihood functions, trainable pattern classifiers: deterministic and statistical approach.

EA C472 Photovoltaic Devices 3 0 3

Introduction to photovoltaic energy conversion: physics of semiconductors, p-n junction band diagram, fermi energy, surface states and types of defects; photovoltaic solar cells; p-n junction, metal - schottky junction, electrolyte - semiconductor junction, and other types of photovoltaic devices; characterisations of solar cells and photovoltaic modules, and applications in various systems: storage battery, DC drives, water pumps, space applications and power plants.

EA C473 Multimedia Computing 3 0 3

Introduction to multimedia; media & data streams; image, video & audio file formats; image & video processing, synthesis of sound signal; image coding & compression, video & audio codecs, low bit rate video telephony; audio-visual integration, lip reading, face animation; augmented reality; multimedia search services, content based image & video indexing; access to multimedia, human-machine interfaces, spoken language interface; algorithm vs. architecture based approaches, multimedia processors, performance quantification; case studies, vision 2010.

EA C474 Retail Management Systems 3 0 3

Retailing history and theories, basic retail management process, retail industry in Indian and abroad, shopper behavior in retailing, retailing formats and location related issues, category management, supply chain management in retail, retail buying, store layout and design, point of purchase communication, retail pricing strategy, building store loyalty and technology in retailing. Case studies and projects in retailing, specially focusing on Indian scenarios.

EA C475 Financial Engineering 3 0 3

Introduction; Review of Markets, Players, and Conventions; Cash Flow Engineering with Forward Contracts; Engineering Simple Interest Rate Derivatives; Swap Engineering; Report Market Strategies; Dynamic Replication Methods and Synthetics; Mechanics of Options; Options Engineering with Applications; Pricing Tools; Applications of Fundamental Theorem of Finance; Fixed Income Engineering; Tools for Volatility Engineering: Volatility Swaps and Volatility Trading; Engineering of Equity Instruments: Pricing and Replication, computational methods such as Monte Carlo Simulation.

EA C476 Power Apparatus & Networks 3 2 4

Essential fundamentals of power networks: overview of power systems and changing landscape; sources of electrical energy and environmental consequences; the Indian power industry; fundamental principles of power networks; magnetic prerequisites. Apparatus in power networks: transformers; synchronous generators; transmission lines, cables, HVDC; loads and power quality. Analysis and operation: power flow; rotor angle and voltage stability; control of large interconnected power networks. Protection: fault calculations, relay co-ordination and circuit breakers; transient overvoltages, protection by surge arrestors, and insulation coordination. Management of vertical utilities, utility deregulation and open access: operational economics of the power industry, privatization; deregulation and energy markets.

EA C477 Foundations of Nanomechanics 3 0 3

Introduction to nano-mechanics; mechanics at molecular level; stress, strain and elastic relations; system equations for a static deformable solid; dynamic behavior at molecule level ; equation of motion in an isotropic solid; Micro cantilever, General components of na-

no-mechanics device; high resolution force spectroscopy; measuring intermolecular adhesion, lateral force microscopy, experimental nanostructures; nano tribology; adhesion and stiction; nano-magneto-rhehology; nanoindentation.

EA C481 Expert Systems 3*

The object of this course is to study in details the features of expert systems and their role in the scientific world of today and tomorrow. It concentrates on the tools available to the knowledge engineer, expert systems, building techniques, and the difficulties which may be encountered during the development of an expert system.

EA C482 Fuzzy Logic and Applications 3 0 3

Fuzzy sets, fuzzy binary relations; fuzzy logic, fuzzy reasoning; applications in decision making, control theory, expert systems, artificial intelligence etc.

Electronics and Communication Engineering

ECE C272 Circuits and Signals 3 0 3

Course description is same as given under EEE C272.

ECE C313 Microelectronic Circuits 3 0 3

Course description is same as given under EEE C424.

ECE C364 Analog Electronics 3 3 4

Course description is same as given under EEE C364.

ECE C383 Communication Systems 3 3 4

Course description is same as given under EEE C383.

ECE C391 Digital Electronics and Computer Organization 3 3 4

Course description is same as given under EEE C391.

ECE C392 Modern Communication Technologies 3 0 3

Modern communication systems overview, Digital modulation techniques, Channel capacity and coding, Digital link improve techniques, Digital receiver design and performance analysis, Wireless communication systems: wireless channel models and link improvement techniques, multiple access schemes. Basic concept of mobile network, Optical Communication Systems: Transmitters, receivers and other optical Communication subsystem, Optical wireless systems.

ECE C393 Information Theory & Coding 3 0 3

Random variables and random processes; Information sources and source coding theorem, Kraft inequality, Shannon-Fano codes, Huffman codes, Arithmatic Codes, Lempel-Ziv-Welch algorithm, universal source codes; channel capacity: channel capacity; noisy channel coding theorem for discrete memoryless channels; channel capacity with feedback; continuous and Gaussian channels; error control coding: linear block codes and their properties, hard-decision decoding, convolution codes and the Viterbi decoding algorithm, iterative decoding; turbo codes and lowdensity-parity-check codes; rate distortion theory: rate distortion function, random source codes; joint source-channel coding and the separation theorem; cryptography: basic concepts on cryptography and cryptoanalysis, security issues; private-key encryption algorithms- stream ciphers, block ciphers, Shannon's theory; introduction to number theory - modular arithmetic, exponentiation and discrete logarithms in Galois field; public-key encryption algorithms- Diffie-Hellman public-key distribution scheme, RSA public-key cryptosystem; Message authentication, hashing functions, digital signatures.

ECE C394 Communication Networks 3 0 3

Packet switching and circuit switching; layered network architecture (OSI model), point-to-point protocols and links: physical layer, error detection and correction, ARQ retransmission strategy, framing, X.25 standard,

queueing theory and delay analysis: Little's theorem, analytical treatment of M/M/1 and M/M/m queuing systems, simulation of queueing systems, delay analysis for ARQ system, multi-access protocols and techniques: Aloha systems, CSMA, IEEE-802 standards, routing and flow control. TCP/ IP protocols, ISDN, ATM, network security, design of a LAN system with commercially available functional units. Wireless LAN: adhoc network, security issues

ECE C452 Electromagnetic Fields & Microwave Engineering 3 0 3

Course description is same as given under EEE C452.

ECE C491 Special Projects 3

Course description is same as given under BIO C491.

Economics

ECON C211 Fundamentals of Finance and Accounting 3 0 3

This course is a broad introduction to finance and related areas. An introduction to basic accounting principles for measuring and communicating financial data about a business enterprise to external parties, single and double entry, ledgers, journal, trading, profit and loss and appropriation accounts, trial balance and balance sheet; cash flow statements; capital budgeting and risk management using risk return trade-off notions; introduction to working capital management; structure of capital market; primary and secondary markets; financial market reforms, source of investment information; portfolio selection.

ECON C212 Principles of Economics 3 0 3

Nature and scope of economic science, its relationship with other social sciences; quantification of economic variables, theories of consumer behaviour and of the firm: linear economic models; market structures; social accounting and basic elements of economic planning.

ECON C311 Microeconomics 3 0 3

Consumer behaviour under risk; production functions and linear programming applications; derivation of cost and supply functions; commodity pricing under imperfect markets; factor pricing; multimarket equilibrium; optimization over time; welfare optimization.

ECON C321 Macroeconomics 3 0 3

Systems of national accounts; input-output system; flow of funds system; monetary circulation and exchange; basic model of income determination; classical model; obstacles to full employment; Keynes' model, derivation of IS and LM functions; three sector model; four sector model; inflation and Philips curve.

ECON C322 Public Finance: Theory and Practice 3 0 3

Theories of taxation; the effects of taxation on consumption, production and distribution; theories of public expenditure; effects of public expenditure on the economy; deficit-financing; the economics of public debt; federal finance system in India; role of fiscal policy in India.

ECON C341 Economic Growth and Planning 3 0 3

Economic growth and development; models of economic growth: Harrod-Domar, Solow-Swan, the neoclassical model of growth, the Fel'dman model, Cambridge models, models of technical progress; the problem of economic development; the theories of economic development: the classical model, Rostow stages theory, balanced and unbalanced growth, the Lewis theory, dualistic models; the physical quality of life and human development indexes; economic planning; strategies of planning; planning in India; plan models: Mahalanobis model, long-term planning models, multi-sectoral models.

ECON C342 Econometrics 3 0 3

Specification of models; estimation of single equation economic models and related problems; autocorrelation; heteroscedasticity; multi-collinearity; interpretation; forecast-

ing and verification; estimation methods and problems in simultaneous equation systems.

ECON C362 Money, Banking and Financial Markets 3 0 3

Money and its functions; money markets; foreign exchange markets; financial markets; financial derivatives; the banking firm; non-banking financial institutions; Indian banking; monetary transmission mechanisms; money and inflation; theory of rational expectations; central banking: determinants of the money supply; tools, goals and targets of monetary policy; international monetary and financial system.

ECON C372 International Trade and Balance of Payments 3 0 3

The international economy; early trade theories; comparative advantage model; neo-classical trade theories: gains from trade, offer curves, terms of trade; edgeworth box, factor endowments and the Heckscher-Ohlin model; alternative models of trade and intra-industry trade: the imitation-lag hypothesis; product cycle theory; international trade and economic growth; international factor movements; foreign direct investment and multinational corporations; protection; economic integration; GATT & WTO; the balance of payments accounts; balance of payments equilibrium; economic policy in the open economy.

ECON C411 Project Appraisal 3 0 3

Prerequisite: ECON C212

Criteria for selection of a project; factor intensity; commercial profitability; national economic-profitability; limitations of market prices; estimation of shadow prices; linkup project appraisal to national objectives; McGaughey and Thorbeck approach; Little-Mirrlees method; UNIDO guidelines approach; limitations of the conventional project appraisal; towards a new framework for project appraisal.

ECON C412 Security Analysis and Portfolio Management 3 0 3

Course description is same as given under CDP C313.

ECON C421 Issues in Indian Economy 3 0 3

Problems of Indian agriculture; land reforms; input management; pricing of agricultural output; rural infrastructure; rural credit and commercial banking; underemployment and rural-urban migration; agriculture v/s industry; small scale v/s large scale; public sector v/s private sector; joint sector; size of the plan and budgetary resources; inflation and income growth; taxation and black money; sharing of resources between centre and states; regulations and black market; import substitutions and export promotion; expansion of money supply and monetary controls.

ECON C422 Functions & Working of Stock Exchanges 3 0 3

Course description is same as given under CDP C323.

ECON C431 Regional Economics 3 0 3

Concept of a region; scope and method of regional economics; criteria for location of economic activities; regional economic structure; measurement of regional economic activity; interregional theory of income and trade; regional economic growth and its impact on regional structure; public policy.

ECON C436 Strategic Financial Management 3 0 3

(Pre-requisite: ECON C481= FIN C342= MGTS C382 Financial Management or MBA C416 Corporate Finance and Taxation)

Company Value and the Manager's Mission: Introduction to Valuation, Why Value Value? The Value Manager, Cash Is King and Value-Based Management. Approach to Valuation - A Practitioner's Guide: Frameworks for Valuation. Valuation Methods: Discounted, Relative and Contingent Claim. Analyzing Historical Performance. Forecasting Performance.

Estimation of Discount Rates. Estimation of Cash Flows. Estimation of Growth Rates. Valuation Models: Dividend-Discount Models, Free-Cash-Flow-To-Equity Discount Models, Free-Cash-Flow-to-firm Approach, Price/Earning Ratio, Price/Book Value Ratio and Price/Sales Ratio. Measuring and Managing the Company Value: Company Value vs. Shareholders Wealth Maximization - TSR. Economic Value Added, Market Value Added and Cash Value Added. Wealth Creator by the Indian Corporates. Analyzing the Company Performance - Application of Balanced Scorecard (BSC). Applying Valuation: Multibusiness Valuation. Mergers, Acquisition , and Joint Ventures.

ECON C451 Technology Forecasting 3 0 3

Importance of technology forecasting (TF) as a useful tool in planning and decision making in management, economic planning and planning of R&D; TF techniques like Delphi, extrapolation, normative techniques, morphological analysis, correlation methods and modelling techniques; applications in decision making; development planning and business.

ECON C461 Analysis of Indian Economy 3 0 3

The course attempts to analyse, based on statistical data, different significant aspect of the Indian economy. Among the topics to be covered are: agriculture, population; infrastructure; public sector; industries; administrative price policy & subsidies, external aid; public debt; etc.

ECON C471 Resources and Environmental Economics 3 0 3

This course is intended as a response to the recent explosion of interest in resource and environmental issues. Among the topics to be covered are: exhaustible resources; renewable resources; resource scarcity; natural environment; pollution; environmental control and regulation; etc.

ECON C481 Financial Management 3 0 3

Concepts and techniques of financial management decision; concepts in valuation - time value of money; valuation of a firm's stock, capital asset pricing model; investment in assets and required returns; risk analysis; financing and dividend policies, capital structure decision; working capital management, management of cash, management of accounts receivable; inventory management, short and intermediate term financing, long term financial tools of financial analysis, financial ratio analysis, funds analysis and financial forecasting, operating and financial leverages.

ECON C491 Special Projects 3

Course description is same as given under BIO C491.

ECON G511 Dynamic Modelling and Control of National Economies 5

ECON G521 Modern Cost Engineering 5

Course description for the above courses are to be developed.

ECON G531 Theory of Macroeconomic Policy 5

This course focuses on macroeconomic policy as the major application of the theoretical material and also considers the implications of macroeconomic events for asset price determination, management, decisions, social problems and personal employment and retirement planning. Topics to be covered are: the foundations of aggregate supply and demand: use of AD-AS model; the busines cycle; applications in the areas of asset market, management decisions, social problems, etc.

ECON G541 Economic Systems Analysis 5

Course description to be developed.

Electrical and Electronics Engineering

EEE C272 Circuits and Signals 3 0 3

Two port parameters; passive network synthesis; modern filter theory; active RC filters; representation of deterministic signals; fourier

integral; modulation; sampling; convolution; correlation; DFT & FFT; Z transform; network realization; direct form I & II; cascaded form; parallel form; digital filter design; IIR; FIR & window functions; bilinear transformation; signal coding algorithms; digital signal processors.

EEE C364 Analog Electronics 3 3 4

This course deals with the introduction and applications of various analog and mixed signal ICs. It includes discrete and IC amplifier basics; low and high frequency amplifiers; linear and non linear Op-amp circuits; non linear ICs; precision circuits; comparators; Schmitt triggers; non-sinusoidal and sinusoidal waveform generators; phase-locked-loops; analog switches; IC power amplifiers; RF/IF amplifiers; switched capacitor circuits; data converters; IC sensors and systems. Laboratory and computer simulation experiments in analysis, design and characterization of electronic circuits also form part of the course.

EEE C371 Electromechanical Energy Conversion 3 3 4

Theory; performance; testing; applications and control of d.c. machines; induction machines; synchronous machines and transformers; experiments on testing and control of machines and transformers; fractional hp motors; miniature motors.

EEE C374 Power Systems 3 0 3

Transmission line parameters and calculations, circle diagram; Incidence and network matrices, algorithm for network matrices, load flow studies; optimum generating strategies; load frequency control; insulators, cables; corona. Power system protection-generators, transformers and lines.

EEE C381 Electronic Devices & Integrated Circuits 3 0 3

Single pn junction devices - rectifier diodes, switching diodes, zener diodes, varactor diodes, UJTs, LEDs, etc; bipolar junction transistors - current gain mechanism, high frequency and switching behaviour; pnpn devices; JFET; MOSFET; other MOS & CMOS devices; optoelectronic devices; device fabrication techniques; introduction to ICs; microwave semiconductor devices.

EEE C383 Communication Systems 3 3 4

Principles of modern analog and digital communication with more emphasis on digital communication. Amplitude and angle modulation, sampling, PCM, DM, ADPCM, pulse shaping, digital modulation: FSK, PSK, DPSK, QPSK etc.; information theory, source coding & channel coding, Shannon capacity theorems; emerging trends in communication systems. Experiments in analog and digital communication.

EEE C391 Digital Electronics and Computer Organization 3 3 4

Course description is same as given under CS C391.

EEE C414 Telecommunication Switching Systems and Networks 3 0 3

Course description is same as given under CS C414.

EEE C415 Digital Signal Processing 3 0 3

Introduction; design of analog filters; design of digital filters (IIR and FIR); structures for the realization of digital filters; random signals and random processes; linear estimation and prediction; Wiener filters; DSP processor architecture; DSP algorithms for different applications.

EEE C416 Digital Communication 3 0 3

Introduction, the modeling and characterization of information sources, algorithms for source coding and encoding of analog output sources; Information transmission through AWGN channels using digital modulation methods and BER estimation; Digital communication through band limited Gaussian noise channels; channel coding and decoding; Wireless communication channels: its characterization and modulation schemes for such channels; emerging trends in the above field.

EEE C417 Computer Based Control Systems **3 0 3**

Prerequisite: AAOC C321 and CS C391 or EEE C391 or INSTR C391

Introduction to process control and Computer based control, elements of computer based control loop, digital sensors and their applications, field buses and specifications, types of digital and intelligent controllers, types of industrial control valves and their selections, PID vs Fuzzy and Neural Techniques of control, programmable logic controllers, SCADA and its applications, distributed control systems comparison between PLC, DCS, Fuzzy. ANN, industrial network hierarchy, industrial standards for networking, application of PLC in power system and process industries.

EEE C422 Modern Control Systems **3 0 3**

State variable characterisation of linear continuous - time and discrete - time systems, controllability, observability, stability; sampled data systems; Z transforms; non-linear systems; phase plane and describing function methods; calculus of variations; optimal control.

EEE C423 Combinatorial Mathematics **3 0 3**

Course description is same as given under CS C451.

EEE C424 Microelectronic Circuits **3 0 3**

Basic single and two transistor amplifier configurations; current mirrors & current sources; active loads; biasing in discrete and integrated circuit amplifiers; voltage sources and voltage references; differential and multistage amplifiers; frequency response of amplifiers; frequency compensation; output stages and power amplifiers; filters and tuned amplifiers; signal sources and communication circuits etc, illustrative example of analog integrated circuits. The course will emphasize MOS/CMOS and bipolar transistor circuits. Computer simulation exercises using SPICE and other software packages will be prescribed.

EEE C432 Medical Instrumentation **3 0 3**

Basic components of bio-medical instruments, bio-electric signals & recording electrodes, transducers, recording and display devices. Patient care and monitoring systems, cardiovascular measurements-blood pressure, blood flow, cardiac output, heart sounds etc.; instrumentation for respiratory and nervous systems, analysis of EEG, ECG, EMG, EOG and action potentials, non- invasive diagnostic measurements - temperature, ultrasonic diagnosis, CAT scan techniques, sensory measurements-motor response, analysis of behaviour etc. biotelemetry, biofeedback, clinical laboratory instruments, X-ray diagnosis. Recent advances in biomedical instrumentation- microprocessor based systems, lasers & optical fiber based systems.

EEE C433 Electromagnetic Fields and Waves **3 0 3**

Maxwell's equations; application of circuit theory and field theory; Maxwell's equations in free space and time varying fields; plane waves in dielectric and conducting media; solution of wave equations; the poynting vector; the poynting theorem; poynting vector in conducting media and circuit application; wave polarization; linear, elliptical and circular polarization; wave reflection, refraction and diffraction; transmission lines and resonators; Smith chart, and its applications in stub matching and impedance matching; discontinuties; antennas and radiation; halfwave dipole antenna; loop antenna; helical antenna; directive arrays; frequency independent antennas; reflector and lens antennas; horn antennas; antenna arrays; Friis formula; antenna practices and antenna measurements.

EEE C441 Television Engineering **3 0 3**

Monochrome TV-nature of the composite video signal; camera tubes, generation of special waveforms, transmitters, antenna, receivers, picture tubes, receiving antenna elements of colour TV and industrial TV.

EEE C443 Analog & Digital VLSI Design **3 0 3**

Prerequisite: EEE C381

Physics and models of MOS transistors; basic IC building blocks; MOS operational amplifiers; Analog system design applications; Digital circuits - MOS & CMOS inverters, logic gates, PLA and storage circuits, etc.. Introduction to analog and digital VLSI design; CAD for IC design and CAD applications in circuit simulation and layout generation.

EEE C444 Real–Time Systems 3 0 3

Course description is same as given under CS C444.

EEE C452 Electromagnetic Fields & Microwave Engineering 3 0 3

Electromagnetic waves; Maxwell's equations; Poynting theorem and wave equations; propagation of EM waves; transmission lines; microstrip lines; wave guides; cavities and antennas; microwave generators, microwave amplifiers; measurement at microwave frequencies.

EEE C453 Discrete Mathematical Structures 3 0 3

Course description is same as given under CS C453.

EEE C461 Power Electronics 3 0 3

PNPN devices, power transistor characteristics, rating and specifications; triggering mechanism and commutation circuits; controlled power rectifiers, Inverters (DC to AC converters), choppers (DC to DC Converters); speed control of DC motors, speed control of AC motors; other industrial applications of thyristors and power transistors; voltage regulation and starting of electrical drives; logic modules for static converters; introduction to application of microprocessors for electrical drives.

EEE C462 Advanced Power Systems 3 0 3

Prerequisite: EEE C371 or INSTR C371

Symmetrical components, sequence impedances; fault calculations; short circuit studies; circuit breakers and their selections; power system stability, power system protection--generators, transformers and lines; waves on transmission lines, protective devices -- grounded and ungrounded systems.

EEE C471 Electronic Measurements and Instrumentation 3 0 3

Elements of electronic measurement and instrumentation; signal sources; voltage and current measuring instruments; waveform analysis instruments; display and recording instruments; device testers, DC power supplies and IC regulators; bridge instruments; basic digital instruments, industrial electronic practices.

EEE C472 Satellite Communication 3 0 3

Review of microwave communications and LOS systems; the various satellite orbits like GEO, MEO, LEO; the satellite link analysis and design; the communication transponder system like INSAT, INELSAT etc; the earth segment and earth station engineering; the transmission of analog and digital signals through satellite and various modulation techniques employed; the multiple access techniques like FDMA, TDMA, CDMA, DAMA, etc; the INSAT program; salient features of INSAT – systems and services offered; satellite services offered by INTELSAT, INMARSAT and future satellites like IRIDIUM etc; future trends in satellite communications.

EEE C491 Special Projects 3

Course description is same as given under BIO C491.

EEE G510 RF Microelectronics 5

Introduction; application of RF electronics in modern systems; basic concepts in RF circuit design, active RF components: various RF diodes and transistors and their circuit models, matching and biasing networks, RF amplifier design: low power, low noise and broadband amplifiers, RF oscillator design; negative resistance oscillator; dielectric resonator oscillators, phase noise. RF Mixers: Balanced mixers; low noise mixers; noise in RF circuits, microwave transmitters and receivers.

EEE G511 Integrated Electronics 3 2 5

Review of basic semiconductor devices and ICs, fabrication and design of integrated circuits, comparison of current bipolar and MOS technologies, VLSI design methodology and layout examples, etc. The main objective of this course is to enable the students to keep pace with the rapidly changing semiconductor technology.

EEE G512 Embedded System Design 3 1 4

Introduction to embedded systems; embedded architectures: Architectures and programming of microcontrollers and DSPs. Embedded applications and technologies; power issues in system design; introduction to software and hardware co-design.

EEE G520 Wireless and Mobile Communication 3 2 5

Signal propagation in a mobile environment, modulation, coding, equalization; first generation generation systems; multiple access techniques like FDMA, TDMA, CDMA, spread spectrum systems; second & third generation systems, UMTS, IMT-2000; Wireless LAN, Wireless ATM and Mobile IP; emerging trends in Wireless & Mobile Communication.

EEE G521 Optoelectronic Devices, Circuits & Systems 3 2 5

Physics of optical radiation and principles of calculation in radiation physics & optics, fundamental laws of photometry. Interaction between optical radiation and matter. Radiation sources. Parameters of IR detectors and junction photodetectors, parameters common to emitters and receiver, radiation measurements, optoelectronic components, optoelectronic integrated devices, photodetector circuits, methods of modulation and optoelectronic system design and applications.

EEE G531 Testable Design and Fault Tolerant Computing 3 2 5

Course description is same as given under CS G531.

EEE G541 Distribution Apparatus and Configurations 3 2 5

Basic configuration of a distribution set-up at the consumer end. Transformer types, specifications, performance, protection, and sizing. Types of cables and insulation, cable parameters, ampacity and protection. Ratings of LV switchgear and their use in selection, switching transients and clearing time. Properties of fuses with reference to ampacity. Meters, instrument transformers, and their application. Voltage control at distribution levels. Elementary concepts of power quality: power factor, frequency, and harmonic content.

EEE G542 Power Electronic Converters 3 2 5

The importance of the converter as an interface between source and load. DC-DC converters: Buck, boost, and buck-boost configurations. AC-DC converters: Diode and thyristor converters in single and three phase. Inversion in thyristorised converters and applications of line commutated inverters. DC-AC converters: Switch mode voltage source inverters in single and three phase, PWM operation of different types, VSI's operating in multi-levels, space vector modulation techniques. AC-AC converters: Thyristor fed AC loads, the cycloconverter. Matrix converter arrays and their operation as DC-DC and DC-AC converters.

EEE G543 Power Device Microelectronics and Selection 3 0 3

Thermal features of power device packaging, the issues of $R_{\theta JC}$ and $R_{\theta CS}$, heat flow and effect on device temperature, heat sink design and selection. The two-layer junction behaviour, the concept of drift region, characterisation of power diodes. The base operation in a thick film BJT, steady state characteristics, turn ON and turn OFF times, the multistage power Darlington. The four-layer junction behaviour, two transistor model of a thyristor, dynamic model for a four layer junction device. GTO thyristors, the turn OFF mechanism in four layer junction

devices, current technological problems. MOS operation and characteristics, characterisation and structure of the power MOSFET. Development of the MOSFET to IGBT, technological advantages, characterisation, and dynamic behaviour. Current technological problems in insulated gate technologies. Introduction to matrix converters.

EEE G544 Steady State and Dynamics of Electric Motors 3 2 5

Direct current machines, dynamic characteristics of PM and shunt DC motors. The Reference Frame theory, balanced steady state phasor relations and voltage equations. Symmetrical induction machines: commonly used reference frames and per-unit system, analysis of steady state and dynamic operation and free acceleration characteristics from different reference frames. Synchronous machines: equations in different reference frames, per-unit system, steady state analysis, dynamic analysis for load changes and faults. Brushless DC machines: voltage and torque equations in machine variables, and rotor reference frame variables, analysis of steady state and dynamic performance. Operational impedances and time constants for synchronous machines. Linearised machine equations, and reduced order machine equations. Symmetrical and asymmetrical two-phase induction machines: conversion to stationary reference frame, analysis of steady state operation of the asymmetrical machine, single phase induction machine.

EEE G545 Control and Instrumentation for Power Electronic Systems 3 0 3

The regulation and control problem with reference to power electronic converters. Converter models for feedback: basic converter dynamics, fast switching, piece-wise linear models, discrete-time models. Voltage mode and current mode controls for DC-DC converters, comparator based control for rectifier systems, proportional and proportional-integral control applications. Control design based on linearisation: transfer functions, compensation and filtering, compensated feedback control systems. Hysteresis control basics, and application to DC-DC converters and inverters. General boundary control: behaviour near a boundary, and choice of suitable boundaries. Basic ideas of fuzzy control techniques, and performance issues.

Sensors for power electronic circuits, speed and torque transducers.

EEE G546 Systems Simulation Lab. 4

Simulation tutorial problems on single- and three-phase AC-DC converters, DC-DC buck-, boost-, and buck-boost converters, DC-AC inverters in single and three phase with different levels of control complexity. Simulation of practical applications from utility and drives. May also include a small project.

EEE G552 Solid State Drives 3 2 5

Introduction to the drive system: requirements, components and benchmarks; Review of motor theory; Power electronic control of motors: requirements and operational issues; Static speed control of induction motors: the AC power controller, slip energy recovery, VSI and CSI controlled induction motors; Speed control of synchronous motors and associated machines; The problem of DC motor speed control: rectifier and chopper controllers; Advanced induction motor drive control: vector control, current modulation, importance of microcontroller based systems; Organisation of microcontrollers: sensing and actuation of signals, interrupt handling and timing, priority of tasks in a microcontrolled drive system.

EEE G553 Utility Applications of Power Electronics 3 0 3

Static excitation systems: converters as used in SES, control and the IEEE types, enhancement of stability. HVDC transmission: configurations of line-commutated converters, constant current and constant extinction angle control at device terminal level, individual phase and equidistant pulse firing control at device level, active and reactive power considerations. FACTS: impedance type and inverter type FACTS devices, the static var compensator, the thyristor controlled series reactor, the STATCOM and its developments in the form of UPFC and SSSC. Active filters: the power quality problems at distribution level, inverter control by transient p-q theory, configuration of active filters and their control, existing bottlenecks.

EEE G554 Soft Switching Converter Technologies 3 0 3

Series, parallel, series-parallel resonant DC-DC converters, half and full bridge topologies, analysis and design. Sinusoidal analysis of resonant converters, soft switching, load resonant properties, exact characteristics. Soft switching mechanisms of semiconductor devices, zero current and zero voltage switching quasi resonant converters, resonant switch topologies, soft switching in PWM converters and inverters, multi resonant converters, control of resonant and soft switching converters, EMI suppression, snubbers, load resonant converters, passive components at high frequencies.

EEE G555 Transformer and Motor Design 3 0 3

Course description for the above course is to be developed.

EEE G556 DSP Based Control of Electric Drives 3 0 3

State space and transfer matrix representations, representation of nonlinear systems by update of parameters, output feedback and state feedback control, basic notion of state estimation. Sampling of signals, discrete representation of signals, z-transforms. Nature of discrete time poles and zeros. A/D and D/A converters as system elements. FIR and IIR behaviour, noise and its nature. AR, MA, and ARMA models of systems. The Fourier transform and what it conveys. Processing requirements of a DSP, floating point DSP's: the TMS320C3x family. Memory organisation, interrupt systems, and I/O interface with the TMS320C3x family. The TMS320C31 as an embedded controller, drive control features. Applications in vector and direct torque control of synchronous motors, vector and direct torque control of induction motors, torque control of SRM's.

EEE G581 RF & Microwave Engineering 3 2 5

Introduction to radio frequency engineering; advantages; various frequency bands; propagation; transmission lines; microwave waveguides and components; their characterizations; s-parameters and their use; microwave transistor; FETs, Gunn diode, IMPATT diodes; microwave tubes; Klystron; two cavity Klystron amplifier analysis; reflex Klystron; TWTs; high power tubes; cross field tubes; microstriplines; MMICs; microwave measurements; microwave antennas and microwave communication system; microwave applications; ISM applications; introduction to EMI and EMC; microwave hazards.

EEE G582 Telecom Network Management 3 2 5

Network architecture and protocols; LAN, MAN and WANs; internetworking; network planning; network management concepts and standards; administrative, operational and fault management; security issues; remote network management.

EEE G591 Optical Communication 3 2 5

Optical communication systems and components; optical sources and transmitters (basic concept, design and applications); modulators (electro-optic, acousto-optic and laser modulation techniques); beam forming; focussing and coupling schemes to optical repeators; optical amlifiers; optical field reception; coherent and non-coherent lightwave systems; fibre optic communication system design and performance; multichannel lightwave systems; long haul communications; fibre optic networks.

EEE G592 Mobile & Personal Communication 3 2 5

History of mobile radio; the mobile radio signal environment; review of statistical techniques; path over flat as well as hilly terrain; effects of RF system design on propagation; received signal envelope and phase characteristics; modulation schemes employed; functional design of mobile radio systems, diversity schemes-space; frequency and polarization diversity; mobile radio system functional design; signal error analysis versus performance criteria; multiple access schemes; classification of the concepts of sensitive topics; new concepts data transmission via cellular; spectrum and technology of WLL.

EEE G611 Computer Aided Analysis and Design 2 3 5

Course description is same as given under CE G611.

EEE G612 Coding Theory & Practice 3 2 5

Codes for data-compression: instantaneous codes; Kraft inequality; Mcmillan theorem; Huffman codes; codes for error-detection and correction; binary symmetric channel; channel capacity, Shannon's fundamental theorem; linear codes; Macwilliam's identity; Reed-muller codes; cyclic codes; BCH codes; codes for secrecy and security; private-key cryptosystems; affine codes; twisted codes; one-time-pads; public-key cryptosystems based on large primes and discrete logarithms.

EEE G613 Advanced Digital Signal Processing 5

Review of stochastic processes, models and model classification, the identification problem, some field of applications, classical methods of identification of impulse response and transfer function models, model learning techniques, linear least square estimator, minimum variance algorithm, stochastic approximation method and maximum likelihood method, simultaneous state and parameter estimation of extended kalman-filter, non-linear identification, quasi linearization, numerical identification methods.

EEE G621 Advanced Electronic Circuits 3 2 5

Linear and non-linear operational circuitry, controlled sources, Active filters, power amplifiers, Power supplies, Analog switches and comparators, combinational and sequential logic circuitry. Data transmission

and display, Electronic Controllers, Transducer interfacing and measurement circuits, etc.

EEE G622 Advanced Digital Communication 3 2 5

Introduction to Digital communication, review of probability and statistic processes; review of source coding and characterization of signals; optimum receivers for additive white gaussian noise channel; carrier & symbol synchronization; channel capacity & coding; block & convolutional codes; communication through band – limited linear filter channels; adaptive equalization multicarrier systems; digital communication through fading multipath channel; future trends in digital communication.

EEE G625 Safety Critical Embedded Systems Design 4

Course description is same as given under HTSL ZG631.

EEE G626 Hardware Software Co-Design 4

Course description is same as given under HTSL ZG641.

EEE G627 Networked Embedded Applications 4

Course description is same as given under HTSL ZG651.

Engineering

ENGG C111 Electrical and Electronics Technology 3 0 3

Electric circuit, electromagnetism, magnetic circuit, electrostatics, AC voltage and current, single phase circuits, semiconductor devices, amplifiers, digital systems, microprocessors, DC machines, polyphase circuits, transformers, synchronous machines, induction motors, power electronics, measurements, illumination.

ENGG C212 Introduction to Systems 3 0 3

Systems approach; systems concepts; general systems theory; fuzzy sets; systems planning and control; block diagrams; signal flow graphs; graph theory; systems methodology-measurement and evaluation, model building, suboptimisation, implementation; Forrester's systems dynamics; decision making conflict resolution; management information theory. Development of the above concepts will be taken through various cases reflecting social problems, e.g., education, ecology, energy facility, location, integrated area development, etc.

ENGG C232 Engineering Materials 3 0 3

Mechanical, electrical, electronic and chemical properties and applications of common engineering materials; ferrous and non- ferrous metals and alloys; thermosetting and thermoplastic plastics; natural and synthetic resins; rubber; glass; abrasives and ceramics; common building materials, namely, timber, stone, lime and cement; corrosion of metals and methods of preventing corrosion; protective and decorative coatings; insulating materials; testing of materials.

ENGG C241 Mechanical Technology 3 0 3

Fundamental concepts of heat, work and energy; second law of thermodynamics; properties of gases and vapours; basic cycles; flow of liquids; steam boilers; steam engines and pumps; steam turbines and condensers; hydraulic pumps and turbines; internal combustion engine.

ENGG C242 Maintenance & Safety 3 0 3

Objectives, functions, and types of maintenance; defects due to wear; lubrication and surfacing techniques to reduce wear; maintenance of different equipments and their elements; spares planning; overhauling; TPM; safety and safety management; environmental safety; chemical safety; occupational health management; control of major industrial hazards; managing emergencies; employee participation in safety; HRD for maintenance and safety.

ENGG C264 Fluid & Solid Mechanics 3 0 3

Fluid; fluid properties; fundamental laws; flow of fluid through orifices, notches, and weirs;

flow through pipes and channels; mechanical properties of materials; stress; strain; elasticity; bending moment and shear force; bending stresses; shearing stresses; deflection of beams; columns and struts; torsion.

ENGG C272 Process Technology 3 0 3

Manufacturing process of acids, chlor-alkali, fertilizers, coal, chemicals, pulp and paper, polymers, petroleum and extractive metallurgy; waste management.

ENGG C282 Industrial Engineering Techniques 3 0 3

Industrial systems and organization; engineering economy; work measurement techniques; motivation and time studies; factory planning and materials handling; industrial standardization; critical path methods; quality assurance and statistical quality control; reliability; maintenance and management planning; scheduling; job analysis (evaluation); value engineering.

ENGG C291 Electronics and Instrumentation Technology 3 0 3

Binary logic gates, logic circuits, Boolean algebra and K-map simplification, number systems and codes, arithmatic logic units, flip-flops, registers and counters; introduction to microprocessors, architecture, instruction set and programming, memory and I/O interface devices, examples of digital system design.

English

ENGL C121 English Language Skills I 3
ENGL C122 English Language Skills II 3

The above two unstructured courses are designed to raise progressively the level of proficiency of the normal input to a stage where they can embark on English language and literature. They are intended to develop the language skills of listening, speaking, reading and writing. No student will be permitted to register in more than one course at a time. The presentation of the skills courses in the present break-up is not intended to indicate any sequence. It simply indicates the total number of units and the related number of hours spent in the course through formal contact or self-study only. Thus a student can begin at any one of the courses with the requirement that for the normal input only one (or two) of these courses would be needed. From the description presented above it would be clear that students may register in any one (or both) of these courses with the proviso that registration can be done in only one course per semester.

ENGL C123 English Language Skills 3 0 3

Sounds of English; word structure; word order and effective sentences; listening comprehension; vocabulary extension; phrasal verbs; paragraph writing; reading comprehension; précis writing, letter writing; dicto composition; writing research papers; writing book reviews.

ENGL C221 Readings from Popular Science Writings 3 0 3

JBS Haldane, Julian Huxley, J. Bronowski, George Gamow, Issac Asimov, Alan Issacs.

ENGL C222 Readings from Drama 3 0 3

Oliver Goldsmith, John Galsworthy, T.S. Eliot, John Osborne.

ENGL C231 Readings from Prose and Poetry 3 0 3

Thomas Gray, P.B. Shelley, Dylan Thomas, E.V. Lucas, Robert Lynd, J.B. Priestley.

ENGL C251 Linguistics 3 0 3

Linguistics as a field of study and its relationship with other disciplines; nature of language; its varieties and role in society; concepts of structure, system, unit and class; theories of linguistic analysis.

ENGL C252 Phonetics and Spoken English 3 0 3

Speech mechanism; the English phonemes; word accent; features of connected speech; phonetic transcriptions; varieties of spoken English; spoken English in India; problems of Indian speakers; oral reading of passages including conversation; speech training.

ENGL C261 Creative Writing 3

Principles of creative writing; stimulating creative activity; techniques of creating images; constructing events and creating characters, writing short stories, plays and poems, writing critical essays on works of art.

The course will require from the student a comprehensive report on the techniques learnt and include samples of his creative writings.

ENGL C262 Effective Speaking 3

Nature of spoken language, voice and speech improvement, art of delivery and platform manners, use of body language, principles of public speaking, choosing a subject and purpose, organisation and outlining, forms of explanation and support, introduction and conclusions, style of speech, speeches for special occasions, parliamentary procedures. This will be a heavily practice-oriented course where students will be helped to develop skills of speech making through actual practice.

ENGL C312 Semantics 3 0 3

Introduction; nature of words; meaning, different approaches; sources of ambiguity, semantic changes; measurement of meaning.

ENGL C321 Prose 3 0 3

Bacon, Addison, Swift, Lamb, Hazlitt, Orwell, Russell.

ENGL C331 Literary Criticism 3 0 3

Aristotle, Dryden, Johnson, Coleridge, Arnold, Eliot.

ENGL C341 Fiction 3 0 3

Fielding, Austen, Dickens, Hardy.

ENGL C342 Science Writings 3 0 3

A selection containing contribution by eminent scientists written with a view to popularising science amongst intelligent laymen. The treatment of the course would be to train a student in writing and comprehension of the English language except that the subject matter will deal with science. Through the offering of the course and attempt will be made to interface an arts student to the culture of science.

ENGL C353 Effective Public Speaking 3

Principles of public speaking; importance of effective listening; use of body language; characteristics of voice; ways to control stage fright; measures to develop confidence; audience analysis; modes of delivery; organization of speech; speeches for special occasion: welcome, introduction, felicitation, farewell, valedictory, inaugural; impromptu and extemporaneous speeches; meetings, group discussions, professional presentations, interviews.

(This course is extensively practice-oriented. Theoretical guidelines also will be given to the students for achieving effectiveness in public speaking. Students would be asked to prepare and deliver a number of talks and presentations. Comments and discussions will follow each presentation so as to provide the students opportunity to correct themselves. Group discussions and presentations will be recorded and projected for them to observe their organization, body language and understand the nuances of the characteristics of their voice. Evaluation components will be designed to assess the students' ability to listen actively and speak effectively. The new language laboratory will be used to enable the students to listen to speeches by eminent leaders and renowned personalities who were/are able to attract the masses with their powerful speeches. The lab would also be used to conduct group discussions through computers).

ENGL C361 Drama I 3 0 3

William Shakespeare, Christopher Marlowe, G.B. Shaw.

ENGL C362 Drama II 3 0 3

T.S. Eliot, John Osborne, Eugene Ionesco, Arthur Miller.

ENGL C371 Poetry I 3 0 3

Edmund Spenser, John Milton, John Donne, John Dryden, Alexander Pope, William

Wordsworth, S.T. Coleridge, P.B. Shelley, John Keats.

ENGL C372 Poetry II 3 0 3

Alfred Tennyson, Robert Browning, W.B. Yeats, T.S. Eliot, W.H. Auden, Dylan Thomas.

ENGL C441 Modern Fiction 3 0 3

E.M. Forster, Virginia Woolf, Joseph Conrad, Aldous Huxley, D.H. Lawrence.

ENGL C451 American Literature I 3 0 3

Faulkner, Hawthorne, Henry James, Hemingway, Steinback.

ENGL C452 American Literature II 3 0 3

Edward Albee, Emily Dickinson, Frost, O'Neill, Whitman.

ENGL C461 English Literary Forms and Movements 3 0 3

This course is designed to provide a historical perspective on major forms and movements in English Literature and to develop an insight into various social, religious and other influences on their birth and growth. The course will cover the entire range of literature from renaissance and reformation to modern times.

ENGL C491 Special Projects 3

Course description is same as given under BIO C491.

ENGL G511 Growth of the English Language 5

The Origin and development; old English, middle English and modern English; foreign influences; changes in grammar and phonology; rise of standard English; English in the international context.

ENGL G512 Language and S & T 5

Historical development of communication in science; communicative process in science and technology; language of science & technology; scientific literature; growth and role of scientific journals.

ENGL G513 Social Impact of S&T 5

Elements of scientific thinking; role of science and technology in social change; impact of science on environment; technology and social growth; impact of science & technology in terms of developments in transportation and communication and innovations in sources of energy; impact on the quality of life.

ENGL G521 Principles of Language Teaching 5

Teaching different language skills; grading; sequencing and presentation; teaching at different levels; remedial teaching; techniques of teaching comprehension, grammar, composition; lesson planning; syllabus design; testing.

ENGL G522 Aesthetics and Technology 5

Aspects of aestheticism; emergence of aestheticism; influence of aesthetics on technology; impact of technological explosion on human sensibility and its expression in selected art forms.

ENGL G531 Applied Linguistics 5

Linguistics and language teaching; contrastive linguistics and its applications; error analysis; a linguistic theory of translation; linguistic approach to literature.

ENGL G541 Interpretation of Literature 5

Literary forms and conventions and their development; different critical approaches; practical criticism.

ENGL G551 Information Technology Lab I 5

(This course is specially designed to prepare the stream of input, viz. traditional English graduates, in the use of technology in communication).

This course is built around the theme of use of modern technology for the purpose of presentation and processing of information for effective communication within an organisation. Consistent with this theme, assignments would be drawn from the student's work environment and from one or more areas of the

following: Computerized text processing; use of utility software packages for information processing and production; desk top graphics; desk top video; computerized graphics packages; office automation equipment such as electric typewriters; photography; equipment for projection and preparation of projection material; reprography equipment; duplication equipment; audio visual technology involving equipment such as video systems, audio systems and audio-visual recording equipment; techniques for display and exhibition of formatted information, etc. The course will be unstructured in nature and assignments may require study of the principles of the above areas, or the actual use of equipment and techniques.

ENGL G561 Information Technology Lab II 5

(This course is specially designed to prepare the stream of input, viz. traditional English graduates in the use of technology in communication)

This is a sequal to the first course of the same name. The theme of use of modern technology for the purpose of presentation and processing of information for effective communication within an organization would be further developed. However, assignments would invariably emphasize the integration between various technologies for totality of communication.

ENGL G571 Applied Communication I 5

(This course is specially designed to prepare the stream of input, viz. engineering and hard science graduates in communication methods)

Process of communication; elements of speech; role of body language; dyadic communication; participation in different types of discussion groups, audio-visual aids.

ENGL G581 Applied Communication II 5

(This course is specially designed to prepare the stream of input viz. engineering and hard science graduates, in communication methods)

Elements of effective writing; methods of written exposition; art of condensation; writing technical articles, research papers, proposals, reports, manuals and letters, preparation and use of graphic aids; mechanics of writing; technical editing.

ENGL G591 Project Formulation and Preparation 5

Course description is same as given under BITS G651.

ENGL G611 Twentieth Century English Literature 5

Margret Atwood, Tony Morrison, Samuel Beckett, Harold Pinter, Philip Larkin,Ted Hughes.

Engineering Science

ES C112 Thermodynamics 3 0 3

Concepts and laws of thermodynamics; macroscopic thermodynamic properties; application to closed and open system; microscopic approach to entropy; equations of state; thermodynamics of nonreacting mixtures.

ES C221 Mechanics of Solids 3 0 3

Fundamental principles of mechanics; introduction of mechanics of deformable bodies; forces and moments transmitted by slender members; stress and strain; stress-strain-temperature relations; torsion; stresses and defections due to bending; stability of equilibrium.

ES C222 Energy Conversion 3 0 3

Prerequisite: ES C231

Study of the technical and economic problems in energy conversion; electromechanical conversion principles and devices; present technology including technical and economic comparison of thermal, hydro, and nuclear methods; future energy technology

including analysis of breeder concepts, fusion devices, MHD; solar energy; and fuel cells.

ES C231 Circuit Theory 3 0 3

Electrical circuits as analogous of nonelectrical systems-examples drawn from various disciplines; circuit models, equilibrium equations and their solutions; independent sources; exponential signals; steady-state of electrical circuits; linear dependence; mesh and nodal analysis, network theorems; energy and power.

ES C232 Transport Phenomena I 3 0 3

Course description is same as given under CE C212.

ES C233 Logic in Computer Science 3 0 3

Role of logic in computer science. Propositional logic – syntax and well-formedness, semantics, satisfiability and validity, decision procedures. Predicate logic or first order logic – syntax, and semantics, satisfiability and validity, completeness and compactness, undecidability and incompleteness – Godel's incompleteness theorem. Verification – model checking, linear-time temporal logic and computational tree logic. Program verification – Hoare logic, proofs of correctness. Modal logic, logic programming.

ES C241 Electrical Sciences I 3 0 3

Introduction; basic circuit elements; sources (dependent and independent); Kirchoff's current and voltage law, source representation and conversion; Network theorems; response of RL, RC and RLC circuits; diodes and its applications; transistors - BJT & FETs; amplifiers: biasing and small signal analysis; OPAMPS; Digital Logic gates; Basics of Combinational and Sequential circuits.

ES C242 Structure and Properties of Materials 3 0 3

Study of the basic properties of materials in relation to their molecular structure; emphasis on the structure of metallic, polymeric and ceramic materials in relation to their mechanical, electrical, electronic and chemical properties, methods of imparting desirable properties to materials by inducing changes in molecular structure; property requirements and material selection, criteria for widely ranging service conditions.

ES C252 Electronics 3 0 3

Prerequisite: ES C231

Ideal diodes, rectifier and filters; ideal amplifiers; physical mechanism of devices; small signal models, amplifiers-their evaluation, biasing, frequency response, cascading and signal feed-back; classes of operation of large signal amplifiers; oscillators; modulation; detection.

ES C261 Digital Electronics and Microprocessors 3 0 3

(Only for group C programmes, and not available for groups A & B programmes)

Binary logic gates; logic circuits; Boolean algebra and K-map simplification; number systems and codes; arithmetic logic units; flip-flops; registers and counters; introduction to microprocessors; architecture; instruction set and programming; memory and I/O interfacing; examples of system design.

ES C263 Microprocessor Programming & Interfacing 3 2 4

Elements of digital electronics; PC organization; 80X86 as CPU: Instruction set register set, timing diagrams, modular assembly programming using procedures & macros, assembler, linker & loader concepts; concept of interrupts: hardware interrupts, software interrupts, BIOS and DOS interrupts; disk organization: boot sector, boot partition, root directory & FAT; memory interfacing & timing diagrams; I/O interfacing; programmable I/O devices such as 8255, 8253, 8259, etc.

ES C272 Electrical Sciences II 3 0 3

Introduction; sinusoidal steady state analysis of circuits; three phase circuits; magnetic circuits; transformers; basics of rotating ma-

chines; DC machines; synchronous machine; induction machine.

Engineering Technology

ET C311 Selected Technologies 3

This course will aim basically at a qualitative coverage in a broader sweep with necessary details of certain technological operations which are not generally covered in the standard engineering diploma course. The themes taken up would, among others, include technologies of transportation, communication, information material processing etc. In its operation the course will have restricted formal contact and a large number of hours to be used (unstructured) by the student himself under teacher's supervision.

ET C312 Technology and Energy Assessment 3 0 3

Energy demand and consumption in Indian Industries; contribution of energy cost to production cost; concepts and benefits of energy audit, energy conservation, energy efficiency and DSM; potential for energy efficiency in Indian Industry, and other sectors; key economic and market issues for energy efficiency in India; DSM design concepts; energy audit and energy efficiency case studies; role of ESCO, government's role in energy conservation and energy efficiency; renewable energy applications for energy efficiency.

ET C322 Technology and Environmental Impact 3 0 3

Water pollution: origin, effects and testing, treatment of various Industrial wastes, recycle and reuse; Air pollution: origin, effect and control; Noise pollution; Environmental Impact Analysis.

ET C331 Raw Materials and Process Selection 3 0 3

Choice of location, site and equipment with the raw materials available, raw materials processing, methods of process selection and optimization.

ET C332 Project Preparation 3 0 3

Overview of project and project phases; project formulation aspects in terms of market studies, technical studies, financial studies, economic studies, environmental studies, etc.; project evaluation aspects in terms of commercial profitability prospects, national economic profitability prospects; issues of project preparation in project implementation.

ET C341 Instrumentation & Control 3 0 3

Measurement systems, transducers, feedback control, components: electrical, hydraulic, pneumatic; Signal conditioning and processing, controllers, display, recording, direct digital control, programmable logic controllers, PC based instrumentation.

ET C342 Materials Management 3 0 3

Integrating materials management; policy aspects; purchasing management; warehousing and storage of inventory control systems; appraisal and control; just in time (JIT); automation in materials management.

ET C351 Chemical Process Technology 3 0 3

Course description is same as given under CHE C322.

ET C352 Energy Management 3 0 3

Energy management principles; energy conservation; energy auditing; analysis; formulation of energy management options; economic evaluation, implementation & control; energy conservation techniques – conservation in energy intensive industries; steam generation, distribution systems, and electrical systems; integrated resource planning; demand-side management; cogeneration; total energy schemes; thermal insulation; energy storage; economic evaluation of conservation technologies; analysis of typical applications.

ET C362 Environmental Pollution Control 3 0 3

Course description is same as given under CHE C411.

ET C411 Concepts of Engineering Design 3

Course description to be developed.

ET C412 Production Planning & Control 3 0 3

Generalized model of production systems; types of production flows; life cycle concepts; facilities location and layout planning; aggregate and batch production planning; inventory systems; materials requirements planning; elements of monitoring & production control.

ET C413 Advances in Materials Science 3 0 3

Course description is same as given under ME C442.

ET C414 Project Appraisal 3 0 3

Course description is same as given under ECON C411.

ET C421 Computer Aided Project Planning and Monitoring 3

Course description is to be developed.

ET C422 Computer Aided Manufacturing 3 0 3

Introduction, features of NC machine tools, NC part programming, CAM system devices, interpolators for manufacturing systems, control loops of NC systems, computerized numerical control, adaptive control systems, CAD to CAM, CAPP, industrial robots, computer aided production planning & control, computer aided inspection and quality control, CIM systems.

ET C431 Technology Forecasting 3 0 3

Course description is same as given under ECON C451.

ET C432 Quality Control, Assurance & Reliability 3 0 3

Basic concepts of probability and probability distributions, standard probability distribution, sampling and sampling distributions, confidence intervals, testing significance, statistical tolerance, various types of control charts, statistical process control techniques, value analysis, defect diagnosis and prevention, basic concepts of reliability, reliability design evaluation and control, methods of applying total quality management, production process.

ET C441 Technology Management 3 0 3

Course description is same as given under MGTS C414.

ET C491 Special projects 3

Course description is same as given under BIO C491.

ET G511 Science and Technology Dynamics 5
ET G521 Hi-Tech Management 5
ET G531 Systems Engineering 5
ET G541 Overview of Technology 5

Course description for the above courses are to be developed.

Finance

FIN C312 International Financial Markets & Services 3 0 3

Currency futures, options and swaps; interest rate determination and asset pricing in face of volatile nominal and real exchange rates; international portfolio management; treasury risk management and performance measurement; major international stock exchanges: New York; ISE London; Tokyo; trading and settlement practices; listing of Indian derivatives on Brussles stock exchange; arranging foreign collaboration; floating India funds; syndication of Euro-dollar loans.

FIN C321 Theory of Finance 3 0 3

Functions and operations of capital market, analysis of consumption-investment decisions of investors, diversification and portfolio selection, valuation theory and equilibrium pricing of risky assets, theory of efficient markets and investment and financing decisions of the firm.

Expected utility theory; stochastic dominance; portfolio frontiers; mutual fund separation; asset pricing model; arbitrage pricing

theory; Arrow-Debreu theory; dynamic spanning; options; rational expectations; financial signaling.

FIN C322 Project Finance 3 0 3

Project identification, feasibility; appraisal of projects from technical, financial and economic view points; design of capital structure; factors influencing form of capital; instruments; shares, preference shares, debentures, convertible debentures; borrowing from development finance institutions.

Lease or buy decisions; leasing capital equipment; impact on investment; features of leasing companies in India; legislation regulating leasing; role of leasing companies in industrial countries.

FIN C331 Management Accounting 3 0 3

Accounting as a language for management decisions; Accounting principles, conventions and concepts; concepts relating to financial statements, analysis of financial statements; inventory pricing and valuation; inflation accounting; cost accounting and budgetary control systems - cost determination, standard costs, differential cost and direct costing; profit budgeting and analysis; capital investment analysis; disinvestment decisions.

FIN C332 Econometrics 3 0 3

Course description is same as given under ECON C342.

FIN C341 Investment Banking and Financial Services 3 0 3

Merchant banking function- perspectives; organization of merchant banking function; managing new issues; negotiating terms with financial institutions, brokers, investors and under writers; pricing of further issues- SEBI guidelines; syndication of loans from banks; preparation of loan dossiers and application for financial assistance; negotiations; public deposits to finance working capital; agencies mobilizing public deposits; regulations governing raising of public deposits; cost of public deposits, factoring, forfeiting , structured finance, securitization and personal finance like house loan, personal loan and other individual loans, non-fund based services -credit rating, business advisory services, mergers, de-mergers and acquisition, asset management and insurance commodities services and wealth management.

FIN C342 Financial Management 3 0 3

Course description is same as given under ECON C481.

FIN C411 Project Appraisal 3 0 3

Prerequisite: ECON C212

Course description is same as given under ECON C411.

FIN C413 Risk Management and Insurance 3 0 3

Introduction to risk; types of risk; risk measurement; risk management techniques; risk avoidance, loss control, loss financing, risk retention, risk transfer, internal risk reduction through diversification etc.; insurance business and operations; insurance pricing; insurance v/s hedging; life, health and income risk; property and liability risk – commercial and personal; social insurance; insurance regulation.

FIN C421 Financing International Trade 3 0 3

Export: financial needs - terms of payment, documentary credit, different types of letters of credit, procedure, types and uses; DP, DA arrangement; packing credit; short term finance; medium and long term financing; deferred payment terms; foreign exchange cover; financing for deferred payments; IDBI scheme; buyers credit; export credit and guarantee corporation; financial guarantees; export factoring imports: review current policy provisions; import compression; linking imports exports; classification of imports: OGL specific licenses; negative list, import of capital goods against free foreign exchange; suppliers credit; foreign equity, foreign commercial borrowing; borrowing by export

oriented units, opening letters of credit and remittances against imports; import factoring.

FIN C422 Public Finance: Theory and Practice 3 0 3

Course description is same as given under ECON C322.

FIN C424 Money, Banking and Financial Markets 3 0 3

Course description is same as given under ECON C362.

FIN C431 Marketing 3 0 3

Definition and scope; marketing research; channels of distribution; sales promotion; regulation of marketing and public policy.

FIN C432 Issues in Indian Economy 3 0 3

Course description is same as given under ECON C421.

FIN C433 Advertising and sales Promotion 3 0 3

The communication process and models of persuasive communication; advertising research; advertising campaign components; advertising campaign planning; advertising/media scene; media concepts; media planning & strategy; advertising campaign planning, execution and evaluation; advertising agencies; sales promotion types and techniques; sales promotion strategy; measuring the effectiveness of the promotional program; regulations of advertising and promotion; Extending marketing communication to social communication, personal selling, international advertising, interactive advertising, advertising laws, social, ethical and moral issues.

FIN C436 Strategic Financial Management 3 0 3

(Pre-requisite: ECON C481= FIN C342= MGTS C382 Financial Management or MBA C416 Corporate Finance and Taxation)

Course description is same as given as under ECON C436.

FIN C441 Organisational Behaviour 3 0 3

A new perspective of management; conceptual model of organization behavior; the individual processes- personality, work attitude, perception, attribution, motivation, learning and reinforcement, work stress and stress management; the dynamics of organizational behavior- group dynamics, power & politics, conflict & negotiation, leadership process & styles, communication; the organizational processes- decision making, job design; organizational theory and design, organizational culture, managing cultural diversity; organizational change & development.

FIN C442 Corporate Planning 3 0 3

Assessment of corporate strengths, weaknesses and opportunities; planning and deployment of capital assets; profit planning and control; functions, problems, pressures, responsibilities, limits of the chief executive; evaluation of one's own business undertaking; formulating objectives, strategies, policies and programmes for improving company's present situation; personnel strength and implementation of the policies and programmes.

FIN C451 International Business 3 0 3

Global Trade Protection, Cultural Environment, Legal Aspects, International Monetary System, Overseas Business Options, MNCs, Regional Analysis, Screening and Segmentation, International Marketing Research, International Marketing Strategy, Export Policy and Institutional Infrastructure, Export Finance, Export Payments, Exchange Transactions, Product Planning; Positioning and Management, Distribution Policy; Management and Agreements, International Pricing and Promotion, Organizing for Overseas Markets.

FIN C462 Services Marketing 3 0 3

Distinctive elements, system: relationships with customers; positioning; managing customer portfolio, demand management, service delivery process, pricing; promotion; operating strategy; quality, productivity, human resource management; internationalization of services; services marketing in future.

FIN C491 Special Project 3 0 3

Course description is same as given under BIO C491.

French

FRE N101T Beginning French 3 0 3

Basic grammar; vocabulary; reading practice; translation of simple passages.

Not available for meeting the requirements of any programme except as prerequisite for another French course. Can be taken only on audit.

FRE N102T Technical French 3 0 3

Prerequisite : FRE N101T

Phrases and sentence patterns in technical literature; special technical vocabulary; reading and translation of current technical literature from French to English with the help of a dictionary.

This course is designed to meet the foreign language requirement of the Ph.D. Programme and is not available for meeting the requirement of any other programme. Can be taken only on audit.

German

GER N101T Beginning German 3 0 3

Basic grammar; vocabulary; reading practice; translation of simple passages.

Not available for meeting the requirements of any programme except as prerequisite for another German course. Can be taken only on audit.

GER N102T Technical German 3 0 3

Prerequisite : GER N101T

Phrases and sentence patterns in technical literature; special technical vocabulary; reading and translation of current technical literature from German to English with the help of a dictionary.

This course is designed to meet the foreign language requirements of the Ph.D. programme and is not available for meeting the requirements of any other programme. Can be taken only on audit.

Hindi

HINDI C201 Elementary Hindi 3 0 3

This course is open only for a student whose mother-tongue is not Hindi and who has not studied Hindi in his school curriculum.

An elementary prose selection, comprehension, composition and usage.

HINDI C211 Novel and Short Stories 3 0 3

Origin and development of Hindi short stories and novels.

HINDI C212 One Act Play and Drama 3 0 3

Origin and development of Hindi drama.

History

HIST C112 Main Trends in Indian History 3 0 3

A panoramic view of the development of Indian thought and society; evaluation of Indian life and quality from earliest times through the so-called Hindu, Muslim and British periods; the present day analysis and discussion on the basic features of Indian society, its strength and its weakness; a glimpse into future in terms of the transformation of the Indian society.

HIST C211 Main Currents of Modern History 3 0 3

Renaissance, the major revolutions of the world; rise of nationalism; growth of imperialism; world between the two world wars; super powers and the contemporary world; resurgence of Asia, protest movements in Africa and Latin America; problem of world peace.

HIST C213 Gulf History and Culture 3 0 3

Introduction to the Arab Gulf, Prophet Muhammad and appearance of Islam, Arab Caliphates and expansion of Islam, Ottoman Empire, Islam and its basic tenets, Islamic culture and society, Islamic contribution to civilization, modern history: Age of nation states,

oil and the Arab world, years of turmoil, Arab world in the twenty first century.

Humanities and Social Sciences

HSS C221 Economic Legislation I 3 0 3

Indian contract act; sale of goods act; negotiable; instruments act.

HSS C222 Economic Legislation II 3 0 3

Industries and development regulation act; monopolies and restrictive trade practice act; foreign exchange regulation act; Indian companies act.

HSS C231 Economic Legislation 3 0 3

Indian contract act; sale of goods and hire purchase acts; the negotiable instruments act; company law; industries and development regulation act; consumer protection and unfair trade practices act; monopolies and restrictive trade practices act; foreign exchange regulation act; securities and exchange board of India act, etc.

HSS C232 Indian Financial System 3 0 3

Capital formation and capital markets; savings; financial savings, structure of capital market; primary and secondary markets; developmental financial institutions; linkages between money and capital markets; financial intermedieries and regulation of the financial system; commercial banks; unit trust; mutual funds; call money market; regulation of banking and money markets by reserve bank.

HSS C241 Legal Environment of Business 3 0 3

It provides broad knowledge of various legal aspects within which the business operates. Indian contract act, sale of goods and hire-purchase act, negotiable instruments act, companies act, corporate Tax laws, SEBI, BIFR and others, consumer protection and unfair trade practices act, monopolies and restrictive trade practices act, & FERA.

HSS C311 Taxation 3 0 3

Principles of taxation; economic effects of taxation; tax structure; taxation in practice with special reference to the Indian Income Tax Act 1961.

HSS C312 Bureaucracy 3 0 3

An introduction to the theory of governmental decision making and bureaucratic behaviour. Organisational structure; the role of the bureaucracy in policy making; sources of bureaucratic power; agency interaction; personnel management; differences in agency and bureaucratic power, and decision-making topologies. Company administration and meetings.

HSS C313 Critical Analysis of Literature and Cinema 3 0 3

Creativity and Aesthetics; An overview of Major Movements in Literature and Cinema; Interpretation of Selected Works; Cinema & Art; Understanding Drama: Theme, Character, Plot, form; Understanding Poetry: Diction, Imagery, Symbolism, Structure and Form, Personification, Apostrophe, Sound and Rhythm; Understanding fiction: Setting, Point of View, Plot and Character; Understanding Short Fiction: Meaning and message, Style and Coherence; Understanding Cinema: Plot; Character; Screenplay; Linguistic, Social, Musical codes; Cinematic Codes; Camera Work.

HSS C314 Print and Audio-Visual Advertising 3 0 3

The Dimensions of Advertising; Advertising and Marketing; Creative strategy and Creative process; Creative Execution: Art and copy; Media strategy; Advertising research; Relationship Building: Public relation and Corporate advertising; Ethical issues.

HSS C321 Commercial Law 3 0 3

Elements of economic legislation including general principles of law, monopolies and restrictive trade practices act, securities and contracts, company's act, forms of business organisation and consumer protection.

Humanities

HUM C232 Indian Financial Systems 3 0 3

Course description is same as given under HSS C232.

HUM C311 Journalism 3 0 3

Principles of reporting; the news media and public relations; ground rules for reporters; investigative reporting; specialised reporting of events, trends and activities; creating headlines; editing, copy editing; newspaper style; proof reading; the press and the law.

HUM C312 Contemporary India 3 0 3

Course description is same as given under CDP C332.

HUM C321 Appreciation of Indian Music 3 0 3

The course is intended as an appreciation of Indian music; the emphasis will be upon exposing the students to musical performances, records, tapes, both vocal and instrumental; through these illustrations the consciousness in terms of the distinction between Raag and Taal etc., is expected to be derived; the course will pick up a certain number of Raags from the basic thaats and demonstrate the delineation of the Raag through Alap, through various improvisations based upon compositions; the appreciation of concepts both vocal and instrumental (Sitar and Violin) is expected to be obtained; Karnatik music will also be touched upon particularly in terms of Raags common to Hindustani Music.

HUM C322 Commercial Art 3

Course description is to be developed.

HUM C331 Appreciation of Art 3 0 3

Visual perception and basic techniques used in art, compositional balance, space, movement form, light colour, texture, tensions, expressions lines; mainstreams of art; influence of Indian art abroad; various schools of art-Greecian, Medieval, Christian Renaissance, Baroque and Romanticism, impressionism and post impressionism, fauvism, futurism, expressionism, Dadaism and surrealism, metaphysical art, non-representational and abstract art; analysis of work of art and their evaluation.

HUM C332 Cinematic Art 3

Course description to be developed.

HUM C341 Comparative Indian Literature 3 0 3

This course is intended to acquaint the students with literary achievements in Indian Languages and their home-environment and to give integrated view of Indian literature, literary selections from the best writers in the Indian languages will be studied.

HUM C342 Graphic Art 3

Field of graphic arts; aims; graphic elements; basic principles; subject matter and picture surface; vocabulary of expression; techniques of composing and drawing; graphic products; typography; hand and mechanical printing processes; reproduction of monochromatic and coloured pictures.

HUM C351 Public Administration 3 0 3

Definition, nature and scope of public administration; the chief executive; leadership qualities of an administrator; principles of organization; organization of Ministries of Home and Finance; personnel administration-bureaucracy; recruitment, promotion, conduct and discipline, employer-employee relations; administration at work-planning, policy formulation, decision making, supervision, coordination; integrity in administration; public corporations in India; financial administration in India; local administration in India.

HUM C352 Painting 3

Introduction to the art of painting; styles of painting; techniques for various styles of painting; study of materials used; sketches of dynamic and still life; painting projects.

HUM C361 Accounting in Management 3 0 3

Use of accounting information for management decisions; Basic concepts and mechanics; Balance Sheet and Income & Expenditure statement; Valuation of Inventory and Assets; Depreciation; Capital Surplus and other liabilities; Cost determination; Standard costs; Dif-

ferential costs and direct costing; overhead budgets; Control of programmed expenses.

HUM C362 History of Mathematics 3 0 3

Early periods of mathematical thought in Greece, China, India, Arabia and Egypt. Growth of early development in geometry and algebra and their impact on architecture and social values. The renaissance period and the advent of calculus and analytic geometry. The growth of differential geometry and its application to relativity and mechanics, their continuation into twentieth century. Axiomatic mathematics of the last two centuries and their impact on physics and computer science. Culture and development of mathematical ideas as contributions by fields medalist in the present day set up. Application of mathematical ideas to social sciences. The work of J.Von Neumam, K. Arrow and G. Debru.

HUM C371 Linguistics 3 0 3

Course description is same as given under ENGL C251.

HUM C372 Phonetics and Spoken English 3 0 3

Course description is same as given under ENGL C252.

HUM C381 Musicology - An Introduction 3 0 3

Music and it's philosophy, history of music, different theories regarding the development of music, music as an exact science (mathematics), musical terminology, musical forms and their background, composers, artistes and their contributions, music of different cultures, music and film world, music therapy. Emphasis would be laid on research and knowledge gained through self-experience.

HUM C382 Sankara's Thoughts 3 0 3

Life and achievements of Adi Sankara; pre-Sankara Vedanta; basic concepts and theories of Advaita: Atman and Jeeva, nature, sources and validity of knowledge, Brahman and Isvara, Maya and World, Avidya, bondage and liberation; Sankara's contribution to Indian heritage.

HUM C383 Srimad Bhagavad Gita 3 0 3

The science of Soul; Reincarnation; Karma; Karma Yoga; Transcendental Knowledge; Action in Krishna consciousness; Dhyana Yoga; Knowledge of the Ablolute; Attaining the Supreme; The process of Transmigration; the most confidential knowledge; Bhakti Yoga – The process to go back home, back to Godhead.

(This course is introduced as an elective course in the pool of HSS courses for all A, B and C group programmes).

HUM C411 Professional Ethics 3 0 3

Ethics, nature and purpose; ethical theories; ethics in business and management; ethics in engineering, global ethical issues.

HUM C412 Heritage of India 3 0 3

Foundations of India; India and her ancient culture; life of the people; systems of Indian philosophy; art and archaeology; languages and literature; impact on world civilization; Western influence.

HUM C413 Indian Traditions of Science and Technology 3 0 3

Science and technology in Indus-Sarasvati civilization; theories of ancient Indian technologies including shipping, agriculture, metallurgy, textiles, sculpture and architecture; theories of ancient Indian sciences including asronomy, ayurveda, sulbasutra geometry, alchemy and chemistry, physiology and biology; statististics on Indian industry in pre-colonial and colonial India; creativity in continuity with Indian tradition : the work of Ramanujam, Raman, P.C. Ray and J.C. Bose; challenging directions of pursuit in present day world in consonance with Indian tradition.

HUM C421 Comparative Religion 3 0 3

A clear objective description of the great religions and their appeal to the spiritual aspirations of the different people of the world; a

comparative non-sectarian approach to the understanding of Hinduism, Buddhism, Islam and Christianity; a final summing up bringing the unity of all religions of the world.

HUM C422 Aesthetics 3 0 3

Form and scope of aesthetics, historical background, perceptual sense of beauty and its expression, ideas of Eastern and Western scholars about aesthetics, various arts and aesthetics.

HUM C431 Theatre Art-Acting and Production 3 0 3

General historical background of theatre; general knowledge of acting; its tools and exercises; voice training and practice; a study of stage; various systems of theatres; rehearsal techniques and stage management.

HUM G511 Introduction to Health Systems 3 0 3

Health facilities for SC/ST; Health Systems; Evolution of Medicine; Sociology, health and medicine; Primary health care; Health Development; Health education; Health policy in India; Issues like euthanasia, consumer forums, child labor; Female infanticide; women's health; Role of hospitals; Advances in Public Health; Communications; Evaluation of National Health Systems; Demography; Family Planning; Psycho-social issues.

Instrumentation

INSTR C272 Circuits and Signals 3 0 3

Course description is same as given under EEE C272.

INSTR C312 Industrial Instrumentation and Control 3 0 3

Prerequisite : AAOC C321

Importance of process control, elements of process loop, mathematical modeling, dynamic closed loop characteristics, controller principles & tuning, direct digital loop, hydraulic controllers, pneumatic controllers, electronic controllers, complex & multivariable control schemes, final control elements, P& I diagrams, PLCs, Distributed Control Systems (DCS), AI techniques: expert systems, neural networks, fuzzy logic, genetic algorithms & applications.

INSTR C313 Microelectronic Circuits 3 0 3

Course description is same as given under EEE C424.

INSTR C355 Electronic Instruments and Instrumentation Technology 3 3 4

Electronic indicating, display, recording and analysis instruments, signal generators, frequency synthesizer, counters, elements of design, grounding and shielding, electronic circuits manufacturing technology, metrology, standards in quality management, instrumentation in hazardous area, industrial communication techniques.

INSTR C364 Analog Electronics 3 3 4

Course description is same as given under EEE C364.

INSTR C371 Electromechanical Energy Conversion 3 3 4

Course description is same as given under EEE C371.

INSTR C381 Transducers & Measurement Systems 3 0 3

Importance and types of measurement, generalized measurement system, functional elements, static & dynamic characteristics, primary sensing elements, passive transducers, active transducers, inverse transducers, fiber optic transducers, MEMS based transducers, measurement techniques for motion, seismic, pressure, flow, temperature, level, humidity, pH, viscosity; signal conditioning techniques using bridge, op-amp, instrumentation amplifier, carrier, chopper, charge, isolation amplifier, data converters, filters, modulators; data acquisition systems.

INSTR C391 Digital Electronics and Computer Organization 3 3 4

Course description is same as given under CS C391.

INSTR C392 Analysis Instrumentation 3 0 3

Generalized configuration of an analysis instrument. Off-line analysis instruments: emission spectrometers, UV/VIS/IR absorption spectrophotometers, flame emission and atomic absorption spectrophotometers, X-ray fluorescence spectrometer and diffractometer, NMR and mass spectrometers, pH-meters, gas chromatographs, electrochemical instruments, analytical electron microscopes. On line analyzers: Sampling systems for gases and liquids, fluid density monitors, consistency and viscosity analysers, thermal conductivity gas analysers, paramagnetic oxygen analysers, chemical composition analysers, on-line instruments for measuring standard parameters, e.g. vapour pressure, distillation characteristics, cloud-point, pour point, flash point etc. Recent developments.

INSTR C411 Opto-Electronic Instruments 3 0 3

Optical radiation-its emission, control and detection; optical signal processing; amplifiers and associated electronic equipments. Opto-electronic system design-calorimeters, spectrophotometers, flame photometers, fluorimeter and turbidimeters; project equipments; introduction to laser-based instruments.

INSTR C414 Telecommunication Switching Systems and Networks 3 0 3

Course description is same as given under CS C414.

INSTR C421 Digital Systems 3 0 3

Prerequisite: EEE C391 or INSTR C391

Analysis and design of combinational and sequential digital circuits; data converters - A/D, D/A, V/F and F/V converters; special semiconductor devices, displays, ROM, RAM and their applications in instrumentation, digital instruments; programmable digital testing systems; electronic programmers; introduction to microprocessors, microprocessor based instruments and systems for measurement and control.

INSTR C444 Real-Time Systems 3 0 3

Course description is same as given under CS C444.

INSTR C451 Process Control 3 0 3

Prerequisite : AAOC C321

Course description is same as given under CHE C441.

INSTR C461 Power Electronics 3 0 3

Course description is same as given under EEE C461.

INSTR C471 Electronic Measurements and Instrumentation 3 0 3

Course description is same as given under EEE C471.

INSTR C481 Medical Instrumentation 3 0 3

Course description is same as given under EEE C432.

INSTR C491 Special Projects 3

Course description is same as given under BIO C491.

INSTR G611 Advanced Control Systems 3 2 5

Review of State variable modelling of linear continuous, linear discrete and non linear control systems; Time varying systems; Time domain solution; Controllability and observability; Stability; direct method of Lyapunov; Modal control; Optimal Control System; Calculus of variation, Minimum principle, dynamic programming, search techniques, Ricatti equation, Stochastic processes and Stochastic estimation and control; Adaptive Control system.

INSTR G612 Instrumentation Systems 2 2 5

Course description is same as given under BITS G654.

INSTR G621 Industrial Automation 3 2 5

Computer control theory, sampling of continuous time signals, computer oriented mathematical models, discrete time systems, and analysis of the same, translation of analog design, state space design methods, pole-placement design based on input/output models. Adaptive control principles, implementation of digital controllers, model reference adaptive systems, self-tuning regulators, stochastic adaptive control, auto-tuning, expert controllers, learning systems and other applications.

Information Systems

IS C311 Computer Concepts and Software Systems 3 0 3

Computer Structures; Machine and Assembly languages; Computer Architecture and Operating Systems; Operating Environment for Application Programs.

IS C312 Information Analysis 3 0 3

Software Requirements; Problem Identification and Feasibility Assessment; Notations for Problem Analysis like Data Flow Diagrams, Data Dictionaries and Entity-Relation Diagrams; Requirements Analysis Techniques like SADT and Object-Oriented Analysis; Software Requirements Specification; Behavioural and Non-Behavioural Requirements Specification; Requirements Prototyping; CASE Tools and Applications.

IS C313 Object Oriented Programming and Design 3 2 4

Course description is same as given as under CS C313.

IS C321 Program, Data and File Structures 3 0 3

Problem-solving using a high level programming language; Data abstraction and structuring; Data structures such as Stacks, Queues, Lists, Trees and Graphs and their implementation; Algorithms; Recursion; Sorting and Searching techniques; Files and file structures.

IS C331 Personal Computers and Computing 1 4 3

Personal Computers, State of Art of Personal Computing; Operations and Programming; Study and Practice of General Purpose Software Packages on PCs.

IS C332 Database Systems and Applications 3 0 3

Introduction to Database Management Systems; File organization; Data Independence in databases; Data Models; Query processing systems; Database Design techniques; Concepts of security and integrity in databases;

Distributed Databases; Applications using DBMS.

IS C341 Software Engineering 3*

Prerequisite: TA C252

Course description is same as given under BITS C461.

IS C342 Structures of Programming Languages 3 0 3

Programming paradigms and programming languages; programming language processors; syntax and semantics, binding; data types, structures; abstract data types; subprogram structure; sequence control; recursion; data control; storage management; syntax; translation; operating and programming environments; some theoretical models; case studies from some popular and widely used programming languages.

IS C351 Computer Organization and Architecture 3 2 4

Overview of logic design; Instruction set architecture; Assembly language programming; Pipelining; Computer Arithmetic; Control unit; Memory hierarchy; Virtual memory; Input and output systems; Interrupts and exception handling; Implementation issues; Case studies;

This course covers the fundamentals of computer organization and architecture from a programmer's perspective.

IS C352 Management Information Systems 3 0 3

Course description is same as given under BITS C471.

IS C362 Operating Systems 3 0 3

Course description is same as given under CS C372.

IS C363 Data Structures and Algorithms 3 2 4

Course description is same as given as under CS C363.

IS C411 Information Systems Project 3*

Practical work to be conducted through a project on analysis, planning and design of an information system.

IS C415 Data Mining 3 0 3

Course description is same as given as CS C415.

IS C421 Modelling and Decision Systems 3 0 3

Principles of decision making; modelling, tools of decision making, Decision Support Systems; Study work on available decision systems & packages.

IS C422 Parallel Computing 3 0 3

Course description is same as given under CS C422.

IS C424 Software for Embedded Systems 3 0 3

Course description is same as given as CS C424.

IS C431 Educational Software 1 4 3

Principles of text editing; elementary graphics; concepts of motion and animation; Visual effects in illustrations; design of simple educational software for elementary level subjects.

IS C442 Advanced Algorithms and Complexity 3 0 3

Course description is same as given under CS C442.

IS C444 Real-Time Systems 3 0 3

Course description is same as given under CS C444.

IS C446 Data Storage Technologies and Networks 3 0 3

Course description is same as given as CS C446 Data Storage Technologies and Networks.

IS C461 Computer Networks 2 2 3

Course description is same as given under CS C461.

(Prerequisite: IS C362 Conc.)

IS C462 Network Programming 3 0 3

Overview of computer networks; inter-process communication; network programming; socket interface; client-server computing

model: design issues, concurrency in server and clients; external data representation; remote procedure calls; network file systems; distributed systems design.

IS C471 Computer Graphics 2 2 3

Course description is same as given under CS C471.

IS C472 Geographical Information Systems 3 0 3

Introduction to geographical information systems, theory and applications of GIS, data sensing and collection, fundamental database concepts, fundamental spatial concepts, models of spatial information, representation & algorithms, structures & access methods, architectures and interfaces, data output and display techniques, next generation systems.

IS C481 Graphical User Interfaces 3 0 3

Course description is same as given under CS C481.

Internet Technology & e-Business

ITEB G511 Overview of e-Business 3

e-Business Environment and Opportunities: Background; e-Business evolution; e-Business environment; Diverse opportunities in e-Business; e-Businesses on the Internet. Categories of e-Business - B2B/E2EI, B2C, C2C; Overview of e-Business implementation technologies. e-Business Models - Enterprise portal, CRM, ERP, Supply Chain Planning (SCP), Transport Management System (TMS), Warehouse Management System (WMS), Content Management. e-Business Products-Development products; integration products; generic tools; performance analyzer tools; content management tools; component generator tools. Electronic Transaction and Security – Online payment system and security issues; Secure Transport Protocols, Secure Transactions, Secure Electronic Payment Protocol (SEPP), Secure Electronic Transaction (SET); Security features – certificates for authentication (SSL, third party certifications); security on Web servers and Enterprise Network. Emerging e-Businesses Scenario-Changing economic considerations; Emerging business opportunities and revenue models; emerging technologies; Social aspects.

ITEB G521 e-Business Technologies I 4

Overview of E-Business Architecture- DNA concept; Evolution of DNA – 3-tier and n-tier; Introduction to Presentation, Business and Data layers; HTTPS, Secure Socket Layer, Firewall, Proxy, Network Address Translator. Internet Servers – IIS, Netscape and Apache Servers; Installation, configuration and administration. Presentation Layer – HTML, DHTML, XML, CGI, Perl Script, Java Script; MS Platform – ASP, Active X controls, VB Scripts; SUN Platform- JSP, Java Applets. Business Layer - Technology/computing – COM/DCOM, COM+, CORBA, Java Servlets, EJB.

ITEB G522 e-Business Technologies II 4

Business Layer – Application servers- Weblogic, ATG Dynamo, Websphere, Coldfusion, iPlanet; Transaction Servers- MTS, Jaguar CTS, Tuxedo; MOM Servers- MSMQ, MQ Series, third party MOM servers. Data Layer – Data warehousing concepts; OLAP- concept and tools; XML support in ORACLE and SQL server; ADO, ODBC/JDBC, OLEDB. Case studies using Microsoft and Sun Technologies.

ITEB G621 Supply Chain Management 4

Customer driven strategies in production and distribution systems; Integrated production & distribution networks; SCM in the context of JIT and MRP-II; Distribution Resource Planning; Management of dealer networks; Total Quality Control & product innovation across the supply chain; Incoming logistics & supplier relationships; Value addition analysis; Metrics for management of supply chain performance; Mathematical models and computer assisted decision support for SCM; mathematical programming for SCM.

ITEB G542 Knowledge Management 3

Increasing knowledge work in organizations; technologies to support growth of knowledge work in organizations; scope, cost, efficiency

and reliability of technologies to support knowledge work; role of knowledge in an enterprise; knowledge management process; knowledge management strategies; human aspects of knowledge management; knowledge management technologies; applications of technologies to be covered through cases, reading assignments and use of appropriate software.

ITEB G552 Change Management 3

Nature of organizational change; change management; change perspectives and paradigms; Action Research Teaming; Understanding the human change process; need and opportunity in change initiatives; teamwork; data based change process; motivating and enabling change; becoming an effective change leader; change management competencies and its development.

Japanese

JAP N101T Beginning Japanese 3 0 3

Basic Japanese scripts (Hiragana, Katakana and Kanji); constructing words using Hiragana and Katakana and understanding their meanings; forming sentences, understanding their meanings, learning the related Kanjis; listening and reading comprehension, conversion practice, revision and additional practice through audio cassettes.

Mathematics

MATH C191 Mathematics I (Advanced Calculus) 3 0 3

Functions and graphs; limit and continuity; applications of derivative and integral. Conics; polar coordinates; convergence of sequences and series. Maclaurin and Taylor series. Partial derivatives. Vector calculus in R^n; vector analysis; theorems of Green, Gauss and Stokes.

MATH C192 Mathematics II (Complex Variables and Linear Algebra) 3 0 3

Complex numbers, analytic functions, Cauchy's theorems; elementary functions; series expansions; calculus of residues and applications.

Vector space; basis and dimension; linear transformation; range and kernel of a linear transformation; row reduction method and its application to linear system of equations.

MATH C222 Discrete Structures for Computer Science 3 0 3

Introduction to discrete mathematical structures; Formal logic and predicate calculus; Sets, relations and functions; Proof techniques; Graphs and trees; Primes, factorization, greatest common divisor, residues and application to cryptology; Boolean algebra; Permutations, combinations and partitions; Recurrence relations and generating functions; Introduction to error-correcting codes; Formal languages and grammars, finite state machines.

MATH C231 Number Theory 3 0 3

Primes and factorization; division algorithm; congruences and modular arithmetic; Chinese remainder theorem Euler phi-function and primitive roots of unity; Gauss's quadratic reciprocity law; applications to periodic decimals and periodic continued fractions.

MATH C241 Mathematics III (Differential Equations) 3 0 3

Eigen-values and eigen-vectors. Inner product space and orthonormal bases. Elementary differential equations, Hypergeometric equations, Lengendre polynomials, Bessel functions; Fourier series; Sturm-Liouville problem, series solution for differential equation, systems of first order equations; Laplace transformation and application to differential equations; one dimensional wave equation, one dimensional heat equation & Laplace equation in rectangular form.

MATH C311 Algebra I 3 0 3

Groups, subgroups, a counting principle, normal subgroups and quotient groups, Cayley's theorem, automprhisms, permutation groups, and Sylow's thorems.

Rings, ring of real quaternions, ideals and quotient rings, homorphisms, Eculidean rings, polynomial rings, and polynomials over the rational field.

MATH C312 Algebra II 3 0 3

Prerequisite: MATH C311

Dual spaces, modules, fields, finite fields, extension of fields: algebraic extension, separable and inseparable extension, normal extension, sptitting fields, Galois extension, and Galois group.

The algebra of linear transformations, characteristic roots and characteristic vectors, canonical forms: triangular form, nilpotent form, and Jordan form.

MATH C321 Elementary Real Analysis 3 0 3

Countability and uncountability of sets; real numbers; limits and continuity; compactness and connectedness in a metric space; Riemann integration; uniform convergence.

MATH C322 Measure and Integration 3 0 3

Prerequisite: MATH C321

Lebesgue measure and integration in real numbers, Convergence and Convergence theorems, absolutely continuous functions, differentiability and integrability, theory of square integrable functions, and abstract spaces.

MATH C331 Introduction to Topology 3 0 3

Metric Spaces; Topological Spaces – subspaces, Continuity and homoeomorphism, Quotient spaces and product spaces; separation Axioms; Urysohn's Lemma and Tietze extension Theorem; Connectedness; Compactness, Tychonoff's Theorem, Locally Compact Spaces; Homotopy and the fundamental group.

MATH C332 Introduction to Functional Analysis 3 0 3

Prerequisite: MATH C321

Banach spaces; fundamental theorems of functional analysis; Hilbert space; elementary operator theory; spectral theory for self-adjoint operators.

MATH C352 Differential Geometry 3 0 3

Prerequisite: MATH C321

Curve in the plane and 3D-space; Curvature of curves; Surfaces in 3D-space; First Fundamental form; Curvature of Surfaces; Gaussian and mean Curvatures; Theorema Egreguim; Geodesics; Gauss-Bonnet Theorem.

MATH C353 Statistical Inference and Applications 3 0 3

(Prerequisite: AAOC C111 Probability and Statistics)

Review of elements of probability and statistical methods, Classical Decision theory including parametric and non-parametric methods for testing of hypotheses, Analysis of Variance: One way and two way classifications, Design of experiments: Analysis of Completely randomized design, Randomized block design and Latin square design with one or more missing values, Statistical Quality control for variables and measurements.

MATH C411 Complex Analysis 3 0 3

A rigorous treatment of the theory of analytic functions of complex variables including Cauchy's theorems; maximum modulus theorem; the principles of argument; Jensen's formula; Mittag Lefler theorem; Weierstrass canonical products and analytic continuation.

MATH C412 Concepts of Geometry 3 0 3

Euclidean geometry and non-Euclidean geometries; affine and projective geometry; synthetic projective geometry, duality, perspectiviy, projectivity, coordinatization; analytic projective geometry, polarities, involutions, conics, finite geometries and their applications.

MATH C413 Topological Groups 3 0 3

Basic concepts and eamples; compact and locally compact groups; integration on locally compact groups; convolutions of functions and measures; representation theory; characters and duality theory; applications.

MATH C421 Combinatorial Mathematics 3 0 3

Course description is same as given under CS C451.

MATH C422 Algebraic and Differential Topology 3 0 3

Fundamental group; universal covering space; simplicial approximation; simplicial homology theory; differentiable structures and smoothness; ideas of curvature.

MATH C431 Distribution Theory 3 0 3

Prerequisite: MATH C321

C-infinity functions, distributions and their derivatives; support, convolution and regularization; distributions of finite order; multiplication of distributions; Fourier transforms of distributions; temperate distributions and their Fourier transforms; fundamental solutions.

MATH C441 Discrete Mathematical Structures 3 0 3

Course description is same as given under CS C453.

MATH C451 Ordinary Differential Equations 3 0 3

Existence and uniqueness theorems; properties of linear systems; behaviour of solutions of nth order equations; asymptotic behaviour of linear systems; stability of linear and weakly nonlinear systems; conditions for boundedness and the number of zeros of the nontrivial solutions of second order equations; stability by Liapunov's direct method; autonomous and nonautonomous systems.

MATH C452 Partial Differential Equations 3 0 3

Non linear equations of first order, Charpits Method, Method of Characteristics; Elliptic, parabolic and hyperbolic partial differential equations of order 2, maximum principle, Duhamels principle, Greens function, Laplace transform & fourier transform technique, solutions satisfying given conditions, partial differential equations in engineering & science.

MATH C461 Integral Equations 3 0 3

Classification of integral equations; modelling of problems as integral equations; Volterra equations of the first and second kind; Green's functions; Fredholm equations with degenerate kernels and symmetric kernels; Fredholm equations of the second kind; existence of solutions; numerical solutions.

MATH C471 Nonlinear Optimization 3 0 3

Introduction; convexity and cones; Kuhun Tucker theory; unconstrained and constrained optimization; gradient methods; polynomial optimization; penalty function; generalized convex functions; duality in nonlinear programming; optimality criterion for generalised convex functions; fractional programming.

MATH C481 Commutative Algebra 3 0 3

Modules; direct sums and products; finitely generated modules, exact sequences; tensor product of modules; rings and modules of fractions; localization; Noetherian modules and primary decompositions; integral dependence and valuation theory; integrally discrete valuation rings and Dedekind domains; fractional ideals.

MATH C491 Special Projects 3

Course description is same as given under BIO C491.

MATH D021 Remedial Mathematics 5 0 5

Algebra : Number systems; quadratic equations; progression; permutations and combinations; binomial theorem; vectors, matrices and determinants. Coordinate Geometry: Systems of coordinates, equation of a line and a circle.

Trigonometry: Trigonometric functions, heights and distances; trigonometric identities; sum and product formulae; properties of triangles.

Calculus: Functions and graphs; limits; derivatives of simple functions and their applications; integral as anti-derivative; methods of integration; definite integral.

MATH G511 Design and Analysis of Algorithms 5

Course description is same as given under CS G511.

MATH G512 Selected Topics in Advanced Mathematics for Engineering Situations 5

The topics may include mathematical theory of probability and stochastic processes, Graph theoretical techniques; information theory; pattern recognition; fuzzy sets.

MATH G521 Applied Functional Analysis 5

MATH G531 Number Theory 5

MATH G541 Advanced Methods in Discrete Mathematics 5

Course description for the above courses are to be developed.

MATH G611 Algebraic Number Theory 5

Localization, Galois extensions, Dedekind rings, discrete valuation rings; completion, unramified extensions, ramified extensions; the different and discriminant; cyclotomic fields, roots of unity, quadratic fields, relations in ideal classes; the unit theorem, Minkowski's constant, Zeta function.

MATH G612 Riemann Surfaces 5

Compact Riemann surfaces, algebraic functions, analytic continuations, branched coverings, study of line bundles, Riemann- Roch theorem, Serre duality theorem.

MATH G621 Fibre Bundles 5

Differential manifolds, tangent bundle, vector bundles, principal bundles, functorial properties, the Milnor construction, homotopy classification, Grassmannians, universal bundles, characteristic classes, introduction to K-theory.

MATH G622 Algebraic Geometry 5

Study of varieties, introduction to complex varieties, some ideas on schemes, complete varieties, cohomology of coherent sheaves.

MATH G632 Lie Groups and Lie Algebras 5

Lie groups: basic definitions, one parameter sub-groups, maximal tori, representation theory; Lie algebras: basic definitions, solvable and nilpotent lie algebras, cartan subalgebras, roots and weights, simple lie algebras, classification theorem universal enveloping algebras, PBW theorem.

MATH G642 Complex Manifolds 5

Manifolds and vector bundles: manifolds, vector bundles, & operator & almost complex manifolds; sheaf theory: Sheaf cohomology & Cech cohomology; differential geometry: Hermitian differential geometry, canonical connection & curvature of Hermitian holomorphic bundles, Chern classes of bundles.

Master of Business Administration

MBA C311Business Structure and Processes 4

Fundamental concepts, development of management theory, business forms, (proprietorship etc.); review of managerial functions (planning, organising, staffing, leading and controlling); business processes, structure and systems, socio-economic interface; overview of functional areas: operations/production, finance, accounting, personnel, marketing, materials, international business; developing an industrial culture.

MBA C312 Managerial Economics 3

Fundamental concepts, supply, demand, market mechanism; theory of demand (consumer behaviour); production, costs (theory of the firm); market structures (perfect competition, monopoly, monopolistic competition, oligopoly); circular flow of income, national income accounting, national income determination; money and banking, employment, interest, inflation.

MBA C317 Managerial Skills 1 0 1

Course description is same as that of BITS C317.

MBA C319 Negotiation Skills and Techniques 2 0 2

Course description is same as that of BITS C319.

MBA C321 Legal and Economic Environment of Business 4*

Course description is same as given as under BITS C321.

MBA C411 Organisational Behaviour 4

Evolution and relevance; perception emotions and learning in an organisational set up; attitudes and values, groups and group processes, leadership, power and politics, organizational change, resistance and development, managing conflict.

MBA C412 Human Resource Management 4

Strategic human resource management, manpower planning, job analysis, recruitment and selection, placement, induction, training and development, appraising and managing performance, compensation, employee discipline, workplace safety and health, collective bargaining, industrial relations, human resource accounting and audit.

MBA C413 Quantitative Methods 4

Grouping data, measures of central tendency and dispersion, probability distribution, sampling and estimation, testing hypotheses, chi-square and analysis of variance, regression and correlation, non-parametric methods, time series and forecasting, index numbers, decision theory, linear programming, transportation and assignment problems, queuing theory, network problems, simulation; application of statistical software (SYSTAT, SPSS, SIMULA8, etc.) and spreadsheets.

MBA C414 Technology Management 3 0 3

Course description is same as that of MGTS C414.

MBA C415 Financial and Management Accounting 4

Basic concepts, double entry accounting, journal, ledger, trial balance, profit & loss account, balance sheet, cash flow statement, financial statement analysis, ratio analysis, cost-volume-profit analysis, inventory valuation, inflation accounting, cost accounting and budgetary control systems, financial analysis and forecasting.

MBA C416 Corporate Finance and Taxation 4

Role and environment of managerial finance, time value of money (NPV, IRR), project feasibility, budgeting, long term investment decisions, long term financing decisions (LT & ST), capital structure, dividend decisions, short term financing decisions, working capital management, principles of corporate taxation, income tax, capital gains tax, tax laws and provisions, financial engineering.

MBA C417 Managerial Communication 4

Written communication: memos, letters, notices, agenda, minutes, resolutions, (project) proposals, reports; electronic communication: mail, privacy and workplace monitoring, teleconferencing; oral communication: group communications, presentations, public speaking, media; non-verbal communication, effective listening and feedback; reading skills.

MBA C418 Marketing 4

Definition, marketing research and forecasting demand, creating customer value, satisfaction and loyalty, analysing consumer and business markets, market segmentation, brand equity, brand positioning, product and pricing strategies, managing services, managing value networks and channels, integrated marketing communications, international marketing.

MBA C419 Production and Operations Management 4

Product & service design, plant location, aggregate planning, capacity, process, layout, sequencing & scheduling, line balancing, maintenance, quality (control, assurance, management), statistical quality control, queuing theory, project management. CPM, PERT.

MBA C421 Supply Chain Management 4

Purchase/procurement, stores, material handling systems, inventory analysis, inventory models, disposals, make or buy, outsourcing; vendor selection, development, and relations; Material requirements planning, manufacturing resources planning, ERP, JIT, inbound and outbound logistics, warehousing, transportation, packaging.

MBA C422 Business and Society 4

Corporate social responsibility, business ethics, policies, codes, standards, ethics and decision making, environmental and social issues, workplace diversity, fostering ethics at work (whistle blower policy); business and social etiquette, internet and online behaviour, etiquette and office electronics.

MBA C423 Business Policy and Strategic Management 4

Mission, vision, strategic intent, hierarchical levels of strategy, PEST analysis, SWOT analysis, industry analysis, organisational analysis, BCG matrix, GE matrix, core competencies, five force theory, value chain, competitive advantage, generic strategies, diversification, strategy implementation and control.

MBA C424 International Business 3 0 3

Course description is same as that of FIN C451.

MBA C425 R&D Management 3 0 3

Course description is same as that of STD C322.

MBA C426 Database Management Systems 4

Introduction to data bases and management; data files and structures; hierarchical, relational, network models; distributed data bases; query processing and query optimization, query languages; concepts of security and protection; case study of a data base system.

MBA C427 e-Business and Internet Marketing 4

e-business evolution & opportunities; categories of e-business; e-business models; network infrastructure & web based tools for e-business; e-business risks & risks management; network security and firewall; cryptography and authentication; billing/payment systems; regulatory environment of e-business; ERP/SCM/CRM and web based marketing; business intelligence & intelligent systems; data warehousing and data mining; implementing e-business systems & change management. Case studies and projects in e-business areas; emerging e-business scenarios.

MBA C428 Internet Security and Cyber Laws 4

Examination of issues related to network and information security, security concepts, security attacks and risks, security architectures, security policy management, security mechanisms, cryptography algorithms, security standards, security system interoperation and case studies of the current major security systems.

MBA C429 Recent Advances in ETM 4

Course description is to be developed.

MBA C433 Advertising and Sales Promotion 3 0 3

Course description is same as given under FIN C433.

MBA C436 Strategic Financial Management 3 0 3

(Pre-requisite: ECON C481= FIN C342= MGTS C382 Financial Management or MBA C416 Corporate Finance and Taxation)

Course description is same as given as under ECON C436.

MBA C437 Security Analysis and Portfolio Management 3 0 3

Course description is the same as that of MGTS C412.

MBA C451 Internetworking Technologies 3 0 3

Course description is same as that of EA C451.

MBA C454 Project Appraisal 3 0 3

Course description is same as given under ECON C411.

MBA C471 Management Information Systems 3 0 3

Course description is same as that of BITS C471.

MBA C481 Expert Systems 4

Course description is same as that of EA C481.

MBA C482 Creating & Leading Entrepreneurial Organizations 3 0 3

Course description is same as given under BITS C482.

MBA C483 Marketing Research 3 0 3

Course description is same as given under MGTS C483.

MBA C488 Services Management System 3 0 3

Course description is same as that of BITS C488.

MBA G512 Manufacturing Strategy 4

Course description is same as that of MM G512.

MBA G522 Total Quality Management 4

Course description is same as that of MM G522.

MBA G523 Project Management 4

Course description is same as that of CM ZG523.

MBA G552 Total Productive Maintenance 4

Course description is same as that of MM G552.

MBA G622 Software Project Management 4

Course description is same as that of SECT ZG622.

Mechanical Engineering

ME C211 Applied Thermodynamics 3 0 3

Thermodynamics of power developing and power absorbing reciprocating machines; vapour, gas and refrigeration cycles; regeneration, reheat, compound cycle modifications, combined gas turbine-vapour cycle, binary systems; thermodynamic relations; reactive systems; combustion, adiabatic flame temperature, dissociation, equilibrium.

ME C212 Transport Phenomena I 3 0 3

Fundamentals of the momentum, heat and mass transfer; the control volume approach and integral equations; differential analysis for momentum, heat and mass transfer, and solutions for one- dimensional steady state situations; convective heat and mass transfer; dimensional analysis.

ME C312 Design of Machine Elements 3 0 3

Fundamentals and principles of design; design and selection of machine elements such as shafts, bearings and gears etc; design of mechanisms.

ME C314 Power Plant Engineering 3 0 3

Classification of power plants. Components and layout of; thermal, nuclear, hydro electric power plants. Site selection for various power plants. Combined cycle power plants. Magneto Hydro Dynamics (MHD) systems. Economics of power generation, economic loading of power stations. Load curve analysis; load factor, diversity factor. Power plant instrumentation and controls.

ME C331 Transport Phenomena II 3 2 4

(For Mechanical Engineering)

Fundamental concepts of heat transfer; steady-state and unsteady- state heat conduction; analytical and empirical relations for forced and free convection heat transfer; heat exchanger analysis and design, heat transfer by radiation; elements of mass transfer; one dimensional compressible flow; flow in open channels, associated laboratory.

ME C332 Prime Movers and Fluid Machines 3 2 4

Theoretical analysis of energy and momentum transfer between fluid and rotor; principles of axial, mixed and radial flow compressors, turbines and pumps; design considerations; cascade aerodynamics and performance limitations; applications to power plant systems, laboratory exercises in testing reciprocating machines; rotary machines and refrigeration plants.

ME C342 Production Techniques 3 2 4

Analysis, economics and quality control of metal cutting, plastic working of metals, joining and casting processes, laboratory exercises in metal cutting, plastic working of metals, testing and inspection of weldments and castings.

ME C382 Computer Aided Design 3*

Course description is same as given under EA C342.

ME C392 Advanced Mechanics of Solids & Kinematics 3 0 3

Energy methods; asymmetrical bending; curved beams; thick cylinders; contact stresses; introduction to mechanisms; velocity and acceleration analysis using vector polygon method; kinematics of cams & synthesis of cam profile; gear trains.

ME C412 Production Planning & Control 3 0 3

Course description is same as given under ET C412.

ME C422 Dynamics of Machines & Vibration 3 0 3

Dynamic force analysis in mechanisms; determination of flywheel size; balancing of rotating & reciprocating masses; whirling of shafts; forced vibration & vibration isolation; multi-degree freedom systems; systems with distributed mass & elasticity.

ME C432 Computer Aided Manufacturing 3 0 3

Course description is same as given under ET C422.

ME C441 Automotive Vehicles 3 0 3

Internal combustion engines; vehicle performance; analysis and design of vehicle components. Experimental or theoretical investigation of problems selected from the field of automotive vehicles.

ME C442 Advances in Materials Science 3 0 3

Deformation of materials, deformation at high temperatures and creep, recovery, recrystallization and grain growth, fracture of materials and fatigue failure, deterioration of materials, corrosion and oxidation, surface properties, surface energy and tribology, polymers and fibre reinforced polymeric composites, mechanical testings, nondestructive testing techniques.

ME C443 Quality Control, Assurance & Reliability 3 0 3

Course description is same as given under ET C432.

ME C451 Mechanical Equipment Design 3 0 3

Design analysis for additional machine elements; retainment of bearings and design of machine housing; introduction to techniques of optimisation reliability and value analysis; exercises in detail design; design solutions to meet specified functional requirements.

ME C452 Composite Materials and Design 3 0 3

Introduction to composites, concepts of reinforcement, strengthening mechanisms, fibrous reinforcements, matrix materials, micromechanical aspects of composites, manufacturing methods, composite production design methods-design of tensile members, pressure vessels, storage tanks, and other chemical process equipment made of FRP, design of joints, damage of composites by impact, FRP grids, recent development in manufacturing of composites and technologies.

ME C461 Refrigeration and Air Conditioning 3 0 3

Course description is same as given under CE C461.

ME C472 Precision Engineering 3 0 3

Concept of accuracy, accuracy of numerical control systems, tolerances and fits, acceptance tests for machine tools, static stiffness and its influence on machining accuracy, inaccuracies due to thermal effects, influence of forced vibrations on accuracy, dimensional wear of cutting tools and its influences on accuracy, clamping and setting errors, location principles and errors due to

location, surface roughness and microfinishing processes, dimensioning and dimensional chains, methods of improving accuracy and surface finish, thread and gear measuring instruments, coordinate measuring machines, introduction to computer aided tolerancing.

ME C481 Project Appraisal 3 0 3

Prerequisite: ECON C212

Course description is same as given under ECON C411.

ME C491 Special Projects 3

Course description is same as given under BIO C491.

ME G511 Mechanisms & Robotics 2 3 5

Classification of robots & manipulators; fields of application; synthesis of planar & spatial mechanisms; methods of function & path generation; coupler curve synthesis; linkages with open loop; actuators & drive elements; microprocessor application and control of robots.

ME G512 Finite Element Methods 5

Fundamental concepts, matrix algebra and gaussian limination, one-dimensional problems, trusses, two-dimensional problems using constant strain triangles, axisymmetric solids subjected to axisymmetric loading, two-dimensional isoparametric elements and numerical integration, beams and frames, three-dimensional problems in stress analysis, scalar field problems, dynamic considerations, pre-processing and post processing.

ME G513 Heating and Cooling of Buildings 5

Introduction to HVAC design, basic scientific principles, climatic conditions, building heat transmission surfaces, infiltration and ventilation, heating loads, heat gains and cooling loads, HVAC psychometrics, codes and standards for HVAC systems design, acoustics and vibration, human comfort, air distribution, duct system design, fans and central air systems, air system heating and cooling, air cleaning and filtration, introduction to electrical systems, controls for air distribution systems.

ME G514 Turbomachinery 5

Introduction, thermodynamics, gas turbine plants, steam turbine plants, fluid dynamics, dimensional analysis and performance parameters, flow through cascades, axial turbine stages, high temperature turbine stages, axial compressor stages, centrifugal compressor stages, radial turbine stages, axial fans and propellers, centrifugal fans and blowers, and wind turbines.

ME G515 Computational Fluid Dynamics 5

Philosophy of computational fluid dynamics (CFD), governing equations of fluid dynamics, mathematical behavior of partial differential equations, basics of the numerics : basic aspects of discretization, grids with appropriate transformations, and simple CFD techniques, applications, numerical solutions of quasi-one-dimensional nozzle flows, numerical solution of a two-dimensional supersonic flow, incompressible couette flow, and supersonic flow over a flat plate, advanced topics in CFD.

ME G516 Energy Systems Engineering 5

Basic concepts of energy conversion, generation of electrical and thermal energy, transmission and distribution of electrical energy, load management, detailed analysis of utilization of thermal energy in : boilers, furnaces, compressors, heat transfer equipments, and HVAC systems, energy audit, waste heat recovery systems, cogeneration, demand side management, and management and organization of energy saving projects.

ME G521 Mechanical System Design 2 3 5

Concept of system design; modeling of structural and kinematic systems, and determination of system characteristics; reliability of systems; design of machine elements for specified reliability; concepts of optimization;

techniques of design optimization for linear and non-linear problems.

ME G532 Machine Tool Engineering 2 3 5

Design principles of machine tools; stiffness and rigidity of separate construction elements and their combined behaviour under load; design of stepped and stepless drives; electrical, mechanical and hydraulic drives; design of bearings and sideways; machine tool controls; machine tool dynamics; recent developments in machine tool design.

ME G611 Computer Aided Analysis and Design 2 3 5

Course description is same as given under CE G611.

ME G621 Fluid Dynamics 2 3 5

Course description is same as given under CE G621.

ME G631 Heat Transfer 2 3 5

Course description is same as given under CHE G631.

ME G641 Theory of Elasticity and Plasticity 2 3 5

Course description is same as given under CE G641.

Microelectronics

MEL G512 Optoelectronic Devices, Circuits and Systems 3 2 5

Course description is same as given under EEE G521.

MEL G531 Testable Design and Fault Tolerant Computing 3 2 5

Course description is same as given under CS G531.

MEL G532 Digital Signal Processing 3 2 5

Course description is same as given under EEE G572.

MEL G611 IC Fabrication Technology 3 2 5

Material properties; crystal growth and doping; diffusion; oxidation; epitaxy; ion implantation; deposition of films using CVD, LPCVD and sputtering techniques; wet and dry etching and cleaning; lithographic process; device and circuit fabrication; process modeling and simulation.

MEL G612 Integrated Electronics Systems Design 2 2 4

General architectural features of 8/16/32 bit microprocessors, programmers model of 8086, assembly language programming, hardware design around 8086, bus based systems design, system design around IBM PC, design of real-time systems, ASIC's development tools.

MEL G621 VLSI Design 3 2 5

Introduction to NMOS and CMOS circuits; NMOS and CMOS processing technology; CMOS circuits and logic design; circuit characterization and performance estimation; structured design and testing; symbolic layout systems; CMOS subsystem design; system case studies.

MEL G622 Introduction to Artificial Neural Networks 2 2 4

Fundamentals and definitions; Perceptrons, backpropagation and counterpropagation Networks; Statistical methods for network training; Hopfield nets; Associative memories; Optical neural networks; Applications of neural networks in speech processing, computer networks and visual processing.

MEL G623 Advanced VLSI Design 5

Deep submicron device behavior and models, Interconnect modeling for parasitic estimation, Clock signals and system timing--Digital phase locked loop design, memory and array structures, Input/output circuits design, ASIC technology, FPGA technology, High speed arithmetic circuits design,-Parallel prefix computation, Logical effort in circuit design, Low power VLSI circuits-Adiabatic logic circuits, Multi threshold circuits, Digital BICMOS circuits, Design of VLSI systems.

MEL G624 Advanced VLSI Architectures 5

Instruction set design and architecture of programmable DSP architectures; dedicated DSP architectures for filters and FFTs; DSP transformation and their use in DSP architecture design; Application Specific Instruction set Processor; superscalar and VLIW architectures.

MEL G625 Advanced Analog and Mixed Signal Design 5

Mixed signal blocks and design issues, Design of high speed comparators, opamps, Design of sample and hold circuits, Different architectures of analog to digital and digital to analog converters, Design of CMOS analog multipliers and dividers, Design of switched capacitor filters, Design of phase locked loop, Layout techniques for analog and mixed signal design, noise issues.

MEL G626 VLSI Test and Testability 5

Fault models and types; automated test generation for combinational logic; test generation for sequential logic; need for adding testability logic; design for testability; Adhoc DFT methods; structured DFT; test generation for delay fault; issues in analog circuit testing and testability.

MEL G631 Physics and Modelling of Microelectronic Devices 3 2 5

Physics and properties of semiconductor - a review; pn junction diode; bipolar transistor; metal-semiconductor contacts; JFET and MESFET; MOSFET and scaling; CCD and photonic devices.

MEL G632 Analog IC Design 3 2 5

Basic concepts; BICMOS process and technology; current and voltage sources; differential and operational amplifiers; multipliers and modulators; phase-lock techniques; D-to-A and A- to-D converters; micropower circuits; high voltage circuits; radiation resistant circuits; filter design considerations.

MEL G641 CAD for IC Design 3 2 5

Introduction to VLSI design methodologies and supporting CAD tool environment; overview of `C', data structure, graphics and CIF; concepts, structures and algorithms of some of the following CAD tools; schematic editors; layout editors; module generators; silicon compilers; placement and routing tools; behavioural, functional, logic and circuit simulators; aids for test generation and testing.

MEL G642 VLSI Architectures 2 2 4

Overview of CISC processor architectures; Instruction set architecture of CISC processor; hardware flow-charting methods; implementing microprocessor logic from hard-ware flowcharts; RISC instruction set architecture; Pipelined execution of RISC instructions; pipeline execution unit design; control hazards; design of memory hierarchy.

Manufacturing Engineering

MF C211 Applied Thermodynamics 3 0 3

Course description is same as given as under ME C211.

MF C212 Transport Phenomena I 3 0 3

Course description is same as given as under ME C212.

MF C312 Design of Machine Elements 3 0 3

Course description is same as given as under ME C312.

MF C313 Kinematics and Dynamics of Machines 3 0 3

Kinematics of mechanism: introduction to mechanisms, position, displacement, velocity, acceleration analysis, cam design, gear trains, synthesis of linkages. Dynamics of machines: static force analysis, dynamic force analysis (planar), dynamics of reciprocating engines, balancing, cam dynamics, flywheels, governors and gyroscopes, free and forced vibrations.

MF C314 Metal Forming and Machining 3 2 4

Metal forming: introduction, metal forming machines, metal forming process analysis and

design. Machining: introduction, metal cutting machine tools, mechanics of metal cutting, other aspects of machining processes, grinding and finishing operations, non-conventional machining processes and processing of plastics.

MF C315 Casting and Welding 3 2 4

Casting: fundamentals of casting processes, design of castings, furnaces, foundry mechanization, special casting processes, economics of casting, inspection and defects of casting. Powder metallurgy: introduction, methods of powder production, characteristics and properties of powder, manufacturing methods, furnaces, finishing processes, economics of powder metallurgy. Welding: introduction, various welding processes, design for welding, safe practices in welding, inspection and defects of welding, economics of welding, brazing and soldering.

MF C316 Manufacturing Management 3 0 3

Introduction, product planning, forecasting, facilities location, process planning and design, layout of facilities, performance measures and capacity planning, planning and scheduling, material requirements planning and Just-in-time systems, inventory control, human resource management, financial management, marketing management, customer relationship management.

MF C317 Instrumentation and Control 3 0 3

Course description is same as given as under ET C341.

MF C318 Design of Machine Tools 3 0 3

Introduction to machine tool drives and mechanisms - general principles of machine tool design, regulation of speed and feed rates, design of machine tool structures, design of guideways and power screws, design of spindles and spindle supports, dynamics of machine tools, control systems in machine tools.

MF C319 Mechatronics and Automation 3 0 3

Introduction to mechatronics, sensors and transducers, pneumatic and hydraulic actuation systems, mechanical actuation systems, electrical actuation systems, digital logic, microprocessors and programmable logic controllers; Introduction to automation, features of numerical control machine tools, numerical control part programming, control loops for numerical control systems, computerized numerical control, adaptive control systems, industrial robots, automatic identification and data capture, automated production lines and automated assembly systems.

MF C321 Mechanical Engineering Drawing 3 0 3

Introduction to design process and drawings, review of sectioning, drawing standards, dimensioning and notes, fasteners - screws, bolts and nuts, riveted joints, pins, locking devices, welded joints, pipe joints, unions and valves, assembly drawings with sectioning and bill of materials, cotter and knuckle joints, Assemblies involving machine elements like shafts, couplings, bearings, pulleys, gears, belts, brackets, tool drawings including jigs and fixtures, engine mechanisms - assembly and disassembly, detailed part drawings from assembly drawings, production drawings - limits, fits and tolerances, dimensional and geometric tolerances, surface finish symbols, layout drawings, schematics, process and instrumentation diagrams, piping drawings, structural drawings – examples for reading and interpretation, use of software packages for engineering drawings and reverse engineering.

MF C343 Maintenance and Safety 3 0 3

Course description is same as given under ENGG C242.

MF C382 Computer Aided Design 3*

Course description is same as given under EA C382.

MF C411 Tool and Fixture Design 3 0 3

Tool-design methods, tool making practices, tooling materials and heat treatment, design of cutting tools, gages and gage design, locating and clamping methods, design of drill

jigs, design of fixtures, design of sheet metal blanking and piercing dies, design of sheet metal bending, forming and drawing dies, using plastics as tooling materials, tool design for numerically controlled machine tools and automatic screw machines.

MF C412 Automotive Systems 3 0 3

Frame, suspension, springs and wheels, clutch and gear box, propeller shaft, universal joint, final drive, differential and rear axle, front axle and steering mechanism, brakes, automotive air conditioning, electrical vehicles, automotive electrical systems, automotive electronics systems.

MF C413 Mechanical Vibrations and Acoustics 3 0 3

Introduction, single degree-of-freedom systems: free and forced vibration problems, concept of resonance and damping, vibration isolation, multi-degree-of-freedom systems: modeling of multi-degree-of freedom systems, eigen value problem and calculation of normal modes of a system, forced response using modal superposition techniques, introduction to acoustics - terminology used in acoustics and definitive of fundamental quantities 1D wave, equation (plane waves) & 3D wave equation, formulation and fundamental solution to the equations, measurement of noise & vibration – vibration measurement principles.

MF C414 Manufacturing Excellence 3 0 3

Introduction, frameworks of manufacturing excellence, practices for manufacturing excellence: leadership and change management, manufacturing strategy, innovative product planning, total productive maintenance, total quality management, lean manufacturing, customer relations management, green manufacturing, supply chain management, knowledge management and social responsibility.

MF C415 Noise Engineering 3 0 3

Fundamentals of vibrations, vibrations of strings and bars, vibrations of membranes and plates, acoustic wave equation, acoustic energy and sound intensity, propagation of sound, concept of acoustic impedance, sound power transmission, transmission loss, human response and ratings, various measures of sound, weighting filters, loudness, indices of loudness, acoustic radiation from spherical source and piston source, acoustic sensors, measuring techniques and instruments, octave filtering, sound intensity measurement, intensity mapping, different types of measurement environment and uses, response of beam subjected to an acoustic plane wave, transmission loss of panels, sound absorption coefficient, noise control measures in building, reverberation time and auditorium design, industrial noise control, noise in machinery, traffic noise, vehicle noise, design of silencers and mufflers, active noise control, duct noise control and cabin noise control, practicals on noise measurements in different situations.

MF C416 Work System Design 3 0 3

Introduction to work systems design, productivity and work study, method study: process analysis, man-machine analysis, operation analysis and micro-motion study, introduction to ergonomics and principles of motion economy, work measurement: stop watch time study, work sampling, standard data and predetermined motion time systems, job enlargement and job enrichment, incentive schemes.

MF C417 Internal Combustion Engines 3 0 3

Air standard cycles, fuel air cycles, actual cycles and their analysis, fuels, alternative fuels, carburetion, mechanical and electronic injection systems, ignition, combustion and combustion chambers, engine friction and lubrication, heat rejection and cooling, engine emissions and their control, measurements and testing, performance parameters and characteristics, engine electronics, supercharging, two-stroke engines.

MF C418 Lean Manufacturing 3 0 3

Fundamentals of continuous improvement, value added and waste elimination, elements of lean production: small lot production, setup time reduction, maintaining and improving equipment, pull production systems, focused factories and group technologies, work cells and cellular manufacturing, standard operations, quality of design, systems for eliminating defects, simplified production planning and control systems: scheduling for smooth flow, synchronizing and balancing process, planning and control in pull production, beyond the production systems: managing the supply chain, activity based costing, performance measurement.

MF C421 Supply Chain Management 4*

Course description is same as given under MBA C421.

MF C432 Computer Aided Manufacturing 3 0 3

Course description is same as given under ET C422.

MF C441 Quality Control Assurance and Reliability 3 0 3

Course description is same as given under ET C432.

MF C442 Advances in Materials Science 3 0 3

Course description is same as given under ME C442.

MF C453 Industrial Relations 3 0 3

Course description is same as given under CDP C364.

MF C472 Precision Engineering 3 0 3

Course description is same as given under ME C472.

MF C473 Product Design and Development 3 0 3

Introduction to product design and development, product development planning and process tools, technical and business concerns, understanding customer needs, function modeling, benchmarking and engineering specifications, product architecture, concept generation, concept selection, concept embodiment, modeling of product metrics, design for X, physical prototypes, physical models and experimentation, robust design.

MF C474 Product Design and Development Projects 3 0 3

The course will essentially deal with the practice of product design and development. The student will involve in the design and development of different products. He will be guided by the instructor/resource person. The effort must culminate with a product along with the project report.

MF C481 Project Appraisal 3 0 3

Course description is same as given under ECON C411.

MF C491 Special Projects 3

Course description is same as given under BIO C491.

Management

MGTS C211 Principles of Management 3 0 3

Fundamental concepts of management - planning; organizing; staffing; directing and controlling; production, financial, personnel, legal and marketing functions; accounting and budgeting, balance sheets.

MGTS C233 Principles of Marketing for Engineers 3 0 3

Prerequisite: MGTS C211- Principles of Management

Defining marketing for 21st century. gathering information and scanning the environment. conducting marketing research and forecasting demand, creating customer value satisfaction and loyalty, analyzing consumer markets, analyzing business markets, identifying market segments and targets, branding and positioning, setting product strategy, developing pricing strategies and programs, designing and managing value networks and

channels, managing retailing wholesaling and logistics, designing and managing integrated marketing communications, managing mass communications, managing personal communications.

MGTS C322 Marketing 3 0 3

Course description is same as given under FIN C431.

MGTS C351 Organisational Behaviour 3 0 3

Course description is same as given under FIN C441.

MGTS C362 Human Resource Development 3 0 3

The strategic role of human resources management; human resource development – concept, goal, mechanism, and design the system; manpower planning and policies; staffing process- recruitment & placement, job analysis, selection, managing employee separation, downsizing and outplacement; maintaining & developing people- training & development, developing managers, appraising performance, managing career, employee remuneration; governance- developing employee relations & communication, respective employee rights & managing discipline; trade union; managing safety & health.

MGTS C371 Management Information Systems 3 0 3

Course description is same as given under BITS C471.

MGTS C372 Corporate Planning 3 0 3

Course description is same as given under FIN C442.

MGTS C381 Management Accounting 3 0 3

Course description is same as given under FIN C331.

MGTS C382 Financial Management 3 0 3

Course description is same as given under ECON C481.

MGTS C392 Operations Management 3 0 3

Production systems; operations strategy; product and process design; facility location & layout; capacity planning; aggregate planning; operations scheduling and control; productivity of operations; inventory planning & independent demand systems; MRP; quality management; project management; Japanese approach to operations management (JIT, TPM, continuous improvement).

MGTS C412 Security Analysis and Portfolio Management 3 0 3

Course description is same as given under CDP C313.

MGTS C414 Technology Management 3 0 3

Concept of technology, nature of technological change, economics of technology, corporate technology strategy, analysis for technology strategy, adoption and management of new technology, accounting for technology, appropriate technologies, transfer of technology, influence of government policies on technology, technology, management for sustainable development.

MGTS C422 Function & Working of Stock Exchanges 3 0 3

Course description is same as given under CDP C323.

MGTS C424 Money, Banking and Financial Markets 3 0 3

Course description is same as given under ECON C362.

MGTS C432 Quality Control, Assurance and Reliability 3 0 3

Course description is same as given under ET C432.

MGTS C433 Advertising and Sales Promotion 3 0 3

Course description is same as given under FIN C433.

MGTS C441 Marketing Non-profit Organizations 3 0 3

Particular aspects of marketing for non-profit organizations; characterization of non-profit organizations, organising, analysis, planning, adaptive marketing techniques for non-profit organisation; attracting resources for nonprofit organisations.

MGTS C442 Consumer Behaviour 3 0 3

Concepts and characteristics of modern consumer behaviour; marketers' and consumers' views of consumer behaviour; market segmentation of consumers; consumer motivation; personality, values and involvement; consumers' perception, learning and attitudes, external influences on consumer behaviour-social, cultural, and situational; influences of sales persons and advertising on consumer behaviour; consumer decision process.

MGTS C443 Econometrics 3 0 3

Course description is same as given under ECON C342.

MGTS C451 Project Appraisal 3 0 3

Prerequisite: ECON C212

Course description is same as given under ECON C411

MGTS C452 Materials Management 3 0 3

Course description is same as given under ET C342.

MGTS C453 Industrial Relations 3 0 3

Course description is same as given under CDP C364.

MGTS C461 Technology Forecasting 3 0 3

Course description is same as given under ECON C451

MGTS C462 Services Marketing 3 0 3

Course description is same as given under FIN C462.

MGTS C463 Government and Business 3 0 3

Need for government regulations; statutory provisions governing business transactions; contract act; sales of goods act; regulative role of state; promotional role of state.

MGTS C472 International Financial Markets & Services 3 0 3

Course description is same as given under FIN C312.

MGTS C473 International Business 3 0 3

Course description is same as given under FIN C451.

MGTS C481 Industrial Marketing 3 0 3

Market/consumer orientation, marketing in industrial context, industrial market behaviour, organisational buying and buying behaviour, business forecasting and planning, product planning, new product development, pricing, distribution, management of communications, advertising & personal selling, management of sales force, corporate strategy and industrial marketing.

MGTS C482 Franchising 3 0 3

History and Development, pros and cons of franchising, evaluating, purchasing and financing a franchise, preparations and guidelines for franchise operations, franchise agreement and manuals, international franchising.

MGTS C483 Marketing Research 3 0 3

An examination of the concepts and practical methodology used in marketing research. An overview of marketing research process, with emphasis on research design; data instrument design; questionnaire formulation; sampling plans; data collection methods -interviewing, panels; data analysis and use of computer based information systems for marketing intelligence. Also Time-series & Regression based models of sales forecasting, control and evaluation of marketing function and survey methodology are covered.

Emphasis will be on cases and research projects.

MGTS C491 Special Projects 3

Course description is same as given under BIO C491.

MGTS G511 Advanced Marketing Theories and Advertisement 5

Strategic planning, theory and methods with emphasis on customer, competitor industry and environmental analysis and its application to strategy development and choice. Marketing communication through advertising and related mass media and promotion campaigns and its influence on market and other organisation. Globalisation and marketing aspects.

MGTS G513 Public Programme Evaluation 5

Value judgements & public choice, social welfare-Paretion Welfare Economics; market system, income distribution and government & the market. social cost benefit Analysis (SCBA):SCBA and public sector investment planning, efficiency pricing & the rational of new methodology, problems of pricing comparative advantage, social pricing; the application SCBA: economic pricing of factor of production, social pricing, distribution & public sector; management values of public sector undertakings.

MGTS G521 Business Policy-Structure and Organisation 5

Frame-work of business dynamics; missions; objective and goals; social aspects of business policy; environmental analysis; the dynamic setting of business policy; internal analysis of resources - strength and weaknesses; strategic planning choice, implementation and evaluation; functional policies; orientation in special cases - MNC's high-tech companies, non-profit organisations etc.

MGTS G531 Recent Advances in Organisation Behaviour Theory 5

Emerging challenges of human resource management- a futuristic perspective; unified global theory of management; empowerment; employeeship; entrepreneurship; organisation diagnosis and development; social system and organisational culture-both in the national and global context interpersonal and group dynamics; employee attitudes; leadership and decision making; motivating employees; quality of work life and socio - technical systems; dealing with subordinates, boss, peers, problem employees.

MGTS G541 Management Information and Decision Support Systems 5

Course description is same as given under BITS G641.

MGTS G551 Frontiers in Financial Management 5

Course description to be developed.

MGTS G561 Institutional Finance and Project Appraisal 5

Mobilization of funds internally, externally, financial institutions and international financial institutions, financial and monetary framework of international financial management, foreign exchange markets and negotiations, project definition, preparation of feasibility assessment and selection, project reporting, conventional project appraisal - limitations, towards a new framework.

Management Systems

MGSYS C411 Marketing 2 2 4

Definition and scope, consumer behaviour, competitive behaviour, demand estimation, new product introduction, product/brand management, pricing policies, channels of distribution, credit management, advertising and other sales promotion, positioning, marketing regulation, market research basics of industrial marketing.

MGSYS C421 Organization: Design and Process 2 2 4

Organizational structural characteristics, efficiency, effectiveness and adaptability, structural characteristics including management hierarchy, the design of departments, divisions and groups, reward and control system as well as organizational goals, objectives, politices and procedures, conceptual model for organization behaviour, the dynamics of organization behaviour - group dynamics, communication, conflict and stresses, leadership processes and styles, team de-

velopment and team building, motivation, organization development process, consultant and consultancy styles, many agement of change, resistance to change.

MGSYS C431 Accounting and Finance 2 2 4

Financial accounting, GAAP, cost accounting, budgetary control, valuation of inventory and assets, modern trends, role of internal auditing, internal versus external auditing, accounting control and information systems, introduction to financial management, financial planning and control, working capital management, management of fixed assets.

MGSYS C441 Human Resource Management 2 2 4

Introduction, manpower planning, career and succession planning, procurement of personnel, performance appraisal, job satisfaction and morale, job rotation, employee communication, audit and control, management training and development, wage and salary administration, welfare administration, trade unions and collective bargaining, industrial dispute and worker participation in management.

MGSYS C451 Production & Operations Management 2 2 4

Production & operations management functions; capacity requirement planning; inventory control; layout, handling & location decisions; resource procurement & operation control; project scheduling & resource allocation; the production & operating function; methods of forecasting demand; financial analysis of operating plans; determination of economic order quantity; development of efficient work methods, quality control, management of R&D, technological forecasting, equipment replacement and interfaces with other functional areas.

MGSYS G511 Legal Environment of Business 2 2 4

Need for government regulations; Companies Act; Financial regulations, SEBI, BIFR and others, Contract Act and Sale of Goods Act. Corporate tax laws - Direct and Indirect.

MGSYS G521 Institutional Finance and Project Appraisal 2 2 4

Framework for domestic/international institutional finance evaluation; Project identification, feasibility, appraisal, financial and capital structures, capital market instruments; managing new issues; negotiation with FIs, FIIs and other market players; issue pricing, SEBI guidelines, syndication of loans including term loans, lease financing. Financial projections, profitability, cost and benefit analysis, appraisal criteria- financial, economic and social, risk analysis.

MGSYS G531 Decision Analysis 2 2 4

Introduction to quantitative techniques and statistics, Decision making, intelligence design and choice phases, basic theory of decision making under uncertainty; decision trees, qualification of judgments and preferences, Bayes theorem, the structuring of complex decisions, and multi-attribute utility theory. Statistical estimation and forecasting.

MGSYS G541 Economic Environment of Business 2 2 4

Economic environment, theories and techniques of price and output decision, theory and measurement of demand, production functions, cost output relationships, pricing practices and competitive and eligopolistic market, the social, policital technological and ethical issues confronting contemporary managers and the modern corporation, the role of business in society. Aggregate economies; savings and investment analysis; fiscal policy; monitory policy; central budgets.

MGSYS G551 International Business 2 2 4

International business - an overview, general international environment - political, legal, socio-cultural and economic factors, international operational framework, tax aspects, marketing factors, labour factors and economic integration. BOP analysis, foreign exchange control, governmental policies, inter-

national finance, economic community, IMF, managing multinationals/globalization of operations.

MGSYS G611 Strategic Management & Business Policy 2 2 4

Strategic management elements; internal, external, external environment. assessment of corporate strengths, weaknesses and opportunities; planning and deployment of capital assets; profit planning and control functions problems, pressures, responsibilities, limits of the chief executive; evaluation of one's own business undertaking; formulating objectives, strategies, policies and programmes for improving compay's present situation; personnel strength and implementation of the policies and programmes, development, implementation, evaluation and control of strategies, strategic management of MNCs, management style and behaviour, corporate style, behaviour and culture.

MGSYS G621 Advanced Marketing Theories and Advertising 2 2 4

Strategic planning, theory and methods with emphasis on customer, competitor industry and environmental analysis and its application to strategy development and choice. Advertising and promotion management; profit, goals, market share objectives, setting the budget; target audience selection and action objects; Profiling the decision maker, communication objectives; Brand attitude strategy, processing brand awareness, promotion's action and communication objectives, consumer trial promotions, consumer usage promotion; media selection, media scheduling by effective frequency; advertising strategy research. Ad testing compaign, Evaluation research.

MGSYS G631 Advanced Financial Management 2 2 4

Introduction to financial environment, financing and dividend policies, capital markets and valuation of company, asset pricing model; arbitrage pricing theory; options, futures and swaps; rational expectations; financial signalling; expected utility theory; diversification, portfolio seletion; international capital budgeting; mergers and acquisitions.

MGSYS G641 Management Information and Decision Support Systems 2 2 4

MIS introduction and concept, concept of information, system and management, database management system, decision making, planning, designing, developing implementing and evaluating IS, organisation structure and MIS placement, management support systems; DSS, EIS. ES; applications of artificial intelligence in business.

Manufacturing Management

MM G511 Manufacturing Organization and Management 5

Manufacturing environment; Engineering considerations; Design and planning of manufacturing systems; Manufacturing cost control; Material flow control; Quality; Human resources; Financial management; Marketing management.

MM G512 Manufacturing Strategy 4

Corporate strategy; Missing links in manufacturing strategy; Audit approach; Restructuring; Manufacturing strategy process in practice; Formulation as a process; Operating strategies; Methodology framework; Lean production; Competitive priorities; Strategic value of response time and product variety; Flexibility in context of manufacturing strategy; Manufacturing focus; Business process reengineering; Theory of constraints; Link between strategy and organizational culture; Evolution of manufacturing systems; Operations management strategic perspective.

MM G521 Financial Management 4

Concepts and techniques of financial management decision; concepts in valuation - time value of money; valuation of a firm's stock, capital asset pricing model; investment in assets and required returns; risk analysis; financing and dividend policies, capital structure decision; working capital management,

management of cash, management of accounts receivable; inventory management, short and intermediate term financing, long term financial tools of financial analysis, financial ratio analysis, funds analysis and financial forecasting, operating and financial leverages.

MM G522 Total Quality Management 4

TQM principles and practices; leadership; customer satisfaction; employee involvement; continuous process improvement; supplier partnership; performance measures; statistical process control; ISO 9000; benchmarking; quality function deployment; concurrent engineering; experimental design; Taguchi's quality engineering; product liability

MM G531 Concurrent Engineering 5

Course description is same as given under MSE G531.

MM G532 Logistics Management 4

Role of logistics; Customer service; Logistics information systems; Managing materials flow; Transportation; Warehousing; Packaging issues; Global logistics; Organizing for effective logistics; Methods to control logistics performance; Supply chain management; Implementing logistics strategy.

MM G542 Just-in-Time Manufacturing 4

Introduction; Toyota production system; JIT implementation surveys; Design, development and implementation of JIT manufacturing systems; Supply management for JIT; Framework for implementation of JIT; Theoretical research in JIT systems; Various case studies.

MM G552 Total Productive Maintenance 4

Outline of TPM; TPM – Challenging limits; Maximizing equipment effectiveness; Organizing for TPM implementation; TPM implementation and stabilization; TPM small group activities; the PM prize for outstanding TPM plants.

Public Health

MPH C431 Accounting & Finance 4

Course description is same as MGSYS C431.

MPH G510 Biostatistics & Computers in Public Health 5

Introduction to data classification, analysis and probability; statistical inference – estimation and hypothesis testing; linear regression and correlation; design of experiments; analysis of variance; non parametric procedures & tests; statistical quality control; experimental design in clinical trials and validation; basic techniques in optimization.

Introduction to computer and its component, operating systems; principles and use of standard software packages having application in drug design, development, analysis, etc; principles of software creation; processing concepts, flow charting and algorithms, programming constructs, programming languages, program development sequence; information systems; need, significance concepts, their analysis, design and implementation; software life cycle with special reference to software planning and maintenance.

MPH G512 Environmental & Occupational Health 4

Introduction to environmental health and its importance; pollution from water, air, automobile, chemicals used in agricultural sector and their implication on health and environment; techniques for studying, monitoring and controlling pollution; handling and disposal of domestic industrial and bio-medical refuse, incineration of waste materials; methods of vector control; effect of low frequency electromagnetic radiation and nuclear radiation on public health, occupational health hazards; disaster management.

MPH G513 Public Health & Diseases 4

Tropical diseases – their geography, identification, treatment methods, medicines, design of standard protocols and immunization processes including planning and execution; infections due to ticks and mites; bacterial, parasitic and viral infections- types and their classification, host–parasite relationships, their

mode of proliferation, mechanisms of infestation, carriers, preventive methods and processes; understanding the public health problems related TB, AIDS, leprosy, GI infections and other communicable diseases.

MPH G515 Communication in Health Care 4

Role and importance of communication; effectiveness in oral and written communication; technical reports; technical proposals; research papers, interpersonal communication; business correspondence; use of modern communication aids and mass media; behavioral change communication; design, management & evaluation of IEC.

MPH G521 Health Care Management 4

Basis of organizational culture and management techniques for efficient administration of health delivery; general principles of HR, materials and operation management; understanding the organizational culture that exists in public, private and non-Govt. sector agencies; management information system.

MPH G522 Preventive Nutrition & Health Promotion 4

Basic concepts; nutritional requirements of essential nutrients, proteins, fats, carbohydrates, vitamins and minerals; balanced diet; nutritional problems in public health; nutritional factors in selected diseases; assessment of nutritional status; nutritional surveillance; mal-nutrition; special nutritional programme.

MPH G523 Epidemic & Disaster Management 4

Disaster management; impact and response; relief phase; disaster mitigation in health sector; disaster preparedness; policy development; man-made disasters; international agencies providing health based humanitarian assistance; and strategies for disaster management.

MPH G531 Health Economics & Financial Management 4

Concepts & methods of economic analysis related to health system; organization and policy; demand and supply of scarce resource for health care; health financing & population coverage; determinants of cost & utilization; health insurance; cost-benefit analysis; costing for decision making; fundamentals of accounting; financial statement analysis; budget process & budgetary control; capital investment decision.

MPH G535 Family & Community Health Measures 3

Community-level indicators (CLI) measure aspects of the physical, legal, social and economic environment that reflect and are likely to influence the attitudes and behavior of individuals and community members. They also measure an important step in community-based health promotion interventions, Topics like, rural health services and health sector reforms from community perspective.

MPH G537 Law & Ethics in Public Health 3

Various Acts/ legislations/ rules pertaining to public health and related fields like, drug & pharmaceuticals, medical practice, PNDT, CPCSEA, IHEC, Regulations related to waste disposal.

MPH G538 Telemedicine 3

Advancing the use of digital telecommunications technology for the purpose of improving health care delivery to rural and underserved remote populations. Service areas include clinical services, educational programs, and research and development to provide high quality specialty care in participating rural communities and evaluation of the clinical utility and cost impact of telemedicine. Topic included will be Introduction to Telemedicine, Telehealth, Telemedicine Services, Telemedicine Systems and Telecommunications, Telemedicine Applications, Benefits and Drawbacks of Telemedicine, Information Sources, Advancing Telemedicine, etc.

MPH G539 Inter-sectoral co-ordination in Health Services 3

Roles of public, private, government, non-government sectors in providing health services, Public works department, Sanitation, Waste disposal and management, Water and air pollution monitoring and control, Deforestation, Urbanization and rural development, Employment and occupational health hazards, Training of administrators and enforcement agency staff, Public awareness programs, etc.

MPH G540 Role of Voluntary bodies/ NGO's in Public Health 3

Civil society organizations, Red Cross, Red Crescent movement and nongovernmental organizations in fund raising, international and local humanitarian responses, partnerships and collaborations with civil society, Operations in remote areas and marginalized groups; Role of indigenous voluntary bodies, Functioning of NGOs, WHO in preparedness and response efforts and Needs-based deployment of available resources, Effective health services coordination, etc.

MPH G613 Health Systems and Society 2

Introduction to health systems; functions of health systems; managing health systems; problems of health systems management; Major environmental health problems including quality of water, waste disposal food production and processing, vector control etc. Air pollution and its controlling, Hazards of radiation, municipal and other wastes, Occupational health hazards.

MPH G661 Research Methodology I 5

Course description is same as given under SKILL G661.

MPH G665 Hospital Operations Management 3

Course description is same as given under HHSM ZG665.

MPH G681 Strategic Management 3

Concepts of Strategic Planning; Environment Analysis; Internal and External; Resource Analysis; Organizational Structure and Linkage with Strategies, Formulation, Implementation and Control of Strategic Plan; Communicating Strategic Plan; Case studies.

MPH G692 Epidemiology 2

Introduction to the principles and methods of epidemiology. Epidemiology of some illustrative infectious diseases (of bacterial, rickettsial and viral origins), sexually transmitted diseases, chronic diseases such as cancer, cardiovascular diseases, neurological disorders etc. Use of biostatistics in epidemiology.

Manufacturing Systems Engineering

MSE G511 Mechatronics 3 2 5

Concepts of measurement of electrical and non-electrical parameters; displacement, force, pressure etc. and related signal conditioning techniques, drives and actuators, concepts of microprocessors/ microcontrollers architecture and programming, memory and I/O interfacing. System design concepts through case studies.

MSE G512 Manufacturing Planning and Control 4

Introduction, operations and manufacturing strategy for competitive advantage, product design and planning, forecasting product demand, facilities location, process selection and design, capacity planning, layout of facilities, job design and work measurement, aggregate planning, master manufacturing schedules, material requirements planning for dependent demand, short-term schedules and shop floor control, independent demand inventory systems, logistics and supply chain management, just-in-time systems, maintenance and reliability, quality management, managing projects, strategies for manufacturing excellence.

MSE G513 Maintenance Engineering 5

Introduction, maintenance systems, methods and tools of maintenance analysis, eliability and safety, maintainability, supportability, design for maintenance, maintenance integration, computerized maintenance

management systems, TPM, world-class maintenance systems, and maintenance effectiveness and performance evaluation.

MSE G514 Leadership and Managing Change 4

Individuals as leaders, team leadership and organizational leadership. Introduction to managing change, management of change : organisational structure, culture, recruitment, performance management, human resource development, reward management, employee relations and involvement, downsizing, and evaluating and promoting.

MSE G521 World-Class Manufacturing 3 2 5

The world-class manufacturing challenge, developing a world-class manufacturing strategy, just-in-time, total quality, total employee envolvement, world-class information systems, managing the change, methods and procedures; improved brainstorming methods, using the check-total quality - the first steps, getting people involved, monitoring world-class performance.

MSE G531 Concurrent Engineering 3 2 5

Introduction of concurrent engineering and need, concurrent engineering tools, advances in design and manufacturing engineering, design for manufacture, design for assembly, rapid prototyping, simulation, concurrent approaches to design, manufacturing and other aspects of engineering.

Materials Science and Technology

MST G511 Nondestructive Testing Techniques 3 2 5

Ultrasonic testing, X-radiography, eddycurrent testing, magnetic methods of crack detection, liquid penetrant inspection, acoustic emission and acousto-ultrasonic testing techniques.

MST G512 Ceramics Technology 3 2 5

Ceramic raw materials, their beneficiations and characterisations; crystal structure of important ceramic systems and structural defects; various types of ceramics; white wares, glasses, refractories, cements, abrasives, glass-ceramic, ceramic coatings, electronic ceramics; fabrication processes; grinding, pressing, slip casting, drying, sintering, glass blowing; development of ceramic microstructures; properties of ceramic materials; mechanical, thermal, electrical, optical, magnetic and chemical; ceramic composites, cermets.

MST G521 Materials Characterization Techniques 3 2 5

Materials characterisation - definition; importance and application with case studies, principles and general methods of compositional, structural and defect characterisation, techniques of X-ray, electron and neutron diffraction, EDAX, thermal methods - DTA, TGA, DSC. TMA and DMA; microscopy-optical, electron (TEM & SEM) and spectroscopy -UV, visible, IR and Raman spectroscopy, ESCA and Auger spectroscopy, SIMS resonance method- NMR, ESR, Mossbauer techniques, particle size analysis, electrical and magnetic characterization techniques.

MST G522 Advanced Composites 3 2 5

Definition of composite materials; classification; particulates and dispersion hardened composites, continuous and discontinuous fibre reinforced composites, metal-matrix composites, carbon-carbon composites, molecular composites, micro and multilayer composites, theory of reinforcement; reinforcement by continuous and discontinuous fibres, concept of microfibril; effect of orientation and adhesion; mechanical behaviour of composites, stress-strain relationship, strength, fracture thoughness and fatigue; properties of fibre reinforcement and production technology of composites.

MST G531 Experimental Stress Analysis Techniques 3 2 5

Strain gauges, photoelasticity, brittle lacquer, three dimensional photoelasticity, Moire methods.

MST G532 Electronic Materials 3 2 5

Electrical conduction in glasses and ceramics, non-stoichiometry and valence controlled conduction, ceramic heating elements, fast ion conductors, superconducting materials and devices, dielectric ceramics, ceramics in micro electronics, voltage dependent resistors, positive and negative temperature coefficient resistors. Piezo electric, pyroelectric, ferroelectric and electrooptic ceramic materials and devices, ceramic sensors, magnetic and magneto-optic ceramic devices, ceramics for microwave applications, luminescent and photoconducting ceramics, light transmitting filters, IR transmitting glass, optical fibre technology.

Music

MUSIC N103T Indian Classical Music (Vocal) I 3*

MUSIC N104T Indian Classical Music (Vocal) II 3*

MUSIC N203T Indian Classical Music (Vocal) III 3*

MUSIC N204T Indian Classical Music (Vocal) IV 3*

MUSIC N113T Indian Classical Music (Instrumental) I 3*

MUSIC N114T Indian Classical Music (Instrumental) II 3*

MUSIC N213T Indian Classical Music (Instrumental) III 3*

MUSIC N214T Indian Classical Music (Instrumental) IV 3*

The eight courses given above – four in vocal and four in instrumental - are designed to give theoretical and practical knowledge of Indian Classical Music in Hindustani or Carnatic style.

In the Hindustani series, the student will be introduced to the Hindustani system, *swara gyan,* structure of *Raags* and *Taals*, the ten *Thaats*, and practice in performing selected *raags* through compositions with elaborations.

For the Carnatic style series, the syllabus includes basic *Swara gyana*, structure of *Raagas* and *Taalas*, renderings of graded compositions in the form of *Geetam, Swarajati, Varnam* and *Keertanam*, introduction to the *Melakarta* and *Janya Raaga* system with reference to the seventy two Melakartas, performance practice including compositions and elaborations.

These courses are not available for fulfilling the requirements of any programme in the institute and can be taken only as audit courses.

MUSIC N303T Advanced Indian Music Practice (Vocal) 0

MUSIC N313T Advanced Indian Music Practice (Instrumental) 0

These courses are designed to allow facilities for practice with minimum supervision for students who have satisfactorily completed MUSIC N204T or MUSIC N214T respectively. These courses carry zero units. A student who has met the prerequisite can take these courses as audit courses as many times as he needs.

Pharmacy

PHA C212 Pharmaceutical Analysis 2 3 3

Basic techniques of pharmaceutical analysis, data handling and analysis, sources of error in analysis. The analytical methods would comprise of various titrimetric methods, such as acid-base, complexometric, non-aqueous, oxidation-reduction, precipitation, conductometric; physical and instrumental analysis such as gravimetric, polarography, nephelometry, amperometry, turbidometry, potentiometry; chromatographic separations such as TLC, coloumn, ion-exchange, extraction methods such as gel-filtration, fractionation processes, analysis of metallic and non-metallic elements; water content, as well as evaluation of drug constituents in various pharmaceutical preparation.

PHA C213 Introduction to Physical Pharmacy 2 1 3

Introduction to ingredients, excipients used in pharmaceutical manufacturing, their physi-

co-chemical properties, ionic equilibrium and kinetics, phase diagram, viscosity, refractive index, specific rotation, order of reaction, solubility curves, surface tension, molecular structure and crystal lattices and their significance in pharmacy, pharmaceutical additives their sources, types and uses, flow properties, posology and micromeritics, various systems of medicine, monographs and literature of standards, types of dosage forms.

PHA C241 Microbiology 2 3 3

Course description is same as given under BIO C241.

PHA C311 Natural Drugs 2 3 3

The course imparts a knowledge of the crude drugs of natural origin used in pharmaceutical and medical practice. Study will include the different systems of classifications of crude drugs; cell contents; general principles of cultivation, collection, drying, storage and commerce of natural products of current medical and pharmaceutical importance; their morphologial and microscopical study: use and knowledge of common substitutes and adulterants.

PHA C312 Forensic Pharmacy 3 0 3

A study of the professional pharmacist's relation to the public and to other professions; a critical survey of statutory regulations governing the practice of pharmacy and drug industry in all its aspects; history and ethics of the profession of pharmacy.

PHA C321 Anatomy, Physiology and Hygiene 2 3 3

Anatomical study of the important organs of human body; physiology of various functional systems of human body; general principles of personal and community hygiene and prevention of communicable diseases.

PHA C322 Dispensing Pharmacy 2 3 3

Prescriptions, principles involved in the dispensing of prescriptions; physical, chemical and therapeutic incompatibilities involved and their remedy in such prescriptions; techniques involved in dispensing of mixtures. ENT preparations, parenteral products, radiopharmaceuticals, etc.

PHA C331 Industrial Pharmacy 2 3 3

Pharmaceutical processes and equipments commonly used in pharmaceutical industries; drug extraction and clarification; mixing and granulation; pharmaceutical preparations such as aromatic waters, spirits, syrups, elixirs, lotions, liniments, official solutions, etc.; galenical products like infusions, decoctions, tinctures, extracts, etc, glandular preparations and blood plasma substitutes.

PHA C332 Pharmacology and Toxicology 2 3 3

Pharmacology of important classes of drugs including their mechanism of action, therapeutic uses, side effects, toxic manifestations, indications and contra-indications.

PHA C342 Medicinal Chemistry 2 3 3

Chemistry of selected synthetic and natural organic medicinals and study of structure-activity relationships; representative drugs selected from the following major classes: anaesthetics, hypnotics, sedatives, analgesics, chemotherapeutic agents, antihistaminics, drugs affecting peripheral nervous system, hypotensive drugs and anticancer agents.

PHA C391 Instrumental Methods of Analysis 4

Course description is same as given under BIO C391.

PHA C411 Physical Pharmacy 2 3 3

Course description is same as given under CHEM C451.

PHA C412 Veterinary Pharmacy 3 0 3

Basic framework of various anatomical systems of animals, physiological features of various systems, comparative aspects on pharmacokinetics and pharmacodynamics of veterinary drugs; Tropical diseases of domestic animals, formulation of drug dosage form for animals, dispensing equipment, their selection.

PHA C413 Pharmaceutical Management & Quality Control 3 0 3

Concepts of Pharmaceutical management, Managing of pharmaceutical industry, planning, layouts, designs, current good manufacturing practices, pharmaceutical process validation, documentation, pilot plant scale up technique optimization, pharmaceutical marketing, quality aspects and quality control, managing hospital pharmacy and its importance.

PHA C414 Biopharmaceutics 3 0 3

Biopharmaceutics and Biopoharmaceutical aspects of drug delivery covering absorptions, distribution, metabolism and elimination (ADME) characters of drugs. Compartment model, pharmacokinetics of drugs and their applications, bioavailability, bioequivalence and their studies, drug-drug interactions and other related matters.

PHA C415 Pathophysiology 3 0 3

Cellular pathology, inflammatory, genetic and immunological disorders, infectious diseases- their expression and cause, targets for therapy, diseases of the organ systems, environmental and nutritional pathology.

PHA C416 Chemistry of Synthetic Drugs 3 0 3

Heterocyclic drugs; methods of heterocyclic drug synthesis; mechanisms of important heterocyclic compounds; mechanism based optimization of lead compounds on target sites; biological properties of heterocyclic durgs; synthesis of other special organic compounds of biological importance like steroids, prostaglandins etc.

PHA C417 Pharmacoeconomics 3 0 3

Economic aspects of health care and its applications in the health sector are broadly emphasized. Cost-benefit, cost-effectiveness, cost-minimization, and cost-utility analyses to compare the different pharmaceutical products, drug therapy and treatments are focused. Economic concepts such as supply, demand, efficiency, equity, health policy, market failures, health insurance, pharmaceutical market, measurement of direct and indirect costs to a health care program, economic issues, pharmaceutical regulations, pricing policy and related topics will be covered.

PHA C421 Pharmaceutical Formulations and Biopharmaceutics 2 3 3

Physical, chemical and biopharmaceutical considerations in formulations, absorption, distribution and elimination of drugs; pharmaceutical additives; formulation and stability aspects of solid dosage forms, semi-solid dosage forms and liquids dosage forms; sustained release medication; aerosol products and packaging.

PHA C422 Cosmetic Science 2 3 3

Principles of formulation of typical cosmetic preparations such as cosmetic creams, powders, lipsticks, rouges, hair preparations, dentrifices, aerosol cosmetics, perfumes for cosmetic, their blending and mixing techniques. Some recent and new trends.

PHA C431 Pharmacognosy 2 3 3

The course is intended to impart knowledge to the students in the isolation and evaluation of the active constituents of natural products of medicinal and pharmaceutical importance. Study of active constituents and their variability in the natural products; a systematic study of natural products of medicinal and pharmaceutical importance with special reference to their identification, isolation, separation techniques and properties; biogenesis of alkaloids and glycosides, evaluation of crude drugs including quantitative microscopy.

PHA C432 Hospital Pharmacy 3 0 3

Definition and function, location, organisation, staff, space, equipment. Pharmaceutical services, Medical stores, objectives, procedures for procurement and suplies, Distribution & control, inspection of stocks, Licensing procedures for stocking of alcohol, narcotics, Maintenance of records of stocks, issue and use. Pharmaceutical services for out - patient and in - patient department.

PHA C441 Biochemical Engineering 3 0 3

Course description is same as given under BIO C441.

PHA C442 Applied Pharmaceutical Chemistry 3 0 3

The course comprises of structure, reactions and synthesis of selected carbocyclic and heterocyclic ring systems. Their application for drug design, structure activity relationship, pharmacological action, methods of assay.

PHA C461 Phytochemistry 2 3 3

This course is intended to impart knowledge to the students in the isolation, characterization and chemistry of the natural products derived from various sources, which are of pharmaceutical importance. Intriguing chemistry involved in their invivo production and their importance as structural materials, biologically active molecules like toxins, hormones, life process substrates and drugs will be covered in this course, the evaluation of these substances using qualitative and quantitative methods will also be covered; specail emphasis will be given to newer techniques in the biogenesis of these molecules.

PHA C491 Special Projects 3

Course description is same as given under BIO C491.

PHA G510 Application of Statistics and Computer in Pharmacy 5

Introduction to data classification, analysis and probability; statistical inference – estimation and hypothesis testing; linear regression and correlation; design of experiments; analysis of variance; non parametric procedures & tests; statistical quality control; experimental design in clinical trials and validation; basic techniques in optimization.

Introduction to computer and its components; operating systems; principles and use of standard software packages having application in drug design, development, analysis, etc.; principles of software creation; processing concepts, flow charting and algorithms, programming constructs, programming languages, program development sequence; information systems: need, significance concepts, their analysis, design and implementation; software life cycle with special reference to software planning and maintenance.

PHA G511 Fermentation & Biotechnology 2 3 5

Industrial scale production by fermentation processes of antibiotics, vitamins, alcohol and other selected products, development, selection, isolation and preservation of mutants, media sterilisation, accretion and air sterlisation, continuous fermentation, recent advances in fermentation biotechnology, enzymes, their large scale extraction and purification, principles of immobilisation of enzymes and its applications.

PHA G512 Chemistry of Natural Drugs 2 2 4

Study of recent methods of phytochemical investigations with reference to alkaloids like rauwolfia, vinca, cantharanthus etc.; some selected steroids, terpenes & flavoring agents, their chemistry, structure activity relationship, pharmacological actions and synthetic routes.

PHA G521 Molecular Biology & Immunology 2 2 4

General principles governing the structures and functions of various molecules of the immune system, acquired immune responses, immunological tolerance, genetic control of immunity, hypersensitivity reactions, protein structure, functions, RNA and DNA cloning, principles of Genetic Engineering and its future in drug production.

PHA G522 Chemistry of Macromolecules 2 2 4

Physical, Chemical and Biological properties of biopolymers like proteins, nucleic acids, poly saccharides. Synthetic polymers, biomedical and pharmaceutical polymers with emphasis on recent development.

PHA G531 Disinfection and Sterilisation 2 2 4

Theories and kinetics of the disinfection reaction, study of the principles involved in vivo

and in vitro evaluation of disinfectants and antiseptics, structure activity relationships of the representative groups of disinfectants, sterilisation, heat, ionizing and ultraviolet radiations, ultrasonic waves, filtration, gaseous sterilisation and cellular dessication methods, controls used and special problems involved.

PHA G532 Quality Assurance & Regulatory Affairs 3 2 5

Quality control, quality assurance, quality management, various parameters for achieving quality pharmaceutical products, application of statistics in quality assurance, reliability, current good manufacturing practice (cGMP) for pharmaceutical manufacturing, pharmaceutical process validation, drug regulatory affairs, clinical research protocols, new drug applications, drug product labeling.

PHA G541 Computer Aided Drug Design 3 2 5

3D structure and function of bio-molecules; targets of drugs and design principles; molkecular modeling methodologies; quantitative structure-activity relationships; chemical compound databases and search tools; interactive graphics in drug design; molecular surfaces and algorithm of automated docking of durgs into receptor sites; receptor mapping; introduction to molecular modeling and docking software.

PHA G542 Advanced Physical Pharmaceutics 3 2 5

Preliminary evaluations and molecular optimization, Drug substance considerations including protein, peptide and biological products, Bulk characterization, Solubility analysis, Rheology and dispersed systems, Micromeritics and shape factor analysis, Compression and compaction, Principles of dissolution, Dissolution test design and release kinetics evaluation, Compatibility testing, Stability analysis and test design according to international standard, Studies of broad category of polymers used in drug delivery, Rationale basis of formulation recommendation.

PHA G543 Clinical Research 5*

Fundamentals of clinical trials including design, conduct, analysis and interpretation, randomization and blinding methods, sample size determination, recruitment methods, choice of controls, ethical, regulatory and research clearance including GCP, trial requirements-multi-centric/collaborative and related operational issues, data collection, processing, protocol management and quality control issues, interim analysis and critical review of intervention and therapies, design and results, statistical techniques in analysis and interpretation of results, documentation and reporting, pharmacovigilance.

PHA G611 Advanced Pharmacology 2 3 5

Biochemical pharmacology; pharmacologically active polypeptides; general pharmacological principles involving immunological processes, pharmacogenetics, teratology, pharmacokinetics, drug resistance and related phenomena, drug-interaction; recent advances in the therapy of neoplastic diseases, viral diseases, atherosclerosis and hypertension; topics of recent interest like contraception; use of gases and ions in therapy etc.

PHA G612 Pharmacokinetics & Clinical Pharmacy 2 3 5

The study of pharmacokinetics and its clinical applications in the development, evaluation and use of drugs; the time course of drug and metabolite levels in different fluids, tissues and excreta of the body, mathematical relationship required to develop models to interpret the data for single and multiple dosing, study of bio- availability, dosage regimen adjustment in renal impairment, application of the pharmacokinetic principles to the therapeutic management of patients.

PHA G613 Pharmaceutical Biotechnology 2 3 5

Molecular biology, immunology, recombinant DNA technology and principles of biochemical engineering. Application of biotechnology in diagnosis, therapeutics and production of products of fermentation. Bioinformatic

tools required to store, analyze and use biological information for therapeutic utility, immense potentiality and application f decoding the human genome.

PHA G614 Clinical Pharmacy and Therapeutics 2 3 5

Basic concepts of Clinical pharmacy and its applications, analysis of patient data interpretation of clinical laboratory tests, drug information queries, their sources and interpretation of the information. Clinical pharmacokinetics, therapeutic drug monitoring, drug-drug interactions.

PHA G615 Pharmacy Practice 5

Overview of health care systems, providing drug information, physical examination, diagnostic procedures, drug administration, selection of alternate therapies, clinical alert, nutrition and electrolyte therapy, documentation of pharmacy services, patient counseling, paediatric pharmacy practice, evaluation of drug related problems, environmental, and health care management.

PHA G616 Pharmaceutical Administration and Management 5

Technology innovation and creativity, new drugs and products planning, strategic considerations, project implementation, product development, production management and scale up, preparation of product literature and marketing strategy, IPR processes, human resource development, industrial relations, documentation, R & D management, ethical aspects.

PHA G617 Advanced Drug Delivery Systems 3 2 5

A study of physicochemical and biopharmaceutical factors involved in the design of novel drug delivery systems like mucosal, particulate systems for systemic delivery of bioactive molecules. Special considerations for delivery of protein, peptide and other biological products. In vitro and in vivo evaluation of novel drug delivery systems.

PHA G618 Reterosynthetic Analysis 3 2 5

Course description for the above course is to be developed.

PHA G621 Advanced Medicinal Chemistry 2 3 5

Methods of synthesis; properties, uses, methods of assay and structure-activity relationship of non-mercurial diuretics, psychopharmacologicals, anticancer agents; chemistry of prostaglandins; some concepts of receptor theories, dose response curves, introduction to QSAR.

PHA G622 Chemistry of Natural Drugs & Macromolecules 2 3 5

Size and shape of macromolecules, biomedical polymers, their structure, synthesis and function, chemistry of newer oral contraceptive agents, terpenes used as flavouring agents, newer phytochemical investigations in glycosides, alkaloids, etc.

PHA G632 Dosage Form Design 2 3 5

A study of physical and chemical, pharmacological and biopharmaceutic factors involved in the design and stability of dosage forms; transport of drugs across biological membranes; absorption, distribution and elimination of drugs; formulation additives, closures and containers and sustained release dosage forms; microencapsulation; radio pharmaceuticals.

PHA G642 Laboratory Project 0 6 6

Exercises illustrating principles discussed in theory courses.

Philosophy

PHIL C211 Introductory Philosophy 3 0 3

An overview of some philosophical theories and issues both from India and the western world; nature and purpose of philosophy; theories of cosmology, metaphysics and epistemology; skepticism and its philosophical value; contemporary philosophy.

PHIL C221 Symbolic Logic 3 0 3

A brief historical survey of the development of logic; nature and kinds of arguments; sentential connectives; symbolization of statements and arguments; truth tables, establishing validity of arguments by truth tables and different types of proofs, quantified statements; quantified arguments and their validity.

Physics

PHY C122 General Physics 3 0 3

Philosophy of Science; Newtons laws of motion; Work Energy, Impulse and Momentum; Equilibrium; Moment of a force; Rotation; Periodic motion; First law of thermodynamics; Second law of thermodynamics; Electromagnetic waves; Interference and diffraction; Polarization; Relativistic mechanics; Photons, Electrons and Atoms; Quantum Mechanics; Atoms, Molecules and Solids; Nuclear Physics.

PHY C131 Physics I (Mechanics, Waves & Optics) 3 0 3

Conservation Principles, Rotational Dynamics, Oscillations, Wave Motion, Reflection and Refraction, Interference, Diffraction, Polarisation.

PHY C132 Physics II (Electricity, Magnetism & Modern Physics) 3 0 3

Electric Field, Magnetic Field, Electric Current, Electromagnetic Induction, Maxwell's Equations, Electromagnetic Waves, Bohr Atom, Atomic spectra, Wave Practicle Duality, Uncertainty Principle.

PHY C212 Classical Mechanics 3 0 3

Dynamics of particles; generalized coordinates, Lagrange's and Hamilton's equations; rigid body dynamics; small oscillations; normal modes; canonical transformations; Poisson's brackets; action-angle variables.

PHY C221 Modern Physics 3 0 3

Special theory of relativity; quantum mechanics and applications; atomic and molecular physics; statistical physics; nuclear physics.

PHY C231 Physics Project Laboratory 3*

The course includes projects involving laboratory investigation or laboratory development in physics. The course is normally available to students of second year or higher level. The course must coterminate with a project report.

PHY C232 Computational Physics 3 0 3

Numerical solution of physics problems selected from the basic courses of Mechanics & Vibrations, Electricity of Magnetism, Optics and Modern physics. Various topics like Newton's equation of motion, damped, forced and coupled oscillations, electric fields and potential of charge distributions, interference and diffraction patterns for different slit geometry, energy eigenvalues and eigenfunctions, reflection and transmission coefficients in one dimension, random walk problems, chaotic dynamics and fractals.

PHY C241 Atmospheric Physics 3 0 3

Fundamental concepts, the earth's gravitational field, satellite orbits, distribution of sea level pressure, atmospheric tides; properties of atmospheric gases; properties and behaviour of cloud particles; solar and terrestrial radiation, energy transfer near the earth's surface, heat conduction into the earth, turbulent transfer, vertical fluxes of heat and water vapor, nocturnal cooling, fog formation; geomagnetic phenomena, general properties of waves, scattering of radiation, atmospheric probing, natural signal phenomena, effects of nuclear explosions.

PHY C242 Theory of relativity 3 0 3

Experimental background and postulates; relativistic kinematics and dynamics; relativistic electromagnetism; principles of equivalence; gravitational red shift; general relativity theory.

PHY C311 Electromagnetic Theory I 3 0 3

Boundary value problems, electrostatic and magnetostatic fields in matter, Maxwell's equations, potential formulations of electrodynamics, multipole expansions, energy and

momentum in electrodynamics, electromagnetic waves, dipole radiation.

PHY C312 Statistical Mechanics 3 0 3

Brief review of Thermodynamics, Equilibrium Statistical Mechanics: Microcanonical, Canonical and Grand Canonical ensembles and applications; Quantum Statistical Mechanics, Ideal Fermi and Bose Gases, Cluster expansion, introduction to nonequilibrium Statistical mechanics.

PHY C321 Quantum Mechanics I 3 0 3

State vectors, operators and observables; the uncertainty relation of arbitrary observables; Schrodinger and Heisenberg formulation; equivalence of Schrodinger and Heisenberg formulations; stationary states; the spectrum of the Hamiltonian; orthogonality and completeness; probability amplitudes; survey of exactly solvable problems; Coulomb problem; oscillator; square well, delta function potentials; time independent perturbation theory; variation methods, applicable to bound systems.

PHY C322 Solid State Physics 3 0 3

X-ray diffraction, reciprocal lattice, Brillouin zone, Lattie vibrations, thermal properties, free electron theory of metals, periodic potentials, band theory of solids, semiconductors, magnetism, superconductivity.

PHY C332 Methods of Mathematical Physics I 3 0 3

Generalized functions, Green's functions and boundary value problems for ordinary differential equations. Strum-Liouville problem, eigenfunction expansions, Green's functions and boundary value problems for partial differential equations, group theory, tensor analysis, approximation techniques.

PHY C341 Nuclear Physics 3 0 3

Two nucleon problem, nuclear force, nuclear properties, models of nuclei - vibrational, rotational and shell models, nuclear excitations and decay, nuclear reactions, nuclear reactors, experimental methods in nuclear physics, elementary particles.

PHY C351 Methods of Experimental Physics 2 3 3

Vacuum techniques, sample preparation techniques, X-ray diffraction, SEM, EDX, low temperature techniques, magnetic measurements, Mossbauer and positron annihilation spectroscopy, neutron diffraction, Rutherford back-scattering, techniques in nuclear experimentation, high energy accelerators.

PHY C352 Atomic & Molecular Spectroscopy 3 0 3

Atomic structure, X-ray spectra, Angular momentum and selection rules in Atomic spectra, Alkali spectra, Fine structure, LS coupling, jj-coupling, Doppler Effect, Effect of magnetic field in Atomic spectra, Zeeman Effect, Paschen-Back Effect, Hyper fine structure, stark effect. Rotational spectra of diatomic and polyatomic molecules, the vibrating diatomic molecule, the diatomic vibrating rotator, interaction of rotation and vibration, the vibrations of polyatomic molecules, Raman Spectroscopy, Electronic Spectroscopy of Molecules, Spin in an applied field, Nuclear Magnetic Resonance spectroscopy, Electron Spin Resonance spectroscopy.

PHY C353 Optical Physics & Applications 3 0 3

Review of Maxwell's equations & wave equation, optics of planar interfaces, light waves in matter, paraxial optics, matrix methods, two and multiple beam interference, Fresnel & Fraunhoffer diffraction, temporal & spatial coherence, statistical optics, image formation, polarization, crystal optics, lasers, holography, fiber optics.

PHY C362 Particle Physics 3 0 3

Symmetries, SU(2) & SU(3) symmetries, quark model, relativistic quantum theory, Dirac and Klein-Gordon equations, quantization of radiation, minimal coupling, QED, Standard Model review.

PHY C391 Instrumental methods of Analysis 4

Course description is same as given under BIO C391.

PHY C411 Electromagnetic Theory II 3 0 3

Multipole radiation, the Lienard - Wiechert potentials, field of a uniformly moving charge, radiation from an accelerated charge, Hamiltonian and Lagrangian in electronmagnetic fields, relativistic electrodynamics.

PHY C421 Quantum Mechanics II 3 0 3

Prerequisite: PHY C321

Theory of scattering, phaseshift analysis; the S matrix, time- dependent and time-independent approaches to scattering theory; Born and Eikonel approximations; examples from typical potentials like square well, exponential and delta function potentials; resonances in potential scattering; Coulomb scattering problem and scattering from coulomb and nuclear fields; variational principle applicable in scattering theory; time-dependent perturbation theory; theory of angular momentum; identical particles and spin; Dirac and Klein Gordon equations.

PHY C422 Group Theory & Applications 3 0 3

Abstract group theory; theory of group representations, crystal- symmetry operators, the crystallographic point groups, elementary representations of the three-dimensional rotation group, crystal- field splitting of atomic energy levels, intermediate crystal- field case, weak-crystal-field case and crystal double groups, introduction of spin effects in the medium-field case, group theoretical matrix-element theorems, application of group theory to directed valence; full rotation group and angular momentum; quantum mechanics of atoms; molecular quantum mechanics; solid- state theory.

PHY C432 Laser & Applications 3 0 3

Properties of laser light, Theories of some simple optical processes, Basic principles of lasers, Solid-state lasers, Gas lasers, Semiconductor lasers, Free electron lasers, Liquid, Dye and Chemical lasers, Dynamics of laser processes, Advances in laser physics, Q-switching, Mode-locking (active and passive), Saturable absorbers, Kerr lens mode locking, Non-linear Optics, Laser Spectroscopy, Time resolved spectroscopy, Multi-photon spectroscopy.

PHY C441 Physics Laboratory 0 9 3

Specially designed for M.Sc. (Hons.) Physics; cannot be taken by others under any circumstances. This laboratory course is designed only for M.Sc. (Hons) Physics students in order to develop competence in selected experiments in physics.

PHY C451 Materials Science 3 0 3

Intrinsic and extrinsic semiconductors; Excess carriers in semiconductors; Material technology; Measurement of semiconductor properties; Theory of p-n junctions; Rectifiers; Transistors; Other semiconductor devices.

PHY C461 Process Analysis Instrumentation 3 0 3

Course description is same as given under INSTR C392.

PHY C471 Astrophysics 3 0 3

Celestial Mechanics; Solar System; Stars; Nebulae and Galaxies; Constellations; Cosmology; Techniques of Space-exploration; Latest discoveries and programmes for space exploration. Observation of heavenly bodies.

PHY C491 Special projects 3

Course description is same as given under BIO C491.

PHY G511 Theoretical Physics 5

Calculus of Variations and its applications to Lagrangian and Hamiltonian Dynamics, Thermodynamics and Geometric Optics and Electrodynamics. Geometric and Group theoretic foundations of Hamiltonian Dynamics, Hamilton-Jacobi Theory, Integrability and Action-Angle Variables, Adiabatic Invariants, Transformation (Lie) Groups and Classical Mechanics. Modern Theory of Phase Transitions and Critical Phenomenon: Thermodynamics and Statistical Mechanics of Phase Transitions, General Properties (eg Scaling, Universality, Critical exponents) and Order of

Phase Transitions; Introduction to Landau-Ginzburg (Mean Field Theory) theory for Second Order Phase Transitions, the Ising Model and some Examples, Phase Transitions as a *symmetry-breaking* phenomenon.

PHY G521 Nuclear and Particle Physics 5

Course description for the above course is to be developed.

PHY G531 Selected Topics in Solid State Physics 5

Schrodinger Field Theory (2nd Quantized formalism), Bose and Fermi fields, equivalence with many body quantum mechanics, particles and holes, Single particle Green functions and propagators, Diagrammatic techniques, Application to Fermi systems

electrons in a metal, electron-phonon interaction) and Bose systems (superconductivity, superfluidity).

PHY G541 Physics of Semiconductor Devices 5

Course description for the above course is to be developed.

Political Science

POL C211 Indian National Movement 3 0 3

Indian renaissance; birth of the Indian national congress and progress of Indian nationalism; moderates and extremists rise of communal politics; Gandhi and the non-cooperation movement; swaraj party; Simon Commission and the Nehru report; civil disobedience and the Round Table Conferences; World War II and the constitutional deadlock; Cripps proposals; Quit-India Movement; CR formula and the Wavell Plan, Cabinet Mission Plan; Netaji Subhash Chandra Bose and the I.N.A., Mountbatten Plan - India divided; the aftermath.

POL C212 Modern Political Concepts 3 0 3

Nature and scope of political science; emergence and basis of the state; rights and duties; forms of government; democracy, fascism, capitalism, socialism, anarchism, communism, Maoism, radicalism and Gandhism.

POL C311 Gandhian Thoughts 3 0 3

Sources of Gandhian thoughts, metaphysical convictions, ethical principles, ends and means; Gandhi and religion; theory of satyagraha; political thought; economic thought; social reforms; untouchability; Gandhi and Muslims; Gandhi and women; some items of constructive programme, Gandhi and Marx; his nonviolent state; Gandhism after Gandhi.

POL C312 Marxian Thoughts 3 0 3

Marx and his times; basic tenets; dialectical materialism; economic determinism; doctrine of surplus value; doctrine of class struggle; different schools of Marxism; Leninism; Stalinism; Maoism; future of Marxism.

POL C321 International Relations 3 0 3

Rise of nationalism, World War I, Interregnum; World War II and after; bi-polar politics and detente; instruments for promotion of national interest; diplomacy; propaganda and political warfare; integration of Western Europe; West Asia and world politics; panchsheel and nonalignment; major national foreign policies--USA, USSR, UK and Pakistan; disarmament; UN and World peace.

Psychology

PSY C211 Introductory Psychology 3 0 3

The development of psychology as a science -- individual and the environment; nature; kinds and determinants of perceptions; response mechanism and kinds of responses, motivations, modifications of behaviour through learning, memory and transfer of training; thought processes, problem solving and creative thinking; nature and characteristics of psychological tests; nature and evaluation techniques of intelligence and personality.

PSY C311 Psychology of Human Adjustment 3 0 3

Course description to be developed.

Russian

RUS N101T Beginning Russian 3 0 3

Basic grammar; vocabulary; reading practice; translation of simple passages.

Not available for meeting the requirements of any programme except as prerequisite for another Russian course. Can be taken only on audit.

RUS N102T Technical Russian 3 0 3

Prerequisite: RUS N101T

Phrases and sentence patterns in technical literature; special technical vocabulary; reading and translation of current technical literature from Russian to English with the help of a dictionary. This course is designed to meet the foreign language requirement of the Ph.D. programme. Can be taken only on audit.

Sanskrit

SANS C111 Sanskrit 3 0 3

Simple pieces of Sanskrit prose and poetry to be used for teaching the basic construction of Sanskrit words and sentences. The course will aim at making the student read elementary Sanskrit like a Subhashita Sloka or a Sloka from Ramayana or Mahabharata and be able to understand it with the help of a dictionary.

Science

SCI C121 Social Hygiene 3 0 3

General principles of personal and community hygiene; food and nutrition; environmental sanitation; sources of water; microscopic and macroscopic examination of water; air and ventilation, air pollution; noise and its various aspects; drug addiction and its social consequences; health statistics.

SCI C212 Applied Nutrition 3 0 3

Introduction to nutrition; foods for health; the composition of food; energy requirements; nutritional needs; nutrition and diseases; clinical dietetics.

SCI C311 Agricultural Science 3 0 3

Soils and soil systems; chemical composition of soils and soil fertility; soil fauna and flora and their relationships with soil; important crop plants; methods to improve yield; environmental factors and plant growth; plant diseases and their control; weeds and their control; common agricultural practices in India.

SCI D021 Remedial Science 5 0 5

Physics: Vectors, Newton's laws, conservation of momentum and energy, angular momentum, moment of inertia, simple harmonic motion, Coulomb's law, Ampere's law, Faraday's law, Lenz's law, Kirchhoff's law, a.c., electrical instruments, interference, diffraction, polarization, structure of atom, atomic energy, and wave-particle duality.

Chemistry: Chemical formula and equations; phase diagram; solutions; chemical dynamics; chemical equilibria; electrochemistry.

Skill Area

SKILL G611 Computer Operation and Software Development I 5

SKILL G612 Computer Operation and Software Development II 5

Prerequisite for both: TA C252

These two courses to be offered in two successive semesters will aim to develop the computer skills for running program packages and writing and developing software programmes for as wide areas as possible. Areas would include both the developmental processes involved in innovative education and of academic and applied research.

The operation of and evaluation in the courses would be done through seminars, group discussions, log books and programme outputs. One component of the evaluation

will invariably consist of a lengthy involvement on an intricate task.

SKILL G621 Computer Maintenance I 5
SKILL G622 Computer Maintenance II 5

Prerequisite for both: TA C252

These two courses, to be offered in two successive semesters, will aim to develop the skill for maintenance of computer systems. Through these courses the student would be required to acquire a competence of planned and preventive maintenance, trouble shooting safety procedures etc. If required the student may be asked to undergo part of his training in established computer maintenance organisations. The operation and the evaluation of this course would be achieved through practicals, log books, seminars, quizzes etc. One component of the evaluation will invariably consist of a lengthy involvement on an intricate task.

SKILL G631 Professional Communication I 5
SKILL G632 Professional Communication II 5

These two courses, to be offered in two successive semesters, will aim at imparting communicative competence and demand training in the art of teaching and development of subject matter pertaining to the overall goal of the programme. The courses will operate on unstructured basis and would be monitored by a team of teachers identified for the purpose. Professional Communication II will be a project Course and must coterminate with a project report.

SKILL G641 Modern Experimental Methods I 5
SKILL G642 Modern Experimental Methods II 5

These two courses to be offered in two successive semesters will impart experimental skills in modern areas of interest to the Institute. Emphasis will be laid on operation and use of sophisticated instruments. The organisation and evaluation of these courses would be achieved through practicals, demonstrations, discussion on significance of results, seminars, quizzes etc. One component of evaluation will invariably be full finding of lengthy assignments. These courses will be conducted by a team of teachers who will incorporate professional competence into experimental method taken up for study.

SKILL G651 Techniques in Development Management I 5
SKILL G652 Techniques in Development Management II 5

These two courses, to be offered in two successive semesters, will aim to lead a student into the theory and practice of activities connected with innovation, institutional change and development of teaching and research. Actual cases would be included from BITS. New cases are to be developed. The power of analysis design of models would be the main thread of treatment in these courses. These courses will be operated by a team of teachers. The organisation and evaluation would be achieved through practicals, log books, seminars, quizzes etc. One component shall invariably be a full finding of a lengthy assignment on a particular instrument (Technique) or their use in a larger context of teaching and research.

SKILL G661 Research Methodology I 5
SKILL G662 Research Methodology II 5

These two courses, to be offered in two consecutive semesters, are designed to impart training in methodology of research such as analysis of research problems, mathematical and statistical analysis of data, computer simulation methods, experimental techniques etc. The actual contents of these courses will depend upon the needs and research goals of a particular student. A project report has to be submitted by each student at the end of each course.

The organisation and evaluation of these courses would be achieved through seminars, group discussions, project reports etc. The courses will be conducted by a team of teachers.

Note: All the above mentioned Skill courses will be 'Unstructured' in the sense that they would be completely of 'non- lecture, type but would require committed involvement in the concerned professional engagement. Each course is a combination of two course numbers I & II running in two successive semesters where grades would be awarded for the two components separately. While normally a student will be required to take I & II, in rare occasions he may be asked to take only Course No. I depending on his prior preparation and the ultimate goal to be achieved through the programme. No student can register I and II of the same course concurrently in a semester. Where there is sufficient academic justification to meet the goals of these courses, the Dean Instruction may permit delayed registration in course No. II or in the pair of courses.

Sociology

SOC C211 Dynamics of Social Change 3 0 3

Nature of society, social institutions; concept and nature of socio-cultural change, obstacles, rate and direction of change; factors of social change-ideological, economic, technological and political demographies; agencies of social change-education, leadership, propaganda, legislative reforms; five-year plans and social change, peasant and land reform, bhoodan and gramdan; changing pattern of family, marriage, caste and religion.

Software Systems

SS G511 Design and Analysis of Algorithms 5

Course description is same as given under CS G511

SS G512 Object Oriented Programming 4

Course description is same as given under BITS G521.

SS G513 Network Security 3 1 4

Course description is same as given under CS G513.

SS G514 Object Oriented Analysis and Design 2 2 4

Course description is same as given under CS G 514.

SS G515 Data Warehousing 3 2 5

Introduction, evolution of data warehousing; decision support systems; goals, benefit, and challenges of data warehousing; architecture; data warehouse information flows; software and hardware requirements; approaches to data warehouse design; creating and maintaining a data warehouse; Online Analytical Processing (OLAP) and multi-dimensional data, multi-dimensional modeling; view materialization; data marts; data warehouse metadata; data mining.

SS G516 Computer Organization & Software Systems 5

Programmer model of CPU; Basic concept of buses and interrupts; Memory subsystem organization; I/O organization; Concept of assembler, linker & loader; Types of operating systems; Concept of process; OS functions: Process scheduling, Memory management, I/O management and related issues.

SS G517 Data Structures & Algorithm Analysis 5

Abstract data types; Linear data structures; Hash functions, Binary and other trees, traversal algorithms; Heaps and balanced trees; Sorting and searching techniques; Divide and conquer, recursion, backtracking, branch and bound; Computational complexity and bounds.

SS G518 Database Design & Applications 5

DBMS architecture; Data models: Network model, Hierarchical model and Relational model; Database design & optimization; Query processing & Query optimization; Transaction Processing; Concurrency control; Recovery; Security & protection; Introduction to Object Oriented data model & Multimedia Databases.

SS G521 Fourth Generation Languages and Applications 4

Course description is same as given under BITS G521.

SS G522 Software Development Standards 4

Course description is same as given under BITS G522

SS G531 Pervasive Computing 4*

Course description is same as given under CS G541

(CS G541 and SS G531 are equivalent to each other).

SS G532 Information Theory 4

Course description is same as given under BITS G532.

SS G541 User Interfaces 4

Course description is same as given under BITS G541.

SS G542 Knowledge Management 3

Increasing knowledge work in organizations; technologies to support growth of knowledge work in organizations; scope, cost, efficiency and reliability of technologies to support knowledge work; role of knowledge in an enterprise; knowledge management process; knowledge management strategies; human aspects of knowledge management; knowledge management technologies; applications of technologies to be covered through cases; reading assignments and use of appropriate software.

SS G551 Advanced Compilation Techniques 5

Course description is same as given under CS G551.

SS G552 Software Testing Methodologies 4

Course description is same as given under SECT ZG552.

SS G554 Distributed Data Systems 3 2 5

Course description is same as given under CS G554.

SS G562 Software Engineering & Management 5

Current concepts, methods, techniques, and tools of the software engineering process; software process models; process definition and assessment; software measurement and metrics; project planning, estimation and control; requirements analysis and specification, design methods; quality assurance and testing; configuration management; process improvement; case studies and project work.

SS G624 Computer Based Simulation and Modelling 5

Course description is same as given under BITS G624.

SS G641 Management Information and Decision Support Systems 5

Course description is same as given under BITS G641.

SS G651 Project Formulation and Preparation 5

Course description is same as given under BITS G651.

SS G653 Software Architectures 3 2 5

Course description is same as given under CS G653.

Science and Technology Development

STD C312 Science Communication 3 0 3

Communication within scientific community and between scientific community and the world outside; a special look at science education at all levels; awareness and practical experience in terms of channels of communication, traditional and modern technology based; language of science: some introductory portion of structure of language; issues in the dissemination of science in a traditional society.

STD C322 R&D Management 3 0 3

Distinctive need and particular structure for management of R&D systems; the close relationship between R&D objectives and innovation and precise time targets; micro considerations like economics and cost, science policy, criteria of choice, various issues connected with availability, transfer and marketing of technology; micro considerations in planning, organisation, project selection, formulation and management, R&D cost estimating and budgeting human resources

availability, evaluation and measurement of performance, control problems; mission-oriented research; technology missions enunciated by Indian Government.

STD C331 Science Policy 3 0 3

Growth of science in India, external and internal parameters responsible for scientific growth, science and industry in India, transfer of technology, research priorities in developing countries, criteria for scientific choice, basic and applied research in India, science planning in India, choice of technology, organisation and scientific institutions in India.

STD C342 S&T Development: India Case Study 3 0 3

The course will lay the foundation of characteristics of modern science and its related technology with all earlier science and technology. A back-drop discussion will attempt to examine the manifestation of modern science and technology in non-western societies. The main thrust of the course will be to make a critical analysis of the development of science and technology in India, primarily from the point of view of scientific methods and technological imperative. It will comment on the approach followed so far through comparative studies of establishment of scientific and technological institutions. The coverage will also include an open-ended approach towards formulation of method of implementation of the technology missions recently announced.

The different aspects of the course may be handled by different teachers. If necessary, a term paper will be required with a view to make the student use the concepts and search for source data in the library.

STD C351 An Approach Towards Science of Science 3 0 3

The purpose of this course is to endeavour, on the anticipated prior preparation of an STD student, to embark the student upon this interdisciplinary area. The approach will be to unify the principles of concepts in science, imperatives in technology, philosophy of science, sociology of science, science policy in order for the student to achieve proficiency and develop further in this meta-science.

STD C361 History of S&T 3 0 3

The course will attempt to examine the various stages of manifestation of science and technology in human society; two important benchmarks on the scale of time- advent of modern science with Galileo and beginning of industrial revolution in England - would be the basis in order to appreciate that within science and within technology there is a development prompted by the scientific method and technological imperatives. The course will, within the time available, attempt to identify the various historical and social settings in which a particular stage of development of S&T has taken place. Focussing will be made on how progress of modern science along with development of technology have fundamentally influenced the scientists' approach towards method of science and mode of technology.

STD C371 Issues in Technology 3 0 3

The course is designed to investigate into the methods of technology assessment and choice; aspects of technology innovation and alternate and appropriate technologies; technology forecasting; mode of technology transfer across all boundaries and methods of technology diffusion; fall-out effects of technology; technological imperatives; transformation of technology and its relation to the development of science and the nature of society; the issue of autonomy of technology; measurement of technological change and the concept in ideas of progress.

STD C422 Technology Forecasting 3 0 3

Course description is same as given under ECON C451.

STD C442 Science Writings 3 0 3

Course description is same as given under ENGL C342.

STD C451 Technological Order 3 0 3

A review of the movements associated with the rise of a technological society; analysis of the cultural milieu created by the total stock of technology and the technological acts;

consequences of technology in terms of improvement of human condition and also in terms of new problems generated in its wake; technology and human values.

STD C452 Energy Management 3 0 3

Course description is same as given under ET C352.

STD C461 Science Policy: Country Case Studies 3 0 3

A comparative study of different types of science policy declared or implied in relation to the country of origin and practice.

STD C462 Selected Topics from Science & Society 3

This course is specially designed to introduce motivated students into the realm of classics: studies encompassing several disciplines, even in the areas of hard science and mathematics; the selected topics could also be taken from the areas of application for a specific time-bound assignment; the outcome from the course must be accompanied by a report.

STD C471 Analysis and Assessment of Development 3 0 3

An introductory analysis of issues of development and related concepts, definition of development; the relationship between the technical knowledge, technical operation and technical objects; critical study of some of the much accepted premises and processes of development, the phenomenon of the world of means overwhelming the world of ends, concepts and contradictions in the theory of efficiency and economy of scales; the validity or otherwise of a linear theory of growth; the place of man in the ensemble of techniques, materials and devices.

STD C481 Marketing Non-profit Organisations 3 0 3

Course description is same as given under MGTS C441.

STD C491 Special Projects 3

Course description is same as given under BIO C491

Technical Arts

TA C111 Engineering Graphics 2 4 4

Forms; proportion and presentation; orthographic views; auxiliary views; lines and planes; intersection and development; free hand sketching; working drawing of simple machine parts.

TA C112 Workshop Practice 2 4 4

Casting; metal forming; forging, welding and brazing; metal cutting machines e.g., lathe 'shaper and planer; drilling, milling and grinding; laboratory exercises involving machining, fitting and joining.

TA C162 Computer Programming I 3 0 3

Introduction to computers: building blocks of computers, I/O devices, concept of auxilary and main memory and memory devices; introduction to number systems and information representation inside computer; introduction to UNIX; problem analysis, solution design and program coding using structured programming language.

TA C211 Measurement Techniques I 0 4 2

A laboratory course that covers the lab. components associated with six core science courses in the integrated first degree structure. While the exact component and assignments may vary from time to time the assignments would invariably be illustrative of the theory covered in this portion as well as aim to emphasize the aspects of measurement as a theme in experimental science.

This course is a compulsory requirement for all students who have to compulsorily do the six core science courses. Other students may be permitted to register in this course with prior approval.

TA C222 Measurement Techniques II 1 6 4

Measurement of basic electrical and non-electrical quantities; system performance measurements; analysis of experimental data. The course shall aim to train the student in the skill of operation of instruments in the electrical and electronics, chemical, civil and mechanical engineering applications. Precise lab. exercises will be prescribed from time to time.

TA C231 Business Communication 3 0 3

Managerial communication – national and international contexts, Interpersonal Communication, persuasive communication, communication technology, effective listening group communication, professional presentation.

TA C252 Computer Programming II 3*

Prerequisite: TA C162

Shell programming in Unix; use of advanced filters and other tools like sed and awk; system calls; advanced programming concepts: macro definition and usage, recursion and problem solving; concept of pointers, dynamic data structures using pointers, advanced usage of pointers; bit operations; handling command line arguments, dynamic memory allocation and management; file management; problem solving using simple data structures like stacks, queues, linked lists and binary trees. This course will focus on non-trivial problem solving using the various programming tools available in Unix and the C programming language.

TA C312 Technical Report Writing 3

Elements of effective writing; art of condensation; business letter writing; memos; formal reports; technical proposals; conducting and participating, meetings; notices, agenda and minutes; strategies for writing technical descriptions, definitions and classifications; oral presentation; use of graphic and audio- visual aids; editing.

Technique Oriented Courses

TOC C112 Book-keeping 3 0 3

Concept of double entry; positing and maintenance of basic business accounts; cash book, ledger, journal. Preparation of income and expenditure statement; trial balance and balance sheet.

TOC C211 Book-keeping and Accountancy 3 0 3

Theory of accounting; single and double entry; ledgers; trial balance; manufacturing, trading, profit and loss and appropriation accounts; distinction between capital and revenue; depreciation reserves and provisions; sinking funds; balance sheet.

Negotiable instruments; goods on sale or return; consignments; partnership accounts; goodwill and problems connected therewith; investment accounts; receipts and payments accounts; income and expenditure accounts; royalty, hire purchase and instalment purchase. Company accounts; issue, forfeiture and redemption of shares and debentures; profit prior to incorporation; divisible profits and dividends; statements, returns and other accountancy provisions under companies act.

TOC C212 Library Science 3 0 3

Foundation of Library Science-survey of basic principles and concepts; problem of large scale book selection, acquisition and technical processes; quick and long range reference service; bibliography, abstracting and annotations; information retrieval and literature search; reprography techniques; reprographic reproduction- microfilms, slides, microfiche, photocopying and other non-book material; the role of higher education in the larger society and the innovative role the library can play will be stressed.

TOC C213 Civil Engineering Practice 3*

Basic civil engineering practices such as surveying, soil mechanics, structures, concrete technology, public health, estimating and costing.

Actual structuring will be announced from time to time. Home assignments, fieldwork, etc. will also constitute part of these hours.

TOC C215 Language Laboratory Practice 0 6 3

Writing: Grammar and usage, sentence completion, jumbled sentences, emphatic word order, vocabulary building, message organization, paragraph development techniques and note taking. Reading: Skimming, scanning, rapid reading, analytical reading, factual reading, and aesthetic reading. Listening: Content listening, critical listening, aesthetic listening, empathetic listening, listening to short conversations, stories, lectures,

talks, and great speeches: exposure to different varieties of spoken English through films and clippings. Speaking: Sounds of English, word accent, features of connected speech, transcription, conversation, role play, impromptu, extempore and reading from manuscript. This course is practice oriented and all the exercises and evaluation components will be designed to enhance and assess the student's ability to use the English language actively and effectively.

TOC C223 Comfort Conditioning and Refrigeration 3*

Refrigeration theory; refrigeration cycles; refrigeration systems; refrigeration components and their use; psychrometrics; refrigerants; metering devices; refrigeration and air-conditioning applications; methods of installation; maintenance; diagnosis; repair of refrigeration and air conditioning equipment; heating and cooling loads; distribution components and systems.

Actual structuring will be announced from time to time. Home assignments, fieldwork, etc. will also constitute part of these hours.

TOC C224 Corporate Taxation 3 0 3

Course description is same as given under BITS C224

TOC C235 Electrical & Electronics Engineering Practice 0 6 3

Electrical drawings, tests on energy conversion devices, motor and transformer winding, electrical estimation and costing, hands on experience on electronic bench equipments, device testing, soldering practice, PCB layout and fabrication, simple trouble shooting of electronic circuits, earthing, shielding, experiments on microprocessor kits.

TOC C236 Electronics and Instrumentation Engineering Practice 0 6 3

Operation and maintenance of instruments, electronic equipments and services.

TOC C244 Production and Processing 0 6 3

Machine and hardware specifications, stores and stores keeping, purchase procedures, job estimation and costing; methods analysis, work measurement; investment analysis.

TOC C253 Computer Oriented Problem Solving I 3*

Principles of numeric processing; errors; propagation, simple numerical methods, solving of linear simultaneous equations; numerical differentiation and integration; basic applications of computer oriented numeric methods.

TOC C254 Computer Oriented Problem Solving II 3*

Non numeric processing; string manipulations; applications of non- numeric processing; introduction to computer graphics; applications from business and CAI.

PART VII
COURSE DESCRIPTIONS
(Off-Campus)

Course descriptions for Off-campus Work-Integrated Learning & Collaborative Programmes

AAOC ZC111 Probability and Statistics 3

Probability spaces; conditional probability and independence; random variables and probability distributions; marginal and conditional distributions; independent random variables; mathematical expectation; mean and variance; binomial, Poisson and normal distributions; sum of independent random variables; law of large numbers; central limit theorem (without proof); sampling distribution and test for mean using normal and student's t-distribution; test of hypothesis; correlation and linear regression.

AAOC ZC221 Graphs and Networks 3

Basic concepts of graphs and digraphs behind electrical communication and other networks behind social, economic and empirical structures; connectivity, reachability and vulnerability; trees, tournaments and matroids; planarity; routing and matching problem; representations; various algorithms; applications.

AAOC ZC222 Optimization 3

Optimization of functions of one and many variables with and without constraints; Kuhn-Tucker conditions; gradient methods; linear programming; simplex based and integer programming methods; duality theory; transportation and assignment problems; dynamic programming; branch and bound methods; models of linear production systems, sequencing and scheduling, PERT, CPM.

BITS ZC411 Object Oriented Programming 3

Object orientation concepts and principles: abstraction, encapsulation, modularity, inheritance, and polymorphism; classes and objects; static and dynamic binding; class utilities; metaclasses; object oriented software engineering; programming and problem solving using one or more of the popular object-oriented programming languages like C++ or Java.

BITS ZC423T Project Work 20

Consistent with the student's professional background and work-environment, the student will be required to carry out work-oriented projects. The student would be required to select an area of work that is considered vital to the sponsoring organization. The topic of the project and detailed project outline that is prepared by the student, in consultation with his/her Mentor, needs to be approved by the Dean, WILPD. On approval, the student carries on with the work-centered project, adhering to the guidelines provided in the detailed course handout, taking all the prescribed evaluation components on time. At the end of the semester, the student should submit a comprehensive Project Report, to the Institute for evaluation. The student will be evaluated on the basis of the various interim evaluation components, contents of the report and Seminar/Viva-Voce that may be conducted at Pilani or at any other Centre approved by the Institute.

BITS ZC461 Software Engineering 3

Software engineering concepts and methodology; formal requirements specification; estimation; software project planning; detailed design; techniques of design; productivity; documentation; programming languages styles, code review; tool, integration and validation; software quality assurance; software maintenance; metrics, automated tools in software engineering.

BITS ZC471 Management Information Systems 3

Introduction to Information Systems; Concepts of management, concepts of information, systems concepts; Information Systems and Organizations; decision making process; database systems; data communications; planning, designing, developing and implementing information systems; quality assurance and evaluation of information systems; future developments

and their organizational and social implications; decision support system and expert systems.

BITS ZC481 Computer Networks 3

Introduction, history and development of computer networks; Reference models; Physical Layer: theoretical basis, transmission media, types of transmission; MAC sub-layer: local area networks, FDDI; Data Link Layer: Sliding Window protocols, design aspects; Network Layer: routing algorithms, congestion control algorithms, internetworking; Transport Layer: Integrated Services Digital Network (ISDN), Asynchronous Transfer Mode (ATM) - reference models, service classes, switch design, LAN emulation; Application Layer protocols.

BITS ZG553 Real Time Systems 5

Real time software, Real time operating systems-scheduling, virtual memory issues and file systems, real time data bases, fault tolerance and exception handling techniques, reliability evaluation, data structures and algorithms for real time/embedded systems, programming languages, compilers and run time environment for real time/embedded systems, real time system design, real time communication and security, real time constraints and multi processing and distributed systems.

BITS ZG629T Dissertation 20

A student registered in this course must take a topic in an area of professional interest drawn from the on the job work requirement which is simultaneously of direct relevance to the degree pursued by the student as well as to the employing / collaborating organization of the student and submit a comprehensive report at the end of the semester working under the overall supervision and guidance of a professional expert who will be deemed as the supervisor for evaluation of all components of the dissertation. Normally the Mentor of the student would be the Dissertation supervisor and in case Mentor is not approved as the supervisor, Mentor may play the role of additional supervisor. The final grades for dissertation are Non-letter grades namely Excellent, Good, Fair and Poor, which do not go into CGPA computation.

BITS ZG659 Technical Communication 4

Role and importance of communication; effectiveness in oral and written communication; technical reports; technical proposals; technical descriptions; definitions and classifications; business correspondence; precis writing; memorandum; notices, agenda and minutes; oral communication related to meetings, seminars, conferences, group discussions, etc.; use of modern communication aids.

CM ZC471 Management Information Systems 3

Course description is same as given under BITS ZC471

CM ZC473 International Business 3

International business - an overview, general international environment - political, legal, socio-cultural and economic factors, international operational framework, tax aspects, marketing factors, labor factors and economic integration. BOP analysis, foreign exchange control, governmental policies, international finance, economic community, IMF, managing multinationals/globalization of operations.

CM ZC483 Marketing Research 3

An examination of the concepts and practical methodology used in marketing research. An overview of marketing research process, with emphasis on research design; data instrument design; questionnaire formulation; sampling plans; data collection methods -interviewing, panels; data analysis and use of computer based information systems for marketing intelligence. Also Time-series & Regression based models of sales forecasting, control and evaluation of marketing function and survey methodology are covered.

Emphasis will be on cases and research projects.

CM ZG511 Consultancy Practice 4

Strategic planning and marketing of consultancy services, client consultant relationships, technology transfers, negotiations, agreements, guarantees, organizing and executing consultancy services, quality in consultancy services, technical audit, government policies such as industrial policy, trade policy, technology policy, patent and trade marks etc.

CM ZG513 Financial Management 4

Concepts and techniques of financial management decision; concepts in valuation – time value of money; valuation of a firm's stock, capital asset pricing model; investment in assets and required returns; risk analysis; financing and dividend policies, capital structure decision; working capital management, management of cash, management of accounts receivable; inventory management, short and intermediate term financing, long term financial tools of financial analysis, financial ratio analysis, funds analysis and financial forecasting, operating and financial leverages.

CM ZG515 Quantitative Methods 4

Basic concepts in Operations Research; Analytical & Mathematical Modeling Techniques; Model Building; Inventory Control, queuing theory; Linear Programming; Transportation and assignment problems, simulation, index numbers, decision theory, etc.

CM ZG523 Project Management 4

Concepts and techniques of project formulation, evaluation and implementation; Project planning and scheduling; Risk management; Time-cost trade off; Resource leveling and allocation; Project monitoring and control; Contract management.

CM ZG532 Total Quality Management 4

Nature of quality, dimensions, determinants, costs of quality, traditional quality management, emerging quality standards, ISO 9000, Malcom Baldridge Award, Top management commitment and involvement, customer involvement, quality function deployment, designing and controlling production processes and improving process capability, reliability concepts, developing supplier partnerships, building teams of empowered employees, quality circles, benchmarking and continuous improvement, TQM in services.

CM ZG542 Knowledge Management 3

Increasing knowledge work in organizations; technologies to support growth of knowledge work in organizations; scope, cost, efficiency and reliability of technologies to support knowledge work; role of knowledge in an enterprise; knowledge management process; knowledge management strategies; human aspects of knowledge management; knowledge management technologies; applications of technologies to be covered through cases, reading assignments and use of appropriate software.

CM ZG561 Management of Technology 4

Technology Forecasting and its application in decision making, study of different industrial profiles, choice of technologies considering impact on people and environment, Promotion of Indigenous technology, technology transfer, foreign collaborations, process licensing, equipment selection and purchase, training and retraining of manpower.

CM ZG611 Strategic Management & Business Policy 4

Strategic management elements; internal, external, external environment. assessment of corporate strengths, weaknesses and opportunities; planning and deployment of capital assets; profit planning and control functions problems, pressures, responsibilities, limits of the chief executive; evaluation of one's own business undertaking; formulating objectives, strategies, policies and programmes for improving company's present situation; personnel strength and implementation of the policies and programmes, development, implementation, evaluation and control of strategies, strategic management of MNCs, management style

and behavior, corporate style, behavior and culture.

CM ZG619 Professional Practice 4

This course will aim to achieve a professional development of the student in the context of the overall goal of his/her programme. Depending upon the profession, this course will be conducted in terms of actual participation in professional activities such as teaching laboratory organization, course development, organizational development, R&D work, design, production, data organization, data preparation or management of institutions / hospitals / voluntary organizations etc. The course will also deal with communication aspects such as teaching a course, presenting a paper in the seminar/conference, articulating ideas and concepts to professional audience/customers etc. This course will also deal with the laws and ethics concerned with the profession of an individual.

CM ZG629T Dissertation 20

Course Description is same as given under BITS ZG629T

CONS ZG511 Philosophy and Consciousness 4

The Problem of consciousness. The materialist, Physicalist, Behaviorist and Epiphenomenalist Positions concerning Consciousness. The Neurobiological Approach. the Mind Body problem. Self-identity; the Continuity of the Self; Memory, Consciousness and Intentionality. The Question of "Conscious Experience". Consciousness and Language. Consciousness and the Meaning of Creativity. Artificial Consciousness and Artificial Intelligence. Consciousness and Robots. The transcendence of Consciousness. The Theories of Consciousness in Indian Philosophies. Is Solipsism tenable? The problem of other minds. Intersubjectivity and Humanism.

CONS ZG512 Philosophy and Consciousness - Advanced Topics 4

Course description to be developed.

CONS ZG531 Physics and Consciousness 4

Quantum Mechanics: Philosophical background of modern physics-classical interpretation quantum mechanics (Planck, Einstein and chaos, duality and complimentarity, complimentarity and causality, Heisenberg's uncertainty principle - the indeterminacy relation and philosophical implications - eigen function - normalization and orthogonalisation - Schrodinger equation (time independent) - probability current density - expectation values - Ehrenfest's theorem-group and phase velocities-Gaussian wave packets. Time independent Schrodinger equation-stationary states-nondegeneracy-degeneracy parity. Eigen values and eigenstats problems-one dimensional quantized systems- degeneracy in deep square well penetration of potential barrier. Statistical Mechanics: Classical statistical mechanics: statistical basis of thermodynamics, derivation of thermodynamic formulae, phase space, phase volume, Liouville's theorem, micro-canonical ensemble, canonical ensemble, grand-canonical ensemble and corresponding partition function. Quantum statistical mechanics postulates of quantum statistical mechanics- density matrix-quantum statistical microcanonical, canonical and grand canonical ensembles and their partition functions. Theory of special relativity: The speed of light and ether- Einstein's principle of relativity- the combination of velocities.

CONS ZG532 Neuroscience & Consciousness 4

Embryology, anatomy, physiology, biochemistry, pharmacology, etc. of the nervous system brain, neurons and synapses-apraxias, aphasias, and agnosias- growth and aging- disturbances of consciousness-hemispheric specialization-thinking, learning and memory- sensation & perception and special senses-speech neurolinguistics, speech and communication-emotions, pleasure, and pain-sleep and dream-drugs

altering consciousness, psychedelic- pypnosis & related phenomena; meditation & its effect on health psychopharmacology- extra sensory perception – psychoneuro - immunology- psycho-neuroendocrinology.

CONS ZG541 Biology and Consciousness 4

Living system and cellular organization- heredity and genetic information- the dynamics of genetic matter and modes of transfer of genetic information -the packaging of genetic information and chromosomes- translation of genetic information to proteins and enzymes- hereditary changes, mutation, and mutagene- assimilation, transport, and channel- response of living state to internal and external stimuli, immune response and antibody- hormones and peptide- neurons and nervous system- sensory and motor functions- brain, mind and consciousness- where we lead to?

CONS ZG542 Consciousness Studies – Advanced Topics 4

Matter and quantum theory, philosophical perspective of matter, principles and experimental data of neuroscience including its relevance to consciousness studies, non-classical nature of quantum theory, relational view point for interpreting quantum physical reality, relational view points from biological & mathematics pertaining to consciousness studies.

CONS ZG551 Artificial Intelligence and Consciousness 4

A review of technical progress and difficulties in AI; The `intelligence machine' concept - Turning's `imitation game' metaphor. Searie's `Chinese Room' counter; The `knowledge representation' approach- symbol-system hypothesis of Brain Smith; The symbol grounding problem; Limits to computation arguments; The theory of neural nets; `symbol generation' approach to AI.

CONS ZG552 Foundations of Physics 4

Philosophy of physics including epistemological and ontological issues, Michelson-Morley Experiment; Interpretation; Postulates of Special Theory; Derivation of Lorentz Transformation; Length contraction; Time Dilation; Relativistic kinematics – Relativistic Momentum; Mass-Energy equivalence; Electromagnetism and Relativity- Maxwell's Equations; Lorentz transformation; Relativistic invariance; Field of a moving charge; General Theory of Relativity- Principle of equivalence; Space-Time curvature; Geodesic equation; Gravitation and Metric; Experimental evidence of GTR.

CONS ZG561 Vedanta and Consciousness I 4

A brief history of the Western theories of knowledge' Plato, Aristotle, Descartes, Locke, Hume, Berkeley, Kant, Bohr and Einstein. Introduction to the basic principles of Vedanta-vis-a-vis the concept of matter, conscious, self, Time and God. The differences between Western mind/body dualism and Vedantic jiva / God dualism. The distinction between mind and conscious self in Vendanta. The Vedantic concept of Maya. The Vedantic view of the mind/body problem and the conscious self/matter interaction.

Its possible relevance to emerging foundational issues in quantum physics, artificial intelligence and neuroscience. The course will be based on the Vedanta as elucidated by the Cananyane School of Vaishnavism, of which the more popular Advaita edanta can be seen as a proper subset.

CONS ZG562 Physics and Consciousness - Advanced Topics 4

The axiomatic foundation of classical and quantum theory; the inter-relationship between state, observables and measurement in classical and quantum theory; differences in the physical meaning of the state vector and eigenvectors in Hilbert space; a statement of the measurement problem-the apparent need for the `collapse' postulate; a review of the important differences in the approaches of Bohr and Einstein to the measurement problem. Toward a new quantum theory of the individual quantum system based on a `particle' ontology that integrates the essential insights

of Bohr, Einstein and modern `ontological' Copenhagen interpretation. The complementary relationship between the present quantum theory which is a `wave' ontology and a possible new theory based on `particle' ontology. The different role of consciousness in classical and mechanics. Classical and quantum notions of `information'.

CONS ZG571 Mind, Body Medicine – Current Trends 4

The course will explore the interface between consciousness and clinical medicine. It will scientifically scrutinize the areas in clinical medicine where the issue of the nature and role of consciousness plays a significant role; encourage the study and critical examination of the existing credible scientific models of consciousness that account for relevant phenomena; and empower students to propose fresh and new plausible models with underlying scientific reasoning, especially where none presently exist, using experimental criteria for validation of the proposed models.

CONS ZG572 Matter and Consciousness in Bhagavata Sankhya 4

In-depth study and analysis of the concepts of Sankhya, brief history of the Western Theories of knowledge: Plato, Aristotle, Descartes, Locke, Hume, Berkeley, Kant, Bohr and Einstein; possibilities of applying the concepts of Bhagavata Sankhya for the field of consciousness studies.

CONS ZG573 Study in Advanced Topics I 5

CONS ZG574 Study in Advanced Topics II 5

In the above two courses students will be assigned study work in advanced areas of professional interest. Each student will work under the overall supervision and guidance of a faculty member and will in the end submit a project report encompassing critical review of the material studied.

The organization and evaluation of the course would be achieved through seminars, group discussions, project report etc. The course will be conducted by the team of teachers who provide guidance for study work.

CONS ZG581 Medicine & Consciousness Advanced Topics 4

Course description to be developed.

CONS ZG582 Psychology and Consciousness 4

Course description to be developed.

CONS ZG591 Selected Topics in Consciousness Studies 5

Course description to be developed

CONS ZG629T Dissertation 20

Course description is same as given under BITS ZG629T.

CONS ZG656 Technical Writing 4

Competent technical writing, content editing, review of elementary and advanced consideration in writing effective sentences with correct grammar, methodology for surveying the technical literature on a particular subject, competent presentation of technical ideas of other researchers succinctly.

CS ZC444 Real-Time Systems 3

Introduction to real-time systems, clock synchronization, task assignment and scheduling, programming language with real-time support, ADA, real-time communication protocols, real-time databases, fault tolerant techniques, reliability evaluation methods; case studies in real-time operating systems, simulation of real-time systems, embedded system programming.

CS ZG623 Advanced Operating Systems 5

Overview of advanced operating systems: motivation for their design, and various types of advanced operating systems; Distributed operating systems: architecture of distributed systems, theoretical foundation of distributed systems, deadlock detection/resolution, agreement protocols, file systems, distributed shared memory, scheduling, fault tolerance and recovery; Multiprocessor operating systems: multiprocessor system architectures, multiprocessor operating system design issues, threads, process synchronization, process

scheduling and memory management; Data base operating systems: introduction, concurrency control: theoretical and algorithmic aspects; Case Study: Amoeba and Mach.

DOM ZC211 Functional English 3

Fundamentals of grammar and usage; vocabulary extension; punctuation and capitalization; using the library; paragraph writing; speech improvement; dictation; listening comprehension; Writing short technical descriptions; business letters; applications and notices; reading comprehension; summarizing; giving instruction; oral presentation.

DOM ZC221 Computer Skills and Communication Aids 4

Personal Computers; Components; Storage Devices; Sharing Peripherals and files; Network based resource sharing; Software installation; Diagnostic tools like virus scanners etc.; Internet, E-Mail and other Internet Services; Website design and maintenance; MS Office components and applications; Use of modern communication aids and operation of office automation tools like Scanner, Photo-copier, Printer, Fax, EPABX, OHP, Video screen projectors etc.; Basic trouble shooting and maintenance of computers.

DOM ZC231 Principles and Practice of Office Management 4

Office organization and Management, Office systems and routines, Flow of work, Process of delegation and decentralization, special features of office work, job-subdivision and specification, Manuals, Personnel management, Office correspondence, Departmental correspondence, Management of inwards and outwards mail, Records Management, Classification and filing methods, indexing, Office ergonomics & office layout, layout of furniture, equipment and computers, Collection, Recording, Storing and Archiving of Data, office reports, presentation of data, Tabulation, Charts and Graphs.

DOM ZC212 Business Communication 3

Managerial communication - national and international contexts, Interpersonal Communication, persuasive communication, communication technology, effective listening group communication, professional presentation.

DOM ZC222 Materials Management & Accounting 4

Management of materials, Classification, Codification & Specification of materials, Standardization and Variety reduction, Budgeting and Material Planning, Stores and Store Keeping, Bills processing, negotiable instruments, Inventory control, Principles of purchasing, vendor rating, Buyer –Seller relationship, Disposal of surplus, obsolete and scrap, Legal aspects of purchasing; Essentials of double entry book-keeping, matching of revenues with expenses, cashbook, journal, ledger, trial balance, income and expenditure statement, balance sheet.

DOM ZC232 Basic Management Skills 4

Managerial functions, Planning, Organizing, Leading, Controlling, Managerial skills, Personality, Attitudes, Values, Motivation, Learning, Perception, Work teams, Communication, Conflict and Negotiation, Teams and Groups, Organization Culture, Managing People, Total Quality Management, Project planning, Time Management, Stress Management.

DOM ZC241 University Operations 5

Role of Higher education, Formation of an educational Institution, Rules and regulations, functioning of academic and administrative bodies, Academic regulations, Annual report and Institute bulletin, Introduction to various administrative structures and operations, Introduction to operations of different Divisions and Units, University-Industry linkages, Work integrated learning programmes, Accreditation Process, Legal matters and Right to Information (RTI) Act, Interfacing with outside agencies e.g. UGC, MHRD etc.

DOM ZC242 Hospitality & Events Management 5

Front office procedures, reception, reservation and responsiveness to grievances, Food and society, Ensuring cleanliness, sanitation, service quality and supervision, Handling foreign guests, Cross- cultural etiquettes and handling physically – challenged guests; Budgeting and accounting, Venue selection, Booking and Coordinating travel arrangements, handling visitors and VIP's, Negotiation skills and vendor dealing, Public relations, Learning about local resources, local facilities, local festivals and site visits, Security and loss prevention, First-aid & Emergency management, Logistics planning – stage sound, lighting and photography, media, publicity etc.

DOM ZC252 Housekeeping Operations Management 5

Customer care, cleanliness, etiquette and hygiene issues, clean and tidy appearance, professional presentation, Food and beverage serving, table decoration, floral decoration, Orientation to modern cleaning aids, laundry and linen handling, floor, upholstery, carpet cleaning, Use of chemicals and cleaning products for appropriate uses, Use of protective clothing, waste handling and disposal, Campus maintenance aids, Maintaining safe environment, Identifying potential risk and hazards, Controlling pilferage and losses.

DOM ZC262 Personnel Management Operations 5

Workplace culture, supervising practices for controlling department operations, Manpower planning, Processes of recruitment, selection and induction of employees, Career Planning, planning and conducting effective staff training, monitoring workplace processes and performance, Performance appraisal, confidential reports, periodic reviews and promotions, disciplinary actions, employees benefit schemes, Employee health and safety, outsourcing.

EA ZC412 Flexible Manufacturing Systems 4

Introduction CAD/CAM systems, overview of FMS, system hardware and general functions, material handling system, work holding systems, cutting tools and tool management, physical planning of system, software structure functions and description, cleaning and automated inspection, communications and computer networks for manufacturing, quantification of flexibility, human factors in manufacturing, FMS and CIM in action (case studies), justification of FMS, modelling for design, planning and operation of FMS.

EA ZC451 Internetworking Technologies 3

Introduction to internetworking concepts; the internet architecture; goals and key issued related to internet working technologies; design aspects; HTTP and other relevant protocols; agent technology and tools relevant to the internet; techniques of data compression; voice, video, and interactive video-on-demand over the internet; multimedia operating systems and their impact; multimedia networking; mobile computing; internet security, case studies.

EA ZC473 Multimedia Computing 3

Introduction to multimedia; media & data streams; image, video & audio file formats; image & video processing, synthesis of sound signal; image coding & compression, video & audio codes, low bit rate video telephony; audio-visual integration, lip reading, face animation; augmented reality; multimedia search services, content based image & video indexing; access to multimedia, human-machine interfaces, spoken language interface; algorithm vs. architecture based approaches, multimedia processors, performance quantification; case studies, vision 2010.

EBCT ZG511 Overview of e-Business 3

E-Business Environment and Opportunities: Background; E-Business evolution; E-Business environment; Diverse opportunities in E-Business; E-Businesses on the Internet. Categories of E-Business - B2B/E2EI, B2C, C2C;

Overview of E-Business implementation technologies. E-Business Models - Enterprise portal, CRM, ERP, Supply Chain Planning(SCP), Transport Management System(TMS), Warehouse Management System(WMS), Content Management. E-Business Products- Development products; integration products; generic tools; performance analyzer tools; content management tools; component generator tools. Electronic Transaction and Security – Online payment system and security issues; Secure Transport Protocols, Secure Transactions, Secure Electronic Payment Protocol (SEPP), Secure Electronic Transaction (SET); Security features – certificates for authentication (SSL, third party certifications); security on Web servers and Enterprise Network. Emerging E-Businesses Scenario-Changing economic considerations; Emerging business opportunities and revenue models; emerging technologies; Social aspects.

EDLT ZC211 Electrical & Electronics Technology 3

Electric circuit, electromagnetism, magnetic circuit, electrostatics, AC voltage and current, single-phase circuits, semiconductor devices, amplifiers, digital systems, microprocessors, DC machines, polyphase circuits, transformers, synchronous machines, induction motors, power electronics, measurements, illumination.

EDLT ZC212 Engineering Mechanics 3

Introduction to mechanics, statics of particles, statics of rigid bodies, analysis of structures, friction and its applications, centroid and centre of gravity, moment of inertia and mass moment of inertia, method of virtual work, kinematics of particles: Newton's second law, energy and momentum methods, kinematics of rigid bodies.

EDLT ZC221 Engineering Mathematics I 3

Limit concept; derivatives of elementary functions and their applications; introduction to ordinary and partial differential equations and initial/boundary value problems. Convergence tests for series; power series and interval of convergence; series solution of differential equations. Approximation and error, interpolation; roots of algebraic and transcendental functions, Newton's method.

EDLT ZC222 Engineering Mathematics II 3

Algebra of vectors and matrices; Gauss's row-reduction process; applications of simultaneous linear equations and matrix inversion; determinants and Cramer's rule. Numerical differentiation and integration; numerical methods for solving ordinary and partial differential equations.

EDLT ZC231 Principles of Management 3

Fundamental concepts of management - planning; organizing; staffing; directing and controlling; production, financial, personnel, legal and marketing functions; accounting and budgeting, balance sheets.

EDLT ZC232 Engineering Materials 3

Mechanical, electrical, electronic and chemical properties and applications of common engineering materials; ferrous and non- ferrous metals and alloys; thermosetting and thermoplastic plastics; natural and synthetic resins; rubber; glass; abrasives and ceramics; common building materials, namely, timber, stone, lime and cement; corrosion of metals and methods of preventing corrosion; protective and decorative coatings; insulating materials; testing of materials.

EDLT ZC241 Technical Report Writing 3

Elements of effective writing; art of condensation; business letter writing; memos; formal reports; technical proposals; conducting, and participating, meetings; agenda and minutes; strategies for writing technical descriptions, definitions, and classifications; oral presentation; use of graphic and audio- visual aids; editing.

EDLT ZC242 Fluid Mechanics and Machines 3

Introduction and fundamental concepts, fluid statics, kinematics and dynamics of fluid flow, inviscid flows, pipe flow, open channel flow, incompressible viscous flow, laminar boundary layers, turbulent flows, essentials of compressible flow, dimensional analysis and

similitude, flow measurements, hydraulic turbines, pumps and fluid couplings, compressors.

EDLT ZC311 Manufacturing Process 3

Fundamentals of casting process; forging; powder metallurgy; soldering; brazing and welding technology; metal forming process, its analysis and design; Introduction to Metal cutting, machine tools; mechanics of metal cutting; other machining processes; grinding and finishing operations; non convention machining; chipless machining processes; NC machines programming; control system in CNC; CNC, DNC; FMS and machining center.

EDLT ZC312 Computer Programming 3

Elementary computer organization; introduction to Number Systems; Representation of integers, real numbers and characters on computers; concept of range and accuracy; Arithmetic Overflow; Algorithms and algorithm development; structured program development through step wise refinement. Introduction to C language; Functions; Recursion; Data structure & algorithms; File management & file handling; Problem solving using C.

EDLT ZC321 Mechanics of Solids 3

Fundamental principles of mechanics; introduction of mechanics of deformable bodies; forces and moments transmitted by slender members; stress and strain; stress-strain-temperature relations; torsion; stresses and defections due to bending; stability of equilibrium.

EDLT ZC322 Kinematics & Dynamics of Machines 3

Kinematics of mechanism: introduction to mechanisms, position, displacement, velocity, acceleration analysis, cam design, gear trains, synthesis of linkages. Dynamics of machines: static force analysis, dynamic force analysis (planar), dynamics of reciprocating engines, balancing, cam dynamics, flywheels, governors and gyroscopes, free and forced vibrations.

EDLT ZC331 Optimization 3

Course description is same as given under AAOC ZC222.

EDLT ZC332 Mechanical Engineering Design I 3

Introduction to mechanical engineering design, stress and strain, deflection and stiffness, introduction to materials and manufacturing, failures resulting from static loading, failures resulting from variable loading, design of mechanical elements: screws, fasteners, permanent joints, nonpermanent joints and mechanical springs.

EDLT ZC341 Thermal Engineering I 3

Introduction, temperature, work and heat transfer, first law, second law, entropy applications, properties of pure substances, vapour and gas power cycles, internal combustion engines, refrigeration cycles, psychrometrics and air-conditioning, elements of heat transfer.

EDLT ZC342 Thermal Engineering II 3

Thermal power plants, hydroelectric power plants, nuclear power plants, gas turbine and diesel power plants, non-conventional power generation and analysis.

EDLT ZC411 Computer Aided Design 3

Computer Aided Drafting and tools for graphics; mathematical tools; convergence criteria; design tools like modelling, simulation, spread sheets and use of specialised packages etc.; students will be required to do projects, specialised works for which a pool of guides will be drawn from several disciplines.

EDLT ZC421 Instrumentation & Control 3

Measurement systems, transducers, feedback control, components: electrical, hydraulic, pneumatic; Signal conditioning and processing, controllers, display, recording, direct digital control, programmable logic controllers, PC based instrumentation.

EDLT ZC423T Project Work 20

Course description is same as given under BITS ZC423T.

EDLT ZC431 Mechanical Engineering Design II 3

Lubrication and journal bearings, rolling contact bearings, introduction to gearing, spur helical, bevel and worm gears, clutches, brakes, couplings, flywheels, belts, chains, wire rope, shafts and axles.

EDLT ZC441 Automotive Vehicles 3

Internal combustion engines; vehicle performance; analysis and design of vehicle components. Experimental or theoretical investigation of problems selected from the field of automotive vehicles.

EDLT ZC451 Product Design and Development 3

Introduction to product design and development, product development planning and process tools, technical and business concerns, understanding customer needs, function modeling, benchmarking and engineering specifications, product architecture, concept generation, concept selection, concept embodiment, modeling of product metrices, design for X, physical prototypes, physical models and experimentation, robust design.

EEE ZG512 Embedded System Design 4

Introduction to embedded systems; embedded architectures : Architectures and programming of microcontrollers and DSPs. Embedded applications and technologies; power issues in system design; introduction to software and hardware co-design.

EMAL ZC411 Issues in Technology 3

The course is designed to investigate into the methods of technology assessment and choice aspect of technology innovation and alternate and appropriate technologies; technology forecasting; mode of technology transfer across all boundaries and methods of technology diffusion; fall-out effects of technology; technological imperatives; transformation of technology and its relation to the development of science and the nature of society; the issue of autonomy of technology; measurement of technological change and the concept in ideas of progress. Simultaneous/concurrent engineering, Design for Manufacture Assemble (DFMA), Quality Function Deployment (QFD), Failure Mode Effects Analysis (FMEA), New Product Introduction strategies/ Production Introduction Process (PIP), Value Engineering.

EMAL ZC432 Introduction to Accounting & Finance 4

Accounting as a language for management decisions, Accounting principles, conventions and concepts, concepts relating to financial statements, analysis of financial statements, inventory pricing and valuation, inflation accounting, cost accounting and budgetary control systems - cost determination, standard costs, differential cost and direct costing, profit budgeting and analysis, capital investment analysis, disinvestment decisions. Accounting as a language for management decisions; Accounting principles, conventions and concepts; concepts relating to financial statements, analysis of financial statements; inventory pricing and valuation; inflation accounting; cost accounting and budgetary control systems - cost determination, standard costs, differential cost and direct costing; profit budgeting and analysis; capital investment analysis; disinvestment decisions.

EMAL ZC481 Industrial Marketing 3

Market/consumer orientation, marketing in industrial context, industrial market behavior, organizational buying and buying behavior, business forecasting and planning, product planning, new product development, pricing, distribution, management of communications, advertising & personal selling, management of sales force, corporate strategy and industrial marketing.

EMAL ZG511 Overview of E-Commerce 3

This course is designed to investigate into the methods, technologies, systems and paradigms of data based management in networked systems. It focuses on the issues related with data integrity and security of information and its application in industrial environments, with particular reference for multi-unit companies; covering topics such as

computer networks, the internet and e-commerce, networking design and media, the internet, electronic commerce, concerns of e-commerce.

EMAL ZG532 Quality Assurance & Reliability 5

Quality planning and control, economics of quality control, Specifications, tolerances and process capability studies, total quality control concepts in quality circles, quality incentives. Fundamental concepts of reliability engineering, Failure analysis, Reliability versus quality control, Systems reliability evaluation, reliability allocation, maintainability, and designing for reliability. Illustrative examples of design ensuring reliability to be taken up.

EMAL ZG612 Methods & Techniques of Systems Engineering 5

This course would cover various systems engineering methods and techniques in the context of their application to the design, implementation and operation of large, humanly contrived soft systems. The techniques would be chosen from amongst linear programming, integer programming, queuing theory, inventory control, simulation, maintenance models sampling techniques, forecasting techniques, decision models, network scheduling methods etc. These would be applied in the context of resource planning, facility location, manpower planning, financial management, decision-making, maintenance issues, construction and operation scheduling; planning research issues; social assessment of technology; issues of technology-economy nexus etc.

EMAL ZG614 Management Concepts & HRM 5

Basic principles of management, organizational behavior, organizational design, strategic planning, decision making, Introduction to manpower planning, career and succession planning, procurement of personnel performance appraisal, job satisfaction and morale, job rotation, employee communication, audit and control, management training and development, wage and salary administration, trade Unions and collective bargaining, industrial dispute and worker participation in management.

EMAL ZG629T Dissertation 20

Course description is same as given under BITS ZG629T.

EMAL ZG631 Product Systems Management 5

Production planning, scheduling, coordination, production control systems, product design and management, Factory systems design, Social factors and government regulations.

EMAL ZG632 Materials Management 4

Integrated Materials Management; Materials planning and Control; Inventory Control Techniques Materials Development and Management Purchase Management; Stores Management and Retrieval Systems JIT and MRP Systems; Materials Management and Legal Environment; Value Analysis; Price Negotiation Strategies; Information Systems for Effective Materials management.

EMAL ZG641 Management Information & Decision Support Systems 5

Data & information; characteristics of information; components of management information systems; information flows; design and maintenance of management information systems; decision support systems.

EMAL ZG643 Maintenance Engineering & Safety 4

Basic maintenance systems and practice; maintenance planning; estimating and budgeting; scheduling maintenance jobs; importance of safety; factors affecting safety; safety aspects of site and plant; hazards of commercial chemical reaction and operation; instrumentation for safe operation; safety education and training; personnel safety; disaster planning and measuring safety effectiveness; future trends in industrial safety; maintenance of components and equipments; new dimensions in maintenance covering plant engineering, tribology, materials technology, terotechnology (life cycle costing) etc.; extensive case studies.

EMAL ZG659 Technical Communication 4

Course description is same as given under BITS ZG659.

EMTP ZC312 Managerial Economics 3

Fundamental concepts, supply, demand, market mechanism; theory of demand (consumer behaviour); production, costs (theory of the firm); market structures (perfect competition, monopoly, monopolistic competition, oligopoly); circular flow of income, national income accounting, national income determination; money and banking, employment, interest, inflation.

EMTP ZC432 Introduction to Accounting & Finance 4

Course description is same as given under EMAL ZC432.

EMTP ZG511 Design Engineering I 4

Process Design; equipment speciality engineering; detailed design engineering and drafting of piping system design; process plant layout etc.

EMTP ZG512 Design Engineering II 4

Design of civil, structures, foundation systems; electrical systems; instrumentation systems of process plants.

EMTP ZG523 Project Management 4

Course description is same as given under CM ZG523

EMTP ZG532 Quality Assurance & Reliability 5

Course description is same as given under EMAL ZG532

EMTP ZG533 Environmental Management System 5

Introduction; Principles & elements of successful environmental management UNO and Rio declaration on environment and development (1992); Ecological degradation & ecological balance; EMS; Creating an environmental management system in fine with ISO 14000; Benefits of an environmental management system; Principles & elements of successful environmental management: leadership, environmental management planning, implementing an environmental management system, measurement & evaluations required for an environmental management system, environmental management reviews & improvements; Legal and regulatory concerns; Integrating ISO 9000 & ISO 14000.

EMTP ZG541 Process Plant Simulation 4

Computer aided analysis of chemical process systems; classification and development of mathematical models to various chemical engineering systems; decomposition of networks; tearing algorithms; numerical methods for convergence promotion and solving chemical engineering problems; traditional & non-traditional optimization techniques; specific purpose simulation; dynamic process plant simulation; case study problems using professional software packages.

EMTP ZG612 Methods & Techniques of Systems Engineering 5

Course description is same as given under CM ZG612

EMTP ZG614 Management Concepts & HRM 5

Course description is same as given under EMAL ZG614

EMTP ZG629T Dissertation 20

Course description is same as given under BITS ZG629T

EMTP ZG641 Management Information & Decision Support Systems 5

Course description is same as given under EMAL ZG641

EMTP ZG659 Technical Communication 4

Course description is same as given under BITS ZG659

ENGG ZC111 Electrical & Electronics Technology 3

Electric circuit, electromagnetism, magnetic circuit, electrostatics, AC voltage and current, single-phase circuits, semiconductor devices, amplifiers, digital systems, microprocessors, DC machines, polyphase

circuits, transformers, synchronous machines, induction motors, power electronics, measurements, illumination.

ENGG ZC232 Engineering Materials 3

Mechanical, electrical, electronic and chemical properties and applications of common engineering materials; ferrous and non- ferrous metals and alloys; thermosetting and thermoplastic plastics; natural and synthetic resins; rubber; glass; abrasives and ceramics; common building materials, namely, timber, stone, lime and cement; corrosion of metals and methods of preventing corrosion; protective and decorative coatings; insulating materials; testing of materials.

ENGG ZC241 Mechanical Technology 3

Fundamental concepts of heat, work and energy; second law of thermodynamics; properties of gases and vapors; basic cycles; flow of liquids; steam boilers; steam engines and pumps; steam turbines and condensers; hydraulic pumps and turbines; internal combustion engine.

ENGG ZC242 Maintenance & Safety 3

Objectives, functions, and types of maintenance; defects due to wear; lubrication and surfacing techniques to reduce wear; maintenance of different equipments and their elements; spares planning; overhauling; TPM; safety and safety management; environmental safety; chemical safety; occupational health management; control of major industrial hazards; managing emergencies; employee participation in safety; HRD for maintenance and safety.

ES ZC261 Digital Electronics and Microprocessors 3

Binary logic gates; logic circuits; Boolean algebra and K-map simplification; number systems and codes; arithmetic logic units; flipflops; registers and counters; introduction to microprocessors; architecture; instruction set and programming; memory and I/O interfacing examples of system design.

ESM ZG511 Organisational Behaviour 4

Evolution and relevance; perception emotions and learning in an organisational set up; attitudes and values, groups and group processes, leadership, power and politics, organizational change, resistance and development, managing conflict.

ESM ZG512 Management Information Systems 3

Introduction to Information Systems; Concepts of management, concepts of information, systems concepts; Information Systems and Organizations; decision making process; database systems; data communications; planning, designing, developing and implementing information systems; quality assurance and evaluation of information systems; future developments and their organizational and social implications; decision support system and expert systems.

ESM ZG521 Professional Ethics 3

Ethics, nature and purpose; ethical theories; ethics in business and management; ethics in engineering, global ethical issues

ESM ZG522 Human Resource Management 4

Strategic human resource management, manpower planning, job analysis, recruitment and selection, placement, induction, training and development, appraising and managing performance, compensation, employee discipline, workplace safety and health, collective bargaining, industrial relations, human resource accounting and audit.

ESM ZG531 Overview of Management Concepts 4

Evolution of Management Theory; Major schools of Management theory; Overview of Managerial Functions viz.: Planning, Organizing, Leading and Controlling; Management Roles; Organizational Structure; Organizational Effectiveness; Business Environment and Society. Overview of Organizational Functions viz.: Finance, Human Resource Management, Marketing,

Production and Operations Management, Management Information Systems. Overview of Managerial Competencies viz.: Motivation, Team Effectiveness, Communication, Conflict Management, Leadership, Decision Making, Emotional Intelligence, Stress Management, Creativity and Entrepreneurship, Overview of International Management.

ESM ZG532 Total Quality Management 4

TQM principles and practices; leadership; customer satisfaction; employee involvement; continuous process improvement; supplier partnership; performance measures; statistical process control; ISO 9000; benchmarking; quality function deployment; concurrent engineering; experimental design; Taguchi's quality engineering; product liability

ESM ZG541 Technical Communication 4

Course description is same as given under BITS ZG659

ESM ZG542 Introduction to Accounting and Finance 4

Course description is same as given under EMAL ZC432

ESM ZG611 Research Methodology 5

Methods of collecting and presenting statistical data; Probability distribution; calculation and interpretation of various measures like mean, mode, median and standard deviation; correlation and regression; significance tests and confidence intervals; tests for equality of proportions; tests for equality of means; measures of association; Assignments and case studies from the field of Educational Systems. A project report has to be submitted by each student at the end of the course.

ESM ZG621 Educational Technology and Instructional Design 4

Goals and objectives of education; psychological bases of learning; learner analysis; concept of education technology; instructional strategies; use of application software in education: word processing, spread sheets and presentations; computer and web based instructional strategies; evaluation strategies; instruction design; challenges of inclusive education for differently abled.

ESM ZG629T Dissertation 20

Course description is same as given under BITS ZG629T

ESM ZG631 Counselling 4

Introduction; counsellor's role and qualities; counselling process; optimizing listening skills; educational counselling; psychological testing; learning disability; issues concerning adolescence and youth; child sexual abuse: preventive and remedial measures; preventing and handling stress/depression; counselling skills and techniques used in the field of mental health.

ESM ZG641 International Challenges and Response in Education 4

Challenges in Indian education; universalisation of secondary education; changing socio-economic status; emergence of the middle class and their aspirations; globalization, Open and distance education movement; emergence of new vocations and global value system; international scenarios in education policies; solutions to these challenges: mass personalization of education through ICT, need based curriculum and international collaboration.

ESPC ZC421 Computer Networks 3

Course description is same as given under BITS ZC481.

ESPC ZC424 Software for Embedded Systems 3

Real-time and Embedded Systems; Software issues in Embedded Systems; Software Development Process; Requirements Analysis – Use Cases, Identification and Analysis of use cases, Use Case Diagrams. Design – Architectural Design, Design Patterns, Detailed Design. Implementation – Languages, Compilers, Runtime Environments and Operating Systems for embedded software. Testing – Methodologies, Test Cases

ESPC ZC446 Data Storage Technologies & Networks 3

Storage Media and Technologies – Magnetic, Optical and Semiconductor media,

techniques for read/write operations, issues and limitations. Usage and Access – Positioning in the memory hierarchy, Hardware and Software Design for access, Performance issues. Large Storages – Hard Disks, Networked Attached Storage, Scalability issues, Networking issues. Storage Architecture. - Storage Partitioning, Storage System Design, Caching, Legacy Systems. Storage Area Networks – Hardware and Software Components, Storage Clusters/Grids. Storage QoS – Performance, Reliability, and Security issues.

ESPC ZG512 Embedded System Design 4

Course Description is same as given under EEE ZG512

ESPC ZG513 Network Security 4

This course examines issues related to network and information security. Topics include security concepts, security attacks and risks, security architectures, security policy management, security mechanisms, cryptography algorithms, security standards, security system interoperation and case studies of the current major security systems.

ESPC ZG520 Wireless & Mobile Communication 5

Signal propagation in a mobile environment, modulation, coding, equalization; first generation generation systems; multiple access techniques like FDMA, TDMA, CDMA, spread spectrum sytems; second & third generation systems, UMTS, IMT-2000; Wireless LAN, Wireless ATM and Mobile IP; emerging trends in Wireless & Mobile Communication.

ESPC ZG531 Pervasive Computing 4

Select application architectures; hardware aspects; human-machine interfacing; device technology: hardware, operating system issues; software aspects, java; device connectivity issues and protocols; security issues; device management issues and mechanisms; role of web; wap devices and architectures; voice-enabling techniques; PDAs and their operating systems; web application architectures; architectural issues and choices; smart card-based authentication mechanisms; applications; issues and mechanisms in WAP-enabling; access architectures; wearable computing architectures.

ESPC ZG553 Real-Time Systems 5

Course Description is same as given under BITS ZG553

ESPC ZG573 Digital Signal Processing 3

Introduction; design of analog filters; design of digital filters: (IIR and FIR); structures for the realization of digital filters; random signals and random processes; linear estimation and prediction; Wiener filters; DSP processor architecture; DSP algorithms for different applications.

ESPC ZG612 Fault Tolerant System Design 5

Principles of fault tolerant systems, redundancy, parallel and shared resources, spatial systems, configurations, design aspects etc.

ESPC ZG629T Dissertation 20

Course Description is same as given under BITS ZG629T

ESPC ZG641 Hardware Software Co-Design 4

FPGA and ASIC based design, Low-Power Techniques in RT Embedded Systems On-chip networking. Hardware Software partitioning and scheduling, Co-simulation, synthesis and verifications, Architecture mapping, HW-SW Interfaces and Re-configurable computing.

ESPC ZG651 Networked Embedded Applications 4

Networked embedded systems, Clock synchronization, Protocol mechanisms protocol performance, CAN Bus architecture, USB Architecture, Embedded Internet, Distributed computing, Use of Java in building networked systems, Reliability & Fault Tolerance etc. Mission-critical distributed real-time applications, e.g., military, air traffic control; Prototyping benchmark applications, e.g. simulated air traffic visualization, radar display; Networking: TCP/IP, distributed objects; Embedded system programming and middleware: I/O, analog / digital

conversion, DSP, runtime monitoring of CPU, processes, network equipment; Modeling distributed real-time systems; Quality of service maintenance.

ET ZC341 Instrumentation & Control 3

Measurement systems, transducers, feedback control, components: electrical, hydraulic, pneumatic; Signal conditioning and processing, controllers, display, recording, direct digital control, programmable logic controllers, PC based instrumentation.

ET ZC342 Materials Management 3

Integrated materials management, policy aspects, purchasing management, warehousing and storage of inventory control systems; appraisal and control; just in time (JIT); automation in materials management.

ET ZC362 Environmental Pollution Control 3

Air and water pollutants; sampling and analysis; control methods for air & water pollutants; modeling of different control techniques; advanced wastewater treatment processes; solid waste management, noise pollution; case studies.

ET ZC412 Production Planning & Control 3

Generalized model of production systems; types of production flows; life cycle concepts; facilities location and layout planning; aggregate and batch production planning; inventory systems; materials requirements planning; elements of monitoring & production control.

ET ZC414 Project Appraisal 3

Overview of project and project phases; project formulation aspects in terms of market studies, technical studies, financial studies, economic studies, environmental studies, etc.; project evaluation aspects in terms of commercial profitability prospects, national economic profitability prospects; issues of project preparation in project implementation.

ET ZC432 Quality Control, Assurance & Reliability 3

Basic concepts of probability and probability distributions, standard probability distribution, sampling and sampling distributions, confidence intervals, testing significance, statistical tolerance, various types of control charts, statistical process control techniques, value analysis, defect diagnosis and prevention, basic concepts of reliability, reliability design evaluation and control, methods of applying total quality management, production process.

HHSM ZC417 Managerial Communication 4

Written communication: memos, letters, notices, agenda, minutes, resolutions, (project) proposals, reports; electronic communication: mail, privacy and workplace monitoring, teleconferencing; oral communication: group communications, presentations, public speaking, media; non-verbal communication, effective listening and feedback; reading skills.

HHSM ZC471 Management Information Systems 3

Course description is same as given under BITS ZC471

HHSM ZG513 Biostatistics & Epidemiology 4

Methods of collection and presentation of statistical data; calculation and interpretation of various measures like mean, median, mode, standard deviation, kurtosis, correlation coefficient; probability distributions; sampling and estimation of parameters; tests of hypothesis; data analysis. Introduction to the principles and methods of epidemiology. Epidemiology of some illustrative infectious diseases (of bacterial, rickettsial and viral origins), sexually transmitted diseases, chronic diseases such as cancer, cardiovascular diseases, neurological disorders etc. Use of biostatistics in epidemiology.

HHSM ZG514 Health Care Marketing & Strategic Management 4

Strategic management function within contemporary health services organization with focus on organizational strategic planning processes including principles and methods of strategic assessment, strategy formulation, evaluation, implementation, and control, as well as the role and function of

marketing strategy as part of the strategic implementation process.

HHSM ZG515 Quantitative Methods 3

Basic concepts in Operations Research; Analytical & Mathematical Modeling Techniques; Model Building; Inventory Control, queuing theory; Linear Programming; Transportation and assignment problems, simulation, index numbers, decision theory, etc.

HHSM ZG516 Epidemic & Disaster Management 4

Disaster management; impact and response; relief phase; disaster mitigation in health sector; disaster preparedness; policy development; man-made disasters; international agencies providing health based humanitarian assistance; and strategies for disaster management.

HHSM ZG517 Health Care Management 4

Basis of organizational culture and management techniques for efficient administration of health delivery; general principles of HR, materials and operation management; understanding the organizational culture that exists in public, private and non-Govt. sector agencies; management information system.

HHSM ZG518 Total Quality Management 4

TQM principles and practices; leadership; customer satisfaction; employee involvement; continuous process improvement; supplier partnership; performance measures; statistical process control; ISO 9000; benchmarking; quality function deployment; concurrent engineering; experimental design; Taguchi's quality engineering; product liability

HHSM ZG519 Project Management 4

Course description is same as given under CM ZG523

HHSM ZG629T Dissertation 20

Course description is same as given under BITS ZG629T

HHSM ZG531 Health Economics & Financial Management 4

Concepts & methods of economic analysis related to health system; organization and policy; demand and supply of scarce resource for health care; health financing & population coverage; determinants of cost & utilization; health insurance; cost-benefit analysis; costing for decision making; fundamentals of accounting; financial statement analysis; budget process & budgetary control; capital investment decision.

HHSM ZG631 Introduction to Health Systems & Environmental Health 4

Introduction to health systems; functions of health systems; managing health systems; problems of health systems management; Major environmental health problems including quality of water, waste disposal food production and processing, vector control etc. Air pollution and its controlling, Hazards of radiation, municipal and other wastes, Occupational health hazards.

HHSM ZG665 Hospital Operation Management 3

Operation Management aspects connected with outpatient ward, casualty, operation theatres, diagnostic laboratories, pathology laboratories, pharmacy, diet and nutrition, blood bank, laundry, medical records, security, scheduling and deployment of doctors, nurses and other staff, accounts among others. The course will involve on site visits in a hospital, discussions and presentations on the practical aspects of hospital operations management.

IETAL ZC211 Engineering Mathematics-I 3

Limit concept; derivatives of elementary functions and their applications; introduction to ordinary and partial differential equations and initial/boundary value problems. Convergence tests for series; power series and interval of convergence; series solution of differential equations. Approximation and error, interpolation; roots of algebraic and transcendental functions, Newton's method.

IETAL ZC212 Engineering Mathematics-II 3

Algebra of vectors and matrices; Gauss's row-reduction process; applications of simultaneous linear equations and matrix inversion; determinants and Cramer's rule. Numerical differentiation and integration; numerical methods for solving ordinary and partial differential equations.

IETAL ZC221 Computer Programming 3

Elementary computer organization; introduction to Number Systems; Representation of integers, real numbers and characters on computers; concept of range and accuracy; Arithmetic Overflow; Algorithms and algorithm development; structured program development through step wise refinement. Introduction to C language; Functions; Recursion; Data structure & algorithms; File management & file handling; Problem solving using C..

IETAL ZC222 Engineering Materials 3

Course description is same as given under ENGG ZC232

IETAL ZC231 Principles of Management 3

Fundamental concepts of management - planning; organizing; staffing; directing and controlling; production, financial, personnel, legal and marketing functions; accounting and budgeting, balance sheets.

IETAL ZC232 Engineering Measurements and Techniques 3

Performance characteristics of measuring instruments, measurement methods for mechanical, electrical, radiant, chemical, magnetic and thermal energy variables. Emphasis in this course shall be on the operation and use of instruments.

IETAL ZC241 Technical Report Writing 3

Elements of effective writing; art of condensation; business letter writing; memos; formal reports; technical proposals; conducting, and participating, meetings; agenda and minutes; strategies for writing technical descriptions, definitions, and classifications; oral presentation; use of graphic and audio- visual aids; editing.

IETAL ZC242 Manufacturing Process 3

Fundamentals of casting process; forging; powder metallurgy; soldering; brazing and welding technology; metal forming process, its analysis and design; Introduction to Metal cutting, machine tools; mechanics of metal cutting, other machining processes; mechanics of metal cutting; other machining processes; grinding and finishing operations; non convention machining; chipless machining processes; NC machines programming; control system in CNC; CNC, DNC; FMS and machining center.

IETAL ZC251 Mechanical Technology 3

Course description is same as given under ENGG ZC241.

IETAL ZC252 Production and Operation Management 3

Production & Operation Management functions; capacity requirement planning; inventory control; layout, handling & location decision; resource procurement & operation control; project scheduling & resource allocation; the production & operating function; Methods of forecasting demand; financial analysis of operating plans; determination of economic order quantity; development of efficient work methods.

IETAL ZC311 Automobile Technology – I 3

Introduction; working and construction of IC Engines; its components; cycles; fuel air cycle; diesel cycles; combustion in SI and CI Engines; fuels and combustion; fuel supply systems; scavenging process; engine cooling and lubrication; engine cooling system, friction and lubrication, engine testing and performance; super charging, analytical method of performance and estimation; emission controls; alternate fuels; modern trends in engine development.

IETAL ZC312 Automobile Technology-II 3

Vehicle classification; chassis construction; clutches-friction clutches, fluid coupling; gear box-arrangement and design of gear boxes; epicyclical gear box; torque converters, semiautomatic and automatic gear boxes; propeller shaft; universal joint; differential; rear

axle suspension systems; front axle and steering mechanisms – power steering mechanism; brakes –mechanical, hydraulic and air brakes; servo and power operated brake systems; wheels and tyres; testing and performance of automobiles; vehicle vibration; and human comfort; auto-electrical systems; ignition system-conventional and electronic system, alternators; charging system; storage batteries; wiper motors; lighting system; electronic system, alternators; charging system; storage batteries; wiper motors; lighting system; electrical vehicles; automobile law.

IETAL ZC321 Quality Assurance and Reliability 3

Course description is same as given under ET ZC432.

IETAL ZC322 Materials Management 3

Integrated materials management, policy aspects, purchasing management, warehousing and storage of inventory control systems; stores management; material planning, make or buy decisions; scheduling, strategic sourcing, JIT, Kanban system; inventory costing principle; concept of MRP II; vendor development; central excise, customs, importing, sales tax.

IETAL ZC331 Production Planning & Control 3

Types of production systems and problems of planning and control, product planning, forecasting, product demand, process planning, project management, capacities location and layout of facilities, aggregate planning and scheduling, materials requirement, planning, inventory management, systems and recent trends in production management.

IETAL ZC332 Operations Research 3

Sampling, simulation, design of experiments and analysis of variance, nonparametric tests; correlation and regression analysis; quality control, reliability; decision theory; queuing theory; deterministic and probabilistic inventory systems.

IETAL ZC341 Mechatronics 3

Basic Electricity – electrical parameters like voltage, current, resistance, AC/DC supply: electrical circuit; electromagnetism, its circuits, introduction to single phase and three phase supply, electrical components – relays, MCB, limit switches etc; transformers; elimination; electrical motors – types like induction motors, synchronous machines etc;, its speed control; introduction to electronic devices; semiconductor devices; SCRs, electronic circuits – power supplies, sensing devices; timers; industrial electronics and its application for heating, measuring / gauging etc., Introduction and application of PLCs; introduction to microprocessors; application in an industry Oil hydraulics; fluid logics; hydraulic elements like reservoir, fluid conditioners, pressure control valves, directional control valves and flow control valves; Basic hydraulic circuits for application in machine tools; Pneumatics, its principle, logics, pneumatic elements, basic pneumatic circuits used in machine tools.

IETAL ZC342 Machine Design 3

Fundamentals and principles of design, design and selection of machine elements such as shafts, spindle supports, gears, bearings; etc; design of mechanism; design of machine tool structure; dynamics of machine tools; introduction to CAD, CAM, CIM; Design of jigs and fixtures; press tools for blanking; punching; drawing; combination tools and progressive tools.

IETAL ZC351 Industrial Engineering 3

Industrial systems and organization; engineering economy; work measurement techniques; motivation and time studies; factory planning and materials handling; industrial standardization; critical path methods; quality control; reliability; maintenance and management planning; scheduling; job analysis (evaluation); value engineering.

IETAL ZC352 Maintenance Engineering and Safety 3

Objectives; functions and type of maintenance; wear and service life of

industrial equipment; concepts of assembly; points of wear, defects due to wear, lubrication, and surfacing technique to reduce wear; maintenance of different equipment and their elements; safety and safety management; occupational control of industrial hazards; health management; employees participation; training and development.

IETAL ZC423T Project Work 20

Course description is same as given under BITS ZC423T.

IS ZC332 Database System & Application 3

Introduction to Database Management Systems; File organization; Data Independence in databases; Data Models; Query processing systems; Database Design techniques; Concepts of security and integrity in databases; Distributed Databases; Applications using DBMS.

IS ZC342 Structures of Programming Languages 3

Programming paradigms and programming languages; programming language processors; syntax and semantics, binding; data types, structures; abstract data types; sub-program structure; sequence control; recursion; data control; storage management; syntax; translation; operating and programming environments; some theoretical models; case studies from some popular and widely used programming languages.

IS ZC351 Computer Organization and Architecture 3

Overview of logic design; Instruction set architecture; Assembly language programming; Pipelining; Computer Arithmetic; Control unit; Memory hierarchy; virtual memory; Input and output systems; Interrupts and exception handling; Implementation issues; Case studies

IS ZC361 Data Structures and Algorithms 3

Introduction to software design principles, modularity, abstract data types, data structures and algorithms; analysis of algorithms; Linear data structures – stacks, arrays, lists queues and linked representations; Pre-fix, in-fix and post-fix expressions; Recursion; Set operations; Hashing and hash functions; Binary and other trees, traversal algorithms, Huffman codes; Search trees, priority queues, heaps and balanced trees; Sorting techniques; Graphs and digraphs; Algorithmic design techniques; Data structures for external storage, multi-way search and B-trees.

IS ZC362 Operating Systems 3

Introduction to operating systems; Various approaches to design of operating systems; Overview of hardware support for operating systems; Process management: process synchronization and mutual exclusion, interprocess communication, process scheduling; CPU scheduling approaches; Memory management: paging, segmentation, virtual memory, page replacement algorithms; File systems: design and implementation of file systems; input/output systems; device controllers and device drivers; Security and protection; Case studies on design and implementation of operating system modules.

IS ZC415 Data Mining 3

Data Mining – introduction, fundamental concepts; motivation and applications; role of data warehousing in data mining; challenges and issues in data mining; Knowledge Discovery in Databases (KDD); role of data mining in KDD; algorithms for data mining; tasks like decision-tree construction, finding association rules, sequencing, classification, and clustering; applications of neural networks and machine learning for tasks of classification and clustering.

IS ZC424 Software for Embedded Systems 3

Real-time and Embedded Systems; Software issues in Embedded Systems; Software Development Process; Requirements Analysis– Use Cases, Identification and Analysis of use cases, Use Case Diagrams. Design – Architectural Design, Design Patterns, Detailed Design. Implementation –

Languages, Compilers, Runtime Environments and Operating Systems for embedded software. Testing – Methodologies, Test Cases.

IS ZC462 Network Programming 3

Overview of computer networks; inter-process communication; network programming; socket interface; client-server computing model: design issues, concurrency in server and clients; external data representation; remote procedure calls; network file systems; distributed systems design.

MATH ZC161 Engineering Mathematics I 3

Limit concept; derivatives of elementary functions and their applications; introduction to ordinary and partial differential equations and initial/boundary value problems. Convergence tests for series; power series and interval of convergence; series solution of differential equations. Approximation and error, interpolation; roots of algebraic and transcendental functions, Newton's method.

MATH ZC222 Discrete Structure for Computer Science 3

Sets and relations; graphs and digraphs; trees, lists and their uses; partially ordered sets and lattices; Boolean algebras and Boolean expressions; semigroups and machines; codes and applications.

MATH ZC232 Engineering Mathematics II 3

Algebra of vectors and matrices; Gauss's row-reduction process; applications of simultaneous linear equations and matrix inversion; determinants and Cramer's rule. Numerical differentiation and integration; numerical methods for solving ordinary and partial differential equations.

MEBF ZC211 Engineering Mathematics-I 3

Course description is same as given under MATH ZC161

MEBF ZC212 Engineering Mathematics-II 3

Course description is same as given under MATH ZC232

MEBF ZC221 Computer Programming 3

Elementary computer organization; introduction to Number Systems; Representation of integers, real numbers and characters on computers; concept of range and accuracy; Arithmetic Overflow; Algorithms and algorithm development; structured program development through step wise refinement. Introduction to C language; Functions; Recursion; Data structure & algorithms; File management & file handling; Problem solving using C.

MEBF ZC222 Engineering Materials 3

Course description is same as given under ENGG ZC232

MEBF ZC231 Principles of Management 3

Fundamental concepts of management - planning; organizing; staffing; directing and controlling; production, financial, personnel, legal and marketing functions; accounting and budgeting, balance sheets.

MEBF ZC232 Engineering Measurements and Techniques 3

Performance characteristics of measuring instruments, measurement methods for mechanical, electrical, radiant, chemical, magnetic and thermal energy variables. Emphasis in this course shall be on the operation and use of instruments.

MEBF ZC241 Technical Report Writing 3

Elements of effective writing; art of condensation; business letter writing; memos; formal reports; technical proposals; conducting, and participating, meetings; agenda and minutes; strategies for writing technical descriptions, definitions, and classifications; oral presentation; use of graphic and audio- visual aids; editing.

MEBF ZC242 Manufacturing Process 3

Fundamentals of casting process; forging; powder metallurgy; soldering; brazing and welding technology; metal forming process, its analysis and design; Introduction to Metal cutting, machine tools; mechanics of metal cutting; other machining processes; grinding and finishing operations; non convention machining; chipless machining processes; NC machines programming; control system in CNC; CNC, DNC; FMS and machining center.

MEBF ZC251 Mechanical Technology 3

Course description is same as given under ENGG ZC241

MEBF ZC252 Production and Operation Management 3

Production & Operation Management functions; capacity requirement planning; inventory control; layout, handling & location decision; resource procurement & operation control; project scheduling & resource allocation; the production & operating function; Methods of forecasting demand; financial analysis of operating plans; determination of economic order quantity; development of efficient work methods.

MEBF ZC311 Automobile Technology –I 3

Introduction; working and construction of IC Engines; its components; cycles; fuel air cycle; diesel cycles; combustion in SI and CI Engines; fuels and combustion; fuel supply systems; scavenging process; engine cooling and lubrication; engine cooling system, friction and lubrication, engine testing and performance; super charging, analytical method of performance and estimation; emission controls; alternate fuels; modern trends in engine development.

MEBF ZC312 Automobile Technology-II 3

Vehicle classification; chassis construction; clutches-friction clutches, fluid coupling; gear box-arrangement and design of gear boxes; epicyclical gear box; torque converters, semiautomatic and automatic gear boxes; propeller shaft; universal joint; differential; rear axle suspension systems; front axle and steering mechanisms – power steering mechanism; brakes –mechanical, hydraulic and air brakes; servo and power operated brake systems; wheels and tyres; testing and performance of automobiles; vehicle vibration; and human comfort; auto-electrical systems; ignition system-conventional and electronic system, alternators; charging system; storage batteries; wiper motors; lighting system; electronic system, alternators; charging system; storage batteries; wiper motors; lighting system; electrical vehicles; automobile law.

MEBF ZC321 Quality Assurance and Reliability 3

Course description is same as given under ET ZC432.

MEBF ZC322 Materials Management 3

Integrated materials management, policy aspects, purchasing management, warehousing and storage of inventory control systems; stores management; material planning, make or buy decisions; scheduling, strategic sourcing, JIT, Kanban system; inventory costing principle; concept of MRP II; vendor development; central excise, customs, importing, sales tax.

MEBF ZC331 Production Planning & Control 3

Types of production systems and problems of planning and control, product planning, forecasting, product demand, process planning, project management, capacities location and layout of facilities, aggregate planning and scheduling, materials requirement, planning, inventory management, systems and recent trends in production management.

MEBF ZC332 Operations Research 3

Sampling, simulation, design of experiments and analysis of variance, nonparametric tests; correlation and regression analysis; quality control, reliability; decision theory; queuing theory; deterministic and probabilistic inventory systems.

MEBF ZC341 Mechatronics 3

Basic Electricity – electrical parameters like voltage, current, resistance, AC/DC supply: electrical circuit; electromagnetism, its circuits, introduction to single phase and three phase supply, electrical components – relays, MCB, limit switches etc; transformers; elimination; electrical motors – types like induction motors, synchronous machines etc;, its speed control; introduction to electronic devices; semiconductor devices; SCRs, electronic circuits – power supplies, sensing devices; timers; industrial electronics and its application for heating, measuring / gauging

etc., Introduction and application of PLCs; introduction to microprocessors; application in an industry Oil hydraulics; fluid logics; hydraulic elements like reservoir, fluid conditioners, pressure control valves, directional control valves and flow control valves; Basic hydraulic circuits for application in machine tools; Pneumatics, its principle, logics, pneumatic elements, basic pneumatic circuits used in machine tools.

MEBF ZC342 Machine Design 3

Fundamentals and principles of design, design and selection of machine elements such as shafts, spindle supports, gears, bearings; etc; design of mechanism; design of machine tool structure; dynamics of machine tools; introduction to CAD, CAM, CIM; Design of jigs and fixtures; press tools for blanking; punching; drawing; combination tools and progressive tools.

MEBF ZC351 Industrial Engineering 3

Industrial systems and organization; engineering economy; work measurement techniques; motivation and time studies; factory planning and materials handling; industrial standardization; critical path methods; quality control; reliability; maintenance and management planning; scheduling; job analysis (evaluation); value engineering.

MEBF ZC352 Maintenance Engineering and Safety 3

Objectives; functions and type of maintenance; wear and service life of industrial equipment; concepts of assembly; points of wear, defects due to wear, lubrication, and surfacing technique to reduce wear; maintenance of different equipment and their elements; safety and safety management; occupational control of industrial hazards; health management; employees participation; training and development.

MEBF ZC423T Project Work 20

Course description is same as given under BITS ZC423T

MELTI ZC112 Electricity & Magnetism 2

Electrostatics; magnetostatics; induced e.m.f., electrical oscillations; Maxwell's equations; e.m. waves.

MELTI ZC211 Mathematics I 3

Real-valued functions of one real variable; limits and indeterminate forms; differentiability of functions; indefinite and definite integrals; applications of derivatives and integrals. concept of a matrix; operations on matrices; various types of matrices; inverse and adjoint of a matrix; row-reduction method; solution of simultaneous linear equations by matrix methods.

MELTI ZC212 Mathematics II 3

Linear inequalities and associated regions; concept of linear programming problems; graphical solution method; simplex method for maximization problems; concept of basic fleasible solutions; concept of stack variables and their uses in simplex method. basic ideas of statistics; frequency distributions; measures of central tendency, dispersion; moments; skewness and kurtosis; co-efficient of skewness, correlation, regression. Finite differences, Newton's interpolation formulae - forward and backward methods; Lagrange's interpolation formulae; numerical differentiation and integration. Numerical methods for solving equations, iteration method; regula-falsi method; Newton-Raphson method.

MELTI ZC221 Structured Programming 3

Algorithms and problem solving; paradigms of programming; imperative programming; structured programming methodologies; stepwise refinement procedures; structured programming through one of the structured programming languages like Pascal, C or Ada (the actual choice will be made each semester before the course is offered); elementary data types and uses; control structures; conditional structures; iterative structures; input and output handling; structured data types and uses; functions, library and user defined; scoping rules; parameter passing mechanisms; files and file

handling; recursion; some advanced topics for programming.

MELTI ZC231 Circuit Theory 3

Electrical circuits as analogous of non-electrical systems-examples drawn from various disciplines; circuit models, equilibrium equations and their solutions; independent sources; exponential signals; steady-state of electrical circuits; linear dependence; mesh and nodal analysis, network theorems; energy and power.

MELTI ZC241 Principles of Management 3

Fundamental concepts of management - planning; organizing; staffing; directing and controlling; production, financial, personnel, legal and marketing functions; accounting and budgeting, balance sheets.

MELTI ZC251 Mathematics III 3

Ordinary and partial differential equations; Complex numbers; analytic functions; series expansions; Cauchy's theorems; Laplace transform and its applications; Fourier series and transforms; series solution for differential equations.

MELTI ZC252 Electronics 3

Ideal diodes, rectifier and filters; ideal amplifiers; physical mechanism of devices; small signal models, amplifiers-their evaluation, biasing, frequency response, cascading and signal feed-back; classes of operation of large signal ampli-fiers; oscilla-tors; modulation; detection.

MELTI ZC321 Control Systems 3

Mathematical models of physical systems, feedback characteristics of control systems, control system components, time response analysis, stability, frequency response, state-space analysis, compensation.

MELTI ZC364 Analog Electronics 4

Introduction and applications of various analog and mixed signal ICs; discrete and IC amplifier basics; low and high frequency amplifiers; linear and non linear On-amp circuits; non linear IC's precision circuits; comparators; Schmitt triggers; non-sinusoidal and sinusoidal waveform generators; phase-locked-loops; analog switches; IC power amplifiers; RF/IF amplifiers; switched capacitor circuits data converters; IC sensors and systems; case studies in analysis, design and characterization of electronic circuits.

MELTI ZC372 Circuits & Signals 3

Two port parameters; Passive Network Synthesis; Modern Filter Theory; Active RC Filters; Representation of deterministic signals; Fourier Integral, Modulation, Sampling, Convolution, Correlation, DFT & FFT; Z Transform, Network Realization: Direct Form I & II, Cascaded Form, Parallel Form; Digital Filter Design: IIR, FIR & Window functions, Bilinear transformation ; Signal coding Algorithms; Digital Signal Processors.

MELTI ZC381 Electronic Devices 3

Single pn junction devices - rectifier diodes, switching diodes, zener diodes, varactor diodes, UJTs, LEDs, etc; bipolar junction transistors - current gain mechanism, high frequency and switching behavior; pnpn devices; JFET; MOSFET; other MOS & CMOS devices; optoelectronic devices; device fabrication techniques; introduction to ICs; microwave semiconductor devices.

MELTI ZC382 Communication Systems 3

Introduction to analog and digital communication; sampling techniques, Pulse modulation-PAM, PCM, delta modulation, etc. Data transmission- FSK, PSK, DPSK, M-ary modulation; modems, local area networks, computer communication. Examples of typical communication systems - Microwave, satellite, optical, etc.

MELTI ZC391 Digital Electronics 4

Number systems and machine representation, Boolean algebra, combinational and synchronous sequential circuits, logic minimization, programmable logic devices, state table and state diagrams, digital integrated circuits, asynchronous circuits, arithmetic operations and algorithms, introduction to computer organization and architecture, speed considerations, memory organization, I/O design, implementation

issues. The course will also consist of laboratory practice.

MELTI ZC411 Microprocessors 3

Organization of microcomputer; elements of digital electronics- gates, flip-flops, counters (black box approach), loading considerations; programming of microprocessors- register set, addressing modes, instruction set and programming techniques; microprocessor as the CPU: timing details; memory and I/O interfacing techniques; peripheral interfacing devices; design examples.

MELTI ZC471 Electronic Measurements 3

Elements of electronic measurement and instrumentation; signal sources; voltage and current measuring instruments; waveform analysis instruments; display and recording instruments; device testers, DC power supplies and IC regulators; bridge instruments; basic digital instruments, industrial electronic practices.

MELTI ZG511 Design & Analysis of Algorithms 5

Design techniques such as divide-and-conquer, recursion, backtracking, branch-and-bound, simulation; Analysis in terms of average level and worst level efficiency; Relationship to appropriate data structures; Illustrations dealing with problems in computer science, graph theory and mathematics; Computational complexity and bounds; NP-hard and NP-complete problems.

MELTI ZG512 Embedded Systems Design 4

Course Description is same as given under EEE ZG512

MELTI ZG531 Testability for VLSI 5

BIST, boundary sean, stuck-at faults, test generation algorithms for combinatorial logic circuits and sequential circuits, logic simulation and fault simulation, synthesis for test, built in self test, pseudo-random test techniques, other test methods - IDDQ testing, boundary scan etc.

MELTI ZG573 Digital Signal Processing 3

Introduction; design of analog filters; design of digital filters: (IIR and FIR); structures for the realization of digital filters; random signals and random processes; linear estimation and prediction; Wiener filters; DSP processor architecture; DSP algorithms for different applications.

MELTI ZG611 IC Fabrication Technology 5

Material properties; Crystal growth and doping; diffusion; oxidation; epitaxy; Ion implantation; Deposition of films using CVD, LPCVD and sputtering techniques; Wet and dry etching and cleaning; Lithographic process; Device and circuit fabrication; Process modeling and simulation.

MELTI ZG621 VLSI Design 5

Introduction to NMOS and CMOS circuits; NMOS and CMOS processing technology; CMOS circuits and logic design; circuit characterization and performance estimation; Structured design and testing; Symbolic layout systems; CMOS subsystem design; System case studies.

MELTI ZG625 Advanced Analog and Mixed Signal Design 5

Design of high speed compartors and Op-amps; analog buffers; different architectures of A/D and D/A converters; analog multipliers and dividers; design of PLLS; design methods for switched capacitor filters sample and hold circuits; mixed signal design issues; noise coupling from substrate and its reduction; cross talk and shielding; analog layout techniques for mixed signal designs.

MELTI ZG629T Dissertation 20

Course description is same as given under BITS ZG629T

MELTI ZG631 Physics & Modeling of Micro-Electronics Device 5

Physics and Properties of semiconductor - a review; PN junction diode; bipolar transistor; Metal-semiconductor contacts; JFET and MESFET; MOSFET and scaling; CCD and photonic devices.

MELTI ZG632 Analog IC Design 5

Basic concepts; BICMOS process and technology; current and voltage sources;

Differential and Operational Amplifiers; Multipliers and modulators; phase-lock techniques; D-to-A and A- to-D converters; Micropower circuits; High voltage circuits; Radiation Resistant Circuits; Filter design considerations.

MELTI ZG641 CAD for IC Design 5

Introduction to VLSI design methodologies and supporting CAD tool environment; Overview of `C', Data structure, Graphics and CIF; Concepts, structures and algorithms of some of the following CAD tools; Schematic editors; Layout editors; Module generators; Silicon compilers; Placement and routing tools; Behavioral, functional, logic and circuit simulators; Aids for test generation and testing.

MELTI ZG642 VLSI Architecture 4

Overview of CISC processor architectures; Instruction set architecture of CISC processor; hardware flow-charting methods; implementing microprocessor logic from hardware flowcharts; RISC instruction set architecture; pipelined execution of RISC instructions; pipeline execution unit design; control hazards; design of memory hierarchy.

MELTI ZG659 Technical Communication 4

Course description is same as given under BITS ZG659.

METX ZC211 Engineering Mathematics-I 3

Course description is same as given under MEBF ZC211

METX ZC212 Engineering Mathematics-II 3

Course description is same as given under MEBF ZC212

METX ZC221 Computer Programming 3

Course description is same as given under MEBF ZC221

METX ZC222 Engineering Materials 3

Course description is same as given under MEBF ZC222

METX ZC231 Principles of Management 3

Course description is same as given under MEBF ZC231

METX ZC232 Engineering Measurements and Techniques 3

Course description is same as given under MEBF ZC232

METX ZC241 Technical Report Writing 3

Course description is same as given under MEBF ZC241

METX ZC242 Manufacturing Process 3

Course description is same as given under MEBF ZC242

METX ZC251 Mechanical Technology 3

Course description is same as given under MEBF ZC251

METX ZC252 Production and Operations Management 3

Course description is same as given under MEBF ZC252

METX ZC311 Computer Aided Design 3

Computer Aided Drafting and tools for graphics; mathematical tools; convergence criteria; design tools like modeling, simulation, spread sheets and use of specialized packages etc.; students will be required to do projects, specialized works for which a pool of guides will be drawn from several disciplines.

METX ZC312 Foundry Engineering 3

Characteristics of Ferrous & Non Ferrous metals, Materials used in Moulds, Core Making & their additives, Pattern design & method, Various Moulding process including high pressure moulding, Various melting equipment & melting process, Heat treatment of Castings; Chemical, Physical & Non Destructive testing, Defect analysis.

METX ZC321 Quality Assurance and Reliability 3

Course description is same as given under MEBF ZC321

METX ZC322 Materials Management 3

Course description is same as given under MEBF ZC322

METX ZC331 Production Planning & Control 3

Course description is same as given under MEBF ZC331

METX ZC332 Operations Research 3

Course description is same as given under MEBF ZC332

METX ZC341 Mechatronics 3

Course description is same as given under MEBF ZC341

METX ZC342 Machine Design 3

Course description is same as given under MEBF ZC342

METX ZC351 Industrial Engineering 3

Course description is same as given under MEBF ZC351

METX ZC352 Maintenance Engineering and Safety 3

Course description is same as given under MEBF ZC352

METX ZC423T Project Work 20

Course description is same as given under BITS ZC423T

MGTS ZC211 Principles of Management 3

Course description is same as given under MEBF ZC231

MLTSN ZG511 Human Anatomy and Physiology 2

Structure and functions of the body; cells and tissues; Integumentary system and body membranes; musculo-skeletal system; central nervous system; Endocrine; special senses; Blood and lymphatic system; Genito-urinary system; fluid-electrolysis; acid-base balance.

MLTSN ZG512 Enzymology & Metabolism in Health 3

Enzyme; Nomenclature and classification; Biological oxidation; Metabolism of carbohydrates; Metabolism of Proteins; Urea Cycle; Metabolism of lipids; Metabolism of Nucleoproteins.

MLTSN ZG521 Bio-organic and Bio-Physical Chemistry 3

Definition of Biochemistry; Concept of Metabolism; Homeostasis in blood and tissues; chemistry of Carbohydrates; Classification and Chemistry of amino acids and proteins; Nucleic acids; Hemoglobin; pH ; Buffers; Colloids; Membrane Phenomena; Adsorption; Surface tension; Osmotic pressure.

MLTSN ZG522 Human Genetics 2

Structure of animal cell; Mitosis and Meiosis; Mendelian genetics; Genetic material and replication; Chromosomes; DNA structure; Gene expression; Genetic disorders; Genetic basis of Cancer; Chromosome preparation and Cytogenetics.

MLTSN ZG531 Haemopoitic Systems and Basic Haemotologic Techniques 2

Origin and development of blood and blood forming tissues; Erythropoisis; erythrocyte and its functions; Origin, development and functions of Leukocytes and Platelets; collection and storage of blood for hematological tests; serum and plasma; blood smear preparations attaining for microscopy; red blood cell morphology and cytochemistry; Bone marrow biopsy and smear techniques.

MLTSN ZG532 Disorder of RBCs' & Haemoglobin 2

Anaemias; Porphyria; Structure and function of hemoglobin; Investigations of hemolytic anaemias; Megaloblastic and iron deficiency anaemias; Erythrokinetics; Haemoglobinopathies and, paroxysmal nocturnal haemoglobinuria and Polycythaemia.

MLTSN ZG541 General Microbiology 3

Microbiology and application; Microscopy; Bacterial Structure and function; Principles in staining procedures; Classification of Bacteria; Cultivation of Bacteria; Biochemical tests for identification of bacteria; Sterilization and disinfection and Laboratory control of antibacterial Therapy.

MLTSN ZG542 Clinical Immunology 3

Host-parasite relationship; Immunity and types of immunity; Immune system and its functions; Antigens and antibodies; HLA antigens; Acquired Immune response; Humoral and cell mediated immunity; Inflammation and immune response Immunological techniques; Hypersensitivity; Transplantation immunology;

Tumor immunology and Immunization and prophylaxis.

MLTSN ZG551 Computers & Information Systems 3

Organization & function of computers; personal computers; DOS usage; word-processing; spreadsheeting; database management; presentation aids; some exposure to computer software designed specially for hospital & health systems management.

MLTSN ZG552 Clinical Pathology 2

Semen analysis; cerebrospinal fluid-cytology and biochemical analysis; Urine analysis; Cytology and biochemical analysis of aspirated fluids.

MLTSN ZG561 Instrumentation in Medical Laboratory Technology 3

Chromatography including affinity Chromatography and HPLC; Electrophoresis; Isoelectric focusing; Photometry; Spectrophotometry; Fluorimetry; Flame photometry; Spectroscopy; Centrifugation; radio isotopes; GM counter; Liquid scintillation counter; Lyophilisation.

MLTSN ZG562 Blood Banking 2

Human Red cell blood groups; Identification of blood-group antigens and antibodies; Blood grouping and compatibility tests in blood transfusion, Tests for Rh hemolytic disease of newborn.

MLTSN ZG611 Food & Nutrition in Health 4

Vitamins; Minerals; Hormones; Calorimetry; Energy Value of constituents of food; Caloric requirements protein quality- essential and non-essential amino acids;Essential fatty acids and protein energy malnutrition.

MLTSN ZG612 Clinical Biochemistry 4

Disorders of Carbohydrate, amino acid, protein, lipid and nucleoprotein metabolism; Hemoglobinopathies; Liver function tests; Gastric function tests; Renal function tests; Pancreatic function tests; Thyroid function tests; Serum enzymes and isoenzymes; body fluids; transuadates and exudates; Inborn errors of metabolism and molecular diseases.

MLTSN ZG621 Molecular Biology 3

Replication and transcription of DNA; Protein synthesis and its regulations; Repair, Mutation recombination and gene cloning; Methods of Molecular biology; Isolation of DNA and RNA; Southern blotting; PCR Technology; In situ hybridization and Methods of detection of nucleic acids.

MLTSN ZG622 Histopathological Techniques 3

Histology and histopathology; Process of fixation of tissues; Tissue processing; Embedding of tissues; Microtomy; Frozen section methods; Principles of staining and Histochemistry; Electron microscopy in histopathology and Histometry; Cytology and cytochemistry.

MLTSN ZG631 Disorders or Leucocytes, Haemostasis & Coagulation 2

Leucocytosis; Leukopaenia; Leucocyte function; Leukaemias; Myelofibrosis; Lymphomas; Investigations for Leukaemias; Thromobocytopaenia; Coagulation disorders; Disorders of haemostasis; Fibrinolysis; Thrombosis and Hypercoagulability; Investigation of haemostatic mechanism; Assay of coagulation factors; Tests for platelet function and Thrombolytic therapy.

MLTSN ZG632 Diagnostic Microbiology 4

Purpose of diagnostic microbiology; Selection, collection and transport of specimens; Conventional and rapid methods of detection and identification of etiological agent; principles of automated methods for diagnostic microbiology; Immunological principles and methods; Infections of skin and subcutaneous tissues; Bacteraemia and septicemia; Infections of various organ systems; Nosocomial infections;; community acquired infections and laboratory control of prevention of spread of infectious diseases.

MLTSN ZG633T Internship I 15

MLTSN ZG634T Internship II 15

Consistent with the student's professional background and work-environment, the

student will be required to carry out work-oriented projects. Invariably the student would be required to select an area of work in the project that is considered vital to the sponsoring organization. The topic of the project and detailed project outline that is prepared by the student, in consultation with the Mentor, needs to be approved by the Dean, DLPD. On approval, the student carries on with the work-centered project, adhering to the guidelines provided to him through a detailed course handout, taking all the mentioned evaluation components on time. The student needs to submit a cohesive document, which is the Internship Report, to the Institute for evaluation. The student will be evaluated on the basis of the various interim evaluation components, contents of the report and Seminar/Viva-Voce that may be conducted at Pilani or at any other centre by the Institute. The final grades for internship in this programme are Non-letter grades namely Excellent, Good, Fair and Poor, which do not go into CGPA computation.

MLTSN ZG641 Medical Microbiology 4

Characteristics of bacteria and their biology in human infections; cocci and bacilli; Filamentous bacteria; Acid fast bacilli; Vibrio Spirochetes; Mycoplasma; Rickettsiae; Chlamydia; Characteristics of Viruses; Cultivation of Viruses; Virus infections of man and principles of laboratory diagnosis; fungal and parasitic infections and their laboratory diagnosis.

MLTSN ZG651 Epidemiology & Biostatistics 2

Epidemiology- Definition of terms; Determination of sample size; Linear regression; Logistic regression; Case control studies; Screening studies and measures of agreement; Measures of association; The t-test; The chi-square test; Averages and Variation Significance tests and confidence intervals.

MLTSN ZG659 Technical Communication 4

Course Description is same as given under BITS ZG659

MM ZC411 Marketing 4

Definition and scope, consumer behavior, competitive behavior, demand estimation, new product introduction, product/brand management, pricing policies, channels of distribution, credit management, advertising and other sales promotion, positioning, marketing regulation, market research basics of industrial marketing.

MM ZC441 Human Resource Management 4

Introduction, manpower planning, career and succession planning, procurement of personnel, performance appraisal, job satisfaction and morale, job rotation, employee communication, audit and control, management training and development, wage and salary administration, welfare administration, trade unions and collective bargaining, industrial dispute and worker participation in management.

MM ZG511 Manufacturing Organization and Management 5

Manufacturing environment; Engineering considerations; Design and planning of manufacturing systems; Manufacturing cost control; Material flow control; Quality; Human resources; Financial management; Marketing management.

MM ZG521 Financial Management 4

Concepts and techniques of financial management decision; concepts in valuation - time value of money; valuation of a firm's stock, capital asset pricing model; investment in assets and required returns; risk analysis; financing and dividend policies, capital structure decision; working capital management, management of cash, management of accounts receivable; inventory management, short and intermediate term financing, long term financial tools of financial analysis, financial ratio analysis, funds analysis and financial forecasting, operating and financial leverages.

MM ZG522 Total Quality Management 4

TQM principles and practices; leadership; customer satisfaction; employee involvement;

continuous process improvement; supplier partnership; performance measures; statistical process control; ISO 9000; benchmarking; quality function deployment; concurrent engineering; experimental design; Taguchi's quality engineering; product liability

MM ZG523 Project Management 4

Concepts and techniques of project formulation, evaluation and implementation; Project planning and scheduling; Risk management; Time-cost trade off; Resource leveling and allocation; Project monitoring and control; Contract management.

MM ZG541 Product Design 5

Introduction to creative design; user research and requirements analysis, product specifications, Computer Aided Design; standardization, variety reduction, preferred numbers and other techniques; modular design; design economics, cost analysis, cost reduction and value analysis techniques, design for production; human factors in design: anthropometric, ergonomic, psychol giccl, physiological considerations in design decision making; legal factors, engineering ethics and society.

MM ZG542 Just-in-Time Manufacturing 4

Introduction; Toyota production system; JIT implementation surveys; Design, development and implementation of JIT manufacturing systems; Supply management for JIT; Framework for implementation of JIT; Theoretical research in JIT systems; Various case studies.

MM ZG611 Strategic Management & Business Policy 4

Strategic management elements; internal, external, external environment. assessment of corporate strengths, weaknesses and opportunities; planning and deployment of capital assets; profit planning and control functions problems, pressures, responsibilities, limits of the chief executive; evaluation of one's own business undertaking; formulating objectives, strategies, policies and programmes for improving company's present situation; personnel strength and implementation of the policies and programmes, development, implementation, evaluation and control of strategies, strategic management of MNCs, management style and behavior, corporate style, behavior and culture.

MM ZG621 Supply Chain Management 4

Customer driven strategies in production and distribution systems; Integrated production and distribution networks; SCM in the context of JIT and MRP–II; Distribution Resource Planning; Management of dealer networks; Total Control & Product innovation across the supply chain; Incoming logistics and supplier relationships; Value addition analysis; Metrics for management of supply chain performance; Mathematical models and computer assisted decision support for SCM; Mathematical programming for SCM.

NCSM ZG511 History of Science & Technology 4

Scientific traditions, philosophy of science; case studies on evolution concepts and method of science; landmarks of Indian science & technology in ancient & medieval periods; scientific revolution and industrial revolution in Western countries and their effect in colonial India; evolution of S&T museums.

NCSM ZG521 Concepts in Science Communication 3

Introduction to communication in S&T; historical development of communication in science; growth of scientific languages; different modes of communication –print, electronic, audio-visual & interactive; evolution of exhibit ideas and activities from everyday observations; creative thinking and criteria of creativity; passive, active and interactive exhibits; role of interaction and participation in learning process; development of exhibits/activities on socially relevant themes.

NCSM ZG531 Technical Communication 4

Role and importance of communication; theories and process of communication; different modes and media of

communication; effectiveness in oral and written communication; technical reports; technical proposals; technical descriptions; business correspondence; precis writing; memorandum; notices, agenda and minutes; popular science writing, captions/label writing – exhibit specific; oral communication related to meetings, seminars, conferences, group discussions, etc.; use of modern communication aids.

NCSM ZG541 Professional Skills & Techniques-I 4

Design of animated and working exhibits involving mechanical systems and drives; mechanical, optical, Polaroid animation; design of electro-mechanical animation involving power control circuits, electronic control circuits and sequential switching operations using relays, solid state devices; integrated circuits and microprocessor and transducers of different types; concepts in design, design assignments; R&D work leading to development of new concepts and techniques for animated and interactive exhibits; laboratory and project work.

NCSM ZG512 Museum Planning & Organization 4

Methods of planning and theories of management as applicable to development of science museums; safety measures in museums; organization of science popularization network; leadership, decision making and creative planning, financial control and material management; project management; audience research; evaluation and monitoring of activities; use of computer in management and monitoring.

NCSM ZG522 Exhibits & Presentation 3

Exhibits planning, design & evaluation; presentation methods and techniques; types of exhibits & exhibitions; types of learning resources; visitors circulation; colour; illumination; aesthetics; visual communication; ancillary aids; media selection; material study; delivery systems; publication; exposure to photography; silk-screen printing; fibre-glass moulding & casting; video production; digital printing.s

NCSM ZG532 Science Communication & IT 4

Computer concepts; computer languages; operating systems; application programmes; software & hardware basics; data analysis; prototyping. IT in Science communication.

NCSM ZG542 Professional Skills & Techniques-II 4

Basics of Science journalism; basics of presentation and public speaking; popular science writing, script writing, science advertising; label writing; composition and techniques of slide/video demonstrations; video camera operation, editing and special effects, music and synchronized narration; basics of film animation and computer graphics; elements of computer multimedia and CAD; operation and maintenance of equipments; project work.

NCSM ZG611 Museum Management & Operations 4

Organization fundamentals; administration functions; networking operations; execution; man-management; events management; marketing & P.R.; accounting basics; financial aspects; recruitment & training; job evaluation. IPR issues; Procurement, storage and management of collections and exhibits; code of ethics; Maintenance and conservation techniques for S&T objects; methods of documentation of objects; use of computer/video/CD ROM in documentation of objects; security & safety; archiving.

NCSM ZG621 Science Learning in Non Formal Settings 4

Concepts in formal & non-formal education; human psychology and role of creative play; educational technology; teaching-learning process in science museum; development of concepts and themes of educational aids and supporting programs for teachers; mass communication through traveling exhibitions, demonstrations, science drama, puppetry, science fairs/seminars, polyvalent adult education programmes and people science movement; development of new concepts.

NCSM ZG631 Science & Society 3

Science & Society relationship; impact of Science & Technology in society; appropriate

technology, role of society in the development of science; scientific temper and public view of science; ethical issues and values in modern science; science policy studies; Science for citizens; relationship amongst science, culture and mass media; gender and S&T.

NCSM ZG641 Professional Skills & Techniques-III 4

Animated and interactive exhibits; Multimedia with CD ROM, DVI, CDI; virtual presentation; development of software for educational and interactive programs; systems operation and maintenance; electronic, multimedia animation techniques; project work.

NCSM ZG629T Dissertation 20

A student registered in this course must take a topic in an area of professional interest drawn from the on the job work requirement which is simultaneously of direct relevance to the degree pursued by the student as well as to the employing / collaborating organization of the student and submit a comprehensive report at the end of the semester.

NS ZC111 Navigation I 5

Terrestrial and Celestial Navigation; The shape of the earth; Definitions of Great and small circles poles, equator, parallels of latitude, meridian, prime meridian, latitude, longitude, difference of latitude, difference of longitude, departure, geographical mile, nautical mile, statute mile, knot; Introduction to magnetic and gyro compasses, identification of errors to apply to obtain true course / bearing; Navigational charts and the datum used; Interpretation of the symbols and the data given on the chart; Macerator projection and its properties meridional parts; knowledge of and ability to use charts including selection of charts as per scale; identifying the chart from the folio systems or chart catalogue; Knowledge of and ability to use nautical publications such as, sailing directions (Pilots), Tide tables, List of lights, Admiralty list of Radio Signals (RLS) etc.; Short distance parallel and plain sailing; Macerator sailing; Position fixing by Lat / Long, bearing and distance, Bearing and sounding etc.; Using Dead Reckoning to find estimated position allowing for leeway and s*et and drift and estimated speed; Celestial Navigation I:* The nautical astronomy; Celestial sphere, stellar magnitude, Celestial poles, Parallels of declination, Celestial meridian, ecliptic, obliquity of the ecliptic; First point of Aries and of Libra, vertical circle, prime vertical; position on celestial sphere, celestial latitude and longitude; Equinoctial system, declination, Right ascension, Greenwich hour angle; Local hour angle; Horizon system, celestial or rational horizon, true altitude, Zenith; Distance, Azimuth, Amplitude, Geographical position; The solar system, earth's orbit, day and night, seasons; Spherical Triangles and their properties; Solution of right angled and quadrantal spherical triangles and its application; Cosine and Haversine formulae; Solution of oblique spherical Triangles; Calculations of azimuth and determining error of the compasses by observation of a celestial body; ***Navigational Aids I:*** Knowledge and use of basic equipment available for position fixing, such as magnetic compasses, azimuth mirror, pelorus, sextant, chronometer, echo sounder, hand lead line, distance and speed measuring logs, process of checking accuracy of such equipment use of Decca, Loran, Satnav, GPS, knowledge relating their reliability at any given time use of course recorder, telegraph and intra ship communication equipment knowledge of principles which are applied in steering a ship, steering equipment provided on bridge including electric / hydraulic power source, methods of changing over, auto pilot, procedure for changing over from hand to auto & vice-versa knowledge of alarm system indicating failure of any of the above equipment; ***Meteorology I:*** Principles, construction and use of Meteorological instruments; Dew point, Relative humidity, fog, mist, sea temperature, visibility; Knowledge of the characteristics of the earth's atmosphere including the relationship between temperature, wind and pressure. Trade winds; Monsoons, Local winds, land and sea breeze; Understanding the factors involved in making

and recording observations of weather elements; Beufort scale of wind force and state of the sea; Lapse rate; Special optical phenomena; Ability to use the Met codes; ***Watch Keeping I:*** Familiarization with bridge, lookout posts, steering controls, telephones and telegraphs. General knowledge of other bridge equipment and other displays. Set up course recorder and off course alarms; Definitions of the terms used in collision regulations; Introduction to safe watch keeping as specified in STCW 95; Knowledge of the terms look out safe speed and responsibility between vessels, conduct of vessels in sight of one another as used in the Colregs; Knowledge of light, shapes and sound signals specified in the Collregs; Arrival departure procedures and process of keeping an anchor watch; ***Radar Navigation I:*** Procedure of switching on and off the Radar set; Use of range rings, bearing cursor, Recognition of land marks, radar conspicuous objects; Use of Radar in position fixing and collision avoidance activity; Introduction to ARPA; ***Emergency Procedures I:*** Identify muster and embarkation stations and emergency escape routes understand demonstrate company's safety and fire regulations identify and close and open fire, weather tight and watertight doors fitted on your ship under supervision; Identification of the type and scale of emergencies that may affect the safety of navigation and / or passengers, identify the alarm system and the means of communicating an emergency; Locate medical and first aid equipment; Knowledge of initial action to be taken in case of the following: fire or emergency alarm is sounded fire or smoke is detected man overboard, steering failure of electrical power or propulsion power failure of steaming lights shown under the Collregs; unidentified or suspiciously maneuvered vessels in the vicinity; vessels being threatened by pirates; Knowledge of shore side organizations which provide assistance in emergency and process of alerting them; ***Search and Rescue I:*** Recognition of distress and emergency signal; Introduction to search and rescue operations carried out and the importance of the same for safety of lives at sea; Introduction to IMO Merchant ship search and rescue Manual (MERSAR); ***Communications I:*** Use and the necessity of the standard marine navigational marine vocabulary; VHF communications; Use of International Code of Signals; ***Ship Maneuvering and Handling I:*** Principles of ship maneuvering rudder action when going ahead and astern; knowledge of turning circle and stopping distances under different conditions effect of deadweight, draught, trim and under keel clearance on such maneuvers.

NS ZC112 Navigation II ***5***

Terrestrial and Coastal Navigation II: To find a course to steer and the course made good counteracting / allowing the current, leeway and the tidal stream; Calculation of heights of tides and times for a standard port; Thorough knowledge of the use of the nautical publications and the charts; Process of the use of the notices to mariners and the navigational warnings for correction of the nautical publications and the charts; Gnomonic charts- Projection, properties and uses; Middle latitude sailing; Days work; ***Celestial Navigation II:*** Solar system, Planetary motion, Keplars second and third law; Apparent motion of celestial bodies; Identification of celestial bodies; Horizons, sextant altitudes and the corrections to be applied thereto; Theory of position lines, Geographical position, Position lines; Use of nautical almanac; Local, mean and apparent time, sidereal time, equation of time, UTC; Latitude by Meridian altitude; Polaris; Longitude by chronometer by observation of a heavenly body except moon; Intercept by observation of a heavenly body except moon; ***Navigational Aids II:*** Proficiency in use of navigational aids as indicated in Semester I with knowledge of their basic principles, limitations and errors; Adjustment of controls for optimum performance of the auto pilot; ***Meteorology II:*** Ability to use and interpret the information obtained from the meteorological equipment; Knowledge of the characteristics of various weather systems; Ability to apply the

meteorological information available from the weather forecasts; ***Watchkeeping II:*** Maintaining a navigation watch at sea; Handing over and taking over a bridge watch; Thorough of knowledge of Colregs; ***Radar Navigation II:*** Understanding of the functioning of the Radar; Interpretation of information obtained for navigation and collision avoidance; Ability to use ARPA for collision avoidance; ***Emergency Procedures II:*** Emergency signals; Knowledge of procedures and standing orders for actions to be taken in emergencies such as: fire man overboard, steering failure, failure of electrical power or propulsion power failure of steaming lights shown under the Collregs; Receipt of a distress / urgency or a navigational warning message likely collision unidentified or suspiciously maneuvered vessels in the vicinity vessels being threatened by pirates; Precautions including maneuvering of the ship for the protection and safety of the passengers in an identified emergency; Understand bunkering procedures and the role of the deck watch in such process; ***Search and Rescue II:*** Outline knowledge of the contingency plans available on board or as outlined in MERSAR; Practical knowledge of lowering the rescue boat, and use of such boat for rescuing a man overboard, use of emersion suit, thermal protective aid; ***Communications II:*** Efficiency in English language for safety communication, ship to ship communications and ship to shore communications using standard marine navigational marine vocabulary; Proficiency in transmitting and receiving Morse signaling; Ability to use International Code of Signals; Practical use of VHF; Knowledge of using radio equipment for transmission of a distress signal; ***Ship Maneuvering and Handling II:*** Effect of wind and current on ship handling; Procedures for maneuvering a ship for the rescue of persons overboard; Thorough knowledge of steering a ship at sea and in port or canals; Familiarize with engine room machinery and auxiliaries; Knowledge of fuels used for propulsion and power generation.

NS ZC121 Cargo Handling & Stowage I 3

General Cargoes I: Types of cargoes; Preparation of cargo spaces including checking of: dunnage capacity available cleanliness of wells, bilges, strum boxes hold scuppers bilge suction; functioning of non-return valves; appropriate accesses and lighting; Equipment Used for Loading & discharging Cargo; Knowledge of the location of ships bilges and ballast tanks, sounding and air pipes thereto; Opening and closing of cargo spaces; Principle and practice of Stowage of cargoes; Securing of cargoes; Ventilation of cargo spaces**;** ***Hazardous Cargoes I:*** Hold preparations for IMDG cargoes; Classes of dangerous goods, particular hazards involved and their labels; Identification of U.N. number hazards involved and the stowage and other precautions to be taken for IMDG cargoes. EmS, MFAG, and IF codes; Special gear provided when carrying IMDG cargoes.

NS ZC122 Cargo Handling and Stowage II 3

General Cargo II: Preparation of stowage plan; Care of cargo in transit; Knowledge of dock labor regulations; General aspects of specialized cargoes e.g. Oil, Chemicals, Gas, Containers, Heavy lifts, Perishable cargoes; Cargo watch keeping in port; ***Hazardous Cargoes II:*** Hold preparation for IMDG cargoes; Precaution during loading of IMDG cargoes; Stowage and segregation (Segregation tables); Monitoring of IMDG cargoes during transit; Cleaning of cargo spaces after carriage of IMDG cargoes.

NS ZC131 Controlling the Operation of the Ship I 3

Know your ship for personal safety; Knowledge of basic dimensions of ship; Knowledge of safety systems on board; Safe practices for working overside, aloft and when entering into enclosed spaces; Locate and list LSA & FFA, Check same with the plan available on board, Identify emergency stops for main engines and the emergency stops; Knowledge of marine environment protection systems; General ideas of ship construction and proper names of various parts;

Knowledge and use of draft marks and freeboard Identification of knots and splices when working with ropes and wires and appreciation of the safe working load of such ropes and or wires with or without knots and splices; Basic intra ship communication system, Signals to be used in emergencies and other such occasions; General ideas of ship stability; Basic principles of planned maintenance systems; Process of assessment and recording damage to the ship, Process of making good such damage; Ship anchoring and berthing procedures.

NS ZC132 Controlling the Operation of the Ship II **3**

Ability to recognize details from plans available on board; Ship construction, sketching parts of vessel and identify their method of connection to hull / deck. Welding techniques and precautions; Practical transverse stability; Corrosion protection and prevention; Practice of hull and deck maintenance, efficient use of paints and protective materials; Use of planned maintenance system for LSA/FFA; Shipboard record keeping (deck logs, cargo logs, oil record book etc.); Familiarization with the contents of the medicine locker; Introduction to ship masters medical guide; Practice first aid; Code of safe working practices; Dry docking and shipyard practices

NS ZC141 Merchant Shipping I **2**

Industry orientation; Description of the size of a ship by tonnage, cargo carrying capacity, passenger carrying capacity, TEUs, Gross tonnage, Register tonnage, Panama canal and Suez canal tonnage, Ports operations, various types of port ownership, specially designed ports for handling specific cargoes or passenger trades, infra structure needed, ship operating patterns, ship owners, ship managers, bare-boat characters, manning agents / managers; Operations on liner trade, voyage and time Charters, bare boat charters, and tramp trade; Trade specific areas which handle solid bulk cargoes, crude oil, products and chemicals, gas, containers. Why these areas became important for handling of these cargoes. Types of ships, their design to suit the trading pattern or the intended cargoes; Brief historical sketch of the growth of Merchant Shipping in this century and its effect on safety of life at sea and the protection of the Marine environment, indicating the various mile stones such as First and Second World wars, economic crisis created by fluctuations in the oil prices, creation of Flags of conveniences, Ship managers, manning of ships by crews of third world countries, STCW 78 and STCW 95; Give a brief historical sketch of the growth of the Indian shipping , indicate the factors affecting the growth; ***Principles of Management I:*** Cadet role in the organization; Documentation that the cadet is require to posses and the process of updating the same; Importance of cadets place on board ship, the avenues available to the Cadet to make a career on board ship and ashore in the later years; The norms of personal conduct on board and ashore, including relationship with officers, Engineers and the crew members. Process of carrying out of orders, personal appearance, pride of uniform, Cadets Promise; To do my duty to God and my country; To help other people at all times, To place the ship before my friends and family; and my family and friends before myself. The need for good health, exercise, personal hygiene and eye care; Knowledge of the dangers of the extreme climatic conditions, Sexually; Transmitted Disease, abuse of alcohol and drugs, and indiscriminate eating ashore; Importance of keeping the accommodation clean, maintenance of personal clothing and appearances; The 5 Ws and one H about shipping goal setting and time management shipboard organization; Company organization; ***Safety Management I:*** Introduction to Quality and safety management system; Introduction to and use of procedures, checklists, flow charts, tree diagrams and organization charts.

NS ZC142 Merchant Shipping II **2**

Industry Orientation II: Introduction to International Organizations, their formation,

functions and the Conventions proved by these organizations that are now applicable. Role of the National Seamen's Union and the Merchant Navy officers Union in the growth of Merchant navy in India and the development of human resource. Changes in the manning pattern of ships in the last two decades. Knowledge of various shipping organization such as Indian Nation; Shipowner Association, Foreign owners ship managers Association, MAASA; Function of Government organization dealing with shipping such as, Shipping Office, Directorate of Seaman employment, Mercantile Marine; Department, Directorate General of Shipping, National Shipping Board; ***Principles of Management II:*** Leadership vs. management; Responsibility vs. management delegation; ***Safety Management II:*** Introduction to management of safety through ISM code; Communication; Establishment of safety procedures.

NS ZC151 Cadet Record Book I 2
NS ZC152 Cadet Record Book II 2
NS ZC211 Navigation III 5

Terrestrial and Celestial Navigation III: Position determination by horizontal sextant angle; vertical sextant angle running fix with or without current three point bearings double angle on the bow special angles; raising and dipping lights; normal or luminous range of lights; Calculation of heights and time of high and low water at the secondary ports; Passage Planning including: ships routing information, identification of the appropriate charts and the nautical publications for a given passage; Identification and recording navigational dangers; Identifying and recording primary methods of position fixing, planning of an ocean passage and making a landfall; Position reporting systems, preparation of reports; Introduction to navigation in pilotage waters and VTMS; Construction of Mercator chart grid; Introduction to Electronic Chart Display and indicating system; Transferring a great circle track from Gnomonic chart to Mercator chart; Plotting a great circle track on Mercator charting way points (by calculation); ***Celestial Navigation III:*** Earth -Moon system, sidereal period and the synodic period of the moon, phases of the moon, daily retardation, liberation of the moon, Eclipses; Calculation of a position line/s and position through which to draw the same by: Ex- meridian observation of the sun or stars observation of the moon; combination of two or more observation with or without a run in between. Likely errors in position lines due to error in time, altitude and latitude; Twilight, rising and setting; Circumpolar bodies; ***Navigational Aids III:*** Testing control, check list and records to be maintained procedures to be followed to ensure that all position fixing systems and navigational aids are in working order; Knowledge of emergency steering system; Change over procedures from main to emergency steering; Theory of gyro compass; Construction of a typical gyro compass; ***Meteorology III:*** Tropical revolving storms; TLD; Front and frontal depression; Ability to code and decode weather messages; ***Watchkeeping III:*** Thorough knowledge of Colregs Annexes; Performance of effective bridge team procedures; Use of Routine information in accordance with the IMO guide lines; Thorough knowledge of the principles to be observed in keeping a navigational watch; ***Radar Navigation III:*** Use of Radar and ARPA including: plotting techniques and relative and true motion concepts; range and bearing, course and speed of other ships, time and distance of closest approach of crossing, meeting and overtaking ships identification of critical echoes, detecting course and speed changes of other ships, effect of changes in own ships course or speed or both on such encounters; Application of Colregs; Parallel indexing; Principle types of ARPA, their display, characteristics, performance standards and the danger of over reliance. Ability to operate, interpret and analyze information obtained from ARPA including system performance and accuracy, tracking capabilities and limitations, and processing delays use of operational warnings and system tests methods of target acquisition and their limitations, true and relative vectors,

graphic representation of target information and danger areas, deriving and analyzing information, critical echoes, exclusion areas and trial maneuvers; ***Emergency Procedures III:*** Appreciation of procedures to be followed for rescuing persons from Sea assisting ship in distress, responding to emergency which may arise in port, principles of fire safety in port and at sea, precaution against pirates boarding; ***Search and Rescue III:*** Thorough knowledge of MERSAR; Use of EPIRB & SART; Auto keying device, two tone alarm, Watchkeeping on 2182 Hz; ***Communications III:*** Proficiency in Morse code; Thorough knowledge of INTERCO; Through knowledge of the Global Maritime Distress and safety system and its use for transmission of distress and urgency messages; ***Ship Maneuvering and Handling III:*** Effects of squat, shallow water effects and interaction on ship maneuvers; Advantages and disadvantages of single screw, twin screw, and variable pitch propellers and its use in ship handling; Prepare ship maneuver plan for going along side a jetty with or without tug under given weather conditions; Record pilot maneuvers on a chart and identify reasons for individual actions; Engine maneuvers; Process of controlling engine operation and general engine room watch keeping (to maintain watch at sea and on arrival and departure ports).

NS ZC221 Cargo Handling and Stowage III 3

General Cargoes III: Loading homogeneous cargoes; Calculations to ascertain the cargo to be loaded and the remaining space taking into account stowage factor, load factor etc.; Cargo documentation and certification; Knowledge of the process of ballasting and deballasting; ***Hazardous Cargoes III:*** Specialized cargo codes; Detailed aspects of specialized cargoes (Cadets on such ships to receive detailed modules); Action to be taken after discovering an incident involving IMDG cargoes; Use of protective gear and de-contamination procedures; Practical use of Medical First Aid Guide(MFAG); zone formation in an incident (US Concept) and chain of command procedures; Incident drills and training on board.

NS ZC231 Controlling the Operation of the Ship III 3

Understanding the concept of longitudinal stability, Longitudinal centre of floatation, trim Longitudinal centre of gravity; Knowledge of basic principles relating to water tight integrity; Flooding of a compartment, knowledge of action to be taken in accordance with the shipboard contingency plan; Appreciation of stresses and strains under static and dynamically load conditions. Permissible limits; Practical welding and cutting and other shipboard repair work; Knowledge of various paints their properties and use; Thorough knowledge of the company drug and alcohol policy; Legislation; Statutory requirements- Solas, MARPOL, LSA / FFA regulations, SOLAS; Training manual, SOPEP; Familiarization with Marine Conventions relating with the Safety of life at sea, protection of the environment and the assignment of the load lines. Knowledge of rules relating to periodical surveys and certification; MARPOL and associated equipment, systems, records and SOPEP; Fire prevention; Chemistry of fire prevention and methods of detection; Fire drills; Ability to organize safety and abandon ship drills; Contingency planning.

NS ZC241 Merchant Shipping III 2

World Maritime transport; Understand the relationship between the environment, location and the economic prosperity in a world context; Recognize characteristics of the major climatic zones and region; Identify major geographical formation and patterns; Relate climatic and geology / soil to agricultural and industrial activity; Recognize that the population is a major factor influencing resource management the effect thereof on the developed countries and the under developed countries; Projects; List the main shipping lanes and indicating the influences of the prominent cargoes carried on such routes; Analyze the hazards of maritime transport; Relate the influence of the

IMO regulations to the hazards of the maritime transport and traffic congestion; ***Principles of Management III:*** Attitudes; Assertiveness; Multicultural group system; Motivation; Principles of Management; Human relations; Human Resource Development; Use of Information technology; ***Safety Management III:*** International and national organization dealing with safety on board ships; Thorough knowledge of Safety Management system; Shipboard procedures; Ability to conduct internal Audits; familiarization process required under STCW 95.

NS ZC251 Cadet Record Book III 2

NS ZC212 Navigation IV 4

Respond to navigational emergencies. Contingency Plans for Response to Emergencies: Muster list, assignment of duties to personnel, composition of emergency team, drawing of plans to deal with heavy weather damage, fire in specific areas, stranding, abandoning ship, spillage of noxious substances, and collision. Measures which should be taken in emergencies for the protection and safety of the ship, passengers and crew. Precautions to be taken when beaching a vessel—Circumstances in which the vessel is to be beached, precautions to be taken and procedure to be obtained while beaching. Actions to be taken on stranding: Actions to be taken if stranding is imminent and after stranding, distress or urgency signal, discharge of harmful substances, assessment of damage control, refloating by stranded ship with & without assistance. Actions to be taken following a collision: Duties of Master if collision is imminent and following a collision or impairment of the water tight integrity of the hull, measures to limit damage, salving own ship, log book entries. Precautions for the protection and safety of passengers in emergency situations: Duties of some crewmembers to assist and muster passengers, precautions for the protection and the safety of passengers in emergency situations. Means of limiting damage and salving the ship following a fire or explosion: Cooling of compartment boundaries, inspection for damage, continuous watch on damaged area and temporary repairs. Procedure for abandoning ship: Distress calls transmission until acknowledgement, use of distress signal to attract attention, launching of boats and liferafts in heavy weather. Use of auxiliary steering, emergency steering gear and the rigging and use of jury steering arrangements - Change over bridge control to local control in the steering gear compartment, standard emergency steering procedures, proper communication from the bridge, method of securing the rudder in the event of a broken rudderstock, jury steering arrangement. Arrangements for towing and being taken in tow: Permission from owners for towing, early communication with the vessel being towed, procedure for towing in good and rough weather conditions, towing speed. Rescue of persons from a vessel in distress or from a wreck: Waiting for daylight, selection of rescue boats, and use of oil in rough weather. Man-overboard procedures: Recovering a person from the sea in heavy weather, action to take when a person is reported missing at sea. Actions, which can be taken when emergencies arise in port (at berth or at anchor).

NS ZC222 Cargo Handling and Stowage IV 4

Outline knowledge of Tanker Operations: Terms and definitions: General knowledge of tankers and tanker operation, crude oil, refined products, spiked crude, sour crude, Reid vapour pressure, upper flammable and lower flammable limit. Contents and application of the International Safety Guide for Oil Tankers and Terminals (ISGOTT) Oil tanker operations and related pollution-prevention regulations: Segregated ballast, clean ballast, dirty ballast, slop tanks, inert gas system, COW, cleaning and gas freeing tanks, loading and discharging operations on a tanker.

NS ZC232 Controlling the Operation of the Ship IV 4

Develop emergency & damage control plans & handle emergency situations Emergency

situations Demonstrates the knowledge of preparation of contingency plans for response to emergencies: Drawing plans to deal with emergencies, legal aspects and seamanship practises. Understands ship construction with regards to damage control Explains methods and aids for fire prevention, detection and extinction: Fire prevention procedures, different types of fires and fire fighting equipment to be used, fighting fire on different types of ship. Understands functions and use of life saving appliances: Different types of emergencies, actions taken, life saving appliances and instructions to use it. Organise and manage the crew Personnel Management Principles of controlling subordinates and maintaining good relationships: General principles to be followed for maintaining good relationship staff welfare. Staff attitudes: Reasons why people work. Exercise of authority: Why a person must make his own authority, factors to prove fitness for the rank. Group behaviour: Factors affecting group behaviour, discipline. Conditions of employment: Conditions for service & items detailed in the service contract

NS ZC242 Marine Powerplant I **4**

Operate remote controls of propulsion plant and engineering systems and services Marine Power Plants: Diesel engines: Types of diesel engines, operation procedures. Steam turbine systems: Steam turbine and its gearing, working of an impulse turbine, features of water tube boiler. Propeller and propeller shaft: Sketch of a propeller, pitch, slip and efficiency of a propeller, calculation of ship's speed. Bridge control: Bridge control system, bridge control of controllable pitch propeller, indicators and alarms, lateral thrusters. Marine auxiliaries

NS ZC252 Communication Skills **1**

Communication skills to develop English language skills of listening, speaking, reading and writing.

NS ZC262 Maritime Legislation I **3**

Compliance with legislation, Introduction to Maritime Law, Law of the Sea: Conventions on the law of the sea, Territorial sea and the contiguous zone, International straits, Exclusive economic zone and continental shelf, High seas, Protection and preservation of the marine environment. Safety: Outline knowledge of the following safety conventions: International Convention on Load Lines, 1966 (LL 1966), as amended International Convention for the Safety of Life at Sea, 1974 as amended (SO LAS) International Convention on Standards of Training, and Watchkeeping for Seafarers, 1978 (STCW) as amended Convention for the suppression of unlawful act against the Safety of Maritime Navigation 1988 as amended ITU Radio Regulations

NS ZC311 Navigation V **4**

Manoeuvre and handle a ship in all conditions. Manoeuvring when Approaching a Pilot Vessel or Station, with due regard to Weather, Tide, Headreach and Stopping Distance: Preparation of passage plan, contact with the pilot, preparation for picking up the pilot, readiness of anchors for letting go, making a lee for the pilot boat, understanding of headreach and stopping distance of the vessel while picking up pilot. Handling a Ship in Rivers, Estuaries,., having regard to the Effects of Current, Wind and Restricted Water on the Response to the Helm and Stopping Distance: Shallow water effect, turning radius, increased directional stability, slow response by the steering at reduced speeds, squatting, effect of current and wind on helm response. Berthing and Unberthing under Various Conditions of Wind, Current and Tide, with or without Tugs' assistance: Effect of wind, current on handling of the ship while berthing and unberthing with or without tugs, ship-tug interaction. Anchoring Distance: Choice of anchorage, swinging circle, direction and strength of current, procedure of anchoring with one or two anchors in limited anchorage, factors involved in determining the length of anchor cable, dragging anchor, clearing foul hawse/anchor. Lighterage at Sea: Ship to ship transfer guide, Lighterage preparations for both vessels, method of separating on

completion of transfer operations. Dry-docking: Information required by dry dock authorities, ship plans, stern trim, critical condition, use of bilge blocks, breast shores, precautions before flooding the dock.

NS ZC321 Cargo handling and Stowage V 4

Chemical tankers: dedicated or parcel trades, rules regarding chemical tankers, IMO conventions covering the carriage of chemicals in bulk, BCH and IBC codes. Tank cleaning and control of pollution in chemical tankers: Phases in tank cleaning operations, use of fixed or portable tank washing machines, use of slop tanks, cycle of a tank washing system. Annex II of MARPLOT 73/78. Gas tankers: Ch. VII of SOLAS, LNG, LPG, LEG and chemical gases, GO code, certificate of fitness. Cargo operations in gas tankers: Information needed before loading, various cargo operations, hazards with cargo operation with gas tankers.

NS ZC331 Controlling the Operation of the Ship V 4

Organisation of Staff: Manning arrangements: Manning requirements of the ship and factors affecting manning arrangement. Analysis of work: Various factors affecting the analysis of work. Allocation of staff: Master's responsibility for allocation of staff duties. Organising for safety and emergencies: Appointment of safety officer and fire officer, preparation and display of muster list. Organising for staff duties: Watchkeeping and security duties while at sea and in port. Organising for maintenance: Preparation of checklist and work schedules including safety deck, radio room, engine room, catering. Ship's records: Records and certificates to kept on board and maintained in good order. Organising communications on the ship: Holding regular meetings and keeping staff informed, safety meetings. Meeting techniques: Different ways of performing meetings, steps to produce a successful meeting.

NS ZC341 Marine Powerplant II 4

Auxiliaries: Auxiliary boilers: Water tube and fire tube boilers, exhaust-gas heat exchangers, priming. Distillation and fresh-water systems: Operation of a flash evaporator, reverse osmosis, domestic water system. Pumps and pumping systems: Different types of pumps and its uses, typical bilge and ballast system for a dry cargo ship. Steering gears: Different types of steering gears, IMO requirements for steering gears, IMO requirement for testing steering gears Generators, alternators and electrical distribution: Operation of an alternator, A. C. and D. C. distribution systems, use of circuit rackets & breakers. Refrigeration, air-conditioning and ventilation: Properties of a refrigerant, vapour-compression cycle refrigeration plant, air conditioning plant, ventilation system for accommodation and ship holds. Stabilisers: Construction and operation of fin and flume stabiliser. Sewage treatment plants: Operation of chemical and biological sewage treatment plants and relations regarding discharge. Oily-water Separators and oil filtering equipment Incinerators: functioning of a waste incinerator. Deck machinery: Cargo winches, forward windlass, aft mooring winch. Hydraulic systems: Ram & rotary-vane actuators, hydraulic accumulator, heating of oil.

NS ZC351 Technical Report Writing 3

Course description is same as given under MEBF ZC241

NS ZC361 Maritime Legislation II 3

Pollution: Outline knowledge of the following pollution conventions and their amendments: International Convention for the Prevention of Pollution from Ships, 1973. London Dumping Convention (LDC). Intervention convention. Civil Liability convention (CLC) and Fund Convention. Oil Pollution Preparedness, Response & Co-operation Convention (OPRC) Precautions, which should be taken by the master to prevent operational pollution: Use of oil record book, IOPP certificate. Precautions which should be taken by the master to prevent accidental pollution: Routine checking and maintenance of equipment, proper communication during oil operations.

Reporting of incidents: need for prompt reporting, meaning of probability of discharge Passengers Special Trade Passenger Ships Agreement. Protocol and Rules on Space Requirements for Special Trade Passenger Ships, 1973, Athens Convention relating to the Carriage of Passengers and their Luggage by Sea Tonnage, International Convention On Tonnage Measurement of Ships, 1969 as amended.

NS ZC312 Navigation VI 4

Management and Handling of Ships in Heavy Weather and the use of Oil: Assisting a ship or air craft in distress, pooping, broaching-to, precautions to be taken before onset of heavy weather, towing operations, means of keeping an unmanageable ship out of trough of the sea, lessening drift and use of oil. Determining Manoeuvring and Propulsion Characteristics of Major Types of Ships with special reference to Stopping Distances and Turning Circles at Various Draughts and Speeds: Sea-trail turning circle, Turning circle in shallow water at various speeds, effect of wind the behaviour of the ship, trials of steering ability. Practical Measures to be Taken when Navigating in Ice or Conditions of Ice Accumulation on Board: Sources of information on ice condition, ice sterns, measures to be taken when navigation or near ice, precautions in entering ice, ice accommodation on board. The Use of, and Manoeuvring in, Traffic Separation Schemes. Importance of navigating at reduced speed to avoid damage to other ships structures in restricted waters caused by own ship's bow wave and stern wave. Precautions in manoeuvring the ship to be able to launch rescue boats in bad weather

NS ZC322 Cargo handling and Stowage VI 4

Methods and Safeguards when Fumigating Holds: Reasons for the control of pest, International health regulations, precautions when the vessel is fumigated. Cargo Calculations: Draft Survey and related Calculations. Cargo Calculations: Use of ASTM tables for calculating cargo in a tank.

NS ZC332 Controlling the Operation of the Ship VI 4

Training on Board Ships: Training methods: Purpose of on board training. Training in safety: Use of life saving appliances, best methods of survival, donning of lifejackets and immersion suits, demonstration of all life saving and fire fighting appliances Emergency drills: Testing of emergency fire pump, emergency bilge pump, remote shut-off valves and remote stop switches, fire flaps. Training in ship operations: Management meetings to train officers and crew in the deck department, engine department and catering department ship operations. Training in maintenance Training in ISM Code, STCW Convention and Port State Control.

NS ZC342 Marine Powerplant III 4

Marine Engineering Terms and Fuel Consumption: Marine engineering terms: Mass, force, work, power, energy, stress and strain, heat and their units, efficiency of a machine, indicated power, shaft power, propeller power and thrust. Fuel consumption: Admiralty coefficient, fuel coefficient, fuel consumption, displacement and speed of a ship and relationship between them, fuel economy.

NS ZC352 Principles of Management 3

Course description is same as given under MEBF ZC231

NS ZC362 Maritime Legislation III 3

Maritime Labour Conventions and Recommendations (ILO): Outline knowledge of the following labour conventions as amended: Minimum Standards for Merchant Ships, 1976 (No. 147). Seamen's Articles of Agreement, Minimum Age for the Admission of Employment at Sea and of young persons as Trimmers or Stokers. Minimum Requirements of Professional Capacity for Masters and Officers on board Merchant Ships. Certification of ship's' Cooks and Able Seamen. Vocational Training of Seafarers. Wages, Hours of Work on board Ship and Manning. Vacation Holidays with pay for Seafarers. Annual Leave with Pay for Seafarers. Repatriation of Seafarers. Food and

Catering for Crews on Board Ship. Crew Accommodation on Board Ship. Contents of Medicine Chests on Board Ship & Medical Advice by Radio to Ships at Sea. Prevention of Occupational Accidents to Seafarers. Medical Examination of Seafarers. Health Protection and Medical Care for Seafarers. Liability of the shipowners in Case of Sickness, Injury or Death of Seamen. Sickness Insurance for Seamen. Social Security for Seafarers. Seafarers' Welfare at Sea and in Port. Application of the Principles of the Right to Organise and to Bargain Collectively. Arrival Documents and Procedures as amended: International Health Regulations (IHR). Convention on Facilitation of International Maritime Traffic, (FAL 1965). Noting protests. Collision. International Convention for the Unification of Certain Rules of Law with respect to Collision between Vessels, and Relating to Penal Jurisdiction in Matters of Collision or other Incidents of Navigation. Assistance and Salvage. International Salvage Convention. Lloyd's Standard Form of Salvage Agreement (LOF). Convention on Limitation of Liability for Maritime Claims. Classification Societies. Overview of all classification society rules

NS ZC411 Mathematical Techniques for Nautical Sciences 4

Statistical Methods: Use and critical understanding of various transport statistical units employed e.g. capacity ton miles, load ton miles. Compilation of meaningful statistics from operational and other data-interpretation- sources and content of national and international statistics in relation to transport. Statistics for physical distribution management. Numerate problem solving and decision making. Principles of systematic problem solving. Probability theory, decision theory, replacement theory. Techniques of Statistical Analysis. Sampling Distributions and interval Estimates particularly. Normal Distribution and T-Test Hypothesis Testing and statistical inference e g the chi-square Test Non parametric Tests e.g. spearman's Rank correlation. General Operational Research Techniques and Applications to Transport. Rules of calculation and their application to Transport problems Linear programming allocation problems Assignment problems vehicle routeing vehicle scheduling Load planning Depot Location.

Project Planning Techniques: Definition and Elements of Network applications of critical path analysis to Transport situations Resource Allocation project control. Forecasting. Time series analysis seasonal Adjustments exponential smoothing comparative studies of recent Transport forecasts. Inventory Control Techniques. Scope of economic batch quantity calculations. Ordering systems. Material requirements planning. Computer Application. Management information system and management co-operating system Components of management information system, marketing, inventory, manufacturing. Financial, personnel and long-range planning- basic information system-integrated management information system. Research Methodology: Concepts of scientific method-research language- selecting the topic. Hypothesis-formulation, type and characteristics-testing the hypothesis- design-resources-collection and analysis of data-library-indexing-bibliographies-documentation. Constructing Questionnaires-Pilot Studies.

NS ZC421 Quality & Safety Management 4

Basic concepts of Quality, ISO 9000 standards, Quality planning, Quality control, Quality implementation, Internal audits, Certification, International Safety Management Code: Historical process of implementation of Safety and environment, management Systems through IMO resolutions, ISM clauses, Implementation of IM code, Process of preparation of systems in the company's office and on the ships. Role of designated person ashore, Internal audits, Certification process, Process for continuing certification, Role of recognized organizations.

NS ZC431 Basic Maritime Human Resource Management 4

Manpower Resources and Management: Size

and Character of Resident Woking Populations-National and Local Labour Markets-Industrial and Occupational Structure of Working Population, Characteristics of Labour Force and of Employment/Work Available in the Transport Industry in General and Merchant Marine in Particular-Comparison with Other Industries and Sectors. Methods and Techniques of Forecasting Labour Supply and Demand-for the Economy as a Whole-for Transport Sector-For Merchant Marine Factors Influential upon Supply and Demand of Labour. Comparative Costs-Wages/Salaries and Technologies-Employment Stability and Security Career Growth and Development. Labour Market-Sources of manpower Data. Manpower planning-in different conditions of growth, stagnation and decline-manpower plan-relevant data-methods of presentation. Personnel Policies, Methods and Procedures : Recruitment and discharge of Labour-training and development-utilisation and treatment emuneration-control-inter-re!ationship of personnel objectives and policies to commercial objectives and policies- role of line and specialist personnel managers. Recruitment and selection-job analysis-job specifications-person specifications-methods of advertising vacancies-technique of interviewing for selection-formal selection tests-legal restraints on discrimination in recruitment and selection. Training and development - methods of establishing training needs - systematic approaches to training for performance. Methods of training and relevance to objectives. Methods of monitoring and evaluation of training and subsequent performance. Organisation of the training function - role of training division - legal requirements. Remuneration-influence of economic forces-supply and demand-custom-collective bargaining. Methods of establishing differentials by job evaluation. Methods of relating payment to performance-measured-day-work-bound-profit sharing. Methods of comparing different levels of pay. Employee's rights as regards remuneration. Supervision and control-methods of establishing standards of performance- supervision as process of monitoring and influencing performance-performance appraisal and communication-works rules-disciplinary processed and procedures-grievance procedures and handling-forced resignation-dismissal-legal constraints on disciplinary processes. Welfare at work-development of conductive climate and working relationships-legal requirements as regards health and safety at work-non-discriminatory treatment —amenities and benefits of a contractual nature-canteens-clubs-pension-medical. Industrial Relations Policies and Procedures: Industrial relationships in transport/industries and sectors-Organisation of workers into trade unions and staff associations. Employer's assoclations-multiple-unIts undertakings. Objectives pursued by employers/employees. Negotiation, consultations, participation, bargaining. Policies government trade union recognition-structures of bargaining and consultative units-approaches to negotiation and consultation-Organisation of management and workers 'sides development of participation- short-term and long-term objectives. Collective bargaining-formal procedures-agreed procedural rules. Negotiation-grievance-disputes. Collective agreement-terms and conditions of employment. Public policy and legal constraints-code of practice. Significant developments-national and international. Maritime Industrial Relation in India: Seamen, History of maritime labour in India - sources of supply - traditional background and characteristic -educational background - past methods of recruitment and employment - shortcomings of the system. Establishment of seamen's employment office - registration - educational qualifications - physical/health standards - rosters (Company and General) - job rotation. Merchant shipping Act 1958 & seagoing personnel. Shipping master his duties and functions - methods of recruitment - signing on and signing off - articles of agreement - merits and demerits. Statistic of seamen employed and unemployed - their socio-economic problerns -seamen's welfare schemes. Seamen's unions

- history of trade unions of seafarers - methods of registration - election -leadership, strength, bargaining power - activities - impact on industry. Representation in national shipping board - other bodies - international transport federation - international labour organisation.Merchant Navy Training Board. Seagoing officers Petty officers - system of recruitment-duties and functions - working conditions-trade unions. System of Recruitment-educational/physical Health Requirements-Training -Pine-Sea -T. S. Chanakya-MERI-Graduate Entry -Direct Entry. Training -Post Sea-masters &mates-I class and II class engineers-L.B.S.COMSAR college-MERI. STCW convention-META Manual. SCI's MTI Recent development in training institution on account of STOW 95. Industrial Relations, Indian National Shipowners Association - Constitution Membership-Functions. National maritime Board-Constitution-Membership-functions. Maritime union of India-national union of seafarers of India-FUSI-inter island/hinterland. Industrial unrest-Strikes-consequences-Remedies. International bodies connected with seagoing personnel-international transport federation (ITF)-constitution.Membership-functions-elections-leaderShiP-impact on international shipping-Indian participation. international Labour Organisation- Indian representation and participation. Manning costs with reference to various types of ships and services. Staff unions- officers' associations- negotiations-charter of demands —settlements-Agreements implementation.

NS ZC441 Basic Maritime Financial Management **4**

Fundamentals of Accounting: Conservation, continuity, consistency and objectivity in Accounting. Relationship between financial, Accounting and management Accounting. Distinction between capital and reserves. Valuation of Assets and Liabilities. Depreciation, Obsolesce Renewals and Replacements. Value of Current. Cost Accounting Reserves and their purpose. Amalgamation, Contraction and Liquidation. Balance Sheet and principal Accounts ontents and Interpretation of Balance Sheet and Principal Accounts viz, operating/Trading, Profit and Loss, Source and Application of funds. Principal accounting ratios. Capital gearing and reward to capital. Problems affecting balance sheet and accounts. Budgeting: Budget preparation- systems of control appropriate to management and functional levels-relationship to physical budgets and longer-term business plans. Distinction between revenue and capital expenditure-cash flow forecasting- short and long term. Costing: Nature of costs —costing methods for functional. Activities in Transport and Allied Undertakings. Standard and Marginal costs. Costing as tool in decision making, price fixing, investment and rationalisation, back-checking and forecasting. Capital Structure and Sources of Finance: Various forms of capital structure in Transport and Allied undertakings. Capital structure in public and private sector- main sources of finance-financial institutions in General-government control, leasing, hiring and other alternatives to direct financing. Investment Appraisal in Shipping: Methods of financing ship, acquisition and fleet renewal-borrowing and leasing-role of financing institutions- shipping development fund- shipping credit and investment co. of India ltd. commercial banks, shipyards- Asian development bank-world bank, etc. raising loans in foreign money markets- advantages and disadvantages-taxation implications, Grants and subsidies. Cash flow forecasting-discounted cash flow for investment appraisal residual values of ships escalation. Trading Finance: Types of transactions-letters of credit — bill of sale- types of costs, fixed and variable, direct and indirect- port disbursements, daily running costs, bunker costs. Freight and hire calculation and collection. Foreign currency transactions-currency and freight hedging. Auditing and Systems : Duties and responsibilities of statutory auditors. Internal audit and controls. Development and application of system controls on Physical Assets including cash and liabilities. Audit and management

accounting. Voyage Accounting: Preparation of voyage accounts-gross operating profit- net operating profit –results.

NS ZC451 Basic Ship Operation Management 4

Ship operation including surveys and inspection, preparation and practice of dry-docking. Routine maintenance, Checks necessary prior arrival and departure, Testing of controls and vital machinery, Contingency plans. Survey and inspections: Surveys and inspection required under SOLAS, MARPOL, LL AND Classification Society rules. Harmonised system of surveys, Details of items and systems required to be inspected under such surveys, Pre planning of surveys and inspections, Maintenance of records, Certification and validity of certificates, Port state control, powers of inspectors, records needed, Dry docking Preparation of defect lists, Planning of surveys during dry docking, Repair estimates, Supervision, Inspection and completion certificates.

NS ZC461 Basic Commercial Shipping Management 4

The Ship: Types of ships-liners, general cargo, container, tanker, bulk carriers, roll no/roll off and other special-purpose vessels performance and capacity Decks holds and Hatches. Tanks- types and uses. Derricks, winches and specialised cargo handling gear. Bale and grain capacities. Ship tonnages. Load lines. Propulsion. Capacity plans, general arrangement plans stowage plans. Knowle1ge of various specialised vessels. Suitability for cargoes and trades. Legal Requirements for Safe Operation: With special emphasis on: design and construction of vessels, load line and other regulations-fire prevention. Maintenance of vessels and equipment. Training and certification of afloat personnel. Duties and responsibilities of Ships' officers and crew. Sea-routes: Major shipping lanes of the world. Areas of traffic intensity/congestion and other hazards. Effect of IMO conventions/resolution on sea routes. Navigational Aids and services. Factors Affecting profitability. Cargoes: Type, Methods of packing, stowage Factors, stowage considerations ar1J Requirements, Freight Units, Major seaborne commodities. Classification Societies: Various Registries - Classification Requirement - Registers of ships - Abbreviations used and their meanings functions of classification Surveyors - various surveys - classification - continuous load line - safety construction - safety Hatch – Damage - on/off hire - Tonnage, Ships Agency Operations: Ships Documents. Customs and port Authority Requirements services to Master and crew Disbursement Accounts and Funding Agency correspondence canvassing for cargo-support (Marketing) Interpretation and preparation of statement of Facts Lay time statements Demurrage Dispatch Freight Accounts Agents Role in general Average port of Refuge. Owner's Agent of chartered ship. Owners and chatterers Agent of same ship delivery and redelivery of Time charter ships. Disbursements: Port Dues and Taxes pilotage Towage Light rage stevedoring Light Dues. Chartering: Knowledge and procedure of offer and counter-offer Types and standard forms of charter-parties for world Trades Basic clauses in Dry cargo Tanker voyage and Time charter-parties customary terminology and Abbreviation practical Aspects of Lay time provisions Demurrage Detention Despatch freight Dead fright. Liner Operations: Bookings, Freight Units, Calculations for Conventional, Container, RO/RO Services. Documentation of Cargo. Passenger Service-Calculation of Passage- fares, Ticketing-Servicing passengers and Passengers Ships. Transhipments: Shipping Lines in relation to 'through transports of passengers and freight. The movement of people and the connecting services required. Transhipment and Distribution of Cargo. Feeder Services obligations of Different Carriers of same cargo.

NS ZC471 Basic Risk Management 4

History, background and structure of the p&i clubs. Introduction, historical background, the p&i clubs, the p&i industry, p&i insurance, scope of club cover, risks not covered, some underlying principles, claims handling,

underwriting, introduction, the call income, reinsurance, reserves, the club outgoings, entry of a vessel in a p&i club, a cargo - contracts of carriage, introduction, international trade, sale contract, documentary credit, international, conventions, contracts of carriage, contract evidenced by the bill of lading, charter party, Hague and Hague Visby rules, carrier's seaworthiness obligation - article iii rule I, exercising due diligence, carrier's defences - article iv rule 2~, carefully to carry obligations - article iii rule 2, Hamburg rules, cargo liabilities, introduction, club cover, General average, salvage and special charge~, Club cover, Rule 19(18) general average, cargo - contracts of carriage, introduction, chartering arrangements, charter party forms, relationship between the charter party and charter party provisions relating to signing b, charter party exception clauses, time charter parties, voyage charter parties, cargo - loss prevention, introduction, seaworthiness - practical considerations, cargo condition and issuing bills of lading, personal injury, Introduction, seamen, supernumeraries, passengers, third parties, loss prevention, role of the P&I club, stowaways and diversion expenses. Introduction, stowaways, diversion expenses, life salvage, club cover, persons in distress, quarantine, third party damage to ships and property, introduction, collisions, club cover, claims handling, handling collisions, limitations of liability, loss prevention, non-contact damage to ships, damage to property, wreck removal, towage, contracts, indemnities and guarantees, pollution, introduction, historical background, P&I cover relating to pollution. loss prevention, freight, demurrage & defence, introduction, risks covered and nature of FD&D cover, limitations on FD&D cover, the practical working of the FD&D class, underwriting, entry, payment of calls.

NS ZC412 Project Work **20**

Course description is same as given under BITS ZC423T

OASN ZC111 Functional English and Communication **3**

Grammar in usage - Tenses, Prepositions, Phrasal verbs; Communication - Process, Speaking, Listening, Reading, Memory, Self image; Comprehension, Precis writing; Report writing.

OASN ZC112 Ocular Anatomy **2**

Anatomy & Embryology of Sclera, cornea, Uvea, retina & visual pathway.

OASN ZC121 Human Anatomy **2**

Tissues of Body, General Plan of Organ System, Cell structure, and other anatomical aspects of vital organs of body

OASN ZC122 Ocular Physiology **3**

Protective Mechanism in the eye, extraocular muscle, physiology, lens metabolism, Refractive Errors, Visual Acuity, color vision.

OASN ZC131 Human Physiology **2**

Basic concepts of cell physiology, Blood, Digestion, Excretion, Endocrines, Reproduction circulation, Nervous System & Special Senses.

OASN ZC132 Pharmacology **2**

Mechanism of drug action, Dose response relationship, Tachyphylaxis, Pharmacokinetics of drug absorption, distribution, biotransformation; Principles of ocular pharmacology, Optometric diagnostic drugs.

OASN ZC141 Basic Mathematics **3**

Algebra, Trigonometry, Analytical Geometry, Differential Calculus, Integral Calculus, Matrices & Determinants, Vector Algebra, Probability & Statistics.

OASN ZC142 Microbiology **2**

Classification of microbes; structure and physiology of microbial cell; infection and immunity; host parasite relationship; microbiology of milk, air, water and food; physical and chemical methods of controlling microbes; experiments for isolation, cultivation, physiological and biochemical characterization of microbes.

OASN ZC151 Introduction to Computers 3

Personal Computers; Components; Windows environment; Office Automation Software; Document Processing; Spreadsheets; Software suites like Microsoft Office 2000, Personal information management, use of Internet, etc.

OASN ZC152 Pathology 2

Inflammation & repair, Infection, Neoplasia, Circulatory disturbances, Clinical pathology.

OASN ZC161 Principles of Management 3

Fundamental concepts of management - planning; organizing; staffing; directing and controlling; production, financial, personnel, legal and marketing functions; accounting and budgeting, balance sheets.

OASN ZC162 Biological Chemistry 3

Chemistry and functions of constituents of cells and tissues; introduction to enzymes; metabolism of carbohydrates, lipids, aminoacids; nucleic acids and protein synthesis; vitamins and hormones.

OASN ZC171 Scientific Measurements 2

Measurement in the fields of biology, chemistry and physics. Emphasis in this course shall be on the operation and use of modern laboratory instruments.

OASN ZC172 Nutrition & Dietetics 4

Emergence, Scope and Methodology of nutrition as a science; Energy metabolism, Food energy (carbohydrates, fat, protein) and individual nutrients (vitamins and minerals) with special reference to distribution in the body and biochemical role, amount in ordinary foods, digestion, absorption, transport, storage, utilization and disposal, requirements and recommended allowances and their modification under stress conditions, effects of deficiency, incidence, etiology and prevention of deficiency disease, inter-relations with other nutrients; Assessment of nutrients; Assessment of nutritional status of the individual and the community; Formulation of balanced diets, Common nutritional disorders, nutritional adaptation; Nutrition and infection; Principles of dietetics, Diet adaptation; Nutrition and infection; Principles of dietetics, Dietary management of Diseases, Practicals: BSA, BMR measurements and calculations, anthropometric measurements, taking dietary history and nutrient calculations, etc.

OASN ZC181 Hospital Procedures 1

Administration, Bioengineering department, Medical Records, Reception, Computer, Appointment scheduling and Accounts, Laboratory, Funds, fluorescein angiography, Medical Photography, Correspondence, Stores.

OASN ZC182 Molecular Genetics 3

Genetic foundations; Genetic counseling; Transformation, transduction and conjugation; Recombination and complementation; genetic mapping and linkage analysis; Genome organization; Genome maintenance; Gene regulation in Prokaryotis and Eukaryotics. Cloning techniques in E.coli and Eukaryotic cells; Restriction maps; Nucleic acid blotting and hybridization.

OASN ZC211 Ocular Diseases –I 3

Diseases affecting the eyelids & adnexa including orbit, ocular motility, refractive errors, diseases affecting the cornea, sclera.

OASN ZC212 Ocular Diseases –II 3

Diseases affecting uveal tract, retina, vitreous, lens, optic nerve, cranial nerves connected with vision and visual apparatus, ocular manifestation of systemic diseases.

OASN ZC221 Inservice Training –I 6

Theory and practice of Ophthalmic Assistant pertaining to patient care in terms of first aid, CPR, hygiene, positioning and body alignment, transferring patients, temperature, pulse, respiration, blood pressure, etc.

OASN ZC222 Inservice Training – II 6

Theory and practice of Ophthalmic Assistant pertaining to patient care in terms of respiration, nutrition, fluid and electrolytes, elimination, temperature regulation, safely, pain avoidance, movement & exercise,

security, self esteem, sex, vital signs, sensory needs, patients & hospital environment, psychosocial and spiritual needs, etc.

OASN ZC231 Medical & Nursing Records 3

Introduction to Medical Records; history; need for medical record; content of medical records; special records; formats, forms design & control; filing methods, storage & retention; nomenclature & classification systems; indexes & registers; legal aspects of medical records; quality assurance; recent advantages in medical systems.

OASN ZC232 Community Health Care 7

Community eye programmes, mobile eye camps, participation and interaction with social workers for screening rural patients.

OASN ZC241 Introduction to General Medicine & Surgery 4

Introduction to the various systemic disease / disorders and the management / prevention and health education and medical & surgical treatment of ENT, pulmonary disorders, cardiovascular disease & peripheral vascular diseases, disorders of blood, endocrine problems, liver & adjacent structure, digestive system, urinary system, reproductive system, disorders of the brain & neurological disorders, musculoskeletal injuries, dermatological systems.

OASN ZC242 Public Relations 1

Definition - Universe, Phrases, Benefits; Methods - Press relation, Printed word, spoken word, Radio and other Audio media, Film & TV, Research; In action - Employee public, Customer public, Government public, Community public; Specialized - Welfare agencies, Health agencies, Hospitals.

OASN ZC251 Pediatric Health Care 3

Physiological and psychological fundamentals of child development and disorders, infant feeding, major paediatric illnesses, management of paediatric emergencies.

OASN ZC252 Geriatric Health Care 3

Physiological and psychological fundamentals of aging process and disorders, major geriatric ailments and management of geriatric emergencies.

OASN ZC311 Principles of Emergency Patient Care 4

Definition of emergency; use of sedation and local, region and general anaesthesia in the emergency of pain; various routes of intravenous access in emergency patients; basic life support techniques, provision of emergency care, legal aspects of emergency care, emergency care for burns, introduction to emergency drugs including its importance, maintenance and handling.

OASN ZC312 Ophthalmic Operation Theatre Management 5

Introduction, infection control practice for operation theatre personnel, basic aseptic techniques, pre-operative preparation of the patient in OT, positioning of the patient, principles of draping, face mask, surgical scrub, gowning, gloving, instrument set up, handling of sterile items in OT, collection of sterile specimens and eye dressing.

OASN ZC321 Inservice Training –III 6

Theory and practice of Ophthalmic Assistant pertaining to patient care in terms of types of patient's admission for the ocular problems like: (Elective type of admission, emergency type of admission, short stay admission ambulatory type of admission), pre-operative and post operative care for the patients according to the types of ophthalmic surgery, discharge of the patient / instructions for the patients; ocular skills in a lab setting such as contact lenses, eyeglasses, eye prosthesis, and eyelash clipping, etc.

OASN ZC322 Ophthalmic Surgical Instrumentation 5

Basic instruments, sterilization of instrument linen, gloves, etc, different types of sterilization techniques, preparation of sterile instrument for various ophthalmic surgery, sutures & needles, assisting the surgeon for ophthalmic surgery.

OASN ZC331 Technical Report Writing 3

Course description is same as given under MEBF ZC241.

OASN ZC332 Ophthalmic Anesthesia 4

Types of anaesthesia used for ocular surgery, purpose and the indications for local and general anaesthesia, methods and purposes of the following types of infiltration anaesthesis. (nerve block, direct subcutaneous infiltration, retrobulbar anaesthesia, peribulbar anaesthesia, discuss the procedure for topical anaesthetic eye drops, side effects and management of patient with local anaesthetics by injection, methods of general anaesthesia, basic common elements of anaesthetic machines. Safety precautions for care and maintenance of anaesthesia equipment, pre anaesthesia assessment of patient preoperatively, common complications and activities for post anesthetic patients following general or local anaesthesia.

OASN ZC341 Introduction to Ophthalmic Out Patient Care 5

Function and responsibility in FFA procedure, ultra sound, photography, patients details regarding the activities of FFA, out patient consultant clinic, various ophthalmic laser treatments, excimer laser, history taking with physician / ophthalmologist / optometrist, vision check, syringing and glass check, applanation tension, ECG, etc.

OASN ZC342 Ophthalmic Surgical Procedures 6

History of Surgery, Role of the surgeon, Importance of team work and anticipating the needs of surgeons; stresses that may arise during operative procedure; Surgical terminology, types of incision and indications for the use of particular incision; Hemorrhage-signs and symptoms of internal and external; classification and management; identification of types of tourniquets-reasons for use and duration of application, dangers of use; Wounds, types, process of healing, treatment and complications; inflammation; wound infections-causes and treatment; incision and drainage of abscesses; importance of personal cleanliness and aseptic techniques; Pre-operative and post-operative care of the surgical patient; Emergency procedures: Endotracheal incubation; Tracheotomy.

OASN ZC411 Internship – I 20

OASN ZC412 Internship – II 20

During the internship programme the students are rotated in various subspecialties like General out-patient department, Community out-patient department, contact lens clinic, low vision aid clinics, vitreo-retinal clinic, glaucoma clinic, uvea clinic, lens clinic, emergency clinic, cornea clinic. The students work up on their own and they are given exposure in their specialties. Six months of their internship is at Sankara Nethralaya and 6 months at the Rural Eye Hospital, St. Thomas Mount, Chennai.

OPLVP ZC111 Introductory Optometry 2

Basic principles of Optometry; Optometric terminology; Vision Screening; Introduction to Optometric instruments; Overview of the history of the profession, Orientation of profession of Optometry, Review of the current modalities of clinical practice.

OPLVP ZC112 General Anatomy 2

Tissues of Body, General Plan of Organ System, Cell structure, and other anatomical aspects of vital organs of body.

OPLVP ZC113 Remedial Mathematics 2

Basic mathematical concepts from algebra, trigonometry and calculus.

OPLVP ZC114 Remedial Biology 2

Living systems and their properties; major biological compounds; basic physiological processes; introduction to genetics; environment and evolution.

OPLVP ZC121 Ocular Anatomy 2

Anatomy & Embryology of Sclera, cornea, Uvea, retina & visual pathway.

OPLVP ZC 122 General Physiology 5

Cell physiology, Blood, Digestion, Excretion, Endocrines, Reproduction circulation, Nervous System & Special Senses.

OPLVP ZC 131 Ocular Physiology 3

Protective Mechanism in the eye, extraocular muscle, physiology, lens metabolism, Refractive Errors, Visual Acuity, color vision.

OPLVP ZC132 Pharmacology 2

Mechanism of drug action, Dose response relationship, Tachyphylaxis, Pharmacokinetics of drug absorption, distribution, biotransformation; Principles of ocular pharmacology, Optometric diagnostic drugs.

OPLVP ZC141 Physical Optics 4

Nature of light, Interference, Diffraction, Polarization, Laser Optics, Spectrum, Scattering, Surface tension, Viscosity, Newton's rings, Grating, Resolving power of a telescope.

OPLVP ZC142 Basic Biochemistry II 3

Hormones and metabolic regulation; Whole body metabolism; Ocular Biochemistry - aspect of eye, viz. tears, cornea, lens, aqueous, vitreous, retina and pigment Rhodopsin; Biochemistry techniques; Clinical Biochemistry.

OPLVP ZC151 Basic Biochemistry I 3

Chemistry and functions of constituents of cells and tissues; Introduction to Carbohydrates; Proteins; Lipids; Enzymes; Vitamins; Minerals.

OPLVP ZC152 Pathology & Microbiology 3

Inflammation & repair, Infection, Neoplasia, Circulatory disturbances, Clinical pathology, Principles of cultivation of bacteria, sterilization and disinfection.

OPLVP ZC161 Functional English & Communication 3

Grammar in usage - Tenses, Prepositions, Phrasal verbs; Communication - Process, Speaking, Listening, Reading, Memory, Self image; Comprehension, Precis writing; Report writing.

OPLVP ZC162 Mathematics II 2

Heuristic approach to manipulations with sets; language of logic; vectors and matrices, elementary applications; simplex method for a linear programming problem; elementary probability and statistical tools for tests of significance; game theory; graphs and networks; applications to behavioral and managerial sciences.

OPLVP ZC171 Mathematics I 2

Limits; sequences and series; continuity and differentiability of real valued functions of a real variable; integration; applications of derivatives and integrals; linear differential equations with constant coefficients; analytical geometry of conics.

OPLVP ZC172 Geometric Optics II 3

Stile Grawford Effect, Ametropia, Correction of Spherical Ametropia, Magnification, Presbyopia, Aphakia Spherometer & lens gauge, Critical Angle; spectrometer, Facimeter Refractive Index of lenses.

OPLVP ZC181 Geometric Optics I 4

Photometry, Refraction through Spherical Surfaces, Aberration, Fiber Optics, Color theory, Lens Power, Prismatic Power, Gull strands, Schematic Eye, Visual Acuity.

OPLVP ZC182 Hospital Procedures 1

Administration, Bioengineering department, Medical Records, Reception, Computer, Appointment scheduling and Accounts, Laboratory, Funds, fluorescein angiography, Medical Photography, Correspondence, Stores.

OPLVP ZC192 Visual Optics I 2

Review of Geometric optics, Optics of ocular structures, Measurement of the optical constants of the eye. Refractive anomalies and their causes, Refractive conditions, Far and near points of accommodation.

OPLVP ZC211 Low Vision Aids 1

Identifying and evaluating a low-vision patient; Refraction; Demonstrating Aids; Low vision care and rehabilitation; Diagnostic procedures in Low Vision Aids, Case management; Optics of Low Vision Aids; Telescopes.

OPLVP ZC212 Dispensing Optics 3

Surfacing & Polishing, Glazing frame manipulations, Facial development and

frame choice. Dispensing, lens, faults inspection, Marking & edging of bifocal lenses.

OPLVP ZC221 Optometric Optics I 3

Form of lenses, Base curves, lens tools & blanks, Cylindrical lenses, Spherocylinders, Ophthalmic prism, Determining lens power, Aberrations in Ophthalmic lenses, Absorptive lenses.

OPLVP ZC222 Optometric Optics II 3

Types of spectacle frames and lenses, Toric surfaces, Vertex distance & power, Decentration of lenses, Bifocal & multifocal lenses, Tinted lenses, Safety & industrial eye protective lenses, spectacle magnifiers, Fresnel prisms.

OPLVP ZC231 Optometric Instruments 3

Simple and compound microscope, Refractive instruments like trial case, retinoscope, Optometers, Ophthalmoscope, Lensometer, Slit lamp, Tonometer, Fundus camera, Keratometer, Orthoptic instruments, Color vision.

OPLVP ZC232 Nutrition 1

Energy, Carbohydrates, Proteins, Fats, Minerals, Vitamins, Miscellaneous associated eye disorders.

OPLVP ZC241 Clinical Examination of Visual Systems 2

History, Visual acuity testing, ocular motility examination, slit lamp examination, IOP, Gonioscopy, Opthalmoscopy, Examination of lachrymal system, orbit, macular function tests, visual field charting.

OPLVP ZC242 Ocular Diseases II 3

Diseases of eye lids, Lacrimal system, Orbit, Sclera, Conjunctiva and Cornea, Uvea, Vitreoretinal disorders, Cataract, Trauma, Blindness, Neuro-opthalmic disorders.

OPLVP ZC251 Clinics I 4

OPLVP ZC252 Contact Lens I 1

History of development, review of corneal physiology and contact lenses besides detailed instruction to preliminary measurements and investigations, fitting of Hard and Soft Lenses in high and low emetropia, children and adults.

OPLVP ZC261 Visual Optics II 3

Correction of apherical ametropia, Axial vs refractive ametropia, Retinoscopy - principles and methods, objective and subjective methods; noncylinder, transposition of lenses, Spherical equivalent, Effective power of spectacle, Ocular refraction vs spectacle refraction, ocular accommodation vs spectacle accommodation, spectacle magnification and relative spectacle magnification, retinal image blur, depth of focus and depth of field.

OPLVP ZC262 Binocular Vision I 1

Spatial Sense, Grade of Binocular Vision, Panum's Space, Development of Binocular Vision.

OPLVP ZC271 Ocular Diseases I 3

Diseases of eyelids, Lacrimal system, Orbit, Sclera, Conjunctiva and cornea, Uvea, Vitreoretinal disorders, Cataract, Trauma, Blindness, Neuro-opthalmic disorders.

OPLVP ZC272 Computer Programming 3

Course description is same as given under MEBF ZC221

OPLVP ZC281 Public Health and Community Optometry 1

Philosophy of public health, Epidemiology, Health care system, Modes of health & vision care, Environmental vision.

OPLVP ZC282 Clinics II 5

OPLVP ZC311 Biostatistics 3

Methods of collection and presentation of statistical data; calculation and interpretation of various measures like mean, median, mode, standard deviation, kurtosis, correlation coefficient; probability distributions; sampling and estimation of parameters; tests of hypothesis; data analysis. Topics covered will aim to relate to the health field; introduction to decision analysis; decision theory; decision models.

OPLVP ZC312 Geriatric Optometry 1

Structural and Physiological changes in eye; Optical and Refractive changes in eye; Aphakia; ocular diseases in old age.

OPLVP ZC321 Systemic Disease 1

Hypertension, Diabetes, Acquired heart disease, Genetics, Thyroid disorders, Connective tissue disease, General medical emergencies, introduction to neurology.

OPLVP ZC322 Pediatric Optometry 1

Examination and Diagnosis in children; Refractive status; Ocular motility examination; Normal appearance; Pathology and Structural anomalies of Orbit, Eyelids, Lacrimal system, Conjunctiva; Compensatory treatment and Remedial therapy for various diseases.

OPLVP ZC331 Epidemiology 3

Introduction to the principles and methods of epidemiology. Epidemiology of some illustrative infectious diseases (of bacterial, rickettsial and viral origins), sexually transmitted diseases, chronic diseases such as cancer, cardiovascular diseases, neurological disorders etc. Use of biostatistics in epidemiology.

OPLVP ZC332 Principles of Lighting 1

Visual tasks, Synthesis of light, Additive and subtractive synthesis of color, light sources, illumination, lighting installation, photometry, Eye care & lighting.

OPLVP ZC341 Clinics & Special Clinics I 8

OPLVP ZC372 Clinics and Special Clinics II 8

Case sheet, History taking, Lensometry, Visual acuity, Tests for phorias and tropias, External examination, Slit lamp examination, Drugs and method of application, Do's and don'ts - pupillary dilatation, Direct ophthalmology, Indirect ophthalmoscopy, Instrumentation, Patients selection, Keratometry reading, Refraction, Fluorescein pattern, Over refraction, Slit lamp examination, Fitting of hard lenses, Rigid gas permeable lenses & soft lenses in refractive errors and in specialized condition.

The students are made to observe the interns initially, then gradually they are encouraged to work up a patient, and perform various examination techniques.

OPLVP ZC342 Medical Psychology 1

Definition, Emotions & feelings, Motivation, Personality, Normality & Abnormality, Impact of eye diseases on the patient, Rehabilitation of the blind.

OPLVP ZC351 Contact Lens II 1

Toric contact Lens, Bifocal contact lens, disposable contact lens, specialty contact lens, contact lens fitting in post operative cases and bandage lenses, contact lens complications and post fitting management.

OPLVP ZC352 Occupational Optometry 2

Occupational health, hygiene, Factories Act, ESI Act, Occupational diseases, Safety, prevention, Visual standards, Problems of special occupational groups.

OPLVP ZC361 Binocular Vision II 1

ARC, Amblyopia, Clinical evaluation of squint, Heterophoriqs & Tropiqs, Nystagmus.

OPLVP ZC362 Law and Optometry 1

Legal environment and techniques, Therapy of linensure, Optometrists in court, Malpractice, Insurance, Negligence, Ethics, Laws governing Practice of medical profession and Para medical profession in India.

OPLVP ZC371 Basic Accountancy 2

Terms, Principles, Journal & Journalizing, Ledger & Ledger posting, Trial balance, Cash book, Sales & Purchases register, Bank reconciliation, Depreciation, Balance sheet, Income and Sales tax.

OPLVP ZC381 Public Relations 1

Definition - Universe, Phrases, Benefits; Methods - Press relation, Printed word, spoken word, Radio and other Audio media, Film & TV, Research; In action - Employee public, Customer public, Government public, Community public; Specialized - Welfare agencies, Health agencies, Hospitals.

OPLVP ZC382 Project **5**

Student are given a project assignment. They visit nearby schools, factories and help in the running of eye camps.

OPLVP ZC411 Internship I **20**

OPLVP ZC412 Internship II **20**

During the internship programme the students are rotated in various subspecialties like General out-patient department, Community out-patient department, contact lens clinic, low vision aid clinics, vitreo-retinal clinic, glaucoma clinic, uvea clinic, lens clinic, emergency clinic, cornea clinic. The students work up on their own and they are given exposure in their specialties.

OPTO ZC111 Functional English and Communication **3**

Grammar in usage - Tenses, Prepositions, Phrasal verbs; Communication - Process, Speaking, Listening, Reading, Memory, Self image; Comprehension, Precis writing; Report writing.

OPTO ZC112 Basic Accountancy **2**

Terms, Principles, Journal & Journalizing, Ledger & Ledger posting, Trial balance, Cash book, Sales & Purchases register, Bank reconciliation, Depreciation, Balance sheet, Income and Sales tax.

OPTO ZC121 Mathematics I **2**

Limits; sequences and series; continuity and differentiability of real valued functions of a real variable; integration; applications of derivatives and integrals; linear differential equations with constant coefficients; analytical geometry of conics.

OPTO ZC122 Public Relations **1**

Definition - Universe, Phrases, Benefits; Methods - Press relation, Printed word, spoken word, Radio and other Audio media, Film & TV, Research; In action - Employee public, Customer public, Government public, Community public; Specialized - Welfare agencies, Health agencies, Hospitals.

OPTO ZC123 Geometric Optics II **3**

Stile Grawford Effect, Ametropia, Correction of Spherical Ametropia, Magnification, Presbyopia, Aphakia Spherometer & lens gauge, Critical Angle; spectrometer, Facimeter Refractive Index of lenses.

OPTO ZC131 Physical Optics **4**

Nature of light, Interference, Diffraction, Polarization, Laser Optics, Spectrum, Scattering, Surface tension, Viscosity, Newton's rings, Grating, Resolving power of a telescope.

OPTO ZC132 Pharmacology **2**

Mechanism of drug action, Dose response relationship, Tachyphylaxis, Pharmacokinetics of drug absorption, distribution, biotransformation; Principles of ocular pharmacology, Optometric diagnostic drugs.

OPTO ZC133 Hospital Procedures **1**

Administration, Bioengineering department, Medical Records, Reception, Computer, Appointment scheduling and Accounts, Laboratory, Funds, fluorescein angiography, Medical Photography, Correspondence, Stores.

OPTO ZC141 Basic Biochemistry I **3**

Chemistry and functions of constituents of cells and tissues; Introduction to Carbohydrates; Proteins; Lipids; Enzymes; Vitamins; Minerals.

OPTO ZC142 Ocular Anatomy **2**

Anatomy & Embryology of Sclera, cornea, Uvea, retina & visual pathway.

OPTO ZC151 General Anatomy **2**

Tissues of Body, General Plan of Organ System, Cell structure, and other anatomical aspects of vital organs of body.

OPTO ZC152 Ocular Physiology **3**

Protective Mechanism in the eye, extraocular muscle, physiology, lens metabolism, Refractive Errors, Visual Acuity, color vision.

OPTO ZC161 General Physiology **5**

Cell physiology, Blood, Digestion, Excretion, Endocrines, Reproduction circulation, Nervous System & Special Senses.

OPTO ZC162 Basic Biochemistry II **3**

Hormones and metabolic regulation; Whole body metabolism; Ocular Biochemistry -

aspect of eye, viz. tears, cornea, lens, aqueous, vitreous, retina and pigment Rhodopsin; Biochemistry techniques; Clinical Biochemistry.

OPTO ZC171 Geometric Optics I 4

Photometry, Refraction through Spherical Surfaces, Aberration, Fiber Optics, Color theory, Lens Power, Prismatic Power, Gull strands, Schematic Eye, Visual Acuity.

OPTO ZC172 Nutrition 1

Energy, Carbohydrates, Proteins, Fats, Minerals, Vitamins, Miscellaneous associated eye disorders.

OPTO ZC181 Remedial Mathematics 2

Basic mathematical concepts from algebra, trigonometry and calculus.

OPTO ZC182 Principles of Lighting 1

Visual tasks, Synthesis of light, Additive and subtractive synthesis of color, light sources, illumination, lighting installation, photometry, Eye care & lighting.

OPTO ZC191 Remedial Biology 2

Living systems and their properties; major biological compounds; basic physiological processes; introduction to genetics; environment and evolution.

OPTO ZC192 Mathematics II 2

Heuristic approach to manipulations with sets; language of logic; vectors and matrices, elementary applications; simplex method for a linear programming problem; elementary probability and statistical tools for tests of significance; game theory; graphs and networks; applications to behavioral and managerial sciences.

OPTO ZC211 Computer Programming 3

Course description is same as given under MEBF ZC221

OPTO ZC212 Medical Psychology 1

Definition, Emotions & feelings, Motivation, Personality, Normality & Abnormality, Impact of eye diseases on the patient, Rehabilitation of the blind.

OPTO ZC221 Optometric Optics I 3

Form of lenses, Base curves, lens tools & blanks, Cylindrical lenses, Spherocylinders, Ophthalmic prism, Determining lens power, Aberrations in Ophthalmic lenses, Absorptive lenses.

OPTO ZC222 Pathology & Microbiology 3

Inflammation & repair, Infection, Neoplasia, Circulatory disturbances, Clinical pathology, Principles of cultivation of bacteria, sterilization and disinfection.

OPTO ZC231 Optometric Instruments 3

Simple and compound microscope, Refractive instruments like trial case, retinoscope, Optometers, Ophthalmoscope, Lensometer, Slit lamp, Tonometer, Fundus camera, Keratometer, Orthoptic instruments, Color vision.

OPTO ZC232 Optometric Optics II 3

Types of spectacle frames and lenses, Toric surfaces, Vertex distance & power, Decentration of lenses, Bifocal & multifocal lenses, Tinted lenses, Safety & industrial eye protective lenses, spectacle magnifiers, Fresnel prisms.

OPTO ZC241 Clinical Examination of Visual Systems 2

History, Visual acuity testing, ocular motility examination, slit lamp examination, IOP, Gonioscopy, Opthalmoscopy, Examination of lachrymal system, orbit, macular function tests, visual field charting.

OPTO ZC242 Ocular Diseases II 3

Diseases of eye lids, Lacrimal system, Orbit, Sclera, Conjunctiva and Cornea, Uvea, Vitreoretinal disorders, Cataract, Trauma, Blindness, Neuro-opthalmic disorders.

OPTO ZC251 Ocular Diseases I 3

Diseases of eyelids, Lacrimal system, Orbit, Sclera, Conjunctiva and cornea, Uvea, Vitreoretinal disorders, Cataract, Trauma, Blindness, Neuro-opthalmic disorders.

OPTO ZC252 Visual Optics II **3**

Correction of apherical ametropia, Axial vs refractive ametropia, Retinoscopy - principles and methods, objective and subjective methods; noncylinder, transposition of lenses, Spherical equivalent, Effective power of spectacle, Ocular refraction vs spectacle refraction, ocular accommodation vs spectacle accommodation, spectacle magnification and relative spectacle magnification, retinal image blur, depth of focus and depth of field.

OPTO ZC261 Visual Optics I **2**

Review of Geometric optics, Optics of ocular structures, Measurement of the optical constants of the eye. Refractive anomalies and their causes, Refractive conditions, Far and near points of accommodation.

OPTO ZC272 Clinics II **5**

OPTO ZC281 Clinics I **4**

OPTO ZC282 Dispensing Optics **3**

Surfacing & Polishing, Glazing frame manipulations, Facial development and frame choice. Dispensing, lens, faults inspection, Marking & edging of bifocal lenses.

OPTO ZC311 Binocular Vision I **1**

Spatial Sense, Grade of Binocular Vision, Panum's Space, Development of Binocular Vision.

OPTO ZC312 Binocular Vision II **1**

ARC, Amblyopia, Clinical evaluation of squint, Heterophoriqs & Tropiqs, Nystagmus.

OPTO ZC322 Law & Optometry **1**

Legal environment and techniques, Therapy of linensure, Optometrists in court, Malpractice, Insurance, Negligence, Ethics, Laws governing Practice of medical profession and Para medical profession in India.

OPTO ZC323 Contact Lens I **1**

History of development, review of corneal physiology and contact lenses besides detailed instruction to preliminary measurements and investigations, fitting of Hard and Soft Lenses in high and low emetropia, children and adults.

OPTO ZC324 Contact Lens II **1**

Toric contact Lens, Bifocal contact lens, disposable contact lens, specialty contact lens, contact lens fitting in post operative cases and bandage lenses, contact lens complications and post fitting management.

OPTO ZC331 Systemic Disease **1**

Hypertension, Diabetes, Acquired heart disease, Genetics, Thyroid disorders, Connective tissue disease, General medical emergencies, introduction to neurology.

OPTO ZC332 Public Health & Community Optometry **1**

Philosophy of public health, Epidemiology, Health care system, Modes of health & vision care, Environmental vision.

OPTO ZC341 Glaucoma **1**

Aqueous humor dynamics, IOP & Tonometry, Evaluation of Optic nerve head, Visual fields, Open angle glaucoma, Angle closure glaucoma, Secondary glaucoma, Principles of medical therapy.

OPTO ZC342 Paediatric Optometry **1**

Examination and Diagnosis in children; Refractive status; Ocular motility examination; Normal appearance; Pathology and Structural anomalies of Orbit, Eyelids, Lacrimal system, Conjunctiva; Compensatory treatment and Remedial therapy for various diseases.

OPTO ZC352 Occupational Optometry **2**

Occupational health, hygiene, Factories Act, ESI Act, Occupational diseases, Safety, prevention, Visual standards, Problems of special occupational groups.

OPTO ZC371 Clinics & Special Clinics I **8**

OPTO ZC372 Clinics & Special Clinics II **8**

Case sheet, History taking, Lensometry, Visual acuity, Tests for phorias and tropias, External examination, Slit lamp examination, Drugs and method of application, Do's and don'ts - pupillary dilatation, Direct ophthalmology,

Indirect ophthalmoscopy, Instrumentation, Patients selection, Keratometry reading, Refraction, Fluorescein pattern, Over refraction, Slit lamp examination, Fitting of hard lenses, Rigid gas permeable lenses & soft lenses in refractive errors and in specialized condition.

The students are made to observe the interns initially, then gradually they are encouraged to work up a patient, and perform various examination techniques.

OPTO ZC381 Low Vision Aids 1

Identifying and evaluating a low-vision patient; Refraction; Demonstrating Aids; Low vision care and rehabilitation; Diagnostic procedures in Low Vision Aids, Case management; Optics of Low Vision Aids; Telescopes.

OPTO ZC382 Geriatric Optometry 1

Structural and Physiological changes in eye; Optical and Refractive changes in eye; Aphakia; ocular diseases in old age.

OPTO ZC411 Internship I 20

OPTO ZC412 Internship II 20

During the internship programme the students are rotated in various subspecialties like General out-patient department, Community out-patient department, contact lens clinic, low vision aid clinics, vitreo-retinal clinic, glaucoma clinic, uvea clinic, lens clinic, emergency clinic, cornea clinic. The students work up on their own and they are given exposure in their specialties. Six months of their internship is at Sankara Nethralaya and 6 months at the Rural Eye Hospital, St. Thomas Mount, Chennai.

OPTO ZC421 Epidemiology 3

Introduction to the principles and methods of epidemiology. Epidemiology of some illustrative infectious diseases (of bacterial, rickettsial and viral origins), sexually transmitted diseases, chronic diseases such as cancer, cardiovascular diseases, neurological disorders etc. Use of biostatistics in epidemiology.

OPTO ZC422 Project 5

Student are given a project assignment. They visit nearby schools, factories and help in the running of eye camps.

OPTO ZC431 Biostatistics 3

Methods of collection and presentation of statistical data; calculation and interpretation of various measures like mean, median, mode, standard deviation, kurtosis, correlation coefficient; probability distributions; sampling and estimation of parameters; tests of hypothesis; data analysis. Topics covered will aim to relate to the health field; introduction to decision analysis; decision theory; decision models.

OPTO ZG511 Special Clinics I 4

OPTO ZG512 Special Clinics II 4

OPTO ZG513 Special Clinics III 4

Course description for the above courses to be developed.

OPTO ZG611 Advanced Contact Lens II 4

Appearance of Contact Lenses: Pre and Post cleaning; Calculation of DK/L, EOP and oedema; Measurements of corneal swelling with the Phachometer; Measurement of the Oxygen needs of the eye or needs and contact lens transmissibility; The effect of materials and deposits of DK/L; Identification of Lens deposits; The effect of hypoxia on corneal structure; Soft wearing schedules DW Vs EW; Bifocal Contact Lens fitting and assessment; Toric SCL Lenses; Toric RGP Lenses; Advancements in Contact Lens instrumentation and techniques; Visual recognition of conditions and problem solving; Fitting consideration for sports vision; Corneal prosthesis; Special applications of Contact Lens in Research and Industry; Future trends in industry, R & D and marketing for Contact Lenses and associated product: Vision correction by refractive surgery, Ortho keratology etc; Advanced study of Contact Lens research methods and analysis of Contact Lens literature and data basis.

OPTO ZG612 Advanced Contact Lens I 4

Current concepts in anatomy and Physiology of the cornea and tear film, Microbiology and Immunology in relation to Contact Lens wear; Vision and Optics with Contact Lenses; Corneal Topography measurement; use of Slit Lamp in Contact Lens Practice; Correlation of illumination with conditioning observed Pharmacology of Contact Lens solutions; Review of Contact Lens solution contents; The effects of wear on Contact Lenses; Contact Lens wear in dry eye; Soft Contact Lens EW complications: Causes and management; Rigid vs permeable, EW complications: Clinical management; Keratoconus; Overview and contact lens fitting; Contact lens for children; Contact Lenses for aphakics; Contact Lenses for Pseudo Aphakics; Contact Lenses in post refractive surgery/PRK; Lens choice for astigmatism; Soft Contact Lens Design; R.G.P. Lens modification; Contact Lenses and Driving; Bandage Lenses-Assessment of deposits/micro organisms.

OPTO ZC613 Ophthalmic Photography 3

External photography of the eye: Macro photography, slit lamp mydriatic and non mydriatic fundus cameras, slit lamp photography of cornea and lens including high magnification techniques, Photograph of the angle of anterior chamber, Fundus photography by conventional and infrared imaging systems: Fluoresce in photography, Methods of image enhancement, Preparing slides for projection. Advances in video imaging would also be taught.

OPTO ZG623 Research Methodology I 3

Methods of collecting and presentation of statistical data, Calculation and interpretation of various measures like mean, mode, median, mode standard deviations, Probability distribution, Correlation and regression, Significance tests and confidence intervals, Tests for equality of proportion, Tests for the equality of means, Measures of association, Prevalence incidence, rates, ratios, proportions, Questionnaires etc.

OPTO ZG629T Dissertation 20

Course description is same as given under BITS ZG629T

OPTO ZG631 Advanced Glaucoma I 4

OPTIC DISC: Ophthalmoscopic techniques for evaluation of the optic nerve head and optic disc drawings; Optic disc photography; Flicker analysis; Plaimetry; Sterophotogrammetry; Image analyzers, Retinal nerve fiber layer evaluation.

OPTO ZG642 Computers & Information Systems 3

Introduction to MS-Windows; Introduction to MIS, SSADM; Word-processing using MS-Word; Database management and programming using MS-Foxpro; SpreadSheet using MS-Excel; Presentation Graphics using MS-PowerPoint.

OPTO ZG644 Recent Advances in Optometry 4

Course description to be developed

OPTO ZG659 Technical Communication 4

Course description is same as given under BITS ZG659

OPTO ZG663 Research Methodology II 3

Epidemiological basis of disease, Planning a research project, sensitivity, specificity, predictive values, Bias and randomization, Retrospective and prospective studies, Clinical trials, Screening Studies and measures of agreement, Case control studies, Sampling methodology, Data analysis.

OPTO ZG673 Clinical Optometry I 4

The Course in Clinical Optometry consists of the Study of diseases affecting the lids and adnexa including the orbit, ocular motility, refractive errors, Diseases affecting the cornea, sclera.

OPTO ZG 681 Medical Records 4

Introduction to medical records: History, Need for medical record; Content of medical records: Content, Special records, Formats; Forms design and control; Filing methods, storage and retention; Nomenclatures and classification systems; Indexes and registers; Legal aspects of medical records; quality

assurance; Recent advances in medical records system.

OPTO ZG682 Advanced Glaucoma II 4

Visual fields: Interpretation without statistical analysis; Interpretation with statistical analysis. Newer programmes; Psychophysical changes in glaucoma; Psychophysiological and electrophy-siological testing of vision in glaucoma; Ultra-sound biomicroscopy: Early diagnosis of glaucoma.

OPTO ZG683 Clinical Optometry II 4

Diseases affecting uveal tract, retina, vitreous, lens, optic nerve, cranial nerves connected with vision and visual apparatus. It will also involve the study of ocular manifestations of systemic diseases.

PAT ZC121 Mathematics I 3
PATFL ZC121 Mathematics I 3

Limits; sequences and series; continuity and differentiability of real valued functions of a real variable; integration; applications of derivatives and integrals; linear differential equations with constant coefficients; analytical geometry of conics.

PAT ZC122 Mathematics II 3
PATFL ZC122 Mathematics II 3

Heuristic approach to manipulations with sets; language of logic; vectors and matrices, elementary applications; simplex method for a linear programming problem; elementary probability and statistical tools for tests of significance; game theory; graphs and networks; applications to behavioral and managerial sciences.

PAT ZC131 Introduction to Computers 3
PATFL ZC131 Introduction to Computers 3

How the PC works. The anatomy of a PC: Elementary DOS usage; Exercises on keyboard familiarity and DOS; Applications of PC like word-processing, spreadsheeting desk, personal information management etc.

PAT ZC132 Scientific Measurements I 3
PATFL ZC132 Scientific Measurements I 3

Measurement in the fields of biology, chemistry and physics. Emphasis in this course shall be on the operation and use of modern laboratory instruments.

PAT ZC141 Biological Chemistry 3
PATFL ZC141 Biological Chemistry 3

Chemistry and functions of constituents of cells and tissues; introduction to enzymes; metabolism of carbohydrates, lipids, aminoacids; nucleic acids and protein synthesis; vitamins and hormones.

PAT ZC142 Nutrition and Dietetics 4
PATFL ZC142 Nutrition and Dietetics 4

Emergence, Scope and Methodology of nutrition as a science; Energy metabolism, Food energy (carbohydrates, fat, protein) and individual nutrients (vitamins and minerals) with special reference to distribution in the body and biochemical role, amount in ordinary foods, digestion, absorption, transport, storage, utilization and disposal, requirements and recommended allowances and their modification under stress conditions, effects of deficiency, incidence, etiology and prevention of deficiency disease, inter-relations with other nutrients; Assessment of nutrients; Assessment of nutritional status of the individual and the community; Formulation of balanced diets, Common nutritional disorders, nutritional adaptation; Nutrition and infection; Principles of dietetics, Diet adaptation; Nutrition and infection; Principles of dietetics, Dietary management of Diseases, Practicals: BSA, BMR measurements and calculations, anthropometric measurements, taking dietary history and nutrient calculations, etc.

PAT ZC151 General Anatomy 3
PATFL ZC151 General Anatomy 3

Tissues of Body, General Plan of Organ system, cell structure and other anatomical aspects of vital organs of body. Practicals: Autopsy and dissection classes, Computer software, models and charts, etc.

PAT ZC152 Clinical Biochemistry 5
PATFL ZC152 Clinical Biochemistry 5

Role of biochemistry in diagnosis of diseases, clinical manifestations in carbohydrates lipids and protein metabolism including inborn

errors of metabolism and their evaluation. Disorders of kidney and liver and their diagnostic test; blood coagulation disorders and their estimation; clinical enzymology; disorders of ions Ca+and P+metabolism and their diagnosis. Endocrine disorders and diagnosis neurotransmitters, Radioactive isotopes in diagnosis. Practicals: Specimen collection, Clinical haematology, Blood coagulation tests, Biochemical tests, Renal function tests, Estimation of myocardial enzymes, Liver function tests, Urine analysis, Serological screening for HIV, Hepatitis, Syphilis, etc.

PAT ZC161 General Physiology 3
PATFL ZC161 General Physiology 3

Cell physiology, Blood, Digestion, Excretion, Endocrines, Reproduction, circulation, Nervous System & Special Senses. Practicals; Autopsy and dissection classes, Computer software, models and charts, etc.

PAT ZC162 Paediatrics and Geriatrics 2
PATFL ZC162 Paediatrics and Geriatrics 2

Physiological and psychological fundamentals of child development and disorders, infant feeding major paediatric illnesses, management of paediatric emergencies. Physiological and psychological fundamentals of aging process and disorders, major geriatric ailments and management.

PAT ZC171 Cell Biology 3
PATFL ZC171 Cell Biology 3

Fundamental processes of life at cellular and subcellular levels, cell environments, membrane transport, cell movements, division and control mechanisms. Cell differentiation, cell signaling, cell-cell communication. Theory of heredity; sex-linked inheritance; chromosome; chromosome aberrations and disorders. Cell biology practicals; Microscopy, microtome/chromosome aberrations and disorders. Cell biology practicals; Microscopy, microtome/ cryostat. Haematology, Buccal epithelium & Barr bodies, Blood groupings and Rhesus factor, Simple Mendelian Traits and Karyotyping.

PATFL ZC181 Remedial Mathematics 2

Basic mathematical concepts from algebra, trigonometry and calculus.

PATFL ZC191 Remedial Biology 2

Living systems and their properties; major biological compounds; basic physiological processes; introduction to genetics; environment and evolution.

PAT ZC212 Introduction to Surgery 2
PATFL ZC212 Introduction to Surgery 2

History of Surgery, Role of the surgeon, Importance of team work and anticipating the needs of surgeons; stresses that may arise during operative procedure; Surgical terminology, types of incision and indications for the use of particular incision; Hemorrhage-signs and symptoms of internal and external; classification and management; identification of types of tourniquets-reasons for use and duration of application, dangers of use; Wounds, types, process of healing, treatment and complications; inflammation; wound infections-causes and treatment; incision and drainage of abscesses; importance of personal cleanliness and aseptic techniques; Pre-operative and post-operative care of the surgical patient; Emergency procedures: Endotracheal incubation; Tracheotomy.

PAT ZC222 Introduction to Medicine 3
PATFL ZC222 Introduction to Medicine 3

Disease of respiratory system : Tuberculosis; Pneumonia; Allergic disease; Tumors of the lung; Disease of Liver and Gall Bladder Jaundice; Hepatitis; Hepatic Coma; Cirrhosis of Liver; Hemochromatosis; Cholelithiasis; Cholecystitis; Disease of Excretory

System : Acute and Chronic nephritis; Nephrotic Syndrome; Acute and chronic renal failure; Renal calculi; Hemodialysis; Peritoneal Dialysis; Renal Trans plants; Disease of Alimentary System; Peptic ulcer; Cancer stomach; Malabsorption syndrome and inflammatory bowel disorder; Tumors of large

and small intestine; Disease of Musculo Skeletal System: Arthritis and allied Rheumatic disorder; Bone Diseases; Disease of endocrine system : Thyroid Disorder : Hyperthyroidism; Hypothyroidism; Thyroid tumor; Parathyroid: Hyperparathyroidism; Pheochromacytoma; Metabolic Disease : diabetes Mellitus; Disease of Central Nervous System : Epilepsy ; Cerebrovascular Disease; Infection; Disease of Extrapyramidal system; Infectious Disease : Bacterial, Rickettsial, Chlamydial Disease; Gram positive, Gram negative; Syphilis; Typhoid; Viral Diseases : measles; Rubella; Rabies; Chicken pox; AIDS; Protozoal Disease : Amoebiasis; Malaria; Helminthes : Filaria; Round worm; Hook worm.

PAT ZC231 Microbiology 3
PATFL ZC231 Microbiology 3

Microbes in our environment; Microbes on & in our body; Microscope; Morphology of bacteria; Cultivation of bacteria and growth requirements; Mode, Source & Spread of infections; Destruction of Microbes - I: Antiseptics & Disinfections; Destruction of Microbes - II: Sterilization; Destruction of infecting Agent: Antibiotics & Chemotherapy; Immunology; Microbes causing infection in man : Collection, Transport & Preservation of specimens; Microbes causing bacteremia & septicemia in man - Blood culture technique ; Urinary tract infections (UTI); Respiratory tract infections-upper respiratory infections (URI); Lower respiratory tract infections (LRI); Pyogenic infections; Infections of CNC & Body cavities; G.I. Infections; Serological diagnosis of microbial diseases; Antibiotic assay in serum; Fungal infections; Viral infections; Parasitic infections; Surveillance in prevention & control of hospital associated infections (HAI) : Bacteriological analysis of water; Sterility tests for I.V. Fluids; "In-use" testing of disinfectant.

PAT ZC251 Principles of Management 3
PATFL ZC251 Principles of Management 3

Fundamental concepts of management - planning; organizing; staffing; directing and controlling; production, financial, personnel, legal and marketing functions; accounting and budgeting, balance sheets..

PAT ZC261 Technical Report Writing 3
PATFL ZC261 Technical Report Writing 3

Course description is same as given under MEBF ZC241

PAT ZC262 Introduction to Psychology 3
PATFL ZC262 Introduction to Psychology 3

The development of Psychology as a science - individual and the environment; nature, kinds and determinants of perceptions, response mechanism and kinds of responses, motivations, modifications of behavior through learning, memory and transfer of training, thought processes, problem solving and creative thinking; nature and characteristics of psychological tests; nature and evaluation techniques of intelligence and personality.

PAT ZC282 Molecular Genetics 3

PATFL ZC282 Molecular Genetics 3

Genetic foundations; Genetic counseling; Transformation, transduction and conjugation; Recombination and complementation; genetic mapping and linkage analysis; Genome organization; Genome maintenance; Gene regulation in Prokaryotis and Eukaryotics. Cloning techniques in E.coli and Eukaryotic cells; Restriction maps; Nucleic acid blotting and hybridization.

PAT ZC311 Cardiology & Cardiac Surgery 4
PATFL ZC311 Cardiology & Cardiac Surgery 4

Cardiology; the Structural Basis of Cardiovascular Diseases. Embryology of Heart; The Chambers of the Heart; The Heart Valves; Surface Marking of Cardiovascular System; The Great Vessels; Blood supply of the Heart. The functional Basis of Cardiovascular Diseases, Cardiac Cycle; Heart Sounds; The Circulation of Blood; Cardiovascular responses to Exercise; Heart failure and Compensatory Mechanism. The Cellular basis of Cardiovascular Function in Health & Diseases, Heart Cell; Contraction and Relaxation; Excitation; Coronary Perfusion.

The Effects of Cardiovascular Diseases. Angina; Dyspnoea; Fatigue; Pedal edema; palpitation; Clubbing-Cyanosis - Pulse; Blood Pressure. the Diagnostic Tools. ECG; Chest X-ray; ECHO cardiography; Cardiac Catheterization & Coronary Angiography; Blood Analysis. Congenital heart Disease. Development of Heart & Great Vessels; Cyanotic Heart Diseases; Acyanotic Heart Diseases. The Blood Pressure. Control of Blood Pressure; Hypertension - a. Essential Hypertension; b. Malignant Hypertension; Arterial Disease; Structure; Atherosclerosis; Risk Factors; Burger's Disease; Raynaud's Phenomenon Arteries. Thrombosis. Bleeding; Haemostasis; Fibrinolysis; Thrombosis Formation and Structure; Venous & Arterial Thrombosis; Modifying Mechanism. Ischaemic Heart Disease (Ischaemia & Infarct) Angina; Physical Signs; Investigations; management; Infractive Endocarditis; Cause; Pathology; Features; Investigations; Management; Rheumatic Heart Disease; Clinical manifestations; Jone's Criteria; prevention; Physiological & Pathological changes; Practical Management of Cardiovascular Problems; Arrhythmias; Conduction Block; Hypovolemia and Hypervolemia; Heart failure; Hypotension and Hyperactive Care; Preparing a patient mentally & physically; Investigations and plan; Post operative Management; Rehabilitation Programme. Prevention of Heart Diseases; Habits; Food; cardiac surgery; Cardiac patient; Evaluation of cardiac status; The Risk factors; Congenital heart Disease; Cyanotic Heart Disease; Acyanotic Heart Disease; Acquired Heart Disease; Infective; Non infective; Pre-operative Care; The Cardiac Surgery; A. Cardiopulmonary Bypass : Adults, Paediatrics B. Various Closed and Open Heart Operations. Closed Heart Operations a. PDA ligation b. Closed Mitral Valvotomy c. Block trussing Shunt d. Pulmonary Artery Banding e. Pericardiectomy f. Pericardial Window g. Coarctation of Aorta h. Other Shunt operations. Open Heart Operations. Congenital a. Atrial Septal Defect Closure b. Ventricular Septal Defect Closure c. Tetralogy of Fallot Correction d. Surgery for Valvular Disease e. Surgery for Transpositions f. Surgery for Total Anomalies of Pulmonary Venous Connection g. Surgery for Truncus Arteriosus h. Surgery for Pulmonary Atresia i. Other Corrective Surgery, Acquired a. Mitral Valve replacement b. Valvuloplasty c. Aortic Valve replacement d. Tricuspid valve repair e. Coronary surgeries. Postoperative care; postoperative complications; Immediate, Late; Rehabilitation; The follow up of postoperative patient.

PAT ZC312 Advances in Cardiology 2
PATFL ZC312 Advances in Cardiology 2

The advanced topics will be discussed in detail with the help of latest journals and reviews. The latest investigation procedures and treatments will be discussed in the course.

PAT ZC322 Advances in Cardiac Surgery 2
PATFL ZC322 Advances in Cardiac Surgery 2

The advanced topics will be discussed in detail with the help of latest journals and reviews. The latest investigation procedures and cardiac surgical treatment will be discussed in the course.

PAT ZC332 Principles of Emergency Medicine 1
PATFL ZC332 Principles of Emergency Medicine 1

Definition of emergency; use of sedation and local, regional and general anaesthesia in the emergency of pain; various routes of intravenous access in emergency patients; Metabolic emergencies related to diabetes mellitus, hypoglycemia, adrenal, thyroid, kidney, liver and hypertensive crisis; different types of allergic reactions from local to systemic and the treatment for the same.

PAT ZC341 Cardiac Nursing 2
PATFL ZC341 Cardiac Nursing 2

Nursing aspects of Angina; Dyspnoea; Cyanosis Administration of oxygen & its methods; Blood pressure; Nursing aspect of cardiac catheterization & coronary angiography blood analysis; Nursing aspects of cyanotic and acyanotic heart disease; Nursing considerations in atherosclerosis;

Nursing considerations in angina; Nursing management in infective endocarditis; Nursing management in cardiac arrest; Nursing considerations in pre-operative & post-operative care; Cardiac surgery-Nursing assessment of cardiac patients; Nursing considerations in congenital heart disease & acquired heart disease; Pre-operative Nursing considerations; Nursing considerations after cardiac surgery; Introduction to pharmacology; Nursing responsibilities while administering medications, the dose, side effects & adverse reactions; Introduction to anaesthesia; Nursing considerations in using anaesthesia in ICUs; Nursing considerations in oxygen administration; Nursing considerations in Haemodynamic monitoring cardiac output determination & ABG Analysis; Nursing aspects in CPR; Nursing aspects in artificial Ventilation (i) Adult, (ii) paediatrics; Nursing aspects in fluid & electrolyte balance; Rehabilitation; Physiotherapy in Cardiac patient pre & post operative.

PAT ZC342 Medical Instrumentation 2
PATFL ZC342 Medical Instrumentation 2

Basic components of bio-medical instruments, bioelectric signals & recording electrodes, transducers, recording and display devices. Patient care and monitoring systems, cardiovascular measurements, blood pressure, blood flow, cardiac output, heart sounds etc.; instrumentation for respiratory and nervous systems, analysis of EEG, ECG, EMG, and action potentials, non-invasive diagnostic measurement temperature, ultrasonic diagnosis, CAT scan techniques, sensory measurements - monitor response, analysis of behavior etc. biotelemetry, biofeedback, clinical laboratory instruments; X-ray diagnosis, recent advances in biomedical instrumentation - microprocessor based systems, lasers & optical fiber based systems.

PAT ZC381 Anaesthesiology 1
PATFL ZC381 Anaesthesiology 1

Pharmacology of drugs used in Anaesthesia and intensive care; Oxygen delivery systems and its applications; Haemodynamic Monitoring; Cardiac output determination and its prognostic significance; Principles of Arterial Blood Gas Analysis; Cardiac Pulmonary Resuscitation; Basic Life Support Systems - BCLS; Active Life Support systems - ACLS; Principles of Artificial Ventilation I; Principles of Artificial Ventilation II; Intra Aortic Balloon Pump & Cardiac Assist Devices; Paediatric Ventilatory Management & Critical Care; Fluid & Electrolyte Balance Principles; Principles of Cardio Pulmonary Bypass & Management.

PAT ZC382 Data Processing 3
PATFL ZC382 Data Processing 3

Introduction to data processing; files and file structures; indexing techniques; sorting, searching and merging techniques; introduction to database management systems; design of information systems; emerging trends in data processing.

PAT ZC411 Inservice Training I 10
PATFL ZC411 Inservice Training I 10

Rotational Inservice Training I in OPD (out patient department), Biochemistry lab. Pathology lab, CCU (Coronary care unit), Cath lab, Anesthesia, perfusion, OT (Operation theatre), ICU (Intensive care unit), General ward, Rehabilitation.

PAT ZC412 Inservice Training II 10
PATFL ZC412 Inservice Training II 10

Rotational Inservice Training II in OPD (Out patient department), Biochemistry lab, Pathology lab, CCU (Coronary care unit), Cath lab, Anesthesia, perfusion, OT (Operation theatre), ICU (Intensive care unit), General ward, Rehabilitation.

PAT ZC421 Inservice Training III 10
PATFL ZC421 Inservice Training III 10

The student will be trained in one specific inservice department from the list of departments for the Inservice Training - I (PAT ZC411) & Inservice Training - II (PAT ZC412).

PAT ZC422 Inservice Training IV 10
PATFL ZC422 Inservice Training IV 10

It is a continuation of Inservice Training - III (PAT ZC421).

PAT ZC423 Pharmacology & Toxicity 3
PATFL ZC423 Pharmacology & Toxicity 3

Pharmacology of important classes of drugs including their mechanism of action, therapeutic uses, side effects, toxic manifestations, indications and contra-indications.

PAT ZC431 Biostatistics 3
PATFL ZC431 Biostatistics 3

Course description is same as given under OPLVP ZC311

PAT ZC442 Internship I 20
PATFL ZC442 Internship I 20

During Internship I, the students work as full-time assistants to the regular hospital staff. They are given exposure in specialty areas and opportunity to undertake projects or studies of a practical nature by which they develop their clinical skills.

Students are evaluated on a continuous basis. They have also to submit a project report and take a comprehensive examination.

PAT ZC443 Internship II 20
PATFL ZC443 Internship II 20

The course is a continuation of the course PAT ZC442. The operational aspects of the course remain the same as in PAT ZC442.

PAT ZC482 Management Information Systems 3
PATFL ZC482 Management Information Systems 3

Course description is same as given under BITS ZC471

PAT ZG521 Immunology 5

Types of immunity and immune responses; Immunoglobulins and their synthesis; antigen-antibody reaction; cellular interaction in immune response; hypersensitivity; monoclonal and polyclonal antibody production; immuno-regulation; immuno-suppression; and immunological disorders.

PAT ZG522 Selected Topics in Cardiac Sciences I 5

Non-invasive techniques in the diagnosis of heart diseases; pharmacology of drugs used in the treatment of heart diseases; pathological organisms involved in heart diseases; biochemical aberrations in diseased heart tissues; function of coronary circulation in physiological and pathologic states; cerebral pathophysiologic considerations in patients with coexisting carotid and coronary heart disease; pathogenesis and treatment of atherosclerosis.

PAT ZG531 Hospital Operations Management 3

Operation Management aspects connected with outpatient ward, casualty, operation theatres, diagnostic laboratories, pathology laboratories, pharmacy, diet and nutrition, blood bank, laundry, medical records, security, scheduling and deployment of doctors, nurses and other staff, accounts among others. The course will involve on site visits in a hospital, discussions and presentations on the practical aspects of hospital operations management.

PAT ZG532 Critical Care Medicine and Trauma 2

Principles of life support techniques, Initial management of acute medical and traumatic conditions in hospital and pre-hospital situations.

PAT ZG541 Introduction to Health Systems & Environmental Health 4

Introduction to health systems; functions of health systems; managing health systems; problems of health systems management; Major environmental health problems including quality of water, waste disposal food production and processing, vector control etc. Air pollution and its controlling. Hazards of radiation, municipal and other wastes. Occupational health hazards.

PAT ZG542 Biostatistics & Decision Analysis 4

Methods of collection and presentation of statistical data; calculation and interpretation of various measures like mean, median, mode, standard deviation, kurtosis, correlation coefficient; probability distributions; sampling and estimation of parameters; tests of hypothesis; data analysis. Topics covered will aim to relate to the health field; introduction to decision analysis; decision theory; decision models.

PAT ZG551 Clinical Pathology 2

Cell injury and adaptation, disorders of the various systems, acute and chronic inflammation, repair: cell growth, regeneration and wound healing, Neoplasia and response to infection. Oncogenes, Chemical Carcinogenesis

PAT ZG552 Reproductive Medicine 3

Anatomy and physiology of human reproductive system, Gametogenesis, Fertilization, cleavage, fatemap, Cell differentiation and differential gene activity, Molecular event in embryogenesis and organogenesis, totipotency and nucleus transfer techniques, contraception and contraindications, various methods of terminating pregnancy, treatments to common gynecological problems, physiologic changes in pregnancy with nutrition, prenatal care, medical complications and surgical complication of pregnancy, labor and delivery.

PAT ZG629T Dissertation 20

Course description is same as given under BITS ZG629T

PAT ZG661 Selected Topics in Cardiac Sciences II 5

Precutaneous transluminal coronary angioplasty; preoperative assessment of patients with heart diseases; cardiovascular grafts and synthetic materials; new concepts in cardiopulmonary bypass; cardiac transplantation; immunosuppression for cardiac transplantation; myocardial protection in cardiac surgery; warm heart surgery; renal failure after cardiac surgery.

PAT ZG671 Advances in Practice of Physician Assistantship 4

The course examines pathophysiologic mechanisms related to cardiothoracic trauma and disoption of fluid electrolyte in cardiovascular and pulmonary systems. Strategies for various intervenion are examined within a context of scientific and technological advancement in health care facilities. The course will be conducted mainly through seminars & discussions on topics from the latest cardiovascular & physician assistant journals and related publications.

PAT ZG681 Membrane and Liposome Technology 4

Membrane structure and biogenesis: techniques for the study of membrane structure and properties; model of membranes; molecular transport mechanisms; techniques of artificial membrane productions; liposomes - structure and characteristics; carrier mechanisms for targeting therapeutic agents; industrial applications of liposomes.

PAT ZG691 Molecular Medicine 3

Cell lines, cell clones, callus culture, somaclonal variations somatic embryogenesis, protoplast fusion and somatic hybridization, Hybridoma technology, genetransfer methods, transgenic technique, Regulation of gene expression, Inhibition and mutation correction, Genomic libraries, antisense nucleic acids and proteins. Gene therapy, PCR measurement of DNA products, measurement of DNA and protein interactions.

PCML ZC111 Mathematics- I 3

PCRL ZC111 Mathematics- I 3

Sets; theory and coordinate systems, rate, exponential function and integration; growth rates; derivatives; maxima, minima and other applications, anti-derivation; definite integrals; logarithmic functions, approximations; descriptive statistics, standard distributions;

sampling techniques; estimation; correlation and regression.

PCML ZC112 Mathematics – II 3
PCRL ZC112 Mathematics – II 3

Heuristic approach to manipulations with sets; language of logic; vectors and matrices, elementary applications; simplex method for a linear programming problem; elementary probability and statistical tools for tests of significance; game theory; graphs and networks; applications to behavioral and managerial sciences.

PCML ZC121 Organic Chemistry 3
PCRL ZC121 Organic Chemistry 3

Electrophilic and nucleophilic aromatic substitution; nucleophilic additions to carbonyl compounds, aldol and related condensations; amines, malonic ester and acetoacetic ester synthesis; carbohydrates; orbital symmetry and chemical reactions; hetrocyclic compounds.

PCML ZC122 Physical Chemistry 3
PCRL ZC122 Physical Chemistry 3

Chemical thermodynamics, phase equilibria, chemical equilibrium, chemical kinetics and mechanism of various types of reactions, effects of temperature on reaction rates, energy activation, structure and cohesion, molecular spectroscopy, etc.

PCML ZC131 Principles of Management 3
PCRL ZC131 Principles of Management 3

Fundamental concepts of management - planning; organizing; staffing; directing and controlling; production, financial, personnel, legal and marketing functions; accounting and budgeting, balance sheets.

PCML ZC132 Computer Programming 3
PCRL ZC132 Computer Programming 3

Course description is same as given under MEBF ZC221

PCML ZC141 Inorganic Chemistry 3
PCRL ZC141 Inorganic Chemistry 3

Group theory, Inorganic Chemistry in biological systems; chemistry of selected main group elements; coordination chemistry-crystal field, ligand field and molecular orbital theories, chemistry of transitional metals; organometallic compounds; lanthanides and actinides.

PCML ZC142 Measurement Techniques 3
PCRL ZC142 Measurement Techniques 3

Laboratory Techniques pertaining to measurement of parameters such as optical rotatory dispersion, viscosity, absorption spectra, circular dichroism, solubility, melting point, boiling point, dipole moments, refractive index, molecular rotation, etc.

PCML ZC211 Instrumental Methods of Analysis 4
PCRL ZC211 Instrumental Methods of Analysis 4

Principles, configuration, application of instruments like mass spectrophotometer, NMR, UV, IR, X-ray apparatus, atomic spectrophotometer, gas chromatography, liquid scintillation spectrophotometer, laser device, high voltage electrophoresis, ultracentrifuge, DTA, TGA etc.

PCML ZC212 Synthetic Organic Chemistry 3
PCRL ZC212 Synthetic Organic Chemistry 3

Retrosynthetic analysis, synthetic strategies, protecting groups, carbon-carbon bond forming reactions, functional group disconnection, carbon-carbon bond disconnection, ring annelation, multistep synthesis, synthetic equivalents, asymmetric synthesis.

PCML ZC221 Structure & Reactivity of Organic Compounds 3
PCRL ZC221 Structure & Reactivity of Organic Compounds 3

Structure and reactivity; oxidation and reduction, aliphatic nucleophilic substitution; aromatic substitution reactions; eliminations, addition to carbon heteromultiple bonds and rearrangements; stereo chemistry of cyclic compounds.

PCML ZC222 Stereo Chemistry and Reaction Mechanisms 3

PCRL ZC222 Stereo Chemistry and Reaction Mechanisms 3

Relative and absolute configuration; stereochemistry of organic compounds including those containing nitrogen atoms, allenes, and biphenyls; stereochemical implication of various organic reactions; conformational analysis of cyclohexanes and substituted cyclohexanes; mechanism of addition, elimination and substitution reaction.

PCML ZC232 Pharmaceutical Process Technology 3

PCRL ZC232 Pharmaceutical Process Technology 3

Fundamentals of chemical engineering operations such as size reduction, filtration, evaporation, crystallizations, drying. A unified approach to the analysis of equilibrium cascades: distillation, absorption and extraction.

PCML ZC242 Environmental Pollution Control 3

PCRL ZC242 Environmental Pollution Control 3

Environmental pollution: Solid, liquid and gaseous pollutants; removal of soluble and particulate pollutants from atmosphere, natural water systems and process systems; use of current literature for pollution control problems.

PCML ZC251 Organo-Metallic Chemistry 3

PCRL ZC251 Organo-Metallic Chemistry 3

Application of Organolithium, Organomagnesium, Organocopper, Organosilicon, Organoselenium, Organotin and Organozinc Compounds in Organic Synthesis: Palladium mediated C-C, C-N and C-O bond formation

PCML ZC252 Analytical Method Development 3

PCRL ZC252 Analytical Method Development 3

Standard Operating procedures for Analytical Equipment including Performance Qualification and maintenance of Analytical Equipment; Biological and pharmacological methods and pharmaceutical formulation; Stability Indicative Method development; Analytical Method design for Chromatographic methods; Errors; Accuracy; Reliability of results; Confidence interval ; Correlation and regression; the value of statistics.

PCML ZC311 Technical Report Writing 3

PCRL ZC311 Technical Report Writing 3

Course description is same as given under MEBF ZC241

PCML ZC321 Medicinal Chemistry 3

PCRL ZC321 Medicinal Chemistry 3

Chemistry of selected synthetic and natural organic medicinals and study of structure-activity relationships; representative drugs selected from the following major classes; anaesthetics, hypothetics, sedatives, analgesics, chemotherapeutic agents, antihistaminics, drugs affection peripheral nervous system, hypotensive drugs and anticancer agents.

PCML ZC341 Pharmaceutical Quality Control & Regulatory Affairs 3

PCRL ZC341 Pharmaceutical Quality Control & Regulatory Affairs 3

Various parameters for achieving quality pharmaceutical products, statistical applications, current good manufacturing practice (cGMP) for pharmaceutical manufacturing, pharmaceutical process validation, drug regulatory affairs.

PCML ZC351 Structure Elucidation 3

PCRL ZC351 Structure Elucidation 3

Structure elucidation & characterization of various organic compounds using IR, UV, NMR (Proton and Carbon-13) and Mass spectroscopic techniques, X-Ray crystallography and other methods.

PCML ZC423T Project Work 20

PCRL ZC423T Project Work 20

Course description is same as given under BITS ZC423T

PEAB ZC111 Computer Programming 3

PEHR ZC111 Computer Programming 3

PECF ZC111 Computer Programming 3

PEHZ ZC111 Computer Programming 3
PEJS ZC111 Computer Programming 3
PETC ZC111 Computer Programming 3

Elementary computer organization; introduction to Number Systems; Representation of integers, real numbers and characters on computers; concept of range and accuracy; Arithmetic Overflow; Algorithms and algorithm development; structured program development through step wise refinement. Introduction to C language; Functions; Recursion; Data structure & algorithms; File management & file handling; Problem solving using C.

PEAB ZC121 Electrical & Electronics Engineering 3
PEHR ZC121 Electrical & Electronics Engineering 3
PECF ZC121 Electrical & Electronics Engineering 3
PEHZ ZC121 Electrical & Electronics Engineering 3
PEJS ZC121 Electrical & Electronics Engineering 3
PETC ZC121 Electrical & Electronics Engineering 3

Electric circuit, electromagnetism, magnetic circuit, electrostatics, AC voltage and current, single-phase circuits, semiconductor devices, amplifiers, digital systems, microprocessors, DC machines, polyphase circuits, transformers, synchronous machines, induction motors, power electronics, measurements, illumination.

PEAB ZC131 Engineering Mathematics I 3
PEHR ZC131 Engineering Mathematics I 3
PECF ZC131 Engineering Mathematics I 3
PEHZ ZC131 Engineering Mathematics I 3
PEJS ZC131 Engineering Mathematics I 3
PETC ZC131 Engineering Mathematics I 3

Limit concept; derivatives of elementary functions and their applications; introduction to ordinary and partial differential equations and initial/boundary value problems. Convergence tests for series; power series and interval of convergence; series solution of differential equations. Approximation and error, interpolation; roots of algebraic and transcendental functions, Newton's method.

PEAB ZC212 Engineering Mathematics – II 3
PEHR ZC212 Engineering Mathematics – II 3
PECF ZC212 Engineering Mathematics II 3
PEHZ ZC212 Engineering Mathematics II 3
PEJS ZC212 Engineering Mathematics II 3
PETC ZC212 Engineering Mathematics II 3

Algebra of vectors and matrices; Gauss's row-reduction process; applications of simultaneous linear equations and matrix inversion; determinants and Cramer's rule. Numerical differentiation and integration; numerical methods for solving ordinary and partial differential equations.

PEAB ZC221 Principles of Management 3
PEHR ZC221 Principles of Management 3
PECF ZC221 Principles of Management 3
PEHZ ZC221 Principles of Management 3
PEJS ZC221 Principles of Management 3
PETC ZC221 Principles of Management 3

Fundamental concepts of management - planning; organizing; staffing; directing and controlling; production, financial, personnel, legal and marketing functions; accounting and budgeting, balance sheets.

PEAB ZC222 Fluid Mechanics 3
PEHR ZC222 Fluid Mechanics 3
PECF ZC222 Fluid Mechanics 3
PEHZ ZC222 Fluid Mechanics 3
PETC ZC222 Fluid Mechanics 3

Fundamental concepts; fluid statics; integral and differential analyses for fluid motion; dimensional analysis; internal and external fluid flow; fluid machinery; flow through packed bed; agitation; introduction to compressible flow.

PEAB ZC232 Engineering Materials 3
PEHR ZC232 Engineering Materials 3
PECF ZC232 Engineering Materials 3
PEHZ ZC232 Engineering Materials 3
PEJS ZC232 Engineering Materials 3
PETC ZC232 Engineering Materials 3

Mechanical, electrical, electronic and chemical properties and applications of common engineering materials; ferrous and non- ferrous metals and alloys; thermosetting and thermoplastic plastics; natural and synthetic resins; rubber; glass; abrasives and ceramics; common building materials, namely, timber, stone, lime and cement; corrosion of metals and methods of preventing corrosion; protective and

decorative coatings; insulating materials; testing of materials.

PEJS ZC242 Thermodynamics & Kinetics 3

Importance and Fundamental concepts of Thermodynamics, concept of states, systems, equilibrium, extensive and intensive properties, homogeneous and heterogeneous systems, First Law of Thermodynamics, Internal energy, heat capacity, isothermal, and adiabatic processes, Second law of Thermodynamics, criteria of equilibrium, Maxwell's relations, Gibbs-Helmholtz equation, Entropy, Kinetic Theory, Auxiliary Functions, Heat Capacity, Enthalpy, Phase Equilibrium in one component system, Concept of Third law, relation between Cp and Cv, Fugacity, equilibrium constant, use of Y S - functions, Ellingham-Richardson diagrams, phase stability diagrams, Behaviour of Solutions, Thermodynamics of non reacting mixtures, reaction rate theory, Introduction to metallurgical kinetics, heterogeneous reaction kinetics-gas-solid, solid-liquid, liquid-liquid and solid-solid systems, concept of Johnson- Mehl equation, effect of temperature on reaction rates, energy of activation, Solutions, partial molal quantities, ideal and non-ideal solutions, Henry's law, Gibbs - Duhem equation, regular solution, Change of standard state, Phase relations and phase rule, Free energy composition diagrams for binary alloy systems, determination of liquidus, solidus and solvus lines, Effect of pressure on phase transformation and phase equilibria.

PEJS ZC252 Mineral Beneficiations and Agglomeration 3

Early development in Metal Extraction, General methods of extraction, The necessity and methods of beneficiation, mineralogical assessment, Minerals and ores, refining, importance of mineral dressing, principles of flotation, Refractories, different comminution methods-fracture, Crushing and Grinding machines, liberation, size-criteria, energy-size relationships, crushing grinding and attrition, screening and classification, cyclones, concentration processes-density, electrical, magnetic separators and other physical methods, Interfacial phenomenon, surfactants, Floatation principles and froth floatation, liquid-solid separation-floculation, thickening, classification, free and hindered settling, Dry and wet sizing, Jigging, surface chemistry of minerals, dewatering, Pollution in beneficiation plants, Agglomeration: Basic processes-Nodulization, briquetting, Pelletization, sintering, Material Balances in process flows: Component and total mass balances of reactive and non reactive systems including recycling, Batch and steady state flows, Unit Processes in pyrometallurgy: calcination, roasting, sintering, smelting , converting, distillation, Metallothermic reduction and hydrogen reduction, refining processes with examples for metals like copper, nickel, lead, zinc, etc. Unit processes in hydrometallurgy: leaching, purification of leach liquor, solvent extraction and ion exchange process, metal recovery from aqueous phase. Unit processes in electrometallurgy: Faraday's laws of electrolysis, concept of overvoltage, limiting current density, overall cell voltage, series and parallel electrical circuits in refining, Electrowinning and electrorefining with reference to Cu, Zu, Al, Mg.

PEJS ZC262 Iron Making 3

World production of Iron and steel, occurrence and distribution of iron ore, coal and limestone in India and world, General layout of integrated steel plant, Raw materials in ferrous production metallurgy, coke production, agglomeration of iron ores. Technology of blast furnace iron making - operational details, Study of blast furnace processes and blast furnace slag, Blast furnace reactions, Raceway, Cohesive zone, Thermodynamics of slag-metal reactions, high top pressure, oxygen enrichment, injection of auxiliary fuels. Blast furnace design, Furnace productivity, the coke rate, hot metal quality. Alternate routes of iron making, Temperature profile, Aerodynamics, different factors, Irregularities etc., Heat exchange zones in blast furnace.

PEJS ZC272 Furnace Technology 3

Conventional, non-conventional and newer sources of energy, energy management problems in metallurgical Industries, role of high temperature systems and materials , deposits, manufacturing, properties and testing of solid, liquid and gaseous fuels; Principles of fuel combustion and burner design. Classification of refractory, manufacturing and properties of common refractories such as silica, fire clay, high alumina, dolomite, magnesite and chrome refractories. Furnaces, Types, Design of high temperature furnaces, waste heat utilization, heat recuperators and refrigerators, stack design, gas cleaning, heat balance diagrams; furnace dynamics: fluid flow calculations, fuel fired furnaces, electric arc furnaces, vacuum, electron beam, plasma, laser furnaces.

PEAB ZC311 Chemical Engineering Thermodynamics 3
PEHR ZC311 Chemical Engineering Thermodynamics 3
PECF ZC311 Chemical Engineering Thermodynamics 3
PEHZ ZC311 Chemical Engineering Thermodynamics 3
PETC ZC311 Chemical Engineering Thermodynamics 3

Development and applications of the combined first and second laws; relations between state properties; chemical equilibria in reacting and nonreacting systems; statistical concepts, and brief exposure to irreversible thermodynamics; extensive problem assignments throughout.

PEJS ZC312 Steel Making & Casting 3

Fundamentals of Steel making, Historical development of steel making processes. Open hearth, basic oxygen, electric arc and induction furnace steel making, processes, Thermodynamics, kinetics and transport phenomena in steel making, Introduction to ladle metallurgy. Refining of Steel. Continuous Casting, near net shape making, clean steel practices, stainless steel making and emerging trends in steel making and continuous casting. Introduction to casting, Molding Equipment Processes, Molding Sand, Cores, Core Materials, Solidification of Metals.

PEAB ZC313 Technical Report Writing 3
PEHR ZC313 Technical Report Writing 3
PECF ZC313 Technical Report Writing 3
PEHZ ZC313 Technical Report Writing 3
PEJS ZC313 Technical Report Writing 3
PETC ZC313 Technical Report Writing 3

Elements of effective writing; art of condensation; business letter writing; memos; formal reports; technical proposals; conducting, and participating, meetings; agenda and minutes; strategies for writing technical descriptions, definitions, and classifications; oral presentation; use of graphic and audio- visual aids; editing.

PEAB ZC314 Power Plant Engineering 3
PEHR ZC314 Power Plant Engineering 3
PECF ZC314 Power Plant Engineering 3
PEHZ ZC314 Power Plant Engineering 3
PETC ZC314 Power Plant Engineering 3

Classification of power plants. Components and layout of; thermal, nuclear, hydro electric power plants. Site selection for various power plants. Combined cycle power plants. Magneto Hydro Dynamics (MHD) systems. Economics of power generation, economic loading of power stations. Load curve analysis; load factor, diversity factor. Power plant instrumentation and controls.

PEAB ZC321 Chemical Process Calculations 3
PEHR ZC321 Chemical Process Calculations 3
PECF ZC321 Chemical Process Calculations 3
PEHZ ZC321 Chemical Process Calculations 3
PETC ZC321 Chemical Process Calculations 3

Properties of gases, liquids and solids; material and energy balances; elementary process analysis involving phase equilibria and chemical reactions; recycling and unsteady state processes; combustion calculations and typical industrial applications.

PEAB ZC322 Kinetics & Reactor Design 3
PEHR ZC322 Kinetics & Reactor Design 3
PECF ZC322 Kinetics & Reactor Design 3
PEHZ ZC322 Kinetics & Reactor Design 3

PETC ZC322 Kinetics & Reactor Design 3

Kinetics of homogeneous, heterogeneous reactions; ideal reactors, nonideal flow; selectivity; analysis and design of chemical reactors.

PEAB ZC331 Quality Control Assurance & Reliability 3
PEHR ZC331 Quality Control Assurance & Reliability 3
PECF ZC331 Quality Control, Assurance & Reliability 3
PEHZ ZC331 Quality Control, Assurance & Reliability 3
PEJS ZC331 Quality Control, Assurance & Reliability 3
PETC ZC331 Quality Control, Assurance & Reliability 3

Basic concepts of probability and probability distributions, standard probability distribution, sampling and sampling distributions, confidence intervals, testing significance, statistical tolerance, various types of control charts, statistical process control techniques, value analysis, defect diagnosis and prevention, basic concepts of reliability, reliability design evaluation and control, methods of applying total quality management, production process.

PEJS ZC332 Testing of Materials 3

Purpose, sampling and interpretation of testing methods. Destructive testing, Hardness - Hardness tests like Brinell, Rockwell, Vickers, Meyer, Knoop etc., relationship with flow curve, Engineering & true stress-strain curves, evaluation of tensile properties, effect of strain-rate & temperature on flow properties, Comparison, buckling & barreling, Pure bending & flexure formula, Torsion, Stresses for elastic & plastic strain, Torsion Vs. Tension, Tensile testing with associated parameters, Impact, Notched bar impact tests, transition Temperature & metallurgical factors affecting it, Creep, stress rupture & stress relaxation tests, development of creep resistant alloys, prediction of long time properties. Fatigue - Stress cycles & S-N curve, effect of variables like mean stress, stress concentration, surface, size, metallurgical factors etc., Fatigue and fatigue crack growth studies, Formability testing, Transverse rupture strength of brittle materials,torsion testing, Fracture toughness testing (KIC, J-integral etc.).

PEAB ZC341 Heat Transfer 3
PEHR ZC341 Heat Transfer 3
PECF ZC341 Heat Transfer 3
PEHZ ZC341 Heat Transfer 3
PETC ZC341 Heat Transfer 3

Steady and unsteady state heat conduction; forced and natural convection; radiation; condensation and boiling heat transfer; evaporation; heat exchanger.

PEAB ZC351 Mass Transfer 3
PEHR ZC351 Mass Transfer 3
PECF ZC351 Mass Transfer 3
PEHZ ZC351 Mass Transfer 3
PETC ZC351 Mass Transfer 3

Introduction to molecular diffusion and mass transfer coefficients; interphase mass transfer; design of absorption, distillation, extraction and leaching processes.

PEAB ZC352 Energy Management 3
PEHR ZC352 Energy Management 3
PECF ZC352 Energy Management 3
PEHZ ZC352 Energy Management 3
PEJS ZC352 Energy Management 3
PETC ZC352 Energy Management 3

Energy management principles; energy conservation; energy auditing; analysis; formulation of energy management options; economic evaluation, implementation & control; energy conservation techniques – conservation in energy intensive industries; steam generation, distribution systems, and electrical systems; integrated resource planning; demand-side. management; cogeneration; total energy schemes; thermal insulation; energy storage; economic evaluation of conservation technologies; analysis of typical applications.

PEJS ZC362 Steel Processing 3

Introduction to metal casting, Moulding, materials and processes, patterns, sand and binders. directional solidification, rapid

solidification. Solidification of short & long freezing range alloy castings, Gating and Risering of castings, Cupola, rotary furnace, induction furnace, crucible furnace melting, Introduction to cast alloys, classification, microstructures and properties of cast irons, plain carbon and Hadfield Manganese steels, Heat treatment of cast alloys, Casting defects and remedy, Special casting processes, Introduction to metal joining processes, welding, Fundamentals of metal working, Temperature, strain rate, friction & lubrication, Rolling, Classification & processes Forging, Extrusion, Drawing, cold working and warm working, Bulk and sheet metal forming, Mechanical and Hydraulic Presses, Stretching, drawing and bending of sheet metal, Metallurgical changes during metal working; thermo-mechanical processes. Slab analysis of plane strain and axisymmetric upsetting.

PEAB ZC382 Cement Technology 3

Indian & Global Cement Industries; Geological classification of rock; Geo-chemistry of lime stone; Crushing, Grinding and Raw material handling process; different type of milling systems and applications - Raw mill, Coal mill, Cement mill; Kiln system and process, Fuel and firing system, Clinker cooling, storage, grinding and packing; merging trends in cement manufacture.

PECF ZC382 Fertilizer Technology 3
PETC ZC382 Fertilizer Technology 3

Introduction, fertilizer industry in India during last few decades; technology / production of fertilizer products such as intermediates, nitrogenous fertilizers, phosphatic fertilizers, potassic fertilizers, complex fertilizers; guidelines for mixing fertilizers.

PEHR ZC383 Extractive Metallurgy 3
PEHZ ZC383 Extractive Metallurgy 3

Introduction, Methods of extraction and refining of metals, principles of pyrometallurgy, heat transfer and fluid flow, rates of metallurgical reactions, analysis of unit processes, principles of electro and hydrometallurgy.

PEAB ZC412 Process Equipment Design 3
PEHR ZC412 Process Equipment Design 3
PECF ZC412 Process Equipment Design 3
PEHZ ZC412 Process Equipment Design 3
PETC ZC412 Process Equipment Design 3

Application of principles of Chem. Engg. to the selection and design of equipment for Chemical industries; design, cost estimation and selection of process equipment; piping, pressure vessels, heat exchangers, distillation columns etc. Use of computer software packages in the design; plant safety practices; use of codes.

PEAB ZC413 Process Plant Safety and Environment 3
PEHR ZC413 Process Plant Safety and Environment 3
PECF ZC413 Process Plant Safety and Environment 3
PEHZ ZC413 Process Plant Safety and Environment 3
PETC ZC413 Process Plant Safety and Environment 3
PEJS ZC413 Process Plant Safety and Environment 3

Role of safety in society; engineering aspects of process plant safety; chemical hazards and worker safety; hazardous properties of chemicals; safety aspects in site selection and plant layout; design and inspection of pressure vessels; storage, handling and transportation of hazardous chemicals; risk assessment methods; toxic release, fire and explosions; boiling liquid expanding vapor explosions; safety audit; emergency planning and disaster management; case studies

PEJS ZC414 Project Appraisal 3

Course description is same as given under ET ZC414.

PEAB ZC423T Project Work 20
PEHR ZC423T Project Work 20
PECF ZC423T Project Work 20
PEHZ ZC423T Project Work 20
PEJS ZC423T Project Work 20

PETC ZC423T Project Work 20

Course description is same as given under BITS ZC423T

PEAB ZC441 Process Control & Instrumentation 3

PEHR ZC441 Process Control & Instrumentation 3

PECF ZC441 Process Control & Instrumentation 3

PEHZ ZC441 Process Control & Instrumentation 3

PEJS ZC441 Process Control & Instrumentation 3

PETC ZC441 Process Control & Instrumentation 3

Introduction to process control; mathematical models of simple systems, elements of process control loop; stability, time response, design of simple control system; principles of sensors and transducers; instrumentation for typical industries.

PEJS ZG442 Advances in Materials Science 3

Deformation of materials, deformation at high temperatures and creep, recovery, recrystallization and grain growth, fracture of materials and fatigue failure, deterioration of materials, corrosion and oxidation, surface properties, surface energy and tribology, polymers and fibre reinforced polymeric composites, mechanical testings, nondestructive testing techniques.

PHRL ZG511 Advanced Physical Pharmaceutics 5

Preliminary evaluations and molecular optimization, Drug substance considerations including protein, peptide and biological products, Bulk characterization, Solubility analysis, Rheology and dispersed systems, Micromeritics and shape factor analysis, Compression and compaction, Principles of dissolution, Dissolution test design and release kinetics evaluation, Compatibility testing, Stability analysis and test design according to international standard, Studies of broad category of polymers used in drug delivery, Rationale basis of formulation recommendation.

PHRL ZG512 Technical Communication 4

Course description is same as given under BITS ZG659

PHRL ZG513 Application of Statistics and Computers in Pharmacy 5

Introduction to data classification, analysis and probability; statistical inference – estimation and hypothesis testing; linear regression and correlation; design of experiments; analysis of variance; non parametric procedures & tests; statistical quality control; experimental design in clinical trials and validation; basic techniques in optimization.

Introduction to computer and its components; operating systems; principles and use of standard software packages having application in drug design, development, analysis, etc.; principles of software creation; processing concepts, flow charting and algorithms, programming constructs, programming languages, program development sequence; information systems: need, significance concepts, their analysis, design and implementation; software life cycle with special reference to software planning and maintenance.

PHRL ZG514 Quality Assurance & Regulatory Affairs 5

Quality control, quality assurance, quality management, various parameters for achieving quality pharmaceutical products, application of statistics in quality assurance, reliability, current good manufacturing practice (cGMP) for pharmaceutical manufacturing, pharmaceutical process validation, drug regulatory affairs, clinical research protocols, new drug applications, drug product labeling.

PHRL ZG515 Pharmaceutical Administration and Management 5

Technology innovation and creativity, new drugs and products planning, strategic considerations, project implementation, product development, production management and scale up, preparation of product literature and marketing strategy, IPR processes, human resource development,

industrial relations, documentation, R & D management, ethical aspects.

PHRL ZG521 Advanced Pharmaceutical Analysis 5

Review of instrumental analytical techniques and applications; advanced chromatographic analysis like GC, HPTLC, LC-MS, capillary electrophoresis and solid phase chromatography; application of NMR, Mass spectroscopy and X-ray crystallography in structure elucidation of NCE's; particle size analysis using zeta sizer and photon correlation spectroscopy, etc.; application of DTA, DSC and TGA in formulation design; Strategies for bio-analytical method development and validation.

PHRL ZG522 Biopharmaceutics 3

Biopharmaceutics and Biopoharmaceutical aspects of drug delivery covering absorptions, distribution, metabolism and elimination (ADME) characters of drugs. Compartment model, pharmacokinetics of drugs and their applications, bioavailability, bioequivalence and their studies, drug-drug interactions and other related matters.

PHRL ZG523 Pharmacokinetics & Clinical Pharmacy 5

The study of pharmacokinetics and its clinical applications in the development, evaluation and use of drugs; the time course of drug and metabolite levels in different fluids, tissues and excreta of the body, mathematical relationship required to develop models to interpret the data for single and multiple dosing, study of bio- availability, dosage regimen adjustment in renal impairment, application of the pharmacokinetic principles to the therapeutic management of patients.

PHRL ZG524 Dosage Form Design 5

A study of physical and chemical, pharmacological and biopharmaceutic factors involved in the design and stability of dosage forms; transport of drugs across biological membranes; absorption, distribution and elimination of drugs; formulation additives, closures and containers and sustained release dosage forms; micro-encapsulation; radio pharmaceuticals.

PHRL ZG525 Pharmaceutical Process Development & Scale-up 4

Optimization techniques in pharmaceutical processing; development of test systems to evaluate performance of dosage forms and unit operations; Scale-up of unit operations related to various pharmaceutical formulations; process analytical technology (PAT) and its applications in solving problems of scale-up.

PHRL ZG534 Advanced Pharmaceutical Technology 5

Overview of pharmaceutical processes used in pharmaceutical manufacturing; advanced manufacturing equipments for various pharmaceutical dosage forms; current manufacturing techniques for large scale production of tablets, hard and soft gelatin capsules, aerosols, semi-solid preparations including ophthalmic formulations, small and large volume parenterals, and multiparticulate systems; approaches of in-process quality assurance and documentation in automated manufacture; advanced packaging technology for various pharmaceutical dosage forms.

PHRL ZG535 Pharmacoeconomics 3

Economic aspects of health care and its applications in the health sector are broadly emphasized. Cost-benefit, cost-effectiveness, cost-minimization, and cost-utility analyses to compare the different pharmaceutical products, drug therapy and treatments are focused. Economic concepts such as supply, demand, efficiency, equity, health policy, market failures, health insurance, pharmaceutical market, measurement of direct and indirect costs to a health care program, economic issues, pharmaceutical regulations, pricing policy and related topics will be covered.

PHRL ZG545 Clinical Pharmacy & Therapeutics 5

Basic concepts of Clinical pharmacy and its applications, analysis of patient data

interpretation of clinical laboratory tests, drug information queries, their sources and interpretation of the information. Clinical pharmacokinetics, therapeutic drug monitoring, drug-drug interactions.

PHRL ZG629T Dissertation 20

Course description is same as given under BITS ZG629T

POMDP ZC411 Organizational Behaviour 4

Evolution and relevance; perception emotions and learning in an organizational set up; attitudes and values, groups and group processes, leadership, power and politics, organizational change, resistance and development, managing conflict.

POMDP ZC413 Process Plant Safety and Environment 3

Course description is same as given under PEHZ ZC413

POMDP ZC417 Managerial Communication 4

Course description is same as given under HHSM ZC417

POMDP ZC431 Stereo Chemistry and Reaction Mechanisms 3

Course description is same as given under PCRI ZC222

POMDP ZC471 Management Information Systems 3

Course description is same as given under BITS ZC471

POMDP ZG511 Pharmaceutical Process Technology – I 4

Selection of raw material for equipment construction, pharmaceutical processes and unit operations involved in the manufacture of pharmaceuticals such as extraction, communition, micromeritics, mixing, heat transfer, distillation, evaporation, drying , fluid flow, filtration, crystallization, down stream processing, humidification and dehumidification.

POMDP ZG512 Pharmaceutical Process Technology-II 3

Pharmaceutical manufacturing equipments used in the process of granulation, drying, compression and compaction, encapsulation, disinfection and sterilization methods, sterility testing, air handling units, aseptic processing, containers and closures, accelerated stability testing, determination of product shelf –life, design and layout of various processing units and their optimization, design of standard operating protocols and their validation, in process quality control, equipment trouble-shooting and their rectification.

POMDP ZG515 Pharmaceutical Administration and Management 5

Course description is same as given under PHRL ZG515

POMDP ZG522 Quality Assurance and Regulatory Affairs 5

Course description is same as given under PHRL ZG514

POMDP ZG523 Total Quality Management 4

Course Description is same as given under HHSM ZG518

POMDP ZG531 Manufacturing Organization and Management 5

Course description is same as given under MM ZG511

POMDP ZG541 Modern Analytical Techniques4

Fundamentals and applications of sophisticated analytical instruments like NMR, Mass spectrometer; X-ray crystallography; GC, HPLC, UV, IR, Atomic absorption spectrophotometer, High voltage electrophoresis, gel electrophoresis, ultracentrifuge, spectrofluorimeter, DTA, DSC polarimeter in pharmaceutical industry including spectral data analysis and molecular characterization

POMDP ZG629T Dissertation 20

Course description is same as given under BITS ZG629T

POMSA ZC471 Management Information Systems 3

Course description is same as given under BITS ZC471

POMSA ZG511 Disinfection and Sterilisation 4

Theories and kinetics of the disinfection reaction, study of the principles involved in vivo and in vitro evaluation of disinfectants and antiseptics, structure activity relationships of the representative groups of disinfectants, sterilization, heat, ionizing and ultraviolet radiations, ultrasonic waves, filtration, gaseous sterilization and cellular dessication methods, controls used and special problems involved.

POMSA ZG512 Dosage Form Design 5

Course description is same as given under PHRL ZG524

POMSA ZG521 Statistical Process Control 5

What is SPC, history & development of SPC, averages & measures of dispersion, process variation, variable & attribute data, simple statistical problem solving tools: check sheets, histograms, Pareto diagrams, stratification graph, scatter plots, cause & effect diagram; Various types of control charts, control chart for attributes, cumulative sum charts, X bar R charts; construction & interpretation of control charts process capability; Lot try lot acceptance sampling for attributes, acceptance sampling variables, other acceptance sampling procedures.

POMSA ZG522 Quality Assurance & Regulatory Affairs 5

Course description is same as given under PHRL ZG514.

POMSA ZG531 Manufacturing Organization and Management 5

Course description is same as given under MM ZG511.

POMSA ZG532 Supply Chain Management 4

Course description is same as given under MM ZG621.

POMSA ZG541 Modern Analytical Techniques 4

Fundamentals and applications of sophisticated analytical instruments like NMR, Mass spectrometer; X-ray crystallography; GC, HPLC, UV, IR, Atomic absorption spectrophotometer, High voltage electrophoresis, gel electrophoresis, ultracentrifuge, spectrofluorimeter, DTA, DSC polarimeter in pharmaceutical industry including spectral data analysis and molecular characterization

POMSA ZG542 Production and Operations Management 4

Production & operations management functions; capacity requirement planning; inventory control; layout, handling & location decisions; resource procurement & operation control; project scheduling & resource allocation; the production & operating function; methods of forecasting demand; financial analysis of operating plans; determination of economic order quantity; development of efficient work methods, quality control, management of R&D, technological forecasting, equipment replacement and interfaces with other functional areas.

POMSA ZG611 Advanced Pharmacology 5

Biochemical pharmacology; pharmacologically active polypeptides; general pharmacological principles involving immunological processes, pharmacogenetics, teratology, pharmacokinetics, drug resistance and related phenomena, drug-interaction; recent advances in the therapy of neoplastic disease, viral diseases, atherosclerosis and hypertension; topics of recent interest like contraception; use of gases and ions in therapy etc.

POMSA ZG621 Management Information and Decision Support Systems 5

Data & information; characteristics of information; components of management information systems; information flows; design and maintenance of management information systems; decision support systems.

POMSA ZG629T Dissertation 16

Course Description is same as given under BITS ZG629T

POMSA ZG631 TQM Tools and Techniques 5

Benchmarking; introduction, why benchmark; Planning: what to benchmark, benchmarking partners, data collection methods; Analysis: determining the current competitive gap, projecting future performance levels; Integration: developing action plan, implementing specific actions & monitoring progress, re-calibration; Maturity: beyond benchmarking; Quality function deployment, QFD concept, overview & QFD process, the voice of customer developing a QFD matrix, reviewing the matrix for priority items, organizing teams & planning QFD projects; Process RE-engineering, BPR philosophy, possibilities & pitfalls, BPF framework, opportunity assessment, planning & BPR project, risk & impact assessment, planning & implementing the transition; Failure mode & effect analysis; FMEA: concepts & applications in TQM; Quality cost, concepts, quality cost definitions, quality cost program implementation use of quality cost, reducing quality cost.

POMSA ZG641 Technical Communication 4

Course description is same as given under BITS ZG659

POMLM ZC441 Human Resource Management 4

Course description is same as given under MM ZC441

POMLM ZC471 Management Information Systems 3

Course description is same as given under BITS ZC471

POMLM ZC473 International Business 3

Course description is same as given under CM ZC473

POMLM ZG515 Pharmaceutical Administration & Management 5

Course description is same as given under PHRL ZG515

POMLM ZG522 Quality Assurance & Regulatory Affairs 5

Course description is same as given under PHRL ZG514

POMLM ZG523 Project Management 4

Course description is same as given under MM ZG523

POMLM ZG525 Pharmaceutical Process Development & Scale-up 4

Course description is same as given under PHRL ZG525

POMLM ZG532 Supply Chain Management 4

Course description is same as given under MM ZG621

POMLM ZG534 Advanced Pharmaceutical Technology 5

Course description is same as given under PHRL ZG534

POMLM ZG535 Pharmacoeconomics 3

Course description is same as given under PHRL ZG535

POMLM ZG611 Advanced Pharmacology 5

Course description is same as given under POMSA ZG611

POMLM ZG629T Dissertation 20

Course description is same as given under BITS ZG629T

POMLM ZG641 Technical Communication 4

Course description is same as given under BITS ZG659

POWNT ZC211 Computer Programming 3

Course description is same as given under MEBF ZC221

POWNT ZC212 Engineering Mathematics II 3

Algebra of vectors and matrices; Gauss's row-reduction process; applications of simultaneous linear equations and matrix inversion; determinants and Cramer's rule. Numerical differentiation and integration; numerical methods for solving ordinary and partial differential equations.

POWNT ZC221 Engineering Mathematics I 3

Limit concept; derivatives of elementary functions and their applications; introduction to ordinary and partial differential equations

and initial/boundary value problems. Convergence tests for series; power series and interval of convergence; series solution of differential equations. Approximation and error, interpolation; roots of algebraic and transcendental functions, Newton's method.

POWNT ZC222 Electronics and Microprocessor 3

PN Junction diodes; rectifiers, amplifiers - biasing and modeling, frequency response, combinational digital circuits, sequential building blocks, A/C and D/A converters, Architecture of any typical microprocessor and programming, memories, basic of memory and I/O interfacing, system design with microprocessor.

POWNT ZC231 Thermodynamics 3

Concepts and laws of thermodynamics; macroscopic thermodynamic properties; application to closed and open system; microscopic approach to entropy; equations of state; thermodynamics of nonreacting mixtures.

POWNT ZC232 Principles of Management 3

Fundamental concepts of management - planning; organizing; staffing; directing and controlling; production, financial, personnel, legal and marketing functions; accounting and budgeting, balance sheets.

POWNT ZC242 Engineering Measurements 3

Performance characteristics of measuring instruments, measurement methods for mechanical, electrical, radiant, chemical, magnetic and thermal energy variables. Emphasis in this course shall be on the operation and use of instruments.

POWNT ZC251 Electrical Technology 3

Electric circuits; Network Theorems; Electromagnetism; Inductance & Capacitance; Alternating voltage and current; Single phase and poly phase circuits; Transformers; Synchronous Machines; Induction Motors; DC Machines; Measuring Instruments.

POWNT ZC311 Prime Movers & Fluid Machines 4

Theoretical analysis of energy and momentum transfer between fluid and rotor; principles of axial, mixed and radial flow compressors, turbines and pumps; design considerations; cascade aerodynamics and performance limitations; applications to power plant systems, laboratory exercises in testing reciprocating machines; rotary machines and refrigeration plants.

POWNT ZC312 Quality Control, Assurance and Reliability 3

Basic concepts of probability and probability distributions, standard probability distribution, sampling and sampling distributions, confidence intervals, testing significance, statistical tolerance, various types of control charts, statistical process control techniques, value analysis, defect diagnosis and prevention, basic concepts of reliability, reliability design evaluation and control, methods of applying total quality management, production process.

POWNT ZC321 Technical Report Writing 3

Course description is same as given under MEBF ZC241

POWNT ZC322 Power Generation 3

Sources of energy; types of power plants; selection of equipment for I.C. engine, gas turbine, steam, hydraulic and atomic power plants; power plant building and layout; gas loop; feed water system; piping systems; sharing of loads; Solar Energy; Wind energy; Tidal energy; Geothermal energy.

POWNT ZC331 Instrumentation & Control 3

Measurement systems, transducers, feedback control, components: electrical, hydraulic, pneumatic; Signal conditioning and processing, controllers, display, recording, direct digital control, programmable logic controllers, PC based instrumentation.

POWNT ZC332 Energy Management 3

System's view of energy in society involving societal goals, energy resources, the

sub-systems for the generation. T&D, and utilization of energy carriers, energy economics and analysis, energy strategies, policies, policy instruments, policy agents and policy implementation. The "development-oriented end-use approach" to energy analysis, strategy design and policy formulation involving the disaggregation and scrutiny of demand beyond sectors into end-uses and basic needs. Energy management at the national, state, firm, city and village levels.

POWNT ZC342 Power Systems Engineering I 3

Parameters of transmission lines, electrical and mechanical characteristics of transmission line, synchronous phase modifiers - overhead insulators - underground cables - distribution lines - substation practice - relevant portions of Indian Electricity Act.

POWNT ZC411 Environmental Pollution Control 3

Environmental pollution: Solid, liquid and gaseous pollutants; removal of soluble and particulate pollutants from atmosphere, natural water systems and process systems; use of current literature for pollution control problems.

POWNT ZC421 Essentials of Project Management 3

Programmes project management, project manager: role and responsibilities, project management and organization, project planning and scheduling, graphical techniques and PERT, CPM, price estimation and cost control; proposal, control valuation monitoring and trade off analysis in a project environment, pitfalls and future scenario.

POWNT ZC423T Project Work 20

Course description is same as given under BITS ZC423T

POWNT ZC431 Maintenance & Safety 3

Basic maintenance systems and practice; maintenance planning; estimating and budgeting; scheduling maintenance jobs; importance of safety; factors affecting safety; safety aspects of site and plant; hazards of commercial chemical reaction and operation; instrumentation for safe operation; safety education and training; personnel safety; disaster planning and measuring safety effectiveness; future trends in industrial safety; maintenance of components and equipments; new dimensions in maintenance covering plant engineering, tribology, materials technology, terotechnology (life cycle costing) etc.; extensive case studies.

POWNT ZC441 Power Systems Engineering II 3

Elementary principles of power system economics - Powers systems stability, equal area criterion and step by step method - protection, relays and relaying, protection of transmission lines, transformer and generators - High voltage Protection - Symmetrical components, symmetrical and unsymmetrical faults.

POWCP ZC451 Alternative Energy Sources 3
POWNT ZC412 Power System Operation & Control 3
POWNT ZC422 Power System Drawing and Design 3
POWNT ZC451 Alternative Energy Sources 3
POWNT ZC461 Power Plant Engineering 3
POWNT ZC471 Power Electronics & Drives 3

Course description for the above courses to be developed.

POWNT ZC481 Plant Layout & Design 3

Factors affecting plant layout, Types of layout, procedure for plant layout, techniques and tools for planning layout, quantitative layout analysis, material handing equipment, improving and revising existing layout, evaluation of layout, plant location, evaluation of location, design of layout, computer applications in layout design.

QMJ ZC411 Marketing 4

Course Description is same as given under MM ZC411

QMJ ZG511 TQM-Core Concepts 5

Historical perspective; Customer Orientation; Leadership & Management Commitment, Leadership Vs Management, Leadership Style, The Power style, Visioning, Creating Quality

Environment, Delegation Vs Empowerment, Management of learning, Conflict resolution; Teamwork & Employee Involvement, Establishing an inspiring mission, setting up of sound objectives & goals, theory of motivation, create & maintain awareness on quality, promoting open communication, recognition & rewards, team building, self managing teams, quality circles, self development & empowerment; Learning for continuous improvement, Introducing training for participation and employee involvement, analyzing training needs, promoting multifunctionality, evaluation & monitoring of training.; TQM & Systems, system thinking, evolution of organization for quality integrating quality into strategic management, quality policy, resources for quality activities, designing & implementing quality system; Implementing TQM, establishing need to change, cultural change, gaining & sustaining change for continuous improvement, measuring success, communication, recognition.

QMJ ZG512 Human Resource Management & Organizational Learning 5

Developing the human resource; Training & development: analyzing training needs, training methods, evaluation & monitoring of training; Learning organization; Organizational learning single loop & double loop learning; System thinking personal mastery, mental models, shared vision, team learning; Organization development; Formal & informal organization, organization culture, shared beliefs & values; Interpersonal relations; Understanding determinants of interpersonal behaviors, interpersonal styles: an understanding about self & other T.A. approach; Personal effectiveness (Johari Window), interpersonal communication with emphasis on listening.; Team work & employee involvement; Inaslow's need hierarchy, theory of motivation, factors affecting employee involvement, job enlargement, enrichment and rotation, Small group activities: quality circles (structure, launching and institutionalizing), KAIZEN, 5.5 working.

QMJ ZG521 Quality Management System 5

Quality system & quality management, evolution of quality post world war II era i.e. Quality control, quality assurance, total quality control & total quality management; ISO 9000 series of standards, formation of ISO (1947), background & development of ISO 9000. ISO 9000 family of standards, selection & use of appropriate model of ISO 9000. Requirements of ISO 9001; System demonstration & documentation, how to organize formal quality assurance system, pyramid of quality system documentation structure, two tier, three tier & four tier documentation, preparation of quality manual & quality procedures, quality records; Implementing documented quality system, how to proceed, how to implement change, obtaining top management commitment, assessing current company position, developing the implementation plan, initiating people (employees) to own the system, system development; System audit & review, objective of system audit, types of quality audit, product Vs system audit, internal quality audit, management review; System certification, benefits of third party certification, choice of certification body, route to certification, surveillance & renewal; Other quality system standards, relating ISO 9000 with QS 9000 and ISO 14000.

QMJ ZG522 Quality Through Measurement System 5

Measurement principles, measurement process: some statistical concepts, accuracy, precision and trueness, repeatability & reproducibility; Accuracy, error & uncertainty; Error & uncertainty propagation; Quality assurance in measurement; Calibration programme, traceability compliance to ISO 9000 requirements for control of test & measurement equipment; Gage accuracy, gage repeatability and gage reproducibility; Testing & calibration laboratory NABL accreditation system.

QMJ ZG523 Project Management 4

Course description is same as given under CM ZG523.

QMJ ZG531 Statistical Process Control 5

Course description is same as given under POMSA ZG521

QMJ ZG532 Environmental Management System 5

Course description is same as given under EMTP ZG533

QMJ ZG541 TQM Tools & Techniques 5

Course description is same as given under POMSA ZG631

QMJ ZG611 Strategic Management & Business Policy4

Course description is same as given under CM ZG611.

QMJ ZG621 Supply Chain Management 4

Course description is same as given under MM ZG621.

QMJ ZG629T Dissertation 16

Course description is same as given under BITS ZG629T

QMJ ZG658 Technical Communication 4

Course description is same as given under BITS ZG659

SEAC ZC422 Operating Systems 3

Course description is same as given under IS ZC362.

SEAC ZC451 Internetworking Technologies 3

Course description is same as given under EA ZC451

SEAC ZG512 Object Oriented Analysis & Design 4

Object orientation concepts, theories and principles; fundamental concepts of the object model: classes, objects, methods and messages, encapsulation and inheritance, interface and implementation, reuse and extension of classes, inheritance and polymorphism; process of object-oriented requirements specification, analysis and design; notations for object-oriented analysis and design; case studies and applications using some object oriented programming languages.

SEAC ZG514 Data Warehousing 5

Introduction, evolution of data warehousing; decision support systems; goals, benefit, and challenges of data warehousing; architecture; data warehouse information flows; software and hardware requirements; approaches to data warehouse design; creating and maintaining a data warehouse; Online Analytical Processing (OLAP) and multi-dimensional data, multi-dimensional modeling; view materialization; data marts; data warehouse metadata; data mining.

SEAC ZG518 Database Design & Applications 5

DBMS architecture; Data models: Network model, Hierarchical model and Relational model; Database design & optimization; Query processing & Query optimization; Transaction Processing; Concurrency control; Recovery; Security & protection; Introduction to Object Oriented data model & Multimedia Databases.

SEAC ZG531 Pervasive Computing 4

Select application architectures; hardware aspects; human-machine interfacing; device technology: hardware, operating system issues; software aspects, java; device connectivity issues and protocols; security issues; device management issues and mechanisms; role of web; wap devices and architectures; voice-enabling techniques; PDAs and their operating systems; web application architectures; architectural issues and choices; smart card-based authentication mechanisms; applications; issues and mechanisms in WAP-enabling; access architectures; wearable computing architectures.

SEAC ZG552 Software Testing Methodologies 4

Concepts and principles of software testing and quality assurance; software testing tools; functional, structural, integration and system testing techniques; software testing process and its management; evaluation of test effectiveness; testing specialized systems and applications; automated software testing; case studies.

SEAC ZG562 Software Engineering & Management 5

Current concepts, methods, techniques, and tools of the software engineering process; software process models; process definition and assessment; software measurement and metrics; project planning, estimation and control; requirements analysis and specification, design methods; quality assurance and testing; configuration management; process improvement; case studies and project work.

SEAC ZG629T Dissertation 20

Course description is same as given under BITS ZG629T

SEAC ZG651 Software Architectures 5

Systems engineering and software architectures; Hatley-Pirbhai architectural template; architecture flow diagrams; requirements engineering and software architecture; architectural design processes; design post-processing; real-time architectures; architectural design patterns; software architecture and maintenance management; object oriented architectures; client-server architectures; forward engineering for object oriented and client-server architectures; emerging software architectures.

SEAC ZG652 Software Maintenance Management 4

Issues in software maintenance, conceptual issues, scale of effort issues, organizational issues, productivity techniques issues, problem area issues; application systems; maintenance effort; impact of development tools and organizational controls; problems of maintenance; software evolution and maintenance; change management; impact analysis; system release planning; corrective maintenance; adaptive maintenance; perfective maintenance; reengineering source code, restructuring code, maintainability, flexibility, reusability, reliability, efficiency, reengineering tools; software testing & maintenance testing; system release and configuration management; managing the software maintenance process.

SEAC ZG659 Technical Communication 4

Course description is same as given under BITS ZG659.

SEAC ZG661 Software Quality Management 4

Software quality challenges and expectations; quality dilemma; software life cycle and link to quality; quality gates, formal reviews, system requirement reviews, preliminary design reviews, critical design reviews, test reviews; engineering reviews, walkthroughs, inspections, internal reviews; quality gate categories; technical environment and quality; planning for software quality, quality requirements for planning, quality needs, elements of quality planning, quality assessments during planning, software quality organization requirements; quality evaluation of software development process, process quality attributes, measuring software process quality; software process metrics; quality gate integrity; software product quality, standards and conventions, metrics; quality hierarchy, factors; quality assessment; quality evaluation techniques, reviews, walkthroughs, audit, inspections, analytical evaluation techniques; quality systems.

SEAM ZC451 Internetworking Technologies 3

Course description is same as given under EA ZC451

SEAM ZC462 Network Programming 3

Course description is same as given under IS ZC462

SEAM ZG511 Overview of e-Business 3

Course description is same as given under EBCT ZG511

SEAM ZG512 Object Oriented Analysis and Design 4

Course description is same as given under SEAC ZG512

SEAM ZG518 Database Design & Application 5

Course description is same as given under SEAC ZG518

SEAM ZG531 Pervasive Computing 4

Course description is same as given under ESPC ZG531

SEAM ZG552 Software Testing Methodologies 4

Course description is same as given under SEAC ZG552

SEAM ZG622 Software Project Management 4

Course description is same as given under SECT ZG622

SEAM ZG623 Advanced Operating Systems 5

Course description is same as given under CS ZG623

SEAM ZG629T Dissertation 20

Course description is same as given under BITS ZG629T

SEAM ZG651 Software Architectures 5

Course description is same as given under SEAC ZG651

SEAM ZG652 Software Maintenance Management 4

Course description is same as given under SEAC ZG652

SEAM ZG661 Software Quality Management 4

Course description is same as given under SEAC ZG661

SECT ZC213 Probability and Statistics 3

Course description is same as given under AAOC ZC111

SECT ZC221 Structured Programming 3

Course description is same as given under MELTI ZC221

SECT ZC222 Advanced Programming Techniques 3

Dynamic memory management; low level processing; debugging techniques; symbolic debugging tools; visual programming environments; user interfaces; event driven programming; visual design methodologies; prototyping with visual programming aids; creating multi-threaded applications; other emergent advanced programming topics.

SECT ZC241 Principles of Management 3

Course description is same as given under MEBF ZC231

SECT ZC252 Discrete Structures for Computer Science 3

Course description is same as given under MATH ZC222

SECT ZC261 Digital Electronics & Microprocessors 3

Course description is same as given under ES ZC261.

SECT ZC271 Mathematics I 3

Course description is same as given under MELTI ZC211

SECT ZC272 Mathematics II 3

Course description is same as given under MELTI ZC212

SECT ZC322 Database Management Systems 3

Introduction to Database Management Systems; File organization; Data Independence in databases; Data Models; Query processing systems; Database Design techniques; Concepts of security and integrity in databases; Distributed Databases; Applications using DBMS.

SECT ZC362 Programming Languages & Compiler Construction 3

Formal definition, syntax and semantics; simple statements including precedence, infix, prefix and postfix notation; structure of algorithmic languages; list processing and string manipulation languages, One-pass compilation techniques; organization of a compiler including compile-time and run-time symbol tables; lexical scan, syntax scan; object code generation; error diagnostics; code optimization techniques.

SECT ZC413 Computer Organization & Architecture 3

Course description is same as given under IS ZC351.

SECT ZC415 Data Structures & Algorithms 3

Course description is same as given under IS ZC361.

SECT ZC421Computer Networks 3

Course description is same as given under BITS ZC481.

SECT ZC422 Operating Systems 3

Course description is same as given under IS ZC362.

SECT ZC432 Object Oriented Programming 3

Course description is same as given under BITS ZC411.

SECT ZC461 Software Engineering 3

Course description is same as given under BITS ZC461.

SECT ZC462 Network Programming 3

Overview of computer networks; inter-process communication; network programming; socket interface; client-server computing model: design issues, concurrency in server and clients; external data representation; remote procedure calls; network file systems; distributed systems design.

SECT ZG511 Design & Analysis of Algorithms 5

Course description is same as given under MELTI ZG511

SECT ZG512 Object Oriented Analysis & Design 4

Course description is same as given under SEAC ZG512

SECT ZG513 Network Security 4

This course examines issues related to network and information security. Topics include security concepts, security attacks and risks, security architectures, security policy management, security mechanisms, cryptography algorithms, security standards, security system interoperation and case studies of the current major security systems.

SECT ZG514 Data Warehousing 5

Course description is same as given under SEAC ZG514

SECT ZG517 Usability Engineering 5

Usability-driven approach to Information Design; software usability bridge& its critical components; Iterative & evaluation of a two-level approach of UCID (User-Centered Information Design); five key principles of UCID; getting UCID into organization ; Benefits of implementing UCID; key features of UCID;UCID process & analysis; traditional processes for information development & their limitations; Managing UCID; role of usability engineers; preparing the usability plan; implementing a metrics program in typical UCID projects; key contributors; goal setting for software usability & information quality; critical design goals; designing the information architecture ;designing the specifications & prototypes; evaluating prototypes; two-level design activities; designing software labels; designing effective messages; designing online support elements & printed support elements; achieving information design goals; online search & navigation; evaluating information; two-level evaluation; approach achieving information design goals for improved software usability; testing information & validating; quality indicators; retrievability; implementation techniques & issues ;Application of Usability Engineering in typical live projects to validate improved software usability .

SECT ZG552 Software Testing Methodologies 4

Course description is same as given under SEAC ZG552

SECT ZG622 Software Project Management 4

Managing a software development project, concepts, objects of a project, environment of a software project, system development life cycle, tools, review process; documentation in software program management, procedures, diagramming techniques, management; Planning and monitoring a software project, project planning, management tools, software project definitions, project management packages, project control; software project definition, classification, project sizes and methodologies, feasibility, requirements and start-up; programmer productivity; software planning, control tools, accelerated design; prototyping and role in software project management; software production and software project management; software system installation, managing testing requirements, test plans, alpha and beta

systems; emerging directions in project management.

SECT ZG629T Dissertation 20

Course description is same as given under BITS ZG629T

SECT ZG641 Management Information & Decision Support Systems 5

Course description is same as given under POMSA ZG621

SECT ZG651 Software Architectures 5

Course description is same as given under SEAC ZG651

SECT ZG652 Software Maintenance Management 4

Course description is same as given under SEAC ZG652

SECT ZG659 Technical Communication 4

Course description is same as given under BITS ZG659.

SECT ZG661 Software Quality Management 4

Course description is same as given under SEAC ZG661

SECY ZC451 Internetworking Technologies 3

Course description is same as given under EA ZC451

SECY ZC351 Organizational Behaviour 3

Course description is same as given under SEMB ZC351

SECY ZG512 Object Oriented Analysis and Design 4

Course description is same as given under SEAC ZG512

SECY ZG513 Network Security 4

Course description is same as given under SECT ZG513

SECY ZG514 Data Warehousing 5

Course description is same as given under SEAC ZG514

SECY ZG517 Data Structures and Algorithm Analysis 5

Abstract data types; Linear data structures; Hash functions, Binary and other trees, traversal algorithms; Heaps and balanced trees; Sorting and searching techniques; Divide and conquer, recursion, backtracking, branch and bound; Computational complexity and bounds.

SECY ZG518 Database Design and Applications 5

Course description is same as given under SEAC ZG518

SECY ZG531 Pervasive Computing 4

Course description is same as given under SEAC ZG531

SECY ZG562 Software Engineering & Management 5

Course description is same as given under SEAC ZG562

SECY ZG623 Advanced Operating Systems 5

Course description is same as given under CS ZG623

SECY ZG629T Dissertation 20

Course description is same as given under BITS ZG629T

SECY ZG651 Software Architectures 5

Course description is same as given under SEAC ZG651

SECY ZG661 Software Quality Management 4

Course description is same as given under SEAC ZG661

SEHP ZC421 Computer Networks 3

Course description is same as given under BITS ZC481

SEHP ZC451 Internetworking Technologies 3

Course description is same as given under EA ZC451

SEHP ZG512 Object Oriented Analysis and Design 4

Course description is same as given under SEAC ZG512

SEHP ZG513 Network Security 4

Course description is same as given under ESPC ZG513

SEHP ZG514 Data Warehousing 5

Course description is same as given under SEAC ZG514

SEHP ZG517 Data Structures & Algorithm Analysis 5

Course description is same as given under SEHT ZG517

SEHP ZG518 Database Design & Applications 5

Course description is same as given under SEAC ZG518

SEHP ZG552 Software Testing Methodologies 4

Course description is same as given under SEAC ZG552

SEHP ZG562 Software Engineering & Management 5

Course description is same as given under SEAC ZG562

SEHP ZG622 Software Project Management 4

Course description is same as given under SECT ZG622

SEHP ZG623 Advanced Operating Systems 5

Course description is same as given under CS ZG623

SEHP ZG629T Dissertation 20

Course description is same as given under BITS ZG629T

SEHP ZG651 Software Architectures 5

Course description is same as given under SEAC ZG651

SEHT ZC421 Computer Networks 3

Course description is same as given under BITS ZC481.

SEHT ZC451 Internetworking Technologies 3

Course description is same as given under EA ZC451.

SEHT ZC462 Network Programming 3

Course description is same as given under SECT ZC462.

SEHT ZG512 Object Oriented Analysis & Design 4

Course description is same as given under SEAC ZG512.

SEHT ZG513 Network Security 4

Course description is same as given under SECT ZG513.

SEHT ZG514 Data Warehousing 5

Course description is same as given under SEAC ZG514

SEHT ZG516 Computer Organization & Software Systems 5

Programmer model of CPU; Basic concept of buses and interrupts; Memory subsystem organization; I/O organization; Concept of assembler, linker & loader; Types of operating systems; Concept of process; OS functions: Process scheduling, Memory management, I/O management and related issues.

SEHT ZG517 Data Structures & Algorithm Analysis 5

Abstract data types; Linear data structures; Hash functions, Binary and other trees, traversal algorithms; Heaps and balanced trees; Sorting and searching techniques; Divide and conquer, recursion, backtracking, branch and bound; Computational complexity and bounds.

SEHT ZG518 Database Design & Applications 5

Course description is same as given under SEAC ZG518

SEHT ZG520 Wireless & Mobile Communication 5

Signal propagation in a mobile environment, modulation, coding, equalization; first generation generation systems; multiple access techniques like FDMA, TDMA, CDMA, spread spectrum sytems; second & third generation systems, UMTS, IMT-2000; Wireless LAN, Wireless ATM and Mobile IP; emerging trends in Wireless & Mobile Communication.

SEHT ZG552 Software Testing Methodologies 4

Course description is same as given under SEAC ZG552

SEHT ZG562 Software Engineering & Management 4

Course description is same as given under SEAC ZG562.

SEHT ZG573 Digital Signal Processing 3

Course description is same as given under MELTI ZG573.

SEHT ZG591 Optical Communication 5

Optical communication systems and components; optical sources and transmitters (basic concept, design and applications); modulators (electro-optic, acousto-optic and laser modulation techniques; beam forming; focusing and coupling schemes to optical repeaters; optical amplifiers; optical field reception; coherent and non-coherent lightwave systems; fibre optic communication system design and performance; multichannel lightwave systems; long haul communications; fibre optic networks.

SEHT ZG623 Advanced Operating Systems 5

Course description is same as given under CS ZG623.

SEHT ZG629TDissertation 20

Course description is same as given under BITS ZG629T

SEHT ZG651 Software Architectures 5

Course description is same as given under SEAC ZG651

SEMB ZC211 Mathematics I 3

Course description is same as given under MELTI ZC211

SEMB ZC212 Mathematics II 3

Course description is same as given under MELTI ZC212

SEMB ZC213 Probability & Statistics 3

Course description is same as given under AAOC ZC111

SEMB ZC221 Structured Programming 3

Course description is same as given under MELTI ZC221

SEMB ZC222 Advanced Programming Techniques 3

Course description is same as given under SECT ZC222.

SEMB ZC241 Principles of Management 3

Course description is same as given under MEBF ZC231

SEMB ZC252 Discrete Structures for Computer Science 3

Course description is same as given under MATH ZC222

SEMB ZC261 Digital Electronics & Microprocessors 3

Course description is same as given under ES ZC261.

SEMB ZC322 Database Management Systems 3

Course description is same as given under SECT ZC322.

SEMB ZC351 Organisational Behaviour 3

A new perspective of management; conceptual model of organization behavior; the individual processes- personality, work attitude, perception, attribution, motivation, learning and reinforcement, work stress and stress management; the dynamics of organizational behavior- group dynamics, power & politics, conflict & negotiation, leadership process & styles, communication; the organizational processes- decision making, job design; organizational theory and design, organizational culture, managing cultural diversity; organizational change & development.

SEMB ZC362 Programming Languages & Compiler Construction 3

Course description is same as given under SECT ZC362.

SEMB ZC413 Computer Organization & Architecture 3

Course description is same as given under IS ZC351.

SEMB ZC415 Data Structures & Algorithms 3

Course description is same as given under IS ZC361.

SEMB ZC421 Computer Networks 3

Course description is same as given under BITS ZC481.

SEMB ZC422 Operating Systems 3

Course description is same as given under IS ZC362.

SEMB ZC432 Object Oriented Programming 3

Course description is same as given under BITS ZC411.

SEMB ZC451 Internetworking Technologies 3

Course description is same as given under EA ZC451.

SEMB ZC452 Mobile Telecom Networks 3

Fundamentals of mobile telecommunications; with an overview of first generation (analog) systems and more detailed coverage of second generation (digital) technologies; technology basics including descriptions of wireless network elements, spectrum allocation, frequency re-use, characteristics of the transmission medium; over the-air (OTA) interface characteristics; capacity, coverage, speech coding, channel coding and modulation techniques of TDMA and CDMA technologies; network characteristics; architecture, signaling, element management of IS-41 and GSM networks; call processing; call setup and release, handoff, roaming, advanced services; mobile data communications; circuit and packet switched data services, third generation (wideband data) mobile communications system requirements / architecture.

SEMB ZC461 Software Engineering 3

Course description is same as given under BITS ZC461.

SEMB ZC462 Network Programming 3

Course description is same as given under SECT ZC462.

SEMB ZC473 Multimedia Computing 3

Course description is same as given under EA ZC473.

SEMB ZC482 Satellite Communication 3

Review of microwave communications and LOS system; the various satellite orbits like GEO, MEO, LEO; the satellite link analysis and design; the communication transponder system like INSAT, INELSAT etc; the earth segment and earth station engineering; the transmission of analog and digital signals through satellite and various modulation techniques employed; the multiple access techniques like FDMA, TDMA, CDMA, DAMA, etc; the INSAT program; salient features of INSAT – systems and services offered; satellite services offered by INTELSAT, INMARSAT and future satellites like IRIDIUM etc; future trends in satellite communications.

SEMB ZG511 Design & Analysis of Algorithms 5

Course description is same as given under MELTI ZG511

SEMB ZG512 Object Oriented Analysis & Design 4

Course description is same as given under SEAC ZG512

SEMB ZG513 Network Security 4

Course description is same as given under SECT ZG513

SEMB ZG514 Data Warehousing 5

Course description is same as given under SEAC ZG514

SEMB ZG516 Embedded System Design 4

Course description is same as given under EEE ZG512

SEMB ZG552 Software Testing Methodologies 4

Course description is same as given under SEAC ZG552

SEMB ZG582 Telecom Network Management 5

Network architecture and protocols; LAN, MAN and WANs; internetworking; network planning; network management concepts and standards; administrative, operational and fault management; security issues; remote network management.

SEMB ZG591 Optical Communication 5

Course description is same as given under SEHT ZG591

SEMB ZG622 Software Project Management 4

Course description is same as given under SECT ZG622

SEMB ZG629T Dissertation 20

Course description is same as given under BITS ZG629T

SEMB ZG651 Software Architectures 5

Course description is same as given under SEAC ZG651

SEMB ZG659 Technical Communication 4

Course description is same as given under BITS ZG659

SEMB ZG661 Software Quality Management 4

Course description is same as given under SEAC ZG661

SEPC ZC211 Mathematics I 3

Course description is same as given under MELTI ZC211

SEPC ZC212 Mathematics II 3

Course description is same as given under MELTI ZC212

SEPC ZC213 Probability & Statistics 3

Course description is same as given under AAOC ZC111

SEPC ZC221 Structured Programming 3

Course description is same as given under SECT ZC221.

SEPC ZC222 Advanced Programming Techniques 3

Course description is same as given under SECT ZC222.

SEPC ZC241 Principles of Management 3

Course description is same as given under MEBF ZC231

SEPC ZC252 Discrete Structures for Computer Science 3

Course description is same as given under MATH ZC222

SEPC ZC261 Digital Electronics & Microprocessors 3

Course description is same as given under ES ZC261.

SEPC ZC322 Database Management Systems 3

Course description is same as given under SECT ZC322.

SEPC ZC362 Programming Languages & Compiler Construction 3

Course description is same as given under SECT ZC362.

SEPC ZC413 Computer Organization & Architecture 3

Course description is same as given under IS ZC351.

SEPC ZC415 Data Structures & Algorithms 3

Course description is same as given under IS ZC361.

SEPC ZC421 Computer Networks 3

Course description is same as given under BITS ZC481.

SEPC ZC422 Operating Systems 3

Course description is same as given under IS ZC362.

SEPC ZC432 Object Oriented Programming 3

Course description is same as given under BITS ZC411.

SEPC ZC451 Internetworking Technologies 3

Course description is same as given under EA ZC451.

SEPC ZC461 Software Engineering 3

Course description is same as given under BITS ZC461.

SEPC ZC462 Network Programming 3

Course description is same as given under SECT ZC462.

SEPC ZC473 Multimedia Computing 3

Course description is same as given under EA ZC473.

SEPC ZG511 Design & Analysis of Algorithms 5

Course description is same as given under MELTI ZG511

SEPC ZG512 Object Oriented Analysis & Design 4

Course description is same as given under SEAC ZG512

SEPC ZG513 Network Security 4

Course description is same as given under SECT ZG513

SEPC ZG514 Data Warehousing 5

Course description is same as given under SEAC ZG514

SEPC ZG517 Data Structures & Algorithm Analysis 5

Course description is same as given under SEHT ZG517

SEPC ZG518 Database Design & Applications 5

Course description is same as given under SEHT ZG518

SEPC ZG552 Software Testing Methodologies 4

Course description is same as given under SEAC ZG552

SEPC ZG562 Software Engineering & Management 5

Course description is same as given under SEHT ZG562

SEPC ZG622 Software Project Management 4

Course description is same as given under SECT ZG622

SEPC ZG623 Advanced Operating Systems 5

Course description is same as given under CS ZG623.

SEPC ZG629T Dissertation 20

Course description is same as given under BITS ZG629T

SEPC ZG651 Software Architectures 5

Course description is same as given under SEAC ZG651

SEPC ZG659 Technical Communication 4

Course description is same as given under BITS ZG659.

SEPC ZG661 Software Quality Management 4

Course description is same as given under SEAC ZG661

SEPS ZC451 Internetworking Technologies 3

Course description is same as given under EA ZC451

SEPS ZC462 Network Programming 3

Course description is same as given under IS ZC462

SEPS ZG512 Object Oriented Analysis and Design 4

Course description is same as given under SEAC ZG512

SEPS ZG513 Network Security 4

Course description is same as given under ESPC ZG513

SEPS ZG514 Data Warehousing 5

Course description is same as given under SEAC ZG514

SEPS ZG517 Data Structures and Algorithm Analysis 5

Course description is same as given under SEHT ZG517

SEPS ZG518 Database Design and Applications 5

Course description is same as given under SEAC ZG518

SEPS ZG531 Pervasive Computing 4

Course description is same as given under ESPC ZG531

SEPS ZG552 Software Testing Methodologies 4

Course description is same as given under SEAC ZG552

SEPS ZG562 Software Engineering & Management 5

Course description is same as given under SEAC ZG562

SEPS ZG623 Advanced Operating Systems 5

Course description is same as given under CS ZG623

SEPS ZG629T Dissertation 20

Course description is same as given under BITS ZG629T

SEPS ZG651 Software Architectures 5

Course description is same as given under SEAC ZG651

SESAP ZC211 Mathematics I 3

Course description is same as given under MELTI ZC211

SESAP ZC212 Mathematics II 3

Course description is same as given under MELTI ZC212

SESAP ZC213 Probability & Statistics 3

Course description is same as given under AAOC ZC111

SESAP ZC221 Structured Programming 3

Course description is same as given under MELTI ZC221.

SESAP ZC222 Advanced Programming Techniques 3

Course description is same as given under SECT ZC222

SESAP ZC241 Principles of Management 3

Course description is same as given under MELTI ZC241

SESAP ZC252 Discrete Structures for Computer Science 3

Course description is same as given under SECT ZC252

SESAP ZC261 Digital Electronics & Microprocessors 3

Course description is same as given under ES ZC261

SESAP ZC322 Database Management Systems 3

Course description is same as given under SECT ZC322

SESAP ZC362 Programming Languages & Compiler Construction 3

Course description is same as given under SECT ZC362

SESAP ZC413 Computer Organization & Architecture 3

Course description is same as given under SECT ZC413

SESAP ZC415 Data Structures & Algorithms 3

Course description is same as given under IS ZC361

SESAP ZC421 Computer Networks 3

Course description is same as given under BITS ZC481

SESAP ZC422 Operating Systems 3

Course description is same as given under IS ZC362

SESAP ZC432 Object Oriented Programming 3

Course description is same as given under BITS ZC411

SESAP ZC451 Internetworking Technologies 3

Course description is same as given under EA ZC451

SESAP ZC461 Software Engineering 3

Course description is same as given under BITS ZC461

SESAP ZC462 Network Programming 3

Course description is same as given under IS ZC462

SESAP ZC473 Multimedia Computing 3

Course description is same as given under EA ZC473

SESAP ZG511 Design & Analysis of Algorithms 5

Course description is same as given under MELTI ZG511

SESAP ZG512 Object Oriented Analysis & Design 4

Course description is same as given under SEAC ZG512

SESAP ZG513 Network Security 4

Course description is same as given under ESPC ZG513

SESAP ZG514 Data Warehousing 5

Course description is same as given under SEAC ZG514

SESAP ZG552 Software Testing Methodologies 4

Course description is same as given under SEAC ZG552

SESAP ZG622 Software Project Management 4

Course description is same as given under SECT ZG622

SESAP ZG629T Dissertation 20

Course description is same as given under BITS ZG629T

SESAP ZG651 Software Architectures 5

Course description is same as given under SEAC ZG651

SESAP ZG659 Technical Communication 4

Course description is same as given under BITS ZG659

SESAP ZG661 Software Quality Management 4

Course description is same as given under SEAC ZG661

SESL ZC421 Computer Networks 3

Course description is same as given under BITS ZC481.

SESL ZC422 Operating Systems 3

Course description is same as given under IS ZC362.

SESL ZC451 Internetworking Technologies 3

Course description is same as given under EA ZC451.

SESL ZC461 Software Engineering 3

Course description is same as given under BITS ZC461

SESL ZC462 Network Programming 3

Course description is same as given under SECT ZC462

SESL ZC472 Computer Graphics 3

Generation of dots, lines, arcs and polygons; color graphics, shades and levels; image transformation, windowing and clipping; 2-D and 3-D graphics; data structures, algorithms and optimization methods; case studies using GKS, CORE, etc; graphic languages and compilers.

SESL ZG511 Design & Analysis of Algorithms 5

Course description is same as given under MELTI ZG511

SESL ZG512 Object Oriented Analysis & Design 4

Course description is same as given under SEAC ZG512

SESL ZG514 Data Warehousing 5

Course description is same as given under SEAC ZG514

SESL ZG515 Network Security 4

Course description is same as given under SECT ZG513

SESL ZG622 Software Project Management 4

Course description is same as given under SECT ZG622

SESL ZG629T Dissertation 20

Course description is same as given under BITS ZG629T

SESL ZG651 Software Architectures 5

Course description is same as given under SEAC ZG651

SEWI ZC211 Mathematics I 3
SEWP ZC211 Mathematics I 3

Course description is same as given under MELTI ZC211

SEWI ZC212 Mathematics II 3
SEWP ZC212 Mathematics II 3

Course description is same as given under MELTI ZC212

SEWI ZC213 Probability & Statistics 3
SEWP ZC213 Probability & Statistics 3

Course description is same as given under AAOC ZC111

SEWI ZC221 Structured Programming 3
SEWP ZC221 Structured Programming 3

Course description is same as given under MELTI ZC221

SEWI ZC222 Advanced Programming Techniques 3
SEWP ZC222 Advanced Programming Techniques 3

Course description is same as given under SECT ZC222.

SEWI ZC241 Principles of Management 3
SEWP ZC241 Principles of Management 3

Course description is same as given under MEBF ZC231

SEWI ZC252 Discrete Structures for Computer Science 3
SEWP ZC252 Discrete Structures for Computer Science 3

Course description is same as given under MATH ZC222

SEWI ZC261 Digital Electronics & Microprocessors 3
SEWP ZC261 Digital Electronics & Microprocessors 3

Course description is same as given under ES ZC261.

SEWP ZC312 Technical Report Writing 3

Course description is same as given under TA ZC312

SEWI ZC322 Data Base Management Systems 3
SEWP ZC322 Data Base Management Systems 3

Course description is same as given under SECT ZC322

SEWI ZC362 Programming Languages & Compiler Construction 3
SEWP ZC362 Programming Languages & Compiler Construction 3

Course description is same as given under SECT ZC362

SEWI ZC413 Computer Organization & Architecture 3
SEWP ZC413 Computer Organization & Architecture 3

Course description is same as given under IS ZC351

SEWI ZC414 Telecom Switching Systems and Networks 3

Introduction, electromechanical switching, pulse dialing and DTMF dialing, stored program control, space division switching, speech digitization and transmission, time division switching, fundamentals of traffic engineering, telephone networks, signaling, data networks, layered architecture and protocols, LANs, packet switching networks, TCP/IP, ISDN, ATM networks.

SEWI ZC415 Data Structures & Algorithms 3
SEWP ZC415 Data Structures & Algorithms 3

Course description is same as given under IS ZC361

SEWI ZC421 Computer Networks 3
SEWP ZC421 Computer Networks 3

Course description is same as given under BITS ZC481

SEWI ZC422 Operating Systems 3
SEWP ZC422 Operating Systems 3

Course description is same as given under IS ZC362

SEWP ZC423T Project Work 20

Course description is same as given under BITS ZC423T

SEWI ZC432 Object Oriented Programming 3
SEWP ZC432 Object Oriented Programming 3

Course description is same as given under BITS ZC411

SEWI ZC444 Real Time Systems 3

Introduction to real-time systems, clock synchronization, task assignment and scheduling, programming language with real-time support, ADA, real-time communication protocols, real-time databases, fault tolerant techniques, reliability evaluation methods; case studies in real-time operating systems, simulation of real-time systems, embedded system programming.

SEWI ZC446 Data Storage Technologies and Networks 3
SEWP ZC446 Data Storage Technologies and Networks 3

Storage Media and Technologies – Magnetic, Optical and Semiconductor media, techniques for read/write operations, issues and limitations. Usage and Access – Positioning in the memory hierarchy, Hardware and Software Design for access, Performance issues. Large Storages – Hard Disks, Networked Attached Storage, Scalability issues, Networking issues. Storage Architecture. - Storage Partitioning, Storage System Design, Caching, Legacy Systems. Storage Area Networks – Hardware and Software Components, Storage Clusters/Grids. Storage QoS – Performance, Reliability, and Security issues.

SEWI ZC451 Internetworking Technologies 3
SEWP ZC451 Internetworking Technologies 3

Course description is same as given under EA ZC451.

SEWI ZC452 Mobile Telecom Networks 3

Course description is same as given under SEMB ZC452

SEWI ZC461 Software Engineering 3
SEWP ZC461 Software Engineering 3

Course description is same as given under BITS ZC461

SEWI ZC462 Network Programming 3
SEWP ZC462 Network Programming 3

Course description is same as given under SECT ZC462

SEWI ZC471 Management Information Systems 3

Course description is same as given under BITS ZC471

SEWP ZC473 Multimedia Computing 3

Course description is same as given under EA ZC473

SEWP ZG511 Design & Analysis of Algorithms 5

Course description is same as given under MELTI ZG511

SEWP ZG512 Object Oriented Analysis & Design 4

Course description is same as given under SEAC ZG512

SEWI ZG513 Network Security 4
SEWP ZG513 Network Security 4

Course description is same as given under SECT ZG513

SEWI ZG514 Data Warehousing 5
SEWP ZG514 Data Warehousing 5

Course description is same as given under SEAC ZG514

SEWI ZG520 Wireless & Mobile Communication 5

Course description is same as given under SEHT ZG520

SEWI ZG531 Pervasive Computing 4

Course description is same as given under SEAC ZG531

SEWP ZG552 Software Testing Methodologies 4

Course description is same as given under SEAC ZG552

SEWP ZG553 Real Time Systems 5

Course description is same as given under BITS ZG553

SEWI ZG582 Telecom Network Management 5

Course description is same as given under SEMB ZG582

SEWI ZG622 Software Project Management 4
SEWP ZG622 Software Project Management 4

Course description is same as given under SECT ZG622

SEWI ZG629T Dissertation 20
SEWP ZG629T Dissertation 20

Course description is same as given under BITS ZG629T

SEWP ZG651 Software Architectures 5

Course description is same as given under SEAC ZG651

SEWI ZG659 Technical Communication 4

SEWP ZG659 Technical Communication 4

Course description is same as given under BITS ZG659

SEWI ZG661 Software Quality Management 4
SEWP ZG661 Software Quality Management 4

Course description is same as given under SEAC ZG661

SEST ZC425 Data Mining 3
SEYI ZC425 Data Mining 3

Course description is same as given under IS ZC415

SEST ZC421 Computer Networks 3
SEYI ZC421 Computer Networks 3

Course description is same as given under BITS ZC481

SEST ZC473 Multimedia Computing 3
SEYI ZC473 Multimedia Computing 3

Course description is same as given under EA ZC473

SEST ZG512 Object Oriented Analysis and Design 4
SEYI ZG512 Object Oriented Analysis and Design 4

Course description is same as given under SEAC ZG512

SEST ZG513 Network Security 4
SEYI ZG513 Network Security 4

Course description is same as given under ESPC ZG513

SEST ZG516 Computer Organization & Software Systems 5
SEYI ZG516 Computer Organization & Software Systems 5

Course description is same as given under SEHT ZG516

SEST ZG517 Data Structures and Algorithm Analysis 5

SEYI ZG517 Data Structures and Algorithm Analysis 5

Course description is same as given under SEHT ZG517

SEST ZG518 Database Design and Applications 5

SEYI ZG518 Database Design and Applications 5

Course description is same as given under SEAC ZG518

SEST ZG531 Pervasive Computing 4

SEYI ZG531 Pervasive Computing 4

Course description is same as given under ESPC ZG531

SEST ZG629T Dissertation 20

SEYI ZG629T Dissertation 20

Course description is same as given under BITS ZG629T

SEST ZG651 Software Architectures 5

SEYI ZG651 Software Architectures 5

Course description is same as given under SEAC ZG651

SEST ZG652 Software Maintenance Management 4

SEYI ZG652 Software Maintenance Management 4

Course description is same as given under SEAC ZG652

SEST ZG661 Software Quality Management 4

SEYI ZG661 Software Quality Management 4

Course description is same as given under SEAC ZG661

SS ZG513 Network Security 4

This course examines issues related to network and information security. Topics include security concepts, security attacks and risks, security architectures, security policy management, security mechanisms, cryptography algorithms, security standards, security system interoperation and case studies of the current major security systems.

SS ZG514 Object Oriented Analysis and Design 4

Object orientation concepts, theories and principles; fundamental concepts of the object model: classes, objects, methods and messages, encapsulation and inheritance, interface and implementation, reuse and extension of classes, inheritance and polymorphism; process of object-oriented requirements specification, analysis and design; notations for object-oriented analysis and design; case studies and applications using some object oriented programming languages.

SS ZG515 Data Warehousing 5

Introduction, evolution of data warehousing; decision support systems; goals, benefit, and challenges of data warehousing; architecture; data warehouse information flows; software and hardware requirements; approaches to data warehouse design; creating and maintaining a data warehouse; Online Analytical Processing (OLAP) and multi-dimensional data, multi-dimensional modeling; view materialization; data marts; data warehouse metadata; data mining.

SS ZG516 Computer Organization & Software Systems 5

Programmer model of CPU; Basic concept of buses and interrupts; Memory subsystem organization; I/O organization; Concept of assembler, linker & loader; Types of operating systems; Concept of process; OS functions: Process scheduling, Memory management, I/O management and related issues.

SS ZG531 Pervasive Computing 4

Select application architectures; hardware aspects; human-machine interfacing; device technology: hardware, operating system issues; software aspects, java; device connectivity issues and protocols; security issues; device management issues and mechanisms; role of web; wap devices and architectures; voice-enabling techniques; PDAs and their operating systems; web application architectures; architectural issues and choices; smart card-based authentication mechanisms; applications;

issues and mechanisms in WAP-enabling; access architectures; wearable computing architectures.

SS ZG562 Software Engineering & Management 5

Current concepts, methods, techniques, and tools of the software engineering process; software process models; process definition and assessment; software measurement and metrics; project planning, estimation and control; requirements analysis and specification, design methods; quality assurance and testing; configuration management; process improvement; case studies and project work.

SS ZG653 Software Architectures 5

Systems engineering and software architectures; Hatley-Pirbhai architectural template; architecture flow diagrams; requirements engineering and software architecture; architectural design processes; design post-processing; real-time architectures; architectural design patterns; software architecture and maintenance management; object oriented architectures; client-server architectures; forward engineering for object oriented and client-server architectures; emerging software architectures.

TA ZC142 Computer Programming 3

Elementary computer organization; introduction to Number Systems; Representation of integers, real numbers and characters on computers; concept of range and accuracy; Arithmetic Overflow; Algorithms and algorithm development; structured program development through step wise refinement. Introduction to C language; Functions; Recursion; Data structure & algorithms; File management & file handling; Problem solving using C.

TA ZC232 Engineering Measurements 3

Performance characteristics of measuring instruments, measurement methods for mechanical, electrical, radiant, chemical, magnetic and thermal energy variables. Emphasis in this course shall be on the operation and use of instruments.

TA ZC312 Technical Report Writing 3

Elements of effective writing; art of condensation; business letter writing; memos; formal reports; technical proposals; conducting, and participating, meetings; agenda and minutes; strategies for writing technical descriptions, definitions, and classifications; oral presentation; use of graphic and audio- visual aids; editing.

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
ADMINISTRATIVE STRUCTURE

VICE-CHANCELLOR

Director, Pilani Campus | **Director, Goa Campus** | **Director, Hyderabad Campus** | **Director, Dubai Campus**

Deputy Director (Academic) | **Deputy Director (Administration)** | **Deputy Director (Research and Educational Development)** | **Deputy Director (Off-Campus Programmes)**

Divisions

Dean		Dean		Dean		Dean	Dean	Dean	Dean	Dean	Dean	Dean
Faculty Division I	**Instruction Division**	**Faculty Division II**	**Admissions**	**Faculty Division III**	**Educational Development Division**	**Academic Registration & Counselling Division**	**Research & Consultancy Division**	**Student Welfare Division**	**Educational Hardware Division**	**Engineering Services Division**	**Practice School Division**	**Work Integrated Learning Programmes Division**
Group Leaders	Assistant Dean Nucleus members	Group Leaders	Nucleus members	Group Leaders	Assistant Dean Nucleus members	Assistant Dean Nucleus members	Assistant Dean Nucleus members	Chief Warden Nucleus members	Nucleus members	Assistant Deans Nucleus members	Assistant Deans Nucleus members	Assistant Dean Nucleus members
Block Administration, Housekeeping, Physical Facilities, Lab., Classroom & Office Maintenance *Groups* Chem. Engg. Civil Engg. Management Economics & Finance Humanistic Studies Languages	Timetable Teaching Allocation & Implementation Feedback & Monitoring Teaching Workshop	Block Administration, Housekeeping, Physical Facilities, Lab., Classroom & Office Maintenance *Groups* Electrical & Electronics Engineering Engg. Technology Mech. Engg.	Admissions Operation of Flexibilities (Transfer, Dual Degree, etc.)	Block Administration, Housekeeping, Physical Facilities, Lab., Classroom & Office Maintenance *Groups* Bio. Sciences Chemistry Mathematics Pharmacy Physics	Course & Lab. Develop-ment Institutional & Educational Research Ideation Feedback Interface with MHRD, UGC, etc.	Registration Planning & Operation Academic Records of Students Eligibility Transcripts, Provisional Certificates Counselling Academic Counselling Board	Ideation Sponsored Research Consultancy Higher Degree Counselling Committee Doctoral Counselling Committee Interfacing with Agencies for Research	Hostels, NSS, Games & Athletics Student Activities Railway Concessions Scholarships & Aids Students Personal Files & Testimonials Student Discipline Recreational Activity Forum	Central Purchase Central Inventory of equipments	Printing & Reprography Electricity & Water Supply Campus Planning, Buildings' Construction, Maintenance	Establishment of Stations Faculty Allocation Feedback & Monitoring Student Needs at PS Location Station Operation Student Assignment & Evaluation	Off-Campus Work Integrated Learning Programmes Operation of Centres Preparation and delivering of Courses Academic Monitoring Board Admissions, Registration & Students Records

Units

Unit Chief	*Unit Chief*	*Unit Chief*	*Unit Chief*	*Registrar (Unit Chief)*	*Unit Chief*	*Unit Chief*	*Unit Chief*	*Unit Chief*	*Unit Chief*	*Unit Chief*	*Unit Chief*	*Unit Chief*	*Unit Chief*
Accounts & Finance Unit	**Computer Assisted Housekeeping Unit**	**Community Welfare & International Relations Unit**	**Entrepreneurship Development & Intellectual Property Rights Unit**	**General Administration Unit**	**Information Processing Centre Unit**	**Instrumentation Unit**	**Library Unit**	**Placement Unit**	**Public Relations Unit**	**Publications & Media Relations Unit**	**Software Development & Educational Technology Unit**	**Women Studies & Societal Development Unit**	**Workshop Unit**
Budget Officer Nucleus members	Assistant Unit Chief Nucleus members	Nucleus members	Nucleus members	Nucleus members	Group Leader Nucleus members	Group Leader Nucleus	Librarian Assistant Librarians Nucleus members	Nucleus members	Nucleus members	Nucleus members	Nucleus members	Nucleus members	Nucleus members
General Accounts Budget Monitoring Balance Sheet Auditing	Computeri-sation & Processing of Student Records Staff Records Budget preparation Accounts Alumni Records	Staff Welfare Extension Activities Infant Care Centre Inter-national Relations	Entrepreneurship Development Education & Research CEL and Network Activities TBI IPR Facilitation Technology Innovation Centre	Establishment Meetings Institute Records Award of Degrees/ Diplomas & Medals Medical, LTC, etc. Housing, Computer & Vehicle loan Scrutiny of Grades/ Reports	Centralised Computer Facilities *Group* Computer Science & Information Systems	Service & Maintenance of instruments EPABX Projection facilities Cable TV network Stage Light and Public Address System *Group* Electronics & Instrumentation	Books & Journals Acquisition Cataloguing Bibliography Services Archives Library Satellite Libraries Library Automation Inter-library Services	Campus Interviews	Liaison VFAST Hostel Cafeteria Security	All publications of the Institute Publicity through audio-visual and print media publications Media Relations	Software Research & Development Software Consultancy Identification and deployment of Educational Technologies Project Embryo e-learning technologies, course management etc. Desktop video-conferencing Online Book Access Provisioning BITS Virtual University Digital Video Studio	Women empower-ment Socio-economic & health upliftment of rural communities Student-led activities Cross-cultural inter-disciplinary research	Student Training Fabrication Servicing & Maintenance Transporta-tion In-house Power Generation Engineering Faculty Store

PART VIII

ADMINISTRATIVE STRUCTURE

ADMINISTRATIVE STRUCTURE

The Institute has a functional administrative structure (pages VIII-2, VIII-3 and VIII-4). Vice-Chancellor is the executive head of the Institute, including all its campuses. Further, each Campus has a Director who takes care of the day-to-day academic and administrative operations of the Campus. Other than Pilani Campus, for the time being, there are faculty members designated as Incharges of various activities such as Instruction, Registration, Practice School, etc.

Various activities and requirements arising out of innovative educational programmes have been grouped into functions and each functional Division is headed by a Dean and each Unit by a Chief. Unlike other traditional universities, the Institute has the concept of Group instead of Department, which is led by the Group Leader.

For each Division and Unit there are cohesive teams of faculty known as the nucleus to support the activities of the Division/Unit. Thus the administrative officers are:

Dean: Head of a Division

Chief: Head of a Unit

Group Leader: Head of a Group

Every faculty member of the Institute is administratively attached to Divisions/Units or to offices like Vice-Chancellor's Office and Director's Office, Deputy Directors' Office, etc.

OFFICERS OF ACADEMIC ADMINISTRATION

Vice-Chancellor

Prof. L.K. Maheshwari

Vice-Chancellor Designate

Prof. Bijendra N. Jain

Director, BITS, Pilani Campus

Prof. G. Raghurrama

Director, Goa Campus

Prof. K.E. Raman (Acting)

Director, Hyderabad Campus

Prof. V.S. Rao

Director, Dubai Campus

Prof. R.K. Mittal

Deputy Directors

Prof. G. Sundar (Off-Campus Programmes)

Prof. R.N. Saha (Research & Educational Development)

Registrar

Prof. M.M.S. Anand

Chief People Officer

Mr. Ramesh Maheshwari

Chief Financial Officer

Mr. Mukesh Jain

DIVISIONS

FACULTY DIVISION I (FD I) & INSTRUCTION DIVISION (ID)

Dean, FD I & ID

Prof. Ashoke Kumar Sarkar

Assistant Dean, ID

Dr. Ajit Pratap Singh

Nucleus (FD I)

Dr. Arvind Kumar Sharma
(Group Leader, Chemical Engg.)

Prof. Shamsher Bahadur Singh
(Group Leader, Civil Engg.)

Prof. Arya Kumar
(Group Leader, Economics & Finance)

Prof. Nirupama Prakash
(Group Leader, Humanistic Studies)

Dr. Sangeeta Sharma
(Group Leader, Languages)

Prof. Anil Kumar Bhat
(Group Leader, Management)

Nucleus (ID)

Dr. Srikant Routray, Dr. Manoj Kumar, Dr. Shibasish Chowdhury, Dr. Suresh Gupta, Dr. Bhupendra Kumar Sharma, Dr. Rajesh Prasad Mishra, Shri Manoj Kumar Saini, Dr. Navneet Gupta, Ms. M. Revathi, Mr. Puneet Singh.

FACULTY DIVISION II (FD II) & ADMISSIONS

Dean, FD II & Admissions

Prof. S. Gurunarayanan

Nucleus (FD II)

Prof. V.K. Chaubey (Group Leader, Electrical & Electronics Engg.)

Prof. Kodali Rambabu (Group Leader, Mechanical Engg. and Engineering Technology)

Nucleus (Admissions)

Prof. Sudeept Mohan, Dr. Debashis Bandopadhyaya, Dr. Hari Om Bansal, Dr. Hitesh Datt Mathur, Shri Rahul Singhal.

FACULTY DIVISION III (FD III) & EDUCATIONAL DEVELOPMENT DIVISION (EDD)

Dean, FD III & EDD

Prof. Ranendra N. Saha

Nucleus (FD III)

Prof. Ashis Kumar Das
(Group Leader, Biological Sciences)

Dr. Dalip Kumar
(Group Leader, Chemistry)

Dr. Balram Dubey
(Group Leader, Mathematics)

Prof. R. Mahesh
(Group Leader, Pharmacy)

Prof. Rashmi Ranjan Mishra
(Group Leader, Physics)

Nucleus (EDD)

Dr. Shrikant Yashwant Charde, Dr. Vishal Saxena, Dr. Champak Baran Das, Dr. Sanjeev Kumar.

ACADEMIC REGISTRATION AND COUNSELLING DIVISION (ARCD)

Dean

Prof. A.K. Sarkar

Assistant Dean

Dr. Niti Nipun Sharma

Nucleus (ARCD)

Dr. Arun Kumar Giri, Shri Bijay Kumar Rout, Dr. R. Raghunathan, Dr. Subit Kumar Saha, Shri K. Haribabu, Shri Maheshwar Dwivedi, Shri Jitendra Singh Rathore, Shri Sachin U. Belgumwar.

RESEARCH & CONSULTANCY DIVISION (RCD)

Dean

Prof. Ashis Kumar Das

Nucleus (RCD)

Dr. (Ms.) Monika Sharma, Shri Gunjan Soni, Shri Dinesh Kumar, Dr. Hemant R. Jadav, Shri Sharad Srivastava, Shri Amit Kumar Singh, Ms. Sunita Bansal, Dr. Prabhat Nath Jha.

STUDENT WELFARE DIVISION (SWD)

Dean

Prof. B.V. Babu

Nucleus (SWD)

Prof. Sanjay Kumar Verma (Chief Warden), Dr. Kumar Neeraj Sachdev, Mr. K. Vinayak, Dr. S.K. Sahoo, Dr. Navin Singh, Mr. Srinivas Reddy, all resident and non-resident wardens even though reporting elsewhere.

Chief Warden

Prof. Sanjay Kumar Verma

Wardens of Bhawans

Dr. Sanjiv Kumar Choudhary (Ashok), Dr. Hitesh Datt Mathur (Bhagirath), Dr. Subit Kumar Saha (Budh), Dr. Hari Om Bansal

(Gandhi), Dr. Ajit Pratap Singh (Krishna), Dr. Amit Dubey (Malviya), Dr. Kumar Neeraj Sachdev (Ram), Dr. R. Raghunathan (Rana Pratap), Dr. Srikanta Routroy (Shankar), Prof. Sanjay Kumar Verma (Vishwakarma), Mr. K. Vinayak (Vyas), Prof. (Ms.) Surekha Bhanot (Meera), Prof. (Ms.) Kusum Lata, (Meera).

Non-resident Wardens

Dr. Anshuman Dalvi (Ashok), Mr. G. Anand (Bhagirath), Dr. Subhendu Kumar Sahoo (Budh), Mr. Manojkumar Surajkaranji Soni (Gandhi), Dr. Navin Singh (Krishna), Dr. Champak Baran Das (Malviya), Dr. Pintu Modak (Malviya), Dr. Navneet Gupta (Malviya), Mr. Ashish Madhukar Gujrathi (Ram), Mr. Virendra Singh Shekhawat (RanaPratap), Dr. Jitendra Panwar (Shankar), Dr. Rajesh Prasad Mishra (Vishwakarma), Mr. Jitendra Singh Rathore (Vyas), Dr. (Ms.) Poonam Goyal (Meera), Dr. Ravi Kant Mittal (Day Scholar).

Physical Education

Dr. Pintu Modak (In-charge, Physical Education)

National Service Scheme

Prof. Vimal Bhanot (Co-ordinator)

EDUCATIONAL HARDWARE DIVISION (EHD)

Dean

Prof. N.V. Muralidhar Rao

Nucleus (EHD)

Dr. (Ms.) Poonam Goyal, Dr. R.K. Mittal, Dr. Anil Kumar, Dr. Sheth Pratik Nitinchandra, Dr. Ajay Kumar Sah, Dr. T.V.V.L.N. Rao.

ENGINEERING SERVICES DIVISION (ESD)

Dean

Prof. Rajiv Gupta

Assistant Dean

Dr. Anshuman (Maintenance)

Nucleus (ESD)

Dr. Anupam Singhal, Dr. Rajitha K., Ms. Meghna S. Charde.

PRACTICE SCHOOL DIVISION (PSD)

Dean

Prof. G. Sundar

Assistant Deans

Prof. Niranjan Swain

Nucleus (PSD)

Prof. (Mrs.) Kusum Lata, Dr. P. Srinivasan, Dr. Leela Rani, Dr. Devika, Mr. Parikshit Kishor Singh, Prof. M. D. Arora, Prof. B. V. Prasad, Prof. Arun Maity, Mr. Sai Sekhar Das M., Mr. Pavan Kumar Potdar, Ms. R. Bharathi, Prof. J. T. Rao.

WORK INTEGRATED LEARNING PROGRAMMES DIVISION (WILPD)

Dean

Prof. G. Sundar

Assistant Dean

Mr. K. Venkatasubramanian

Nucleus (WILPD)

Dr. Satyabadi Misra, Dr. Mukesh Kumar Rohil, Dr. Abhijit Rameshwar Asati, Dr. Manojkumar Surajkaranji Soni, Dr. Anand G, Mr. Suneel Kumar, Mr. Rajiv Ranjan Singh, Mr. Shailendra Singh Shekhawat, Mr. Kiran D C, Ms. N Mehala, Mr. Vimal SP, Mr. Arshad Javed.

BITS Alumni Affairs Division

Chairman

Prof. K.E. Raman

Faculty -in-charges

Dr. Arya Kumar (Pilani Campus),
Dr. Iven Jose (KK Birla Goa Campus),
Dr. K.V.G. Chandrasekhar (Hyderabad Campus),
Dr. Priti Bajpayee (Dubai Campus)

UNITS

ACCOUNTS & FINANCE UNIT (AFU)

Budget Officer

Shri Mohan Lal

Chief Accountant

Shri V.N. Sharma

COMPUTER ASSISTED HOUSEKEEPING UNIT (CAHU)

Unit Chief

Prof. S.C. Sivasubramanian

Assistant Unit Chief

Prof. Navneet Goyal

Nucleus (CAHU)

Shri Pankaj Vyas, Dr. Yashvardhan Sharma, Dr. Madhukar Mishra, Shri Devashish Sharma, Ms. Neha Gautam, Shri Rahul.

COMMUNITY WELFARE & INTERNATIONAL RELATIONS UNIT (CWIRU)

Unit Chief

Prof. Suman Kapur

Nucleus (CWIRU)

Prof. Rajendra Prasad Pareek, Dr. Sanjana R. Bhat,
Mr. Ashish Madhukar Gujrathi, Dr. Kaushar Vaidya

ENTREPRENEURSHIP DEVELOPMENT & INTELL-ECTUAL PROPERTY RIGHTS UNIT (EDIPRU)

Unit Chief

Prof. Arya Kumar

Nucleus (EDIPRU)

Dr. Omvir Chaudhry, Dr. Usha Manjunath, Mr. Arun Kumar Vaish, Dr. Jyoti, Mr. Rajan Pandey.

GENERAL ADMINISTRATION UNIT (GAU)

Unit Chief

Prof. M.M.S. Anand

INFORMATION PROCESSING CENTRE UNIT (IPCU)

Unit Chief

Prof. Janardan Prasad Misra

Assistant Unit Chief

Prof. Shanmugasundaram Balasubramaniam

Group Leader, Computer Science and Information Systems

Prof. Sudeept Mohan

Nucleus (IPCU)

Mr. Nirmal Kumar Gupta, Mr. Murali P., Mr. Vikas Singh, Mr. Vishal Gupta, Ms. Mayuri A. Digalwar.

INSTRUMENTATION UNIT (IU)

Unit Chief

Prof. Surekha Bhanot

Group Leader

Prof. V.K. Chaubey

Nucleus (IU)

Prof. R.P. Khare, Dr. Karunesh Kumar Gupta, Shri Rajesh Purohit, Shri Pawan Sharma, Shri Nitin Chaturvedi.

LIBRARY UNIT (LU)

Librarian

Dr. Ishwara Bhat M.

Assistant Librarians

Shri D.P. Sharma
Shri Deepak Mehta

Nucleus (LU)

Library Committee members even though reporting elsewhere.

PLACEMENT UNIT (PU)

Unit Chief

Prof. Mani Sankar Dasgupta

Nucleus (PU)

Dr. Hare Krishna Mohanta, Dr. Rajesh Mehrotra.

PUBLIC RELATIONS UNIT (PRU)

Unit Chief

Prof. M.K. Kashiramka

Nucleus (PRU)

Dr. Umesh Dhyani, Dr. M.L. Dash, Shri S.S. Naruka, Shri Ranjit Singh.

PUBLICATIONS AND MEDIA RELATIONS UNIT (PMRU)

Unit Chief

Dr. Ishwara Bhat M.

Nucleus (PMRU)

Dr. (Mrs.) Pushp Lata, Dr. (Mrs.) Geetha B., Dr. (Mrs.) Sushila Rathore, Dr. Virendra Singh Nirban, Dr. Sanjiv Kumar Choudhary, Dr. Gajendra Singh Chauhan, Ms. Ruchika Sharma.

SOFTWARE DEVELOPMENT & EDUCATIONAL TECHNOLOGY UNIT (SDETU)

Unit Chief

Prof. Rahul Banerjee

Nucleus (SDETU)

Dr. Rishikesh Vaidya, Mr. Virendra Singh Shekhawat, Ms. Keskar Swati Pradipkumar, Mr. Avinash Gautam, Mr. Praveen Ranjan Srivastava, Prof. Sundar Balasubramanian (External Member: Theoretical Computer Science), Dr. Gajendra Singh Chauhan (External Member: Communication & Advertisement), Ms. K. Manjusha, Mr. Rajiv Ranjan Singh (External Member: Wearable Computing), Mr. Ajay Rungta, Mr. Rashmi Ranjan Mohapatra.

WOMEN STUDIES & SOCIETAL DEVELOPMENT UNIT (WSSDU)

Unit Chief

Prof. Nirupama Prakash

Nucleus (WSSDU)

Dr. Surya Kanta Maharana.

WORKSHOP UNIT (WU)

Unit Chief

Dr. Kuldip Singh Sangwan

Nucleus (WU)

Dr. A. K. Digalwar, Mr. Girish Kant, Mr. Varinder Kumar, Mr. Navneet Khanna.

OFFICERS OF OTHER ACTIVITIES

BITS Alumni Association (BITSAA)

Prof. R.K. Mittal (President), Vacant (Vice-President), Mr. Yash Kr. Gandhi (Secretary), Mr. Bedanta Krishna Bhuyan (Jt. Secretary), Dr N.N. Sharma (Treasurer), Mr. Harsh Agarwal (Jt. Treasurer), Prof. (Mrs.) Surekha Bhanot, Prof. M.K. Kashiramka, Dr. Umesh Dhyani, Mr. Hari Babu K., Mr. Nand Kumar, Ms. Kopal Sinha, Mr. Karthik Bagga, Mr. Piyush Rathore, Mr. Rahul Kotnala, Mr. Sumesh Agarwal (Members)

Campus Interviews

Prof. Mani Sankar Dasgupta, Prof. S. Gurunarayanan, Dr. Rajesh Mehrotra.

Scholarships & Fellowship Committee (SFC)

Prof. B.V. Babu (Convenor), Prof. Ashoke Kumar Sarkar, Prof. S. Gurunarayanan, Prof. R.K. Mittal, Prof. Sanjay Kumar Verma.

Students Aid Fund (SAF)

Prof. B.V. Babu (Convenor), Prof. Ashoke Kumar Sarkar, Prof. S. Gurunarayanan, Prof. R.K. Mittal, Prof. Sanjay Kumar Verma, Aaditya Jain, Challa Varun Reddy, Konda Susheel, Rahul Rangan, Shantanu Bhadari, Devesh Kumar, Aniruddha C Kadvekar, Shivangi Mittal.

Intensive Teaching Workshop (ITW)

First Semester:

Group I – Prof. Sudeept Mohan (Coordinator), Mr. Sudheeer Thakur, Dr. Hari Om Bansal, Dr. Surya Kant Maharana, Dr. Suresh Gupta

Group II – Dr. S.N.Karbelkar (Coordinator), Dr. R.K.Mittal (CE), Dr. Risikesh Vaidya, Dr. Jitendra Panwar, Dr. Sanjiv Kumar Choudhary

Second Semester:

Group I – Prof. Rakesh Mehrotra (Coordinator), Dr. Arvind Kumar Sharma, Dr.(Mrs) Pushp Lata, Dr. Arvind Sudarshan, Dr. Navneet Gupta

Group II – Dr. Dalip Kumar (Coordinator), Dr. Srikant Y Charde, Dr. Lalita Gupta, Dr. Anshuman Dalvi, Dr. Gajendra S Chauhan.

Counsellors for Students

Prof. Navneet Goyal, Prof. Janardan Prasad Misra, Prof. G. Raghurama, Prof. G. Sundar, Prof. Sanjay Kumar Verma.

International Students Advisor

Prof. Ranendra N. Saha

Central Analytical Laboratory (CAL)

Prof. R. Mahesh (Co-ordinator), Dr. Dalip Kumar, Prof. Ashis Kumar Das, Prof. R.R. Mishra.

Technology Innovation Centre (TIC)

Prof. Arya Kumar, Dr. Anu Gupta.

Centre for Enterprenurial Leadership (CEL)

Prof. Arya Kumar (Convenor), Prof. Anil Kumar Bhat, Dr. Motilal Dash, Prof. Satyabadi Misra, Prof. Vimal Bhanot, Dr. Sangeeta Sharma, Dr. R. Raghunathan, Dr. Usha Manjunath, Dr. Jyoti, Mr. Arun Kumar Vaish, Mr. Prateik Pothuneedi, Mr. Ajay Bhise, Mr. Pranav Theegala, Mr. Rishabh Kaul, Mr. Jayesh Mhatre, Mr. Raghav Mimani, Ms. Lasys Jagirdhar, Mr. Aniket K. Tekawade, Mr. Nikhil R., Mr. Rohit Agarwal, Mr. Eshaan Puri, Ms. Trisha Anand, Ms. Karuna Ahuja, Ms. Anindita Nayak.

Centre for Research on Educational Innovation & Institutional Development (CREIID)

Prof. L.K. Maheshwari (Vice-Chancellor), Dr. M.S. Soni (Coordinator), Shri Brij Mohan Upadhyaya (Secretary).

Committee for Combating Sexual Harassment Problems

Prof. (Mrs.) Surekha Bhanot (Convenor), Prof. Rajiv Gupta, Prof. Ashoke Kumar Sarkar, Prof. (Mrs.) Kusum Lata, Prof. N V Muralidhar Rao (Nodal Officer).

Campus Planning & Maintenance Committee

Prof. Rajiv Gupta (Convenor), Prof. Ashoke Kumar Sarkar, Prof. Budida Varahala Babu, Dr. Anshuman, Dr. Kuldip Singh Sangwan.

House Allotment Committee

Prof. Rajiv Gupta (Convenor), Prof. M.M.S. Anand,
Prof. (Ms.) Suman Kapur.

Visiting Faculty and Students Hostel (VFAST Hostel)

Prof. M.K. Kashiramka.

Infant Care Centre

Prof. (Ms.) Suman Kapur

Recreational Activity Forum (RAF)

Dr. Kumar Neeraj Sachdev (Incharge), Mr. Manikonda Venkata Abhisek, Mr. Prateek Choudhary, Mr. Parne Pruthivi Reddy, Mr. Parihar Aditya Narendra, Ms. Shabnam

Bhattacharyya, Mr. Rajarshi Sen, Dr. Yashvardhar Sharma, Mr. Nikhil Prakash, Mr. Budh Ram, Mr. Ashok Kumar Saini.

UGC Unit & UGC Liaison

Prof. Ranendra N. Saha

Purchase Committee

Prof. N.V. Muralidhar Rao (Convenor), Prof. L.K. Maheshwari, Prof. G. Raghurama, Prof. R.K. Mittal, Prof. Ashoke Kumar Sarkar, Prof. S. Gurunarayanan, Prof. Ranendra N. Saha, Shri Mohan Lal.

Centre for Robotics & Intelligent Systems

Dr. Bijay Kumar Rout (Coordinator), Prof. R.K. Mittal, Dr. Niti Nipun Sharma, Shri Arshad Javed.

Centre for Desert Development Technologies

Prof. Rajiv Gupta (Coordinator), Prof. Surekha Bhanot, Dr. Kuldip Singh Sangwan, Dr. Ajit Pratap Singh, Prof. S. Gurunarayanan, Prof. B.V. Babu, Prof. S.K. Verma, Dr. Jitendra Panwar, Dr. B. Vani, Dr. Manojkumar Surajkaranji Soni, Prof. Nirupama Prakash.

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Earn While You Learn Program (EWYLP)

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Sunilkumar V., Ph.D.	Assistant Professor	Goa
Mitaxi Mehta, Ph.D.	Assistant Professor	Goa
Prasanta Kumar Das, Ph.D.	Assistant Professor	Goa
Teny Theresa John, Ph.D.	Assistant Professor	Goa
Chandradew Sharma, Ph.D.	Assistant Professor	Goa
Ram Shankar Patel, Ph.D.	Assistant Professor	Goa
Tarun Kumar Jha, Ph.D.	Assistant Professor	Goa
Souri Banerjee, Ph.D.	Assistant Professor	Hyderabad
PK Thiruvikraman, Ph.D.	Assistant Professor	Hyderabad
Kannan Ramaswamy, Ph.D.	Assistant Professor	Hyderabad
Aravinda N Raghavan, Ph.D.	Assistant Professor	Hyderabad
Sharmistha Paul, Ph.D.	Assistant Professor	Hyderabad
B. Hari Hara Venkataraman, Ph.D.	Assistant Professor	Hyderabad
Mousumi Das, Ph.D	Assistant Professor	Hyderabad
Meenakshi Viswanathan, Ph.D	Assistant Professor	Hyderabad
Divya Sharma, Ph.D.	Assistant Professor	Hyderabad
Vijay Sharma, M.Sc.(Hons.)	Teaching Assistant	Pilani
Chandrasekhar, Ph.D.	Adjunct Professor	Pilani
S.R. Gowarikar, Ph.D.	Adjunct Professor	Pilani
Anil Jain, Ph.D.	Adjunct Professor	Pilani
Paresh K. Joshi, Ph.D.	Adjunct Faculty	Pilani
Nilay Narain, B.Sc.	Adjunct Faculty	Pilani
M.R. Narayanan, M.Sc.,M.E.	Adjunct Professor	Pilani
Anant Vishnu Narlikar, Ph.D.,Sc.D.	Visiting Professor	Goa
Yagnaswami Sundara Rajan, Post-	Adjunct Professor	Pilani
Satish R. Shetye, Ph.D.	Adjunct Professor	Goa
Kaushik N. Subramanian, M.Sc.	Adjunct Faculty	Pilani

SCIENTISTS/PROFESSIONALS PARTICI-PATING IN SPECIFIC COLLABORATIVE PROGRAMMES:

The list of scientists / professionals from industries/ collaborating organizations who are currently involved and actively participating in running specific collaborative programmes is given below:

BITS - Atomic Energy Education Society, Mumbai Collaboration: M. S. Educational System Management

Dr. S Kulkshetra, Dr. Madan Rao.

BITS - Bharat Forge Limited, Pune Collaboration: B. S. in Manufacturing Engineering

Mr. Amit Kalyani, Mr. Raju Kalyani, Dr. SV Bhave, Mr. G K Agarawal, Mrs Leena Deshpande, Mr. Harish Deshpande, Mr. Vikas Jadhav, Dr. Sanjay D Pohekar, Mr. S Jagadeesswaran, Mr. Vivek S Rane, Mr. K Deshmukh, Mrs Manish Shaik, Mr. N.Junarkar, Mrs. Kanchan Pujari; Chandrakishore S Choudhary, Mr. Avinash Bhadade, Mr. Gajanana Keskar.

BITS – Bhaktivedanta Institute, Mumbai Collaboration: M. S. in Consciousness Studies

Dr. Ravi Gomatam, Dr. R. A. Sinari, Dr. P. K. Joshi, Dr. S. Nagarkatti, Dr. R. K. Shyamsunder, Mr. Greg Anderson, Mr. Claudius D'Souza, Dr. Padmini Shetty, Dr. S. K. Rohida, Dr. K. P. Rajan, Dr. C. Unnikrishnan, Dr. K. Samudravijaya, Mr. Santos Sadan.

BITS – Chambal Fertilizers & Chemicals Limited, Gadepan Collaboration: B. S. in Process Engineering

Mr. Vinod Mehra, Mr. Alok Dayal, Mr. Raghav Mathur, Mr. U. C. Mittal, Mr. J. S. Sodhi, Mr. P. C. Srinivasan, Mr. Sudhir Pandey, Mr. S. K. Arora, Mr. A. K. Agarwal, Mr. U. R. Singh, Mr. R. R. Soni, Mr. Umesh Jain, Mr. P. K. Tyagi, Mr. Rajan Khular, Mr. Inderjeet Singh, Mr. A. K. Saxena, Mr. Mahabir Singh, Mr. Pushpsheel Gupta, Mr. Amit Goyal, Mr. Anil Kumar Gupta, Mr. Kapil Mittal.

BITS – Christian Medical College & Hospital, Vellore, Bombay Hospital, Mumbai and Bombay Hospital, Indore Collaboration: M. Phil. in Hospital & Health Systems Management

From Christian Medical College, Vellore

Dr. George M. Chandy, Dr. Jayaprakash Muliyil, Dr. Anand Job, Dr. R. Selvakumar, Mrs. Sundari Edwin, Mrs. Bharathy Jacob, Mr. Samuel N. J. David, Mr. Samuel Abraham, Sr. Valli Babu, Dr. K. R. John, Dr. Vinod Shah, Mr. J. P. Peter, Dr. John Prakash, Dr. Joseph Kuruvilla, Dr. Mary Mathews, Dr. O. C. Abraham, Dr. Ninan Chacko, Dr. Sunil Chandy, Dr. Suresh David, Dr. John C. Muthusami, Dr. Priya Abraham, Dr. Antonisamy, Dr. Sara Bhattacharji, Dr. Dolly Daniel, Mr. Samson, Mr. Soundaranayagam, Mr. Sivasilam, Mr. Denzil Ranjit Singh, Mr. P. G. Thomas, Mr. Pinto, Mr. Sezlian, Mr. Francis, Mr. Baskaran, Mr. Jayavelu, Mr. Ebenezer, Mrs. Annie Valsan, Mr. Sunny Kuruvilla, Mr. Mathew Asirvatham, Mrs. Kezia Esther Patel, Mr. Ruth Edward, Mr. J. S. Pancharatnam, Prof. Jeyakar Chellaraj, Prof. Allan John, Mr. Ravishankar, Mr. Relton.

From Bombay Hospital, Mumbai and Indore

Mr. B. K. Taparia, Mr. S. V. Muzumdar, Dr. D. P. Vyas, Dr. R. V. Patil, Dr. Bipin Chevale, Dr. S. R. Suryawanshi, Mr. G. P. Sharma, Dr. Rajesh Chaumal, Dr. R. K. Choudhary, Dr. Rajendra Goyal, Dr. Eric Borges, Dr. Inder Talwar, Dr. D. B. Modi, Dr. P. Amin, Dr. Nina Desai, Dr. Maya Parihar, Dr. D. N. Amarapurkar, Dr. J. Sorabjee, Mr. Jaikumar Kapoor, Ms. G. D. Koppikar, Dr. P. M. Bhujang, Dr. Vinay Kothari, Dr. Chaskar.

BITS–Cognizant Technology Solutions, Chennai Collaboration: M. S. in Software Engineering

Ms. Padmaja Ramesh, Mr. Antony Kaspar Rajesh, Mr. Santosh Gopalakrishnan, Mr. M. J. Shankarraman, Mr. R. Ravi, Mr. V. Bhaskar, Mr. G. Sridhar, Mr. M. Shankar, Dr. V. Maheswari, Dr. S. Chelliah, Dr. Murali Raman, Mr. S. Prabhu, Mr. V. Srinivasan, Mr. Sreekumar Gopalan, Mr. Ravi Ramachandran, Mr. Baskar Viswanathan, Mr. Jai Janani Seshadri, Mr. D. Ramesh Kumar, Ms. Christy A, Mr. C. Ramamurthy, Mr. Swaminath Vaidyanathan,

Mr. Ramasamy Prakash, Mr. Sivakumar Agneeswaran.

BITS - Consultancy Development Centre, New Delhi Collaboration: M. S. in Consultancy Management

Dr. Sunil Abrol, Mr. Suresh Kumar, Mr. A. K. Puri, Mr. Srinath Savoor, Dr. S. K. Garg, Mr. K. K. Vohra, Mr. B. G. Gupta, Mr. Rajiv Khurana, Mr. Sunil Soni, Dr. S. K. Laroiya, Mr. Pawan Bakhshi, Mr. S. K. Sharma, Mr. Rohit Mehtani, Dr. Vinay Kumar, Mrs. S. A. Jyoti Bhat.

BITS – Dabur Pharma, Kalyani Collaboration, M. S. Pharmaceutical Operations & Management

Dr. J Chattopadhyay, Dr. D P Das, Dr. S Sarkar, Mr. Rakesh Sharma, Mr. Kaushik Chongder, Mr. Dibyendu Das.

BITS – Dr. Reddy's Laboratories Ltd., Hyderabad Collaboration: M. Sc. (Tech.) in Pharmaceutical Chemistry and M. S. in Pharmaceutics

Dr. Anji Reddy, Mr. Satish Reddy, Mr. G Muralikrishna, Mr. B Karunakar, Dr. K N Singh, Dr. Rajiv A Desai, Dr. Pratap Reddy, Mr. S Kameswara Rao, Mr. Mehar Kiran P., Mr. R. V. Ramesh, Mr. A. Surya Prakash, Ms. Jaya Chitra, Prof. J. T. Rao, Mr. Murali Krishna, Mr. Bipaswan Dash, Mr. Shashank N.Lulay, Mr. A.Karunakar, Mr. N.Badri Vishwanathan, Ms. Indu Jagadesh, Mr. Ch.Praveen, Mr. P. Pratap Reddy, Mr. F. Toorkey, Mr. K.Sitarama Rao

BITS – Frontier Lifeline – Dr. K. M. Cherian Heart Foundation, Chennai Collaboration: B. S. in Physician Assistant

Dr. K. M. Cherian, Prof. N. R. Rajagopal, Dr. B. R. Jagannath, Dr. Soma Guhathakurta, Dr. Ravi Agarwal, Dr. Madhu N. Shankar, Dr. Sanjay. M. Cherian, Dr. Pramod. K. Jiaswal, Dr. Joy. M. Thomas, Dr. G. N. Prasad, Dr. Jaishankar K. , Dr. Snehal Kulkarni, Dr. Prem Sekar, Dr. J. Vimala, Dr. Kinnari Bhatt, Dr. Kirthivasan V. , Dr. Susan Verghese, Dr. Sushma Nayar, Dr. Sai Babu, Dr. Usha Gupta, Ms. Nirmala Jesudasan, Mr. M. Ashok Kumar, Dr. Pradeep K Nair, Dr. S. Kanthimathi, Dr. L. K. Prem Kumar, Dr. Vivek, Dr. C R Srikumari Srisailapathy, Ms. N. G. V. Subhashini, Ms. Deivanai, Ms. Priya Jebakaran, Dr. N Ramanathan, Dr. K S Narayanan

BITS – HCL Technologies Ltd., Chennai Collaboration: M. S. in Software Engineering

Mr. B. C Sekar, Mr. Mohan Rajkumar, Mr. Shan.

BITS – Hindustan Zinc Ltd., CLZS, Chanderia, Chittorgarh Collaboration: B. S. Programme in Process Engineering

Mr. Ravi Gupta, Mr. M. S. Mehta, Mr. Jeykumar Janakraj, Mr. H K Mehta, Mr. Pushkar Kataria, Mr. Dipak Kumar Ghosh, Mr. Rajesh Kumar Bansal, Mr. D. C. Yadav, Mr. R. K. Mukherjee, Mr. S. K. Baidya, Mr. C. Chandru, Mr. Y. S. Verdia, Mr. Harinder Singh, Mr. Pradeep Kumar Chaturvedi, Mr. P. Satpathy, Mr. Jeewan Rajwania, Mr. Col. Kamal Kant, Ms. Shikha Arora.

BITS – HP GDIC, Bangalore Collaboration: M. S. Software Engineering

Mr. P. N. Padmanabha, Mr. N. S. Sekar, Mr. N. C. Naveen, Mr. R. Nagaraja, Mr. Adarsh

BITS – International Centre for Cardio Thoracic and Vascular Diseases, Chennai Collaboration: B. S. in Physician Assistant

Dr. K. M. Cherian, Dr. Soma Guhathakurta, Dr. Ravi Agarwal, Dr. Prashanth Vaijyanath, Dr. Smartin Abraham, Dr. Ganapathi, Dr. Kulasekaran M, Dr. Raghavan Subramanyan, Dr. S. Balaji, Dr. Joy M. Thomas, Dr. G. N. Prasad, Dr. Senthamari, Dr. Prem kumar, Dr. Anand, Dr. Bhima Sankar, Dr. R. Prem Sekar, Dr. C. Shanthi, Dr. Anuradha, Dr. D. Sasirekha, Dr. Nagaraj, Dr. Yogesh C. Sathe, Dr. Anand Rane, Dr. Sudeep Varma, Dr. Charanjit Kaur, Dr. Samuel Sylvester A. , Ms. Farida Farzana. A. J.

BITS – Indian Institute of Quality Management, Jaipur Collaboration: M. S. in Quality Management

Mr. A. K. Malik, Ms. Meenakshi Jwala, Mr. Azad Verma, Ms. B S Sisodia, Mr. B. C. Ashok Kumar, Mr. P. R. Haridas, Mr. R. Subbaraj, Mr. Ravi Kumar,.

BITS - JSW Steel Ltd., Vijayanagar Collaboration: B. S. in Process Engineering

Dr. V. K. Nowal, Mr. H. R. Lal, Dr. S. S. Gupta, Mr. Triveni Kakimani, Mr. Achutha Raghava, Mr. Nagesh Hosahalli, Mr. Shyam Sunder Gupta, Mr. Pankaj Gupta, Mr. Madhu Ranjan, Mr. D Satish Kumar, Mr. SMR. Prasad, Mr. Srinivas Batni, Mr. Shakeel Ahmed Maniyar, Mr. Jeevargi Phakirappa, Mr. Saurabh Kumar.

BITS – L. V. Prasad Eye Institute, Hyderabad Collaboration: B. S. in Optometry

Dr. Gullapalli. N. Rao, Prof. D. Balasubramaniam, Dr. G. Chandra Shekhar, Dr. T. P. Das, Dr. Savitri Sharma, Dr. Usha Gopinathan, Dr. Anil Mandal, Dr. V. Sangwan, Dr. Prashant Garg, Dr. Geeta Vemuganti, Dr. Santosh Honavar, Dr. Archana, Dr. Annie Mathai, Dr. Ajith Babu, Dr. N. Hussain, Dr. Somasheela, Dr. Subhadra Jalali, Dr. Praveen Krishna, Dr. Ramesha, Ramesh Murthy, Dr. Sangamitra Burman, J, Mr. M. Srinivas, Mrs. Vijaya Kumari, Mrs. Beula, Ms. Manjula, Ms. Moneisha Gokhale, Mr. Jachin D. Williams, Dr. Joveeta Joseph, Mr. Krishnaiah, Mr. Subba Rao, Mr. Ganshyam Singh, Mr. Hari Babu, Mr. Y. Vijay Kumar, Mr. Vinod Kumar M. , Dr. Aparna Dugirala, Ms. Rubykalla, Mr. M. Guru Prasad, Ms. Sheela Devi, Ms. Sowndarya, Mrs. Preeji, Ms. Hemalatha, Ms. Padmavathi, Mr. Ganesh Babu, Mr. Azam, Mr. L. Rajesh, Mr. K. Mahesh Kumar, Mr. P. Saandeep Reddy, Mrs. Rammam, Mr. Sateesh, Mr. Pasha, Ms. Saritha, Mr. Nageshwar Rao, Mr. Subash.

BITS– Madras Medical Mission, Chennai Collaboration: B. S. in Physician Assistant and M. Phil. in Physician Assistant

Prof. Alex Zachariah, Shri. Verghese Eapen, Prof. Philomena Mariadoss, Prof. Thankam Rama Verma, Dr. S. Rajan, Dr. Benjamin Ninan, Dr. S. Mullaseri Ajith, Dr. Suresh Kumar, Dr. J Ezhilan, Dr. M K Lalitha, Dr. Ulhas Pandurangi, Dr. Latchumana Dhas, Dr. S. Selva Kumar, Dr. Ramani Devairakkam, Dr. Raveendran, Dr. V. S. Manoharan, Dr. N. Kanagarajan, Dr. Sadullah Basha, Dr. Saratha Kathiresan, Shri. K. Narayanan, Shri. N. Ramanathan, Ms. Smitha Rukmani, Shri. Radhakrishnan, Mr. Prabhu A, Ms. S Nishaa, Ms. Basilea Gunalan, Ms. Sharaon

BITS - Matrix Laboratories, Hyderabad Collaboration: M. Sc. (Tech.) Pharmaceutical Chemistry

Mr. Mohan Sharma, Mr. Ravindra Verma, Mr. Zameer Ahmed, Dr. Sri Ram, Ms. P. Sreelakashmi, Mr. V.Peespati, Mr. Sai Prakash, Ms. T. Padmaja.

BITS – National Council of Science Museums, Kolkata Collaboration: M. S. in Science Communication

Mr. G S Rautela, Mr. Samir Kumar Ray, Dr. J. Sthanapati, , Mr. S Chaudhuri, Mr. S K Emdadul Islam, Dr. Bernard Finn, Ms. E Lee Williams, Ms. Karen Lee, Dr. Babak Ashrafi, Dr. Nigel Briggs, Ms. Ann Rossilli, Ms. Nancy J. Fuller, Prof. Harvinder Singh Jabbal, Mr. E Lee Williams, Ms. Karen Lee, Prof. Ruth Cowan, Ms. Ann Rossilli, Mr. Pathik Guha, Prof. R P Banerjee, Prof. Ambar Mukherjee, Prof. Asish ahiri, Prof. Arunasish Acharya, Mr. Raja Mohanty, Prof. Dr. Tapati Basu, Dr. Debabrata Majumdar, Prof. Kalyan Dutta, Dr. Somenath Ghosh, Mr. Pradip Bakshi, Prof. Subir Sen, Dr. Santanu Chakraborty, Dr. Tushar Chakraborty, Ms. Swati Bhattacharya, Dr. Sisir Sen, Prof. (Dr.) Rita Sinha, Mr. Jitendra Arora, Prof. Chittabrata Palit, Prof. Asim Kr. Mitra, Prof. B N Gupta, Prof. Kunal, Chattopadhyay, Dr. Anirban Das, Dr. Manas Pratim Das, Prof. Samar Bhattacharya, Dr. Siddhartha Roy, Prof. Rajib Bandopadhyay.

BITS – NTPC, Ltd., New Delhi; North Delhi Power Ltd., New Delhi; Tehri Hydro Development Corporation Ltd., Tehri; Essar Power Ltd., Hazira; and Hindalco Industries Ltd., Renusagar Collaboration: B. S. in Power Engineering

Mr. A. C. Chaturvedi, Mr. Ashok Swaroop, Mr. Prem Chand, Ms. Purnima Lahiri, Mr. Anil Kumar Dang, Mr. Pratap Singh, Mr. B. L. Swamy, Mr. Bimal P. Shah, Mr. Sanjay Kumar Sharma, Mr. M. Mondal, Mr. B. P. Sahoo, Mr. M. D. Motwani, Mr. V. Venkatesh, Ms. Snehalata, Mr. K. L. Chowdhury, Mr. A. Manoharan, Mr. D. Ponda, Mr. Rabeen Singh,

Mr. Shivank Singh, Mr. C. V. Nagkumar, Mr. C. Minz, Mr. Arun Kumar, Mr. Anil Matoo, Mr. Chetan Dashora, Mr. Rajat Bhogal, Mr. Suneel Kumar, Mr. Atul Goel.

BITS – Patni Computer Systems Ltd., Mumbai and Pune Collaboration: M. S. in Software Engineering

Mr. Mohiniraj Sutavani, Mr. Anil M. Patil, Mrs. Veena Deshpande, Ms Trupti Nikalje, Ms. Manjusha Khaire , Mrs Palak Jadhav, Ms Soumya H, Ms. Neha Gupta, Mr. Dinesh Anantwar, Mr. SG Lakhadive, Mr. Santosh Kumar Chobe, Dr. N A Joshi, Mr. Sunil Mavinkurve Ms. Trupti Gandhi, Prasad Ramanadhan, Mr. Ashish Jadhav, Ms. Seema Shah,Ms. Rohini Vijayan.

BITS – Persistent, Pune Collaboration: M. S. in Software Engineering

Ms Subhangi Kelkar, Ms Rashmi Rajopadhye, Mr. Siddarth Pendse; Mrs Pradyna Kashikar, Mrs Nilima Diwate, Mr. Sanjay Joshi, Mr. Hitendra Khairnar, Mrs Sneha Thombre, Mr. Sanjeev Pitambare, Mr. Viviek Jog; Mrs Aparna Vaidyanadhan.; Ms. Rachana Sikhare; Mr. Pankaj Patil, Mr. Yogesh Makhija, Mr. Sunil Dhore

BITS – R. L. Institute of Nautical Sciences, Madurai Collaboration: B. S. in Marine Engineering and B. S. in Nautical Technology

Dr. R Lakshmipathy, Mr. M Subramanian, Capt. Subhendu Hati, Mr. C Chandrasekar, Mr. D M Joseph, Mr. S Jayakumar, Mr. Ram Ambalam, Mr. V Kannan, Mr. C Chidambararaj, Mr. G Balasubramanian, Mr. G K Sadanandam, Mr. R Nagarajan, Mr. R Rajendran, Mr. A Dhandapani, Mr. K Karanthamalai, Mr. N Rajmohan, Mr. T Thangaraj, Mr. R Samayamuthu, Mr. V Ravikumar, Mr. S Nanda, Mr. A Baskaran, Mr. Rooswelt Aruputharaj, Mr. T Thangaraj, Mr. Ravikumar V, Mr. Samayamuthu R, Mr. R Ramesh, Mr. M R Sivakumar, Mrs. Selvi Glory Theresa, Cdr. S A Sreekumar, Mr. M Muthukumar, Mr. K Jithesh Kumar, Mr. S S Kalyani, Cdr. S P Singh, Mr. N Chandrasekaran, Mr. R Thennarasu, Mr. V Murugesan, Mr. V Prabhakar, Mr. Vasudevan K, Mr. Vaithianathan P, Mr. Nagrajan R, Mr. Senthilikumar S, Mr. K Alagarasamy, Mr. Ramaswamy R, Mr. Muthuvelu G, Mr. Sermalai L, Mr. Ranilakshmi K, Mr. Sundar A, Mr. Pulandiran K, Mr. Ramakrishnan G, Mr. Vidya Poornachari D K, Ms. K S Anushiya, Mr. Ganesan P, Mr. Joseph R, Mr. Debabrata Bandyopadhyay, Mr. N Mohanram, Ms. Deepa D, Mr. Manual Robin P, Ms. P Srikirthika, Mr. K Krishnan, Mr. P Thirikalamoorthy, Capt. Ravi Praveen, Mr. R G Pradeep, Mrs. B Sudha, Mr. Nandeeswaran S, Mr. Ramaswmy R, Mr. Suresh Babu R S, Mr. Sivakumar P, Mr. S Selvam, Mr. Venkatasubramanian G, Mr. Muthukamatchi M, Mr. Rajendran R J, Mr. Ponkumar M, Mr. Raja R, Ms. S Sarala, Mr. S Rajendran, Mr. R Subburaj, Mr. K Venkatesh Babu, Mr. R Perumal, Mr. N Shenbgam, Mr. S Kennedy, Mr. I Selvaraj.

BITS – Sankara Nethralaya, Chennai Collaboration: B. S. in Opthalmic Assistant, B. S. in Optometry, M. S. in Medical Laboratory Technology and M. Phil. in Optometry

Dr. S. S. Badrinath, Dr. Lingam Gopal., Dr. T. S. Surendran, Dr. S. Meenakshi, Dr. HNMadhavan, Dr. J. Biswas, Dr. Vasanthi Badrinath, Dr. K. Lily Theresa, Dr. Sulochana K N, Dr. N. Ankayarkani, Dr. K. Krishna Kumar, Dr. Doreen Gracis, Dr. Sudhir RR, Dr. Umashankar V, Dr. Subbulakshmi J, Dr. Ronnie George, Dr. Pramod Bhende, Dr. M B Sudharshan, Dr. PS Rajesh, Dr. P P Santanam, Dr. Krishna Kumar, Dr. L Srinivasa Varadharajan, Dr. Sushma Verma, Dr. S. Ramasamy, Dr. S. Narasimhan, Prof. Veeraraghavan, Dr. Sumathi Narayanan, Dr. Ian Sundaraj, Dr. R. Mathialagan, Dr. Revathy Ravindran, Dr. Gowri Sivaraman, Prof. S. Seshasayee, Prof Pichamuthu, Dr. J Malathy, Dr. Sripriya S, Dr. Mythili V, Dr. Balasubramaniam J, Dr. Varatharajan R, Shri. Ramanathan, Dr. Sowittra N, Dr. Mamatha G, Dr. Jayamurga Pandian A, Dr. Coral K, Dr. Mahalakshmi, Dr. Madhavan Jagadeesan, Ms. Aarthi, Ms Anusha H, Ms. Bharathi S, Ms. Bharatselvi M, Ms. Gayathi R, Ms. Harini R, Ms. Iyer Gomathy Narayanan, Ms. Revathy M, Ms. Saijyothi A V, Ms. Selvi R, Ms. Sowmya M, Ms. Vinitha Kumari, Ms. Rajeswari, Ms Priya, Mr. Jothi Balaji, Mr

Viswanathan, Mr. Srinivasan, Ms. Anuradha, Ms. Valarmathi, Ms. Vijayalakshmi, M Valaramathi, Ms Lokapavani, Mr. Banukumar, Ms. Rahima, Ms Gella Laxmi, Ms. Aparna, Ms. Jameel Rizwana, Mr. S Ve Ramesh, Ms. Abhinaya Priya, Ms. Aishwaryah, Ms. N Sabiha Jamal, Mr G Sharavanan, Ms. G Vasanth, Ms. Dharani, Mr Siddharth Srivatsav, Mr. Kabilan, Ms. Shailaja, Ms Monica, Ms. Divya.

BITS – Strides Arcolab Limited, Bangalore Collaboration: M. S. Pharmaceutical Operations and Management

Dr. Kusum Devi, Dr. Asha A. N., Dr. Raman Dang, Dr. Manju Nath Ghate, Dr. Sarsija, Ms. Arpitha Kaushik, Mr. Ananda Rao, Mr. Neeraj Kumar Sharma, Ms. Shobha Rani Hiremath, Mr. Bhaskar Rao.

BITS – SAP Labs, Bangalore Collaboration: M. S. Software Engineering

Mr. Kush Desai, Mr. Markus Bell, Ms. Anke Bohmueller, Ms. Pooja Suresh, Ms. Vandana Jha, Mr. S Harish Krishnan, Ms. Geetha K Joshi, Mr. Dinesh Kumar C, Mr. Bhasker Rao, Mr. L. Srevats Subromaniam

BITS – Tata Chemicals, Babrala Collaboration: B. S. in Process Engineering

Mr. Homi R Khushrokhan, Mr. Kapil Mehan, Mr. B SudhakarHead, Mr. V K Bhatia, B. Prasannatha Rao, Mr. Neraj K Chaturvedi, Mr. Rajul Sharma, Mr. Dinesh Agrawalla, Mr. Ankur Kaushik, Mr. Asheesh Srivastava, Capt. Santosh.

BITS – Tech Mahindra Limited, Pune, Mumbai, Kolkata, Chennai, Bangalore, Noida and Hyderabad Collaboration: M. S. in Software Engineering and M. S. in Telecommunications and Software Engineering

Mr. Sujit Baksi, Mr. L Ravichandran, Mr. Rakesh Soni, Col.(retd) LK Bhatia, Mr. Uday Vartak, Mr. Ved Prakash Nirbhay, Mr. Prakash Devan, Mr. Andy Ranaweera, Mr. Ashirwad Tillu, Cmdr(rtd) Dr. Prem Chand. Mr. Rajendra Kembhavi, Mr. Sanjeev Parida, Ms. Meetra Roy, Ms. Gargi Banerjee, Mr. S Vidyashankar Col.(retd) Surendra Patnaik, Mr. Saurabh Agrawal, Mr. Anubhav Yadav, Mr. Saravanan Mariappan, Mr. Sindhu Rajendra , Ms. Amrita Dheepti, Mr. P.V. Mathew, Mr. Mohinish Vaidya, Mr. Dinaz Srivastava, Mr. Riyaz Mulla, Ms. Vaishali Phatak, Dr. N.S.T. Sai, Ms. Jayanti Patil, Mr. Ravindra Joshi, Ms. Medha Pandit, Ms. Chaitra Kadle, Mr. K Parasu Ramudu, Mr. Mahalaxmanrao Chappedi, Ms. Elizabeth Zachariah, Mr. Amit Bakshi, Mr. Kuldeep Kumar, Mr. Ravi Jain, Ms. Anuradha Deb, Ms. Subalakshmi Venkatesh, Mr. Parag Tamhankar, Ms Pradyna Kashikar, Mr. Parag Mahajani, Ms Yogeshri. Deore, Dr. Neena Joshi, Dr. Samudra Vijay, Mr. Hitendra Khairnar, Mr. Sanjay Joshi, Dr. Samina Boxwala, Ms Geeta Joshi, Mr. Rakesh Shukla, Mrs Sudha Purohit, Mr. Satish Pathak, Mr. Amralal Verma, Mr. V K Bhide, Ms. P Jayarekha, Mrs Chetana Khairnar, Mr. Srevats Laxman, Mr. Sanjeev Pitambare; Mr. Kevin Naronha; Mr. Sanjay Kumar, Mr. Souvik Samanta, Mr. Abhijit Ranjerkar, Mr. Ashwini Vilas Patki, Mr. Dinesh Agarawalla, Mr. Kavi Arasu V, Mr. M Mohan Rao, Mr. Md. Aslam Hamidullah, Mr. N A Joshi, Mr. Nazneen Ansari, Ms. Prachi Harkare, Ms. Pradnya A. Kashikar, Mr. Rakesh Mishra, Mr. Sallauddin Shaikh, Mr. Sandip Roy, Mr. Sanjay Joshi, Mr. Satish Pathak, Ms. Sheeba Philips, Ms. Sneha Thombre, Mr. Souvik Samanta, Ms. Ujwala Potdar, Mr. Yogesh Makhija.

BITS – Technip, Chennai Collaboration: M. S. in Engineering Management

Shri. J. Raja, Ms. Suganthi, Dr. P. Ravilochanan, Dr. Natteri Sudharsan, Shri. A. V. Sethuraman, Shri. S Shanmugham, Shri. J K Rao, Ms. Vedavalli Rangan, Mr. N Muralidharan.

BITS – Tolani Maritime Institute, Induri Collaboration: B. S. in Marine Engineering and B. S. in Nautical Technology

Mr. Rohet Tolani, Dr. Sujata Naik, Mr. B.K. Saxena, Cdr. R. K. Razdan, Dr. S.G. Dixit, Capt. K Iyer, Mr. D.D. Mundra, Mr. I.K. Basu, Dr. S Sonkamble, Dr. Sanjay Pohekar, Dr. Sanjeet Kanungo, Dr. Ravindra Ingale, Cdr. S Dasgupta, Capt Subhash Deshpande, Capt V

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Alumni Home	- -	242166	-	-	-
Birla Education Trust, Director (Col VN Ratnakar)	- -	242254	242248	-	-
Birla Education Trust, Deputy Director (Shri JC Pande)	- -	242286	242512	-	-
Birla Museum, Director (Dr VN Dhaulakhandi)	- 293	242158	244655	-	-
Birla Sarvajanik Hospital, CMO (Dr RK Jain)	- -	242114	242116	-	-
CEERI, Director (Dr Chandrashekhar)	- -	242111	244222	-	-
M.S. Eye Hospital, CMO (Dr PK Sehgal)	- -	242369	242357	-	-
Post Master, Vidya Vihar, Pilani	- -	242723	-	-	-
Rajasthan State Electricity Board	- -	242142	242235	-	-
SDO (Tel)	- -	245900	243700	-	-
State Bank of Bikaner & Jaipur, BITS Extension counter	- -	244379	-	-	-
State Bank of Bikaner & Jaipur, Manager	- -	242287	242221	-	-
UCO Bank, Manager	- -	242136	242141	-	-

* ***Please dial first number to contact the officer and the second number for the office.***

** ***Dial STD code (01596) before dialing the IP phone number, if calling from outside.***

\# ***Mobile numbers***

Note:

1. Numbers below 400 are in old exchange and above 400 are in new exchange.
2. To call a number from one exchange to another first dial number 8 followed by the actual number. You will get connected to the number after getting 3 (or) 4 beep tones.

TELEPHONE NOS.
BITS, Pilani – K.K. BirlaGoa Campus
Postal Address: BITS, Pilani – Goa Campus, Near NH 17-B, Bye Pass Road, Zuari Nagar – 403 726, Goa
Homepage: www.bits-goa.ac.in

STD Code 0832 **Switch Board / Exchange No.: 2580000 / 2557033**
FAX 2557031

	Land Line	
	Office	**Residence**
Director (Acting) (Prof KE Raman)	2580101	2975338
Faculty In-charge		
Administration (Prof MK Deshmukh)	2580316	2580702
Students Welfare (Prof BJC Babu)	2580102	2580701
Chief Warden (Prof Suresh Ramaswamy)	2580115	2580704
Admissions, Registration & Instruction (Prof AP Koley)	2580313	2580710
Computer Centre (Dr DM Kulkarni)	2580401	2580501
Computer Assisted Housekeeping (Prof JV Rao)	2580422	2580720
Community Welfare (Dr Meenal Kowshik)	2580304	2580512
Audio Visual (Dr PN Deepak)	2580431	2580719
Library (Mrs Anuradha V)	2580402	-
Student Activity Centre (Dr Bharat M Deshpande)	2580438	2580722
Practice School (Dr Gaurav Dar)	2580326	2580712
Student Publications (Dr Judith Braganca)	2580305	-
Student Recreation & Cultural Activities (Dr NN Ghosh)	2580318	-
Research & Consultancy and Educational Development (Dr SD Manjare)	2580112	2580703
Student Sports Activities (Dr Srinivas Krishnaswamy)	2580308	2580504
Public Relations (Dr RP Pradhan)	2580314	2580709
Medical Centre (Dr Raghavendra KM)	2580682	2580685
Workshop (Dr PM Singru)	2580338	2580728
Incharge for General Functions		
Accounts & Finance (Mr MJ Suryavanshi)	2580122	-
Medical Centre (Dr Raghavendra KM)	2580682	2580684
Purchase, Stores & Estate Maintainance (Mr AK Patil)	2580399	2580708
Wardens		
Chief Warden (Prof Suresh Ramaswamy)	2580115	2580704
AH 1 (Mr VK Deshpande)	2580312	-
AH 1 (Mr M Bedekar)	2580433	2580505
AH 2 (Dr DM Kulkarni)	2580401	2580501
AH 2 (Dr Ranjan Dey)	2580412	2580512
AH 3 (Dr Anil Kumar)	2580446	2580732
AH 3 (Dr Saroj S Baral)	2580119	-
AH 4 (Mr N Kubendran)	2580223	-
AH 4 (Dr Dhanumjaya)	2580144	2580514
AH 5 (Dr TK Singh)	2580435	2580508
AH 5 (Dr Anjan Chattopadhyay)	2580319	2580750
AH 6 (Dr Shibu Clement)	2580298	2580515
AH 6 (Dr Aswini K Mishra)	2580258	-

	Land Line	
	Office	**Residence**
AH 7 (Dr Prasanta K Das)	2580448	-
AH 7 (Mr PV Rao)	2580413	2580707
AH 8 (Dr Sujit Kumar Ghosh)	2580154	-
AH 8 (Dr CP Kiran)	2580111	2580516
CH 1 (Dr R Pradhan)	2580314	2580709
CH 1 (Mr Gautam G Bacher)	2580295	-
CH 2 (Mr Nitin Upadhay)	2580331	2580506
CH 3 (Dr RN Behra)	2580129	-
CH 4 (Dr Meenal Kowshik)	2580304	2580512
CH 4 (Dr Anasuya Ganguly)	2580244	-
CH 5 (Dr Neena Goveas)	2580403	2580509
CH 5 (Dr Rashmi Chauhan)	2580153	-
CH 6 (Dr Dibakar Chakraborty)	2580173	-
Group Leaders		
Biological Sciences (Dr Utpal Roy)	2580303	2580731
Chemistry (Dr Sunil Bhand)	2580332	2580721
Chemical Engineering (Dr Srinivas Krishnaswamy)	2580308	2580504
Computer Science (Dr Bharat M Deshpande)	2580438	2580722
Economics (Dr Mridula Goel)	2580254	2580735
EEE and E & I (Dr. KR Anupama)	2580317	2580752
Humanities & Management (Prof Meenakshi Raman)	2580280	2580705
Mechanical Engineering (Dr Pravin M Singru)	2580338	2580728
Mathematics (Dr Reeta Dubey)	2580322	2580730
Physics (Dr P Nandakumar)	2580427	2580739

TELEPHONE NOS.

BITS, Pilani – Hyderabad Campus

Postal Address: BITS, PIlani – Hyderabad Campus, Jawahar Nagar, Shameerpet Mandal, R.R. District, Hyderabad – 500078, Andhra Pradesh

Homepage: www.bits-hyderabad.ac.in

STD Code 040 FAX 66303998

	Office
Director (Prof. V S Rao)	66303801
Faculty In-Charges	
Admissions (Dr. V R Vinayaka Rao)	66303509
Academic Registration & Counseling (Dr. M Srinivas)	66303511
Research, Consultancy & Educational Development (Dr. P Yogeeswari)	66303515
Information Processing & Business Intelligence Unit (Dr. Chittaranjan Hota)	66303504
Student Welfare (Dr. I Sreedhar)	66303512
Instruction (Dr. A Vasan)	66303510
Publications & Media Relations Unit (Dr. M G Prasuna)	66303531
General Administration (Mr U Madhava Rao)	66303500
Community Welfare (Dr. Kannan Ramaswamy)	66303526
Engineering Services (Dr. Srinivasa Prakash Regalla)	66303520
University- Industry Linkages (Dr. P N Rao)	66303501
Workshop (Dr. Amit Kumar Gupta)	66303518
Placements (Dr. M B Srinivas)	66303521
Faculty Division – I (Dr. Souri Banerjee)	66303513
Faculty Division – II (Dr. N Moorthy Muthukrishnan)	66303502
Dy. Librarian (Mr M S Uday Kumar)	66303809
Other In-Charges	
Central Analytical Laboratory (Dr. D Sriram)	66303506
Alumni Affairs (Dr. K V G Chandrasekhar)	66303527
Security (Dr. D K Satpathi)	66303507
Website (Dr. R Gururaj)	66303525
Central Entrepreneurial Leadership (Dr. M B Srinivas)	66303521
WILP (Mr B R Murthy)	
Maintenance (Mr T Srinivas)	
N.S.S. (Dr. K S Raju)	66303519
Purchases (Mr G Srinivas)	66303826
Group Leaders	
Civil Engineering (Dr P N Rao)	66303501
Chemistry (Dr N Rajesh)	66303503
Computer Science & Information Systems (Dr C Hota)	66303504
Biology (Dr Vidya Rajesh)	66303505
Pharmacy (Dr P Yogeeswari)	66303515
Mathematics (Dr.Addepalli Ramu)	66303516
Physics (Dr.Souri Banerjee)	66303513
Mechanical Engineering (Dr.Srinivasa Prakash Regalla)	66303520
Electrical & Electronics Engineering (Dr N Moorthy Muthukrishnan)	66303502
Chemical Engineering (Dr. Aradhana Srivastava)	66303517
Electronics & Communication Engineering (Dr M B Srinivas)	66303521
Humanities & Languages Group (Dr. M G Prasuna)	66303531
Economics & Management Group (Dr China Hussain Yaganti)	66303549

Hostel Wardens	
Resident Wardens	
Chief Warden & Warden , Krishna Bhawan (Dr P K Thiruvikraman)	66303508
Krishna Bhawan (Dr. Punna Rao Ravi)	66303539
Ram Bhawan (Dr. Anupam Bhattacharya)	66303522
Shankar Bhawan (Dr M Srinivas)	66303511
Shankar Bhawan (Dr. K V G Chandra Sekhar)	66303527
Ram Bhawan, ,(Dr D K Satpathi)	66303507
Meera Bhawan, (Dr Joy Anuradha)	66303538
Non-Resident Wardens	
Shankar Bhawan, (Dr Kannan Ramaswamy)	66303526
Meera Bhawan, (Ms Rakhee)	66303524

ACADEMIC CALENDAR FOR PILANI CAMPUS

SOME IMPORTANT DATES

2010

JULY							AUGUST							SEPTEMBER						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
				1	2	3	1	2	3	4	5	6	7				1	2	3	4
4	5	6	7	8	9	10	8	9	10	11	12	13	14	5	6	7	8	9	10	11
11	12	13	14	15	16	17	15	16	17	18	19	20	21	12	13	14	15	16	17	18
18	19	20	21	22	23	24	22	23	24	25	26	27	28	19	20	21	22	23	24	25
25	26	27	28	29	30	31	29	30	31					26	27	28	29	30		

OCTOBER							NOVEMBER							DECEMBER						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
31					1	2		1	2	3	4	5	6				1	2	3	4
3	4	5	6	7	8	9	7	8	9	10	11	12	13	5	6	7	8	9	10	11
10	11	12	13	14	15	16	14	15	16	17	18	19	20	12	13	14	15	16	17	18
17	18	19	20	21	22	23	21	22	23	24	25	26	27	19	20	21	22	23	24	25
24	25	26	27	28	29	30	28	29	30					26	27	28	29	30	31	

2011

JANUARY							FEBRUARY							MARCH						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
30	31					1			1	2	3	4	5			1	2	3	4	5
2	3	4	5	6	7	8	6	7	8	9	10	11	12	6	7	8	9	10	11	12
9	10	11	12	13	14	15	13	14	15	16	17	18	19	13	14	15	16	17	18	19
16	17	18	19	20	21	22	20	21	22	23	24	25	26	20	21	22	23	24	25	26
23	24	25	26	27	28	29	27	28						27	28	29	30	31		

APRIL							MAY							JUNE						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
					1	2	1	2	3	4	5	6	7					1	2	3
3	4	5	6	7	8	9	8	9	10	11	12	13	14	5	6	7	8	9	10	11
10	11	12	13	14	15	16	15	16	17	18	19	20	21	12	13	14	15	16	17	18
17	18	19	20	21	22	23	22	23	24	25	26	27	28	19	20	21	22	23	24	25
24	25	26	27	28	29	30	29	30	31					26	27	28	29	30		

☐ HOLIDAYS AND RECESS

First Semester 2010-2011

July 5, 2010	Registration for Practice School II
July 5, 2010	Practice School II begins
July 27	Admission to Higher Degree and Doctoral Programmes
July 29	Admission to Integrated First Degree Programme
July 30-31	Freshmen Orientation Programme
August 2	First Semester begins
August 2	Registration for all students
August 3	Class-work begins
August 15	Independence Day (H)
August 17	Last day for substitution of courses
August 18	Last day for submission of Application for Merit Cum Need Scholarship
August 24	Raksha Bandhan (H)
September 2	Janmashtami (H)
September 11	Id ul-Fitr (H)
October 2	Mahatma Gandhi's Birthday (H)
October 11	Last day for withdrawal from courses
October 16-17	Dussehra (H)
November 5 - 6	Diwali (H)
November 21	Guru Nanak's Birthday (H)
November 29	Last day for class work
December 1	Comprehensive Examination begins
December 14	Practice School II ends
December 14	Comprehensive Examination ends
December 14	First Semester ends
December 15 to January 5, 2011	Recess
December 25	Christmas (H)
January 1, 2011	New Year (H)

Second Semester 2010-2011

January 4, 2011	Admission to Higher Degree and Doctoral Programmes
January 5	Admission to integrated First Degree Programme
January 5	Freshmen Orientation Programme
January 6	Second Semester begins
January 6	Registration for all students
January 6	Registration for Practice School II
January 6	Practice School II begins
January 7	Class-work begins
January 14	Makar Sankranti (H)
January 21	Last day for substitution of courses
January 21	Last day for submission of Application for Merit-Cum Need Scholarship
January 26	Republic Day (H)
February 8	Basant Panchami and Founder's Day (H)
March 2	Shivratri (H)
March 16	Last day for withdrawal from courses
March 19 - 20	Holi (H)
April 12	Ram Navami (H)
April 16	Mahavir Jayanti (H)
April 17	Registration for Practice School I
April 28	Last day for class work
May 2	Comprehensive Examination begins
May 14	Comprehensive Examination ends
May 14	Second Semester ends
May 18	Summer Vacation begins
May 23	Summer Term begins
May 23	Practice School I begins
June 17	Practice School II ends
July 15	Summer Term ends
July 15	Practice School I ends
July 16	Summer Vacation ends

ACADEMIC CALENDAR FOR K.K. BIRLA GOA CAMPUS

SOME IMPORTANT DATES

2010

JULY							AUGUST							SEPTEMBER						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
				1	2	3	1	2	3	4	5	6	7				1	2	3	4
4	5	6	7	8	9	10	8	9	10	11	12	13	14	5	6	7	8	9	10	11
11	12	13	14	15	16	17	15	16	17	18	19	20	21	12	13	14	15	16	17	18
18	19	20	21	22	23	24	22	23	24	25	26	27	28	19	20	21	22	23	24	25
25	26	27	28	29	30	31	29	30	31					26	27	28	29	30		

OCTOBER							NOVEMBER							DECEMBER						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
31					1	2		1	2	3	4	5	6				1	2	3	4
3	4	5	6	7	8	9	7	8	9	10	11	12	13	5	6	7	8	9	10	11
10	11	12	13	14	15	16	14	15	16	17	18	19	20	12	13	14	15	16	17	18
17	18	19	20	21	22	23	21	22	23	24	25	26	27	19	20	21	22	23	24	25
24	25	26	27	28	29	30	28	29	30					26	27	28	29	30	31	

2011

JANUARY							FEBRUARY							MARCH						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
30	31					1			1	2	3	4	5			1	2	3	4	5
2	3	4	5	6	7	8	6	7	8	9	10	11	12	6	7	8	9	10	11	12
9	10	11	12	13	14	15	13	14	15	16	17	18	19	13	14	15	16	17	18	19
16	17	18	19	20	21	22	20	21	22	23	24	25	26	20	21	22	23	24	25	26
23	24	25	26	27	28	29	27	28						27	28	29	30	31		

APRIL							MAY							JUNE						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
					1	2	1	2	3	4	5	6	7				1	2	3	4
3	4	5	6	7	8	9	8	9	10	11	12	13	14	5	6	7	8	9	10	11
10	11	12	13	14	15	16	15	16	17	18	19	20	21	12	13	14	15	16	17	18
17	18	19	20	21	22	23	22	23	24	25	26	27	28	19	20	21	22	23	24	25
24	25	26	27	28	29	30	29	30	31					26	27	28	29	30		

☐ HOLIDAYS AND RECESS

First Semester 2010-2011

July 5, 2010	Registration for Practice School II
July 5, 2010	Practice School II begins
July 27	Admission to Higher Degree and Doctoral Programmes
July 29	Admission to Integrated First Degree Programme
July 30	Freshmen Orientation Programme
July 31	Registration for 1st and 2nd Year Students
August 2	First Semester begins
August 2	Registration for all other students
August 3	Class-work begins
August 15	Independence Day (H)
August 17	Last day for substitution of courses
August 18	Last day for submission of Application for Merit Cum Need Scholarship
August 24	Raksha Bandhan (H)
September 2	Janmashtami (H)
September 11	Ganesh Chaturthi (H)
September 11	Id ul-Fitr (H)
October 2	Mahatma Gandhi's Birthday (H)
October 11	Last day for withdrawal from courses
October 16-17	Dussehra (H)
November 5 - 6	Diwali (H)
November 21	Guru Nanak's Birthday (H)
November 29	Last day for class work
December 1	Comprehensive Examination begins
December 14	Practice School II ends
December 14	Comprehensive Examination ends
December 14	First Semester ends
December 19	Goa Liberation Day (H)
December 15 to January 5, 2011	Recess
December 25	Christmas (H)
January 1, 2011	New Year (H)

Second Semester 2010-2011

January 4, 2011	Admission to Higher Degree and Doctoral Programmes
January 5	Admission to integrated First Degree Programme
January 5	Freshmen Orientation Programme
January 5	Registration for 1st and 2nd Year Students
January 6	Second Semester begins
January 6	Registration for all other students
January 6	Registration for Practice School II
January 6	Practice School II begins
January 7	Class-work begins
January 14	Makar Sankranti (H)
January 21	Last day for substitution of courses
January 21	Last day for submission of Application for Merit-Cum Need Scholarship
January 26	Republic Day (H)
February 8	Basant Panchami and Founder's Day (H)
March 2	Shivratri (H)
March 16	Last day for withdrawal from courses
March 20	Holi (H)
April 12	Ram Navami (H)
April 16	Mahavir Jayanti (H)
April 17	Registration for Practice School I
April 22	Good Friday (H)
April 28	Last day for class work
May 2	Comprehensive Examination begins
May 14	Comprehensive Examination ends
May 14	Second Semester ends
May 18	Summer Vacation begins
May 23	Summer Term begins
May 23	Practice School I begins
June 17	Practice School II ends
July 15	Summer Term ends
July 15	Practice School I ends
July 16	Summer Vacation ends

ACADEMIC CALENDAR FOR HYDERABAD CAMPUS

SOME IMPORTANT DATES

2010

JULY							AUGUST							SEPTEMBER						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
				1	2	3	1	2	3	4	5	6	7				1	2	3	4
4	5	6	7	8	9	10	8	9	10	11	12	13	14	5	6	7	8	9	10	11
11	12	13	14	15	16	17	15	16	17	18	19	20	21	12	13	14	15	16	17	18
18	19	20	21	22	23	24	22	23	24	25	26	27	28	19	20	21	22	23	24	25
25	26	27	28	29	30	31	29	30	31					26	27	28	29	30		

OCTOBER							NOVEMBER							DECEMBER						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
31					1	2		1	2	3	4	5	6				1	2	3	4
3	4	5	6	7	8	9	7	8	9	10	11	12	13	5	6	7	8	9	10	11
10	11	12	13	14	15	16	14	15	16	17	18	19	20	12	13	14	15	16	17	18
17	18	19	20	21	22	23	21	22	23	24	25	26	27	19	20	21	22	23	24	25
24	25	26	27	28	29	30	28	29	30					26	27	28	29	30	31	

2011

JANUARY							FEBRUARY							MARCH						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
30	31					1			1	2	3	4	5				1	2	3	4
2	3	4	5	6	7	8	6	7	8	9	10	11	12	6	7	8	9	10	11	12
9	10	11	12	13	14	15	13	14	15	16	17	18	19	13	14	15	16	17	18	19
16	17	18	19	20	21	22	20	21	22	23	24	25	26	20	21	22	23	24	25	26
23	24	25	26	27	28	29	27	28						27	28	29	30	31		

APRIL							MAY							JUNE						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
					1	2	1	2	3	4	5	6	7					1	2	3
3	4	5	6	7	8	9	8	9	10	11	12	13	14	5	6	7	8	9	10	11
10	11	12	13	14	15	16	15	16	17	18	19	20	21	12	13	14	15	16	17	18
17	18	19	20	21	22	23	22	23	24	25	26	27	28	19	20	21	22	23	24	25
24	25	26	27	28	29	30	29	30	31					26	27	28	29	30		

☐ HOLIDAYS AND RECESS

First Semester 2010-2011

July 5, 2010	Registration for Practice School II
July 5, 2010	Practice School II begins
July 27	Admission to Higher Degree and Doctoral Programmes
July 29	Admission to Integrated First Degree Programme
July 30-31	Freshmen Orientation Programme
August 2	First Semester begins
August 2	Registration for all students
August 3	Class-work begins
August 15	Independence Day (H)
August 17	Last day for substitution of courses
August 18	Last day for submission of Application for Merit Cum Need Scholarship
August 24	Raksha Bandhan (H)
September 2	Janmashtami (H)
September 11	Ganesh Chaturthi (H)
September 11	Id ul-Fitr (H)
October 2	Mahatma Gandhi's Birthday (H)
October 11	Last day for withdrawal from courses
October 16-17	Dussehra (H)
November 5-6	Diwali (H)
November 29	Last day for class work
December 1	Comprehensive Examination begins
December 14	Practice School II ends
December 14	Comprehensive Examination ends
December 14	First Semester ends
December 15 to January 5, 2011	Recess
December 25	Christmas (H)
January 1, 2011	New Year (H)

Second Semester 2010-2011

January 4, 2011	Admission to Higher Degree and Doctoral Programmes
January 5	Admission to integrated First Degree Programme
January 5	Freshmen Orientation Programme
January 6	Second Semester begins
January 6	Registration for all students
January 6	Registration for Practice School II
January 6	Practice School II begins
January 7	Class-work begins
January 14	Makar Sankranti (H)
January 21	Last day for substitution of courses
January 21	Last day for submission of Application for Merit-Cum Need Scholarship
January 26	Republic Day (H)
March 2	Shivratri (H)
March 16	Last day for withdrawal from courses
March 20	Holi (H)
April 4	Hyderabad Campus Foundation Day (H)
April 12	Ram Navami (H)
April 17	Registration for Practice School I
April 28	Last day for class work
May 2	Comprehensive Examination begins
May 14	Comprehensive Examination ends
May 14	Second Semester ends
May 18	Summer Vacation begins
May 23	Summer Term begins
May 23	Practice School I begins
June 17	Practice School II ends
July 15	Summer Term ends
July 15	Practice School I ends
July 16	Summer Vacation ends