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THE INSTITUTE

In order to cater to the country's need of trained manpower of higher learning in science and technology, the Indian Institute of Technology at Kharagpur, first of the chain of fifteen IITs, was established in 1950. The idyllic, sylvan setting at Hijli was chosen to provide a cordon sanitaire to the serious learners for uninterrupted pursuit of studies. From a modest start in the dilapidated Hijli jail buildings, IIT Kharagpur has gone on to be engaged in a virtually continuous process of development. The handsome main building with its majestic tower was inaugurated in 1956 and Pandit Jawaharlal Nehru in the first convocation in the same year said "Here in the place of that Hijli detention camp stands this fine monument of India, representing India's urges, India's future in the making. This picture seems to me symbolic of changes that are coming to India".

Today, IIT Kharagpur has come a long way to its present position of pre-eminence with nineteen academic departments, eight multidisciplinary centres, a School of Management, a School of Telecommunications, a School of Medical Science and Technology, a School of Information Technology and a School of Intellectual Property Law named after Rajiv Gandhi, a School of Water Resources, a School of Infrastructure Design and Management, a School of Engineering Entrepreneurship and several sophisticated central facilities. It is the largest and the most diversified among the IITs and strives to produce scientists and technologists of the highest calibre to help the nation become self-reliant in its technological needs and to provide leadership in the field of technical education and research. Some of the distinctive features of the programmes at IIT Kharagpur are science based engineering education, emphasis on complete education, continuous internal evaluation and flexibility for experimentation, up gradation and innovation in curriculum design. IIT Kharagpur has a number of distinctions to its credit among all the IITs, such as the first Master's programme on Management, first Master's Programme on Medical Science and Technology for practicing Medical Doctors. In a study, sponsored by the Department of Science and Technology, Government of India, IIT Kharagpur has the highest relative employment productivity index among the IITs and is the top supplier of fresh engineers/technologists to the public and private sector industries. It also ranked first among the IITs in the production of science and engineering PhDs.

ACADEMIC STRUCTURE OF THE INSTITUTE

Number of Departments	: 19
Number of Centres	: 8
Number of Advanced Schools	: 8
Number of UG Courses	: 17
Number of Dual Degree Courses	: 15
Number of PG Courses	: 52
Number of Int. M.Sc. Courses	: 7
Number of LLB Courses	: 1

POSTGRADUATE DEGREES / DIPLOMAS CONFERRED IN THE YEAR 2011

MTech/MCP/MBA /MS/MMST : 839 M.Sc.: 216 LLB: 19
Ph.D. conferred during the 57th annual convocation held on 22nd August 2011 : 245

LIBRARY

Central Library is one of the largest libraries in science, technology, medical science and management in Asia, having an excellent collection of 3.8 lakh documents, and subscribing to 1250 print journals, 40000 e-books, and providing online full-text access to 10000 e-journals of the major publishers like Elsevier, Science, Springer, IEEE, IEE, ACM, ASME, ADCE etc. Beside that the Central Library also providing access to major bibliographical databases like Compendex, INSPEC, SciFinder, Scholar, Web of Science, Scopus and MathScience Net. All regular library services have been automated using library software package "**LibSys**". Central Library has an excellent digital library section to facilitate seamless access to various subscribed IINDEST-AICTE Consortium e-resources as well as provide access to Institutional Repository Server, installed for faculty, research scholars and others to post their intellectual output. The library has installed CCTV cameras in each reading halls and strategic locations of Central Library buildings for auto-surveillance and security. Recently, selected 5000 text books have been made RFID enabled through an RFID pilot project sponsored by MHRD. The Central Library has access to all Springer e-books published during the years 2005 to 2012 and CRCnetBASE e-books published during the years 2004 to 2012..

TECHNOLOGY STUDENTS GYMKHANA

The concept of the Technology Students' Gymkhana as a forum of Sports and Games, Social and Cultural and Technology activities, in which the students, the faculty, staff and their families can take deep interest is unique, and was introduced at IIT Kharagpur for the first time way back in the fifties. The Technology Students' Gymkhana is an organization for fostering

and developing extra-curricular activities among the students. Through sports, games and cultural activities it helps to cultivate the spirit of constructive co-operation, leadership qualities and organizational abilities among the students. The Gymkhana is the nerve-centre of this residential campus and has enriched the quality of student life. Gymkhana has a large number of facilities. These include a well-equipped modern Gymnasium, a standard swimming pool and two stadiums, namely, Jnan Ghosh stadium and Tata Sports Complex. Besides these, there are also floodlit Basketball, Volleyball and Tennis Courts. Club activities are also encouraged where students can display and develop their talents in various fields, e.g. photography, dramatics, social service, Yoga, etc. The Gymkhana also organizes annual social and cultural festival "Spring Festival", and Techo-Management festival "Kshitij".

ACCOMMODATION AND AMENITIES

The Institute is fully residential. Students are accommodated in 19 Halls of Residence, 14 for boys and 4 for girls and one with family accommodation for the Research Scholars/ Defence Personnel (M. Tech.). The halls have 24 hours internet connectivity. All the Halls of Residence have regular catering facilities. Some additional food outlets are located within the campus; a few late evening canteens are available as well in some of the Halls of Residence. Several restaurants including air-conditioned ones and a Café Coffee Day unit are located in the campus, particularly in the hostel area. For daily necessities and groceries, one can walk down to the Tech. Market within the Campus. A larger market, Golebazar, is about 5 kms. from the Campus. Three banks with ATM facility are located inside the Campus. The State Bank of India branch with core banking services is in the campus close to the Institute Main building and it provides foreign exchange facilities as well. An extension counter of Syndicate Bank is situated on the first floor of the Institute main building. A branch of Punjab National Bank is situated in the Tech. Market where business transactions are carried out in the afternoon. In addition, an Axis Bank ATM is available as well inside the Gymkhana premises. Post Office is located close to the State Bank branch. Outlets of a few courier service are also available within the campus.

South Eastern Railway has been operating a counter in the Institute Main Building area extending Railway ticket booking facilities especially to the students and the campus residents.

There are also a few privately run outlets in the campus to cater facilities for railway ticket booking, air ticket booking, car rental and STD / ISD phone calls.

RECREATIONAL/EXTRA-CURRICULAR ACTIVITIES

IIT Kharagpur aims at the all round development of personality, with emphasis on physical, socio-cultural and value-oriented education. In the rich tapestry of culture that marks this IIT, students play a vital role. They participate in almost all decision-making bodies of the Institute, starting from hostel administration to Senate, and organize cultural and techno-management activities throughout the year, culminating in the Spring Fest and Kshitij.

Technology Students' Gymkhana, the nerve centre for sports, cultural and social activities, helps to cultivate the spirit of constructive co-operation, leadership qualities and organizational abilities among the students. It has a number of outdoor and indoor stadia for sports and games, a modern swimming pool and a gymnasium. Photography Club, Fine Arts Club, Publicity Club, Music Club, Yoga Club, Film Society, Dramatics Society, Aquatics Society, Astronomy Club and many more special interest groups are supported by the Gymkhana. Lately a large number of technology and social service focused student societies have been formed, quite often the local chapter of an international body. The halls of residence also offer a few in-house sports facilities in addition to the central facilities. A large expansion on Gymkhana facilities is nearing completion to offer many more choices on facilities in greater numbers.

HEALTH CARE

The B. C. Roy Technology Hospital is located at the center of the Campus. It provides indoor and outdoor medical facilities for common ailments. However, a few specialized visiting medical practitioners regularly attend the outdoor chambers. The Hospital has its round the clock emergency medical attendance arrangement, and a 24x7 medicine counter. Complicated cases are referred for treatment to the State Hospital or to the Railway Hospital or to Hospitals in Kolkata. The Institute has Students' Medical Insurance Coverage which is obligatory on the part of the students and which usually covers a part of medical expenses for such referred cases. 24 hours Institute ambulance service is also available for the purpose of shifting the patients to other hospitals for better management. A few specialized medical practitioners are also available around the IIT campus for private consultation; this list of neighbourhood medical facilities is posted at <http://noticeboard.iitkgp.ernet.in/hospi.htm>

COUNSELLING CENTRE

The Counselling Centre offers a broad range of services including psychological assessment, individual therapy, group therapy, as well as medication and management to promote mental health, life skills training, emotional resilience and

overall wellbeing of the student community. Full-time clinical psychologists and a visiting psychiatrist are available for consultation. The centre has also initiated an *outreach program* that involves building up a team of sensitized wing representatives from each Hall of Residence to help reach students in need.

SPONSORED RESEARCH AND INDUSTRIAL CONSULTANCY CELL (SRIC)

The synthesis of teaching and research is fundamental to IIT Kharagpur. IIT Kharagpur is highly rated for the quality and breadth of its research enterprise, for the innovation of its faculty, for the excellence of its Ph.D programs, and for the amount of funding received in support of its research initiatives. We are particularly noted for our openness to multidisciplinary research, and several new initiatives expand a long IIT Kharagpur tradition of cross-disciplinary research and collaboration. The impact of our research ripples through India and around the world. IIT Kharagpur's research programs reach across the campus and beyond, linking together 19 departments, 16 academic centers and a large number of advanced R&D laboratories, stimulating the integration of inquiry, new knowledge, and education.

During the year 2010-2011 the Institute received from the Government, private and international funding agencies/enterprises 183 research projects for a total value of Rs. 110 crores and 115 consultancy projects worth Rs. 11.70 crores aggregating a total of 298 projects for Rs.121.7 crores.

IIT Kharagpur is entrusted with the development of ASICs for the read out system for CBM experiment at the Facility for Antiproton and Ion Research (FAIR), Darmstadt, Germany, the new international accelerator facility and one of the largest research projects world-wide. IIT Kharagpur has a distinguished track record in the development of specialized softwares such as power management software, telemedicine software, communication empowerment software for physically challenged, software for medical measurements, tools for security and biometric authentication and ocean dynamics based software for storm surge measurements. An advanced research facility in reliability engineering with active participation of top government agencies including BARC has recently been created. Other examples of research in frontier areas include MEMS based components for RF application, development of functional groups for immobilization of functional proteins on MEMS based microsensor surfaces etc. Our pioneering works on advanced chip design and CAD for VLSI and MEMS continue to attract researchers and funding from the best institutes and well-known companies of the world. In the past year we have started setting up of a major research infrastructure for MOCVD and initiated development of MBE cluster tool based epitaxial nano-semiconductor infrastructure and process integration facility.

In the areas of Life Sciences, ongoing interdisciplinary research in non-invasive measurements, advanced image processing, implants, protein structure analysis and drug design, merit special mention. The Institute has sustained activities in artificial heart development program, male contraceptive (RISUG), green technology, insect resistant cotton, enzymatic processes, Aloe Vera processing, and bio depolymerisation of low grade lignite .

The major research initiatives in nanotechnology and nano-materials include work on polymer nano-composites, nano-wires and semiconductors. The area of micro-fluidics and bio-nano-mems has developed new techniques for DNA hybridization, micro-scale cooling for electronic components and digital microfluidics are examples of research at the cutting-edge.

In the area of environment, the Institute has taken up a major initiative under the Ganga River Basin Management Plan funded by the Ministry of Environment and Forests to address issues related to environmental water quality, water resources management, ecology and bio-diversity as well as socio-economic policy, law and governance. In Earth Sciences, a major activity is undertaken for seismic hazard assessment, microzonation and evaluation of vulnerability, risk & socio-economic impacts for the city of Kolkata. IIT Kharagpur has won one of the eleven IBM International Centennial Grants awarded this year for supporting its smarter planet strategies to community service.

IIT Kharagpur has continued its long standing research commitment to the Energy Sector through sustained activities in biomass production, biofuels, fuel cells, lithium-ion batteries and energy materials, production of renewable hydrogen combined with CO₂ capture etc. Our newly developed P. K. Sinha Centre for Bioenergy is taking an integrated and collaborative approach to solve energy, climate change and economic challenges, collaborating with internationally renowned Bioenergy Centers such as University of California at Berkeley (UCB) and Energy Biosciences Institute (EBI), Purdue University and University of California at Davis.

Industry – academia partnership at IIT Khargpur is thriving with industries forming partnerships in joint research projects, acquiring technologies developed in the institute and seeking consultancy supports. Some of the major research initiatives in recent years include Centre for Railway Research, Steel Technology Center, major R&D Centers in Energy Sector in collaboration with DVC, Tea Engineering Research Center, Vodafone-Essar-IIT Kharagpur Centre of Excellence in Telecommunications, National Program in Marine Hydrodynamics, Centre of Excellence in Information Assurance, National facilities for EPMA, General Motors Collaborative Research Laboratory in Electronics Controls and Software (ECS) and a Regional Center for Rural Technology Action Group (RUTAG) are some of the recent such successful initiatives.

JOINT MTECH / MCP- PhD PROGRAMME OF IIT KHARAGPUR

IIT Kharagpur invites applications for the Joint Masters and PhD programme in Engineering and City Planning for the admission year 2012-2013. This programme encourages bright and motivated student to enroll themselves for PhD after completion of first year of MTech/MCP programme.

Under this programme, at the end of first year, interested students having CGPA 8.0 and above are eligible to appear for written test and/or interview to judge their suitability to enroll for PhD. **Those who do not qualify for PhD can continue with their two-year MTech/MCP programme.**

Students selected for PhD will have to complete the two year academic requirements of MTech/MCP programme before enrolment for PhD. For these students the MTech/MCP and PhD degree will be awarded together upon successful completion of PhD.

The programme is open to students of all categories with a Bachelor's degree in Engineering/Technology/Architecture/MSc or equivalent professional degrees (AMIE etc.) and having a valid GATE score. Seats are reserved for OBC/SC/ST candidates and persons with disability (PD) as per Government of India rules.

DEPARTMENT OF AEROSPACE ENGINEERING

The Department of Aerospace Engineering, established in 1965, offers B. Tech, Dual degree and M. Tech programmes in Aerospace Engineering. Active research programme, leading to MS and PhD degrees, also exists. The Department has a large number of well-equipped laboratories in the areas of Aerodynamics, Structures and Propulsion, Flight Mechanics and Intelligent Systems. Facilities in the Aerodynamics Laboratory include an airflow bench, subsonic wind tunnel, supersonic tunnel, cascade tunnel and smoke tunnel. The other major wind tunnels include an industrial tunnel for studying wind effect on structures and a gust tunnel for studying unsteady flow problems. The Structures Laboratory is equipped with photoelastic polariscope, electromagnetic vibration shakers, a ten ton capacity universal testing machine, a torsion testing machine, computerized experiments related to deflection of curved bars, shear centre apparatus and buckling of struts having Interface for digital display of force, strain, deflection and angle with Experiment Software for each experiment, computerised vibration fundamental kits (VFT), a fatigue testing machine and the associated electronic instrumentation for carrying out dynamic structural tests. The Instron 1342 (upgraded model and serial number: 8800MK3050) servo-hydraulic materials testing machine with HP-300 High Speed Data Acquisition System for static, dynamic and fatigue testing of structural elements and Vibration Shake Table are excellent facilities in this department. A microprocessor controlled Brabender climatic chamber and an ultrasonic flaw detector are in use in the Composites. The laboratory is in process of acquiring some more new experimental facilities such as Photo elasticity unit with artificial vision system which is used for quality and quantity measurement in any point and is very suitable for the introduction and study of photo elasticity, pin jointed frameworks, virtual work and forces in truss (Resolution) with computerised digital display of force, strain, deflection etc. Major Propulsion Laboratory facilities include Axial Flow Fan Test Set, Centrifugal Fan Test Unit, Ram Jet and Pulse Jet facility, Reaction Turbine Test facility, Nozzle Pressure Distribution Unit, Flame Propagation and Stabilization Unit, Nozzle Performance and Jet Reaction Unit and Droplet Combustion Test Rig. The Department also has excellent computational laboratories equipped with high performance computational facilities besides a large number of workstations and high end PCs. The department also offers adequate facilities to the students to design, build and fly remotely controlled/auto-controlled model aircrafts including UAVs and MAVs. The Department offers M. Tech Degree in:

AE Aerospace Engineering

Course Content:

Core Subjects: Aerodynamics, Structures, Propulsion, Flight Mechanics, Machine Computation Laboratory.

Elective Subjects: Computational Aerodynamics, Wind Tunnel Design and Testing, Industrial Aerodynamics, Turbulence, Gas Dynamics, Hypersonic Aerodynamics, Advanced Viscous Flow, Introduction to Atmospheric Boundary Layer, Missile Aerodynamics, Aeroelasticity, Advanced Structural Dynamics, Experimental Stress Analysis, Fracture Mechanics, FEM in Aerospace Structures, Composite Structures, Plates and Shells, Advanced Propulsion System, Combustion Process in Jet Engines, Aircraft Fuel Systems, Advanced Gas Turbine Theory, Advanced Air Breathing Propulsion, Automatic Control of Aircraft, Space Dynamics, Principles of Aircraft Design.

Areas of Research: Computational Fluid Dynamics, Industrial Aerodynamics, Unsteady Aerodynamics, Turbulence, Aeroacoustics, Hypersonic Reacting Flows, Flow-Induced Vibration and Fluid-Structure Interaction, Structural Dynamics, Computational Structural Mechanics, Structural Mechanics, Composite Structures, Aeroelasticity, Injector Studies, Droplet/Spray Characterization and Burning, Ramjet studies, Spacecraft Dynamics and Control, Aircraft Dynamics and Control, Intelligent Systems, Navigation (Aircraft and Satellite), Micro Air Vehicle, UAV, Probabilistic Mechanics in Aerospace Space Structures, Smart Structures, FGM. The Department is currently running a large number of sponsored research projects from different sponsoring agencies such as Aeronautics R & D Board, DST, Aeronautical Development Agency, Indian Space Research Organisation and others.

DEPARTMENT OF AGRICULTURAL AND FOOD ENGINEERING

Among the IITs, only IIT Kharagpur has the distinction of having Agricultural and Food Engineering Department. The Department has been established on a broad pattern and takes up research in interdisciplinary areas with an integrated approach of science and technology. It has a wide-ranging postgraduate programme in six specializations and offers research programmes in diverse areas. The undergraduate and postgraduate teaching is well established and has been well received by the industries and other organizations. The Department offers the following specializations at M.Tech. level:

- AG1 Farm Machinery and Power**
- AG2 Land and Water Resource Engineering**
- AG3 Food Processing Engineering**
- AG4 Agricultural Biotechnology**
- AG5 Aquacultural Engineering**
- AG6 Agricultural Systems and Management**

Course Content:

AG1: Tractor Systems Design I and II, Farm Machinery Design and Testing, Soil Dynamics in Tillage and Traction, Alternative Energy Sources, Instrumentation and Research Techniques, Tractor Ergonomics, Land Grading and Earth Moving Machinery Systems for Precision Agriculture, Computer Aided Design of Tractors and Farm Machines.

AG2 : Surface Water Hydrology, Advanced Groundwater hydrology, Geo-Informatics for Land and Water Resources, Water Resources Systems Analysis, On-farm Water Management, Climate Change and Water Resources, Watershed Management, Pumping Systems, Non-point Source Pollution and Management, Vadose Zone Hydrology, Modelling and Simulation for Agricultural Water Management.

AG3 : Food Chemistry, Advanced Mechanical Operations in Food Processing, food Process and Products Technology, Advanced Thermal Operations in Food Processing, Transfer Process in Food Engineering, Fat and Oil Technology, Grain Process Engineering, Food Handling and Packaging, Nutraceuticals and Functional Foods, Advanced Food Technology, Food Process Modelling, food Plant and equipment Design, Instrumentation and Control in Food Industry.

AG4 : Principles of Plant Breeding, Plant Metabolites and Separation Technology, Crop Breeding and biotechnological Applications, Recombinant DNA Technology, Modern Genetics, Advanced Plant Physiology, Environmental Microbiology and Biopollution Control, Pharmacognosy and Metabolic Engineering, Seed Technology, Food Biotechnology.

AG5 : Fishery Biology and Fish Culture Techniques, Open Channel Hydraulics and Coastal Engineering, Design of Aquacultural Facilities and Equipment, Planning and Design of Aquacultural Projects, Water Quality Management Practices, Principle and Fishing Technology, Advanced Aquaculture Technology, Computational Techniques in Fisheries, Water Resources System Analysis, Processing and Preservation of Aquacultural Products, Advanced Fishing Technology, Unit Operations in Aquacultural Products Processing Transfer Processes in Food Engineering.

AG6 : Crop Production Systems, Soil Systems, Management and Productivity, Systems Approach in Agriculture, Plant Nutrition, Wasteland and Forest Management, Soil-Plant-Water Relationships, Water Resources System Analysis, Climate Change and Agricultural Production System, Seed Technology, Tea Science and Process Technology, Marketing of Food and Agricultural Products, Agro Project Cash Flow Analysis and Management.

Areas of Research: Tractor systems design, Modelling and performance simulation, Machine operators' safety and comfort, Precision agriculture and bioinstrumentation, Tillage and traction modelling, Combination tillage implements, Electronic Seed metering mechanisms, Solar, Wind and Biomass energy application, Biodiesels.

Optimal control and decision support systems for irrigation projects, Hydrological modelling of agricultural watersheds, Integrated watershed management, Application of remote sensing and GIS in natural resources management, Furrow irrigation modelling, Rainwater harvesting, Artificial groundwater recharge, Groundwater modelling, Automation of drip and sprinkler irrigation systems, Quantification and Control of non-point source pollution of water resources.

Osmo-air drying, Concentration and dehydration, Extrusion, Biomass and by-product utilization, Cryopreservation and cryogrinding, Expression and solvent extraction of vegetable oil, Parboiling and milling of paddy, UHT processing of milk, Biodegradable packaging film, Tea processing, Detoxication of mycotoxins, Cold storage, Control atmosphere storage, Biosensors, CFD in Food Processing and Preservation, Health Foods and Nutraceuticals, Microwave drying and heating systems, Heat transfer in non Newtonian Flow.

Plant tissue culture engineering, Biotechnology of medicinal, aromatic and ornamental plants, Micropropagation and cryopreservation of medicinal plants, Screening and isolation of plant bioactive compounds, Molecular cloning of genes for

plant secondary metabolites, Harnessing biodegradable polymers and bioactive compounds from microalgae, Production of microalgal fuels (biodiesel and bioethanol), Production of herbal and microbial-based biopesticides, Production of microbial and therapeutic enzymes, Microbial biotransformation of complex biopolymers to value added products, Waste water management.

Plant nutrition and soil management, Organic farming, Wasteland development and forest management, Water management, Weed management, Cropping systems management, Water and solute transport, Ecology and environmental pollution, Cultivation and utilization of medicinal plants, Climate change adaptation/mitigation, Economics of agro-production and processing, Marketing of agro-commodities.

Computer aided design of Aquacultural farm, Fish feed development, Water quality control, Waste utilization in aquaculture, Stability and hydrodynamics of fishing gears and vessels, Development and performance evaluation of aeration systems.

DEPARTMENT OF ARCHITECTURE AND REGIONAL PLANNING

The Department of Architecture and Regional Planning was established in 1952 in this Institute, and has been involved in teaching and research in the areas of Architecture, Regional Planning, and City Planning. It is recognized as one of the leading Departments in the country offering undergraduate, post-graduate and doctoral programmes. The department currently offers a postgraduate course in **Master of City Planning**.

City planning has been described as the art and science of ordering the use of Land and siting of buildings and communication routes so as to secure the maximum degree of economy, convenience and beauty, whose main impetus is thus "foreseeing and guiding change." Thus City Planning is a process of formulating a plan, which narrates a blue -print of actions and decisions to reach a predetermined goal, within a predicted period of time.

The city planning course offered here is unique. On one hand it is broad based, exposing students to grasp complex issues of urban development, surveying techniques, analytical tools, decision making processes and management techniques. On the other hand the second year is devoted for in depth learning and specialisation, spending considerable time in seminars, viva-voce and preparing dissertation thesis.

The academic input among others, focuses on issues related to, Socio-Economic and Physical Aspects of Human Settlements, Housing, Transportation Planning, New Town Planning, Urban Revitalisation and Conservation, Utilities and Infrastructure Planning, Development Economics, Environmental Planning, Urban Design, Landscape Planning, GIS and Remote-sensing, Tourism and Recreation Planning. The Department offers following specialization:

AR City Planning

Course Content:

The Core Courses are: Planning Theory and Process, Statistical Techniques and Computer Programming, Transportation Planning and Traffic Engineering, Planning Legislation and Professional Practice, Development Management and Finance, Planning Workshop I and II (including Two-week field study in each).

Depending on their interests, the students are required to take up three Elective Courses in the first and second semesters each. The electives are grouped as follows:

Elective – I: Housing and Community Planning, Housing Policies and Programmes, District and Rural Area Planning;

Elective – II: Social Aspects of Human Settlements, Dynamics of Settlement Systems, Regional Development and Planning;

Elective – III: Utilities and Services Planning, Water Resources Economics, Development of Human Resources, Disaster Management;

Elective – IV: Remote Sensing and GIS in Planning, Systems Modelling and Analysis, Planning Informatics;

Elective – V: Quantitative Methods in Planning, Regional Analysis and Programming, Environmental Planning, Metropolitan Planning;

Elective – VI: Tourism and Recreational Planning, Urban Conservation Studies, Urban Design, Landscape Planning;

The students are also required to take up an eight weeks summer-internship. This would be undertaken in any leading planning organization, development authority, or planning laboratory. The Department provides assistance in organizing the training programme. Seminars, presentations and group-discussions are regular components of the course. A comprehensive viva-voce is conducted to review their knowledge base at the end of the stages of learning. The students finally work on a dissertation on an area of their interest, and defend it through the final viva-voce.

Areas of Research: Urban Fringe Areas, Housing and Community Planning, Urban Open Spaces, Transportation Planning, Watershed Management, Heritage Studies and Conservation, Infrastructure Planning and Systems Management,

Computer Applications in Architecture and Planning, GIS and Remote-sensing Applications. The Department is engaged in various live projects on urban planning.

DEPARTMENT OF BIOTECHNOLOGY

Biotechnology program in IIT Kharagpur was initiated in 1986 with the introduction of M.Tech Course in Biotechnology with the generous support from the Department of Biotechnology, Government of India. The program bred excellence in the spheres of teaching / training and research. The wide appreciation of the program in the country and abroad led to introduction of an undergraduate course in Biotechnology and Biochemical Engineering in 1994, and an independent Department in 1999, with B.Tech (Hons.), Dual degree M.Tech, Joint M.Tech-Ph.D, Ph.D and Post-Doctoral activities. In the M Tech course, a balanced exposure (both in theory and in practice) of modern biology and bioprocess engineering is given. The achievements in Industry-Institute collaborative research, process / product / equipment development, patent and technology transfer on inventions are indicative of the excellence of the program. The faculty has strong interaction with reputed Institutions of national and international importance. The Department has state-of-the-art facilities in Cell and Molecular Biology, Structural Biology (Macromolecular crystallography), Plant Biotechnology, Biochemistry, Fermentation, Biochemical Engineering, Downstream Processing, Bioinformatics, r-DNA Technology, Bio-separation, Microbiology and Immunology, Molecular Genetics, Protein Chemistry, Proteomics, Genomics. The Department offers M.Tech degree in :

BT Biotechnology and Biochemical Engineering

Course Content:

Core Subjects: Bioseparation Technology, Immunotechnology, Biotechnology of Plant Metabolites, Recombinant DNA Technology.

Electives: Aspects of Biochemical Engineering, Process modeling and simulation, Secondary Metabolism in Plants and Microbes, Protein Engineering, Immobilization Technology, Biophysics and Instrumentation in Biology, Statistical Techniques in Computer Programming, Data Warehousing and Data Mining, Object oriented programming, Quality control in Biotechnology, Bioprocess Plant and Equipment Design, Crop Breeding and Biotechnological Application, Industrial relations, Total Quality Management, Materials Management, Development of human resources, Interpersonal communication.

Lecture classes are supported by well planned laboratory demonstrations in Animal Cell culture & Immunotechnology, Bioseparation and Bioprocess Technology, Plant Biotechnology Recombinant DNA Technology

Areas of Research: High frequency mass propagation, cell culture and metabolic/ genetic manipulation in plant in liquid media and bioreactor; Production and analysis of transgenic plants; Microbial herbicide production; Continuous ethanol production by using novel bioreactor; Rapid and landfill gas generation process, hydrogen production by bacterial fermentation; Process development optimization; Marine biotechnology; Characterization of fibroin protein and analysis of fibroin gene structure; Biomaterials for tissue engineering; Characterization of virus infecting tasar silk worms; Gene expression in prokaryotic and eukaryotic system; Lectin based diagnostic and immunomodulators; Proteomics and protein-protein interaction; Monoclonal antibody production, recombinant protein production in plant, animal and microbial cells; Metagenomics and bioremediation; Functional genomics of bacterial cell wall; Mechanisms of antimicrobial resistance; Structural Biology and protein crystallography of important proteins from M.tuberculosis and S.aureus; Structure based inhibitor/drug design; Structural bioinformatics.

DEPARTMENT OF CHEMICAL ENGINEERING

Department of Chemical Engineering is one of the premier and oldest Departments of this Institute. This Department has been in the forefront of Chemical Engineering education and research in India, providing undergraduate and postgraduate education. New courses along with state-of-the-art research facilities meeting the needs of ever changing world are the strong points of this Department. The Department has a large number of well-equipped laboratories covering the areas of Unit Operations, Petroleum Refining and Petrochemical Technology, Combustion Engineering, Reaction Engineering, Process Dynamics and Control, Computer Aided Process Engineering (CAPE), Mineral Processing, Physical Measurements and Industrial Analysis. Keeping pace with the frontier areas of development in the profession, research facilities have been created in the areas of Membrane Technology, Interfacial Phenomena and Micro-scale Heat Transfer and Real Time Intelligent Control System, Multiphase Flow polymer Composites. Active participation of faculty and students in sponsored research projects equips the students with skills for research as well as industrial assignments.

The Department offers MTech degree in:

CH Chemical Engineering

Core subjects: Advanced Fluid dynamics, Advanced Mass Transfer, Advanced Heat Transfer, Process Dynamics and Control, Advanced Mathematical Techniques in Chemical Engineering

Elective subjects: Optimization Techniques in Process Design, Process Modeling and Simulation, Industrial Pollution Control, Petroleum Refinery Engineering, Advanced Thermodynamics, Multiphase Flow, Reservoir Engineering, Green

Technology, Transport Processes in Physiological Systems, CFD Applications in Chemical Processes, Microscale Energy Transport, Polymer Engineering, Energy Conservation in Process Industries, Chemical Engineering Principles in Polymer Processing. Advances in Biochemical Engineering, Real Time Intelligent Process Systems, Novel Separation Processes, Petrochemical Technology, Chemical Reactor Analysis, Combustion Engineering, Mineral Beneficiation, Reactor Stability and Control, Computer Process Control, Fluidization Engineering, Project Engineering and Management, Hazard Analysis and Risk Management in Chemical Industry, Flow of Complex Mixtures, Manufacturing and Characterization of Polymer Matrix Composites, Storage and Handling of Materials, Hazardous Waste Treatment and Management.

Areas of Research: Transfer Operations, Reaction Kinetics, Process Modeling and Simulation, Nonlinear Control, Membrane Technology, Environmental Engineering, Micro-scale Heat Exchange, Reaction Engineering, Petroleum Refining and Petrochemicals, Coal Processing, Particle Technology and Mineral Beneficiation, Bioprocess Engineering and Biofuels, Surface science and Nanotechnology, Modeling of Physiological systems.

DEPARTMENT OF CIVIL ENGINEERING

The Department of Civil Engineering is one of the first few major departments in the Institute started in 1951 and has been offering BTech (Hons) in Civil Engineering all along. The MTech programs were started in 1955 and the first doctoral degree was awarded in 1960. The department has a large number of projects and has been contributing significantly towards research, development and teaching at both under-graduate and post-graduate levels. In addition to BTech (Hons) course in Civil Engineering, the department also offers MTech and PhD programmes in five areas of specialization. The course content, areas of research and laboratory facilities are briefly mentioned below. The Department offers MTech degrees in:

- CE1 Hydraulic and Water Resources Engineering**
- CE2 Transportation Engineering**
- CE3 Environmental Engineering and Management**
- CE4 Geotechnical Engineering**
- CE5 Structural Engineering**

Course Content:

CE1 : Free surface flow; Applied hydrology; Hydraulic structures; Viscous fluid flow; Geohydraulics; Remote sensing in land and water Resources; Advanced computational hydraulics; Hydraulics of sediment transport; Turbulent fluid flow; Integrated watershed management; Hydropower engineering; River engineering; Water resources system analysis.

CE2 : Geometric design of streets and highways, Pavement design; Pavement Materials; Pavement Construction; Pavement Evaluation and Rehabilitation; Transportation System Planning; Transportation Economics, Transit Planning and Operation; Traffic Engineering; Design and Planning of Airports; Analysis of Transportation systems.

CE3 : Water Supply Systems; Wastewater Management; Industrial Water Pollution Control; Solid Waste Management; Air Quality Management; Environmental Impact Assessment; Environmental Management; Environmental Chemistry and Microbiology; Advanced water and waste water treatment; Hazardous waste management; Environmental hydraulics.

CE4 : Soil Exploration-planning and methods; Characterization of soils; Basic Geo Mechanics; Applied Soil Mechanics; Foundation Engineering; Soil Structure Interaction; Soil Dynamics and Earthquake Engineering; Rock mechanics and Tunnelling; Computational Geomechanics; Behaviour of Unsaturated Soil; Ground Improvement; Offshore Geotechnical Engineering; Optimization.

CE5 : Advanced Structural Analysis; Elasticity, Plasticity and Visco-elasticity; Elastic Stability; Reinforced Concrete Structures; Metal Structures; Pre-stressed Concrete; Composite Structures; High-rise Structures; Random Vibration and Earthquake Resistant Structures; Shell Structures; Probabilistic Design; Optimization; Offshore Structures; Computational Mechanics; Finite Element Analysis; Construction Management and Planning.

Areas of Research: Flood forecasting; Clear water scour; Sediment transport and jet diffusion; Stochastic hydrological analysis and reservoir study through remote sensing; Mathematical modelling of unsteady flow on fluvial beds; Bridge pier scour and confluence scour; Ground water engineering; Drought analysis; Numerical models for free surface flow; Physical models of hydraulic structures; Resource mapping and flood analysis using remote sensing and GIS; End-depth in channels; Application of Fuzzy set, NN, and GA in water resources.

Traffic flow simulation; Planning of rural and urban transport systems; Development of new pavement materials; Modification and evaluation of bituminous binders using polymers and waste rubbers; Pavement analysis and design; Non-destructive evaluation of pavements.

Environmental impact assessment; System analysis and water quality management; mathematical modelling of river and estuarine pollution control; bio-reactors; water-hyacinths and aquatic weeds for pollutant removal; Water distribution

networks and physico-chemical process for water quality control, Solid waste management, Heavy/trace metal removal, Industrial air pollution and control; Rural Water Supply; Aerobic/anaerobic treatment of waste waters; Pesticides removal and degradation; Bio-filtration for air pollution control; Process modification for pollution minimization. Environmental life cycle assessment.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

The Institute initiated its undergraduate program in Computer Science and Engineering in 1982. Since then the activities of the CSE Department have proliferated in various directions. A postgraduate course in Computer and Information Technology leading to an MTech degree was introduced in the 1986-87 session. Full scale thrust on research activities leading to a PhD degree was initiated in the 80s with the first PhD awarded in 1986. The department has excellent hardware as well as software facilities. The hardware laboratory is well equipped with the latest equipment for training, research, and development on microprocessor-based systems. The software laboratory has a state-of-the-art computer cluster comprised of a Compaq server running Windows, and the following Linux/Unix servers: a DEC server, a SUN Enterprise server, a SUN Blade server, SUN Ultra SPARC stations, IBM and Intel servers. These servers are interconnected over a 100 Mbps LAN. The Software lab has over 45 thin clients acting as student access points. To facilitate research and training in the emerging areas the department has set up specialized laboratories in areas such as Multimedia, VLSI/CAD, Parallel processing, Systems, Networks and Bioinformatics. The department also has a Microsoft funded lab that is used for providing Microsoft tools support to the department community in addition to research and development in wireless and embedded systems. The departmental LAN is connected to the institute-wide backbone through multiple Gigabit links (fibre-optic), and the Institute LAN is connected to the Internet via VSAT and high-speed fibre-optic lines. The departmental library is well equipped with the latest books available in all the different areas of Computer Science and Engineering. The Department offers following specialization:

CS Computer Science and Engineering

Course Content:

The curriculum of the course consists of three core courses and seven electives. A wide range of electives is offered to enable the students to select subjects in their special areas of interest. Some of the courses are listed below:

Advances in Algorithms, High Performance Computer Architecture, Distributed Systems, Logic for Computer Science, Testing and Verification of Circuits, Cryptography and Network Security, Algorithms for Bioinformatics, Artificial Intelligence, Advanced Graph Theory, Computational Complexity, VLSI System Design, Speech and Natural Language Processing, Object Oriented Systems, Internet Protocols and Applications, Data Warehousing and Data Mining, Database Engineering, Advanced Microprocessor Based Systems, Intelligent Systems, Advances in Operating Systems Design, Parallel and Distributed Algorithms, Real Time Systems, Theory of Programming Languages, Machine Learning, Fault Tolerant Systems, Computational Geometry, Software Engineering, CAD for VLSI Design, Quantum Computing, Advances in Digital and Mixed Signal Testing.

Areas of Research: Algorithms, Artificial Intelligence and Knowledge based systems, Computer Networks, Computer Architecture, Computer Vision and Image Processing, Computer Graphics, Computational Geometry, Data Base Management Systems, Distributed and Parallel processing, Fault tolerant computing, Logic and Semantics, Real-time systems, Verification of Hardware and Software, Programming Languages, Software Engineering, VLSI Systems Design.

DEPARTMENT OF ELECTRICAL ENGINEERING

The first postgraduate programme to be started in the department was on "Electrical Machines" in the year 1955, followed by "Control Systems" in 1959. With the establishment of a Power Electronics Laboratory in 1972, the courses under "Electrical Machines" were updated and the programme was redesignated as "Machine Drives and Power Electronics" in 1981. The third specialization on "Power Systems" was introduced in 1965, that has now been redesignated as "Power and Energy Systems" since 2010. The program on 'Instrumentation' which started in 1972 has now been renamed as 'Instrumentation and Signal Processing'. Thus, the Department offers the following areas of specialization for the M. Tech degree:

- EE1 Machine Drives and Power Electronics (MDPE)
- EE2 Control System Engineering (CSE)
- EE3 Power and Energy Systems (PES)
- EE4 Instrumentation and Signal Processing (INST)

Course Contents:

Core Courses:

EE1 The subjects presently offered are: Power Electronics Converters and Machine Drives, Machine Analysis, Advanced Machine Drives and Advanced Power Electronic Converters, Power Electronics and Machines Laboratory, Machine Drives Laboratory.

EE2 The subjects presently offered are: Control Theory, Estimation of Signals and Systems, Optimal Control and Non-linear Control, Control Systems Laboratory.

EE3 The subjects offered are: Renewable and Distributed Energy Systems, Power System Analysis and Operation, Power System Protection, Power System Dynamics and Control, Power & Energy Systems Laboratory and Power & Energy Systems Simulation Laboratory.

EE4 The subjects offered are: Analog Signal Processing, Programmable and Embedded System, Statistical Signal Processing, Mixed Signal Circuits and Systems on Chip, Advanced Sensing Techniques, Embedded Systems Laboratory, Real-Time Signal Processing Laboratory and Instrumentation Laboratory.

In addition to the “core” subjects mentioned against each specialization above, students are required to choose six “elective” subjects (one of which may be a HSS / Management subject) in their special areas of interest. Practical oriented laboratory exercises are carried out in the first two semesters. Three hours per week are earmarked for “seminar” in the first two semesters followed by a comprehensive viva voce at the end of the second semester. A project dissertation on a relevant problem under the supervision of a faculty member and / or persons from industry follows the course work of two semesters.

The Department offers a large number of electives for specialization in various areas. Some of the electives are : Industrial Instrumentation, Digital Signal Processing, Computational Methods and Algorithms in Signal Processing, Digital Control, Data Communication Systems, Industrial Automation and Control, Biomedical Signal Processing , Process Monitoring and Fault Diagnostics, Nonconventional Electrical Energy Systems, Intelligent Control, Optoelectronics based Instrumentation, , Electric Vehicles, Digital Image Processing, Chaos Fractals and Dynamical Systems ,Artificial Intelligence applications to Power System, Special Electrical Machines , EMC & EMI Control, High Voltage and Insulation Engineering, Industrial Applications of High Voltage Engineering, Wind Energy, Advanced Digital Signal Processing. In addition, students can choose appropriate elective subjects from other departments i.e. Computer Science and Engineering, Electronics and Electrical Communication Engineering, Mechanical Engineering, Mathematics, Reliability Engineering Centre and Materials Science Centre.

Areas of Research: The current research activities in the Department are mainly centered around the following areas :

DSP / Microcontroller based controllers for induction and synchronous machines , parameter-adaptive controllers for indirect field-oriented AC motor drives and speed sensor less operation, direct field orientation of induction motors with rotor flux observers, modeling and implementation of cyclo-converter fed drives, variable speed constant frequency generation systems using induction generators, superconducting coil based UPS systems, linear induction and synchronous machine based propulsion systems, electric vehicle propulsion systems, VLSI based design of DC-DC converters, control of chaos in power electronic converters. Transient stability analyses of power system, optimal load-flow, load forecasting and contingency analysis. Expert system based analysis and synthesis of active circuits, superconducting devices. HVDC transmission, condition monitoring of power system equipment, fiber optic and other optoelectronic CTs and RTs for power systems, non-conventional energy sources, distributed power systems, deregulation in power system , power system control, distance relays using travelling wave estimation, control and optimization of linear systems, application of neural networks for controller design and system studies, controller design, model order reduction, nonlinear dynamical systems, fractals, embedded systems, robust control , fuzzy control , sliding mode and variable structure controller design, large scale systems, fractional order systems, orthogonal functions, genetic algorithm applications in control, multivariable controller design, periodic controllers, decentralized controller design, systems with time delay, MEMS, discrete event systems, fault tolerant control , knowledge based selection of transducers , signal processing, process automation of steel mills, robotic sensing, testing and fault diagnosis of analog and mixed signal circuits, biomedical instrumentation, instrumentation and control of bioprocesses .

DEPARTMENT OF ELECTRONICS AND ELECTRICAL COMMUNICATION ENGINEERING

The Department of Electronics and Electrical Communication Engineering (E&ECE), IIT Kharagpur was established right at the inception of the institute in 1951. In its initial years, the department’s activities were restricted to research, primarily fulfilling the country’s needs. Thereafter undergraduate studies started and the students used to receive B. Tech (Hons.) degree in Electrical Engineering and the subjects on Electronics were offered in the final year. As the area grew further, from 1958 the Institute started offering B. Tech (Hons) degree in Electronics and Electrical Communication Engineering. Since its inception, the E&ECE department of IIT Kharagpur has been a pioneer in introducing subjects in the fields of Communications, Microwave and Computer Engineering. The department has been involved in teaching and research in diverse aspects of Telecommunication, Microelectronics, Computer Vision, Electromagnetics, and Light wave Engineering.

The Department offers MTech degree in:

EC2 Micro Electronics and VLSI Design
EC3 RF and Microwave Engineering
EC4 Telecommunication Systems Engineering

EC5 Visual Information and Embedded Systems Engineering

Course Content:

Core Course:

EC2 Solid State Circuits, VLSI technology and process modelling, VLSI CAD, VLSI circuits and systems, and five number of elective subjects to be chosen from core subjects of EC1, EC3, EC4, EC5, or elective list. It also includes one HSS elective and three number of laboratory subjects distributed over two semesters and a seminar each in the two semesters.

EC3 Electromagnetic engineering, Antenna theory and practice, Analytical and computational techniques in electromagnetics, RF and microwave integrated circuits, and five number of elective subjects to be chosen from core subjects of EC1, EC2, EC4, EC5, or elective list. It also includes one HSS elective and three number of laboratory subjects distributed over two semesters and a seminar each in the two semesters.

EC4 Modern digital communication techniques, Digital voice and picture communication, Mobile Communication and Fading, Telecommunication switching and networks, and five number of elective subjects to be chosen from core subjects of EC1, EC2, EC3, EC5, or elective list. It also includes one HSS elective and three number of laboratory subjects distributed over two semesters and a seminar each in the two semesters.

EC5 Digital Image Processing, Embedded systems Design, Pattern Recognition and Image understanding, Computer communication and Networks and five number of elective subjects to be chosen from core subjects of EC1, EC2, EC3, EC4, or elective list. It also includes one HSS elective and three number of laboratory subjects distributed over two semesters and a seminar each in the two semesters.

Electives: Neural networks and applications, Estimation and prediction in computer control, Machine intelligence and expert systems, Computer visualization and solid engineering and automation, Adaptive system and signal processing, Parallel and distributed processing, Design and analysis of algorithms, Multimedia systems and applications, Mobile computing, Fuzzy set theory and application, Digital system testing and testable design, Formal languages and automata theory, Performance evaluation of computer systems and networks, Relational and object oriented database design, Optical signal processing, Fibre optic sensors, Nonlinear optics, Laser Technology, Lightwave networks, Compound semiconductor and applications, Architectural design of ICs, Hybrid Microcircuits Technology, Optoelectronic and display devices, Microwave semiconductor devices, Digital signal processing and applications, Technology CAD, MEMS and Microsystems, Nanoelectronics devices engineering, Superconducting devices and application, Bioelectronics, EMI and EMC techniques, Microwave remote sensing and radar cross section, Phased array antennas, Microwave measurement Telecommunication systems modelling simulation and software, Mobile communications and fading, Secure communications, Telematics and informatics.

Areas of Research:

Thrust Areas of the Department:

- | | |
|----------------------------------|------------------------------------|
| 1. Silicon Heterostructures | 2. Nanoelectronics |
| 3. MEMS | 4. CAD and VLSI Technology |
| 5. Wireless Communication | 6. Wireless Networks |
| 7. Optical Communication | 8. Optical Networks |
| 9. Sensor Networks | 10. Computational Electromagnetics |
| 11. EMI / EMC | 12. RF System Design |
| 13. Smart Antennas | 14. Digital Signal Processing |
| 15. Image and Video Processing | 16. Multimedia Processing |
| 17. Machine Intelligence Systems | 18. Speech Recognition |
| 19. Integrated Optics | 20. Embedded Systems |

The research activities can be grouped under several major areas as mentioned below:

Communication Engineering: Digital Modulation Techniques, Digitization of Speech; Bandwidth Compression of Speech Signals; Picture Coding; Spread Spectrum Techniques; Speech Frequency, Multimedia Encryption, Satellite Communication, Mobile Communication, Computer Communication.

Visual Information and Embedded Systems: Computer Vision, Computer Networks, Microcontrollers and embedded systems, Fuzzy Techniques and Pattern Recognition, Image and Video Processing, Video and Multimedia Coding, Automated Visual Inspection, Gesture Recognition, Real-time Architectures for Image and Video Processing, Video Transcoding, Multimedia Networking, Video Indexing and Retrieval, Biomedical Image Processing.

Microwave, Millimeterwave and Antenna Engineering: Microwave Antennas, RF and Microwave Integrated Circuits, Millimetric Waves, Magnetostatic Waves, Microstrip Antennas, Phased Array Antennas, EMI/EMC/PSD, Microwave and Millimeterwave Systems and Propagation, Computational Techniques, Radar Cross Section.

Microelectronics: CVD for Silox and Polysilicon, Plasma Processing and Ion-beam, High Speed Address Multipliers, Gate Array, Process Modelling, Special purpose Signal Processors and their application in Biomedical Instrumentation, CAD of LSI/VLSI Systems, Device Modelling, MEMS.

DEPARTMENT OF GEOLOGY AND GEOPHYSICS

Started in 1951, the Department of Geology and Geophysics offers advanced specializations and research opportunities in traditional, modern and applied areas of Earth Sciences. The Department, one of the largest in the country, has a long record of quality teaching and research. The Department runs a collaborative research and training programme with DAAD, Germany. The alumni of the department have set up highly distinguished tradition all over the globe and include six recipients of S.S. Bhatnagar Prize, two Vice-Chancellors, one Director General of GSI, Director AMD and ONGC. Over the years a large number of graduates of this Department have also come to occupy important positions in professional organizations, several universities and research institutes both in India and abroad. The Department has contributed textbooks and reference books to the national and international Earth Science community.

Outstanding faculty, excellent work atmosphere and modern laboratories with wide-ranging research activities have been the strong points of this department. The major facilities for analytical geochemistry include X-ray Fluorescence Spectrometer, Atomic Absorption Spectrophotometer with FIAS and Graphite furnace, Laser Raman Microspectrometer, Total Organic Carbon Analyzer, Gas Chromatograph, Differential Thermal Analyzer/ Differential Scanning Calorimeter, Hot-Cold Stages for Fluid Inclusion Studies. The Department houses two National facilities such as the Stable Isotope Gas Source Mass Spectrometer (for O,S and C isotopic ratios in geological materials) and equipment for Anisotropy of Magnetic Susceptibility studies (for studying deformation records in rocks).

A Global Broad-band Seismological Observatory indicates a significant milestone in the infrastructure for Earthquake Seismology. The Department also possesses state-of-the-art equipment for gravity, magnetic, electrical and electromagnetic studies. The Nuclear Geophysical laboratory has the Radon and Thoron Measurement facilities using Solid State Nuclear Track Devices and other Emanometric Techniques. The department possesses state of the art geophysical equipment such as McSeisSX 48 channel engineering seismograph, Accelerographs, Broadband seismometer and Recorders, Gravimeter, Fluxgate and Proton Precession Magnetometers, Aquameter, DDR and Signal Stacking Resistivitymeters, VLF electromagnetic instrument, Magnetotelluric instrument.

Basic infrastructure for research and teaching includes research-level polarizing and stereo microscopes, and excellent computational facilities.

Intensive field training in, structural geology, sedimentary geology, and geophysical techniques of prospecting is an integral part of the curriculum. In addition, students have the opportunity to participate in the activities of the Earth Science Study Circle, which promotes both curricular and extra-curricular activities.

The Department offers MTech degree in:

GG1 Exploration Geosciences

Hydrocarbon Exploration, Applied Micropaleontology, Basin analysis and Reservoir Characterization, Instrumental Methods in Geosciences, Experimental Techniques in Geosciences Lab, Shallow Surface Geophysics, Advanced Petrology and Geochemistry, Advanced Techniques of Mineral Exploration, Groundwater Exploration and Management, Remote Sensing and GIS (Theory and Lab), Engineering Properties of Rocks and Solids (Theory and Lab), Geostatistics, Geoinformatics and Data Analysis, Geophysical Exploration Techniques, Digital Signal Processing in Geophysics, Geophysical Tomography, Isotope Geology and Environmental Modeling, Environmental Hydrogeology, Advanced Vertebrate Paleobiology, Marine Geosciences.

Course Content: Mathematical Methods in Seismology, Applications of Inverse Theory in Geophysics, Geophysical Signal Processing Laboratory, Computational Seismology, Physics of Earth and Geodynamics, Computational Seismology Laboratory, applied Elasticity and Plasticity, Continuum Mechanics and Rheology, Finite Element Method in Engineering, Structure Dynamics and Earthquake Engineering, Advance Structure Analysis, Stochastic Process Simulation, Computational Linear algebra, Logics of computer Science, Digital Image Processing, digital Signal Processing and applications, Neural Networks and Applications, Geographical Information System, Artificial Intelligence, Computational Geomechanics, Geotechnical Earthquake Engineering, Dynamics of soil and foundation, Overview of computer Science, Data Structure and Algorithm, computer Graphics, Pattern Recognition in Geosciences, computer Graphics and Visualization, Database Engineering, Theory of Programming Languages, Multimedia systems and Applications, Geoinformatics and Data Analysis, Fuzzy Set Theory and applications, Management of Human Resources and Industrial Relations, Enterprise Resource Planning, Advanced Production and Inventory control, IT and Management of Information System.

Areas of Research: The faculties are currently engaged in research in a broad range of disciplines. These include

Crustal evolution studies: Investigation of the evolutionary history of ancient and modern cratons and mobile belts from phase petrologic, structural and fluid inclusion data, and integrated studies involving one or more components. Granite tectonism and emplacement mechanisms. Study of the ancient and modern sedimentary rock record targeted towards understanding sedimentary basin evolution under different tectonic conditions, and monitoring palaeoenvironmental changes. Metallogeny of base and precious metals in tandem with crustal evolution in different parts of India, with special emphasis on relevance to the Mineral Industry.

Paleontological studies: Analysis of ancient life forms (invertebrates and vertebrates) to understand palaeobiology, lifestyle and evolution. Micropaleontological research on marine and inland fauna to understand past climatic conditions, with special emphasis on reconstructing monsoonal patterns.

Geophysical research: Earthquake source studies, reconstruction of the 3-D architecture of the continental lithosphere in active as well as ancient orogenic belts from seismic, electromagnetic/ magnetotelluric gravity and magnetic data. Integrated geophysical investigation of geothermal areas, Mapping of mid-crustal conductors using MT studies, Integrated Electrical and EM studies for groundwater and mineral exploration, Geophysical and tomography, Modeling and inversion of various geophysical data for complex 2-D and 3-D structures using numerical methods.

Environmental research: Pollution of soil-air-water by natural and anthropogenic causes, and utilization of waste in restoration of wasteland. Hazard assessment due to natural radioactivity and at waste disposal sites. Seismic microzonation for assessment of earthquake hazard.

Interdisciplinary research work using techniques of Remote Sensing and GIS are carried out in the field of resource potential mapping for ground water and mineral deposits and groundwater contamination.

DEPARTMENT OF INDUSTRIAL ENGINEERING AND MANAGEMENT

Department of Industrial Engineering and Management has a long history of teaching, research, and consultancy in the areas of Industrial Engineering, Productivity Improvement, Operations Research, Systems Engineering, Production/Operations Management, Materials Management and Inventory Systems, Quality Engineering and Management, Supply Chain Management, MIS, ERP, and E-Commerce in the country. It offers BTech (Hons) in Industrial Engineering, Dual Degree in Industrial Engineering and Management, two year MTech in Industrial Engineering and Management, MS and PhD programmes. Also in collaboration with the Department of Mechanical Engineering, it offers a Five-year Dual Degree Programme leading to BTech (Hons) in Manufacturing Engineering with MTech in Industrial Engineering and Management.

The faculty members of the department undertake a large number of industry-sponsored projects in which the BTech and MTech students actively participate and get valuable industrial and project handling experience. The department offers MTech degree in:

IM Industrial Engineering and Management

Course Content: The compulsory subjects include: Decision Modelling, Work System Design, Production Planning and Inventory Control, Advanced Decision Modelling, and Systems Modelling and Analysis. In addition, a large number of elective subjects are offered in various areas of Operations Management, Information Technology, Quality, and Ergonomics that includes Supply Chain Management, Networks and Project Management, Human Factors Engineering, Quality Engineering, Facility Layout and Design, Financial Management and Accounting, and so on. After the completion of the two-semester course work, a student carries out a project work leading to a thesis on a live industrial problem. Seminars and group discussions on various topics are some of the regular features of the course.

Areas of Research: Work System Design and Ergonomics, Facilities Planning, Inventory Control and Analysis, Supply Chain Management, Enterprise Resource Planning, Productivity Management, Project Engineering and Management, Maintenance Management, Quality Engineering and Management, Financial Management, Corporate Planning, System Dynamics Modelling and Simulation, Simulation Games, Management Information System, Decision Support Systems, Software Engineering, Environmental Management, Technology Management, Intellectual Property Systems, E-commerce.

DEPARTMENT OF MATHEMATICS

Since its inception in 1951, the Department has been contributing to teaching and research in Mathematics and Statistics. However, over the past few decades due to rapid growth of Computer Science as an area of Mathematical Sciences, the department has been focusing its attention to Computer Science as well. At present, the Department offers a five-year integrated M.Sc. course in Mathematics and Computing, a Joint M.Sc-PhD course in Mathematics, and a Joint MTech-PhD course in Computer Science and Data Processing. The Department also offers Mathematics, Statistics and Computer Science subjects to students of other departments. The department has an excellent computing environment in its own Computer laboratories which are equipped with Sun Fire V250 Server connected with Sun Ray 100 Thin client, SGI 02 Work station, IBM RS6000 Server, VXL Terminal Server and several Pentium machines. All these systems are connected to other computing facilities in the Institute through Internet via VSAT. For further information about the department, one may visit its website www.webmath.iitkgp.ernet.in

The MTech programme in Computer Science and Data Processing has been running successfully since 1983. The programme gives an opportunity to students, who have not specialized in Computer Science at degree level but have adequate foundations in Mathematics or Electronics/Electrical/Physics, to specialize in Computer Science. The programme aims to produce software professionals who can design and develop systems and applications software, maintain available systems efficiently, and can adapt themselves to research and developments in the rapidly changing field of Computer Science. It is expected that students joining this course should be acquainted with at least one high-level programming language.

The Department offers M.Tech degree in:

MA Computer Science and Data Processing

Course Content:

Core subjects: Theory and Practice of Programming Languages, Algorithms and Data Structures, Systems Programming, Operating Systems.

Electives: Object-oriented Programming, Discrete Structures in Computer Science, Advanced Numerical Techniques, Theory of Compiler Design, Fuzzy sets and Applications, Software Engineering, Graph Theory and Algorithms, Parallel Algorithms, Formal Languages and Theory of Computation, Mathematical Logic and Logic Programming, Queueing, Inventory and Reliability, Pattern Recognition and Scene Analysis, Queueing Theory in Computer Science, Switching and Automata Theory, Information and Coding Theory, Artificial Intelligence, Advanced Computer Algorithms, Computer Networks, Computer Languages, Advanced Programming Techniques, Computer Architecture, Computer Graphics, Multi-Objective Programming, File Organization and Database Systems, Advanced Techniques in Operations Research, Fractals, Cryptography and Security Issues, Computational Linear Algebra, Computational Fluid Dynamics, Foundations In Computer Science, Decision Theory, Stochastic Process and Simulation, Time Series and Forecasting, Similarity Transformation and Perturbation methods, Wavelet Analysis, Non-linear Dynamics, Computational Algebra, Advanced Multi-variate Analysis, Optimization by vector space methods, Computational Topology, Computational Geometry.

There is a provision for six hours of Computer Laboratory per week in the first two semesters, a seminar in each semester and a comprehensive project work after the course work.

Areas of Research: Real and Complex Analysis, Functional Analysis, Algebra, Modern Algebra and Applications, Fluid Mechanics, Bio-Mechanics, Elasticity and Plasticity, Numerical Analysis, Operations Research, Mathematical Modelling, Theoretical Computer Science, Parallel and Distributed Computing, Compiler Design, Database Systems, Image Processing, Artificial Intelligence, Statistical Inference, Queueing Theory, Probabilistic Models, Stochastic Process and Forecasting, Fuzzy Mathematics, Relativity, Gravitation and Cosmology, Graph Theory and Combinatorics.

DEPARTMENT OF MECHANICAL ENGINEERING

The Department is organised into three broad areas of **Applied Mechanics, Thermal Science and Engineering, Manufacturing Processes and Systems.**

MTech courses are offered in three specializations with wide flexibility in selecting subjects of interest. Research is emphasized at all phases to promote curiosity, creativity and confidence aimed at the intellectual and material advancement of the nation. All twenty three laboratories of the department are well equipped with computational and experimental research facilities in wide ranging fields of mechanical engineering. The Department facilities include computer controlled UTM, hip and knee joint simulators, tribological test rigs, stress analysis test facilities, machinery fault simulator, rotor dynamics test rigs, modal test facility, noise and vibration control facility, digital laser vibrometer, test rigs for evaluation of acoustical materials, robots, robot controllers and flexible manipulators, several high speed data acquisition systems, infrared thermal imaging system, stereoscopic particle image velocimetry (PIV) system, vibration isolated optical table, low speed wind tunnel, measuring instruments related to flow, pressure and heat transfer, hot wire anemometer, two-phase flow probes, high speed camera system, IC engines performance test rig, gas chromatograph, CAM, instrumented resistance welding machine, synergic MIG welding machine, cutting tool performance test rig, EDM and ECM setup, CNC High Efficiency Deep Grinding (HEDG) grinding system, PVD hard and soft tool coating system, vibration measurement and fault diagnosis, high power fiber laser, pulsed Nd-YAG, excimer and cw CO₂ lasers, plasma coating and selective laser sintering machines. There is an excellent central workshop equipped with conventional and modern CNC machine tools. An excellent computing environment has been created with state-of-the-art facilities and related accessories all networked with the institute backbone. Advanced softwares are available in the areas of neural network, CAD, FEM, rigid body dynamics, system modeling, control systems and CFD. In the last few years, the department research and laboratory facilities have been significantly augmented through major sponsored projects and institute funding. The faculty members teaching the courses are actively engaged in research and consultancy in their areas of specialisation. The MTech courses offered are:

ME1 Manufacturing Science and Engineering

ME2 Thermal Science and Engineering

ME3 Mechanical Systems Design

Course Content:

ME1 The course is a balanced mix of advanced courses in the area of manufacturing processes and systems. Subjects cover areas of Primary manufacturing processes, Machining, Computer control and Monitoring of manufacturing system along with electives in Surface engineering, Micro manufacturing, Abrasive machining, Soft computing, Modern manufacturing processes, Welding technology, Metal forming, Manufacturing information system, Laser processing of materials, rapid prototyping, Intelligent machines and systems, and numerical modeling of manufacturing processes etc.

ME2 Advanced thermodynamics, Heat transfer, Fluid mechanics, Computational methods, Computational Fluid Dynamics, Experimental methods, and a large number of electives from sub-specialisation areas of thermal science, such as Refrigeration and air-conditioning, Energy conservation, Compressible flows, I.C. Engines, Solar energy technology, Gas turbines and Jet propulsion, micro-fluidics, etc.

ME3 Core subjects: Advanced mechanics of solids, Vibration analysis, Automatic Control, Applied Elasticity, Lubrication and rotor dynamics, Experimental stress analysis, Tribology, Mechanics of Composites, Machinery fault diagnosis and signal processing, Engineering design optimization, Vibration isolation and control, Continuum mechanics, Robotics and robot applications, Fluid drives and control, Human body mechanics, Micro and Nanomechanics, Modern control, Nonlinear vibrations, Fracture Mechanics, etc.

Areas of Research: Fluid mechanics, CFD, Industrial fluid power and control, Two phase flow, Heat transfer, Liquid fuel atomisation and Spray combustion, I.C. engines, Fluidised bed combustion, Refrigeration and air conditioning, Transcritical CO₂ based heat pumps, Thermal system modelling and optimization, Solar energy, Optical diagnostics of thermo-fluid systems, Thermal hydraulics of nuclear plants, Micro-fluidics and Micro-scale transport processes.

Casting, Welding and Metal forming, Machining and grinding, Machine tools, Cutting tools and Coatings, Tool condition monitoring, Plasma-spray ceramic coating, Electrophysical machining processes, Precision manufacturing and laser processing. Systems modelling and design using Bond Graphs, Computer aided design and manufacture, Computer aided process planning, Rapid prototyping, Intelligent machines and systems, numerical modeling of manufacturing processes, System modelling and design using Bond graphs, modelling and control of microsystems, MEMS. Quality assurance and Reliability, Vibration based condition monitoring, Automotive Engg., noise and Vibration and Noise Control, Signal Processing in Mechanical Systems. Finite element and Boundary element methods, Computational solid mechanics, Non-linear mechanics, Fracture mechanics, Composite materials, Non-linear elasticity, Smart materials and Structures, Biomechanics, Industrial, bio- and nano-Tribology, Surface engineering. Mechanical systems dynamics, Rotor dynamics, Vehicle dynamics, Bifurcation and Chaos, Fault tolerant control, Mechanical handling systems and Industrial automation, Industrial fluid power and control.

DEPARTMENT OF METALLURGICAL AND MATERIALS ENGINEERING

The Department since its inception in 1954 has been in the forefront of education in Metallurgical Engineering and since 1994 apart from metallic materials its focus has also turned to the other engineering materials like ceramic, polymer and electronic materials. It has served the needs of the growing metallurgical industry and has been actively engaged in materials research and continuing education programmes. The M Tech programme is aimed at producing trained personnel for research and development work, as well as for industrial consultancy and project.

The Department has fairly well equipped laboratories and among others, sophisticated equipments like Atomic Absorption Spectrometer, X-ray diffractometer, Hot stage Microscope, DSC, DTA-TGA, TMA, Digital Hardness Testers, Nano-indenter, Creep Testing Machine, Pin-on-disc and Fretting wear Testing Machines, Multi-Tribometer, Vacuum Induction Melting Furnace, Vacuum Arc Melting Furnace, Programmable High Temperature Furnaces, Microwave Sintering Furnace, Forging Press, Melt Spinning Unit, High Energy Ball Mills, Attritor Mill Plasma Planter, Constant Load and Slow strain rate SSC Testing Machines, Optical Microscopes with Image Analysis System, BET Surface Area analyzer, Helium Pycnometer, Magnetron Sputtering Unit, Electron Beam Evaporation Unit, Profilometer, etc. These are further supported with latest models of TEM, SEM, FESEM, X-ray Diffractometer, Atomic Force Microscope, Particle size Analyzer, 50m Ton Servo-hydraulic INSTRON etc. at our Central Research Facility. In addition, the Department has excellent computational facilities.

The Department offers the following specialization :

MT Metallurgical and Materials Engineering

Course Content:

Core Courses: The Core courses in this programme are thermodynamics of Engineering Materials, Metallurgical Kinetics, Principles and Techniques of Materials Characterization, Programming and Numerical Methods in Materials Engineering, Principles of Materials Engineering (for students with Non-Metallurgy background). A large number of elective courses are also offered, so that the students can specialize in any of the following fields :

Extractive Metallurgy and Modeling, Physical Metallurgy/Materials Engineering, Manufacturing/process Metallurgy, Powder Metallurgy, Corrosion Science and Technology.

Elective Courses: Agglomeration and Direct Reduction of Iron Ores, Rate Phenomena in Metallurgical Processes, Diffusion in Metallurgical Processes, Principles of Materials Engineering, Diffraction Techniques in Materials Engineering, Advanced composite Materials, Interfaces in Nanostructure Thin Film Semiconductors, Ceramics and Refractories : Synthesis, Properties and Applications, Advanced Ceramic Technology, Surface Modification and Coating Technology, Solidification Processing, Processing by powder Metallurgy Techniques, Vacuum Techniques, Advanced Mechanical Behaviour of Materials, Laser Engineering, Computational Fluid Flow, Heat and Mass Transfer in Metallurgical Processes, Surfaces and Interfaces, Dislocation Theory, Mechanical and Thermal Behaviour of Polymers, Crystals Growth and Characterization, Glass Technology, Secondary steel making, Modeling and Simulation of Metallurgical Processes, Fracture Mechanics and Analysis of Engineering Failures, Phase Transformation and phase Equilibria, Heat Treatment Technology, High Temperature Corrosion Biomaterials Advanced Materials and Processes, Thin Film Technology, Amorphous Materials and Applications, Advances in Iron and Steel making, Energetics in Metallurgical Industries, Theory and Practice of Sintering, Advanced Welding Technology, Experimental Stress Analysis, Advances in Mechanical working of Materials, Advances in Electron Microscopy and Analysis, Optoelectronic Materials and Devices, Polymer Reaction

Engineering and Reactor Design, Technology of Polymer composite, Magnetism and Magnetic materials, Texture in Materials Engineering, Laser Processing Materials, Imperfections in solids.

These apart, the students can also opt for relevant electives offered by other Department and Centres.

The Laboratory courses include Computer Programming Lab (compulsory), Physical Metallurgy Lab (Compulsory for students with Non-Metallurgy background), Ferrous process Metallurgy and Modeling lab, X-ray and Electron Metallography lab, Phase Transformation Lab, Fracture Mechanics and Analysis of Engineering Failures lab, Materials joining Lab, Powder Metallurgy Lab, and Corrosion and Oxidation lab.

DEPARTMENT OF MINING ENGINEERING

The discipline of Mining Engineering is unique to IIT Kharagpur. The Department started in 1956 with the first batch of BTech students. It has played a pioneering role in the introduction of modern mining engineering curriculum in India. Subjects including geomechanics, subsurface environment, industrial management, applications of operations research and computer methods, have been developed and offered with continuous efforts to absorb and disseminate new concepts.

Facilities for research have been created over the years in the areas of mine fires and explosions, model studies in mine aerodynamics, rock excavation engineering, experimental geomechanics, geomatics and remote sensing, clean coal technology, mines safety, CBM, environmental assessment and numerical modelling. The tradition of inter-departmental research cooperation at IIT enriches the MTech and Ph.D. programmes in Mining Engineering. The Department has awarded more number of Doctoral degrees in mining engineering compared to any other institution in India. The faculty are actively involved in sponsored research and industrial consultancy. There is a strong interaction between industry and the Department in diversified research areas. A number of continuing education programmes for industry executives and teachers are offered on a regular basis.

Masters programme of two years duration in mineral engineering started in 1966, while another course in mine planning and mechanization started in 1970. In the current pattern the Department offers MTech in 'Mining Engineering'. The curriculum provides wide scope for the students to specialize in a variety of areas through the selection of appropriate elective subjects offered by various Departments at IIT, Kharagpur. The inclusion of new courses like Tunneling Engineering, Reliability and Quality Engineering, Petroleum Engineering, Mineral Processing and GPS Technology in the regular syllabus has widened the scope of the programme. Ample facilities exist for computer based investigations, and the students have wide access to various engineering software, testing facilities, and analytical equipment available at IIT.

The Department offers MTech degree in:

MN Mining Engineering

Course Content:

The course emphasizes the following aspects of mining engineering and allied earth sciences subjects:

Geomechanics and Ground Control, Subsurface Environment, Surface Mining and Surface Environment, Geomatics and Remote Sensing, Economics and Mine Planning, Occupational Hazards Assessment and Safety Engineering, Reliability and Quality Engineering, Environment Pollution and Control, Quantitative Decision Making, Numerical Analysis, Remote Sensing, GIS and GPS, and Advanced Mineral Processing.

Areas of Research: Reliability, Quality, Safety and Occupational Hazards: Human Behaviour Analysis; Quality Control and Reliability; Supply Chain Management; Injury Epidemiology Safety Management; Geostatistics. Rockmechanics and Ground Control: Floor Bearing Capacity; Longwall Ground Control; Reinforcement and Roof Support Design; Drilling and Blasting; Stability of Large Underground Excavations; Image processing for rock mass characterization; Finite and Discrete Element Methods. Subsurface Environment: Fluid dynamics for shock loss analysis; Mine climate simulation and ventilation. Mine System Engineering: Neural Networks; Fractals and Fuzzy Theory; Genetic Algorithms for Mining Systems; Optimization of Mining Systems; Mine System Design and Mine Machinery Analysis. Mine Planning: Mine Closure Planning; Slope Stability Analysis; Facility location; Capacity Utilization; Investment and Financing Strategic Planning; Ground Movement Analysis. Environmental Pollution Control: Active and Passive Treatment of Water Pollution; Dust and Hazard Estimation; Ground Water Modelling; Environmental Policy Studies; Contamination Migration, Clean Coal Technology; Advanced surveying and GPS; Geo-spatial and Geo-imaging; Rescue Robotics.

DEPARTMENT OF OCEAN ENGINEERING AND NAVAL ARCHITECTURE

The Department of Ocean Engineering and Naval Architecture set up in 1952 to offer a degree course in Naval Architecture was the first of its kind in India. It started offering a postgraduate diploma in Naval Construction from 1973-74 and a postgraduate diploma in Ship Design and Construction from 1974-75, following a request from the Ministry of Defence, Government of India. The postgraduate diploma was subsequently upgraded to the degree of Master of Technology in Naval Architecture from 1980-81 based on the recommendation of Nayudamma Committee. With the changing scene worldwide, the BTech (Hons) is now awarded in 'Ocean Engineering and Naval Architecture' from 1991-92 and the M.Tech. in Ocean Engineering and Naval Architecture from 2001-02.

Besides offering the BTech and MTech programmes, the Department also offers a Five-year dual degree MTech programme in Ocean Engineering and Naval Architecture. Research oriented programmes leading to MS and PhD in the different research areas of the Department are pursued.

The Department is equipped with different laboratories and facilities created over the years and this includes (a) *Ship Hydrodynamics Laboratory* – The laboratory consists of a towing tank 150m long, 4m wide and 2.5m deep and equipped with a towing carriage of maximum speed of 6m/sec. The towing carriage has resistance and propulsion dynamometers with NI based hardware to control the carriage speed and Labview based data acquisition system. A 2D wave maker, single paddle, wetback type with AWACS (Automatic Wave Absorption and Control System) that can generate regular and irregular waves upto 40cm wave height and upto 3 sec wave period is installed at one end of the towing tank. The laboratory has a GPRS linked, Motion Recording Unit (MRU) that can record all 6 DoF. The hydrodynamics laboratory conducts resistance, propulsion and seakeeping experiments for ship models. (b) *Circulating Water Tunnel* – A circulating water tunnel with a test section of 6m long, 2m wide, 1.5m deep and water speed of 1m/sec with flow control facilities enables studies of flow around floating and submerged bodies as well as measurement of sediment transportation. (c) *Welding and Marine Construction Laboratory* – This laboratory is equipped with various welding units, namely submerged arc welding, shielded metal arc welding, friction stir welding and gas welding. The laboratory also has a set up plate forming using line heating. The welding units have suitable computer support for data acquisition and analysis. Work carried out in this laboratory is in the area of welding simulation, residual stress, weld induced distortion and control. (d) *Structure and Vibration Laboratory* - The laboratory is equipped with a 50kN Universal Testing Machine complete with all accessories to carry out experiments with tensile, compressive and bending loads. The equipment also has a multipoint digital strain data logger. (e) *Model Making Workshop* – To support the experimental activities for the above mentioned laboratories, the Department has a well equipped workshop to fabricate ship models and other accessories for experiments. The models are made of wax, wood, fibre glass, perspex, foam, etc.

The Department also has a Computational Hydrodynamics Laboratory (sponsored by Naval Research Board) and a CAD Laboratory. The laboratory is equipped with various soft wares like WAMIT, ORCAFLEX, MAXSURF, MULTISURF, SHIPFLOW, SHIPCONSTRUCTOR, ANSYS, etc.

The Ocean and Atmospheric Science and Technology Cell (OASTC) is also located in the Department of Ocean Engineering and Naval Architecture. The objective of the Cell, established by the Ministry of Earth Science, Govt. of India, is to promote R&D activities in Ocean Science and Technology having societal impact. The cell invites suitable proposals for funding in relevant thrust areas of ocean science and technology.

Department offers MTech degree in:

OE Ocean Engineering and Naval Architecture
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Course Content:

The basic concepts necessary for an appreciation of the field of Ocean Engineering are provided through various core courses such as Analysis of Ocean Structures, Ocean Hydromechanics, Marine Construction and Repair Techniques, Dynamics of Ocean Vehicles, Advanced courses in specific area of Ocean Engineering including CAD-CAM in Design and Production, Computational Methods in Structural Mechanics and Hydromechanics are available in the form of electives. The elective courses offered by the Department are: Ocean Engineering Materials, Dynamical Oceanography, Safety and Marine Pollution, Coastal Engineering, Hydroelasticity, Mechanics of Floating Systems, Ocean Engineering Vehicles and Systems, Powering of Ocean Vehicles, Ship Design, Advanced Ocean Structural Analysis, Computational Methods in Marine Hydrodynamics, CAD-CAM in Marine Design and Production. The courses are so designed that the students from other engineering disciplines can easily adopt themselves to the course curriculum and later specialize themselves in areas like Structural Mechanics, Hydrodynamics, Marine Design and Production and Ocean Technology. Experimental work in the Department Laboratories also forms a part of the M.Tech programme. MTech applicants are required to submit a dissertation, which may be in one of the areas of research in the Department.

Areas of Research:

In the last half a century, the Department has made significant contributions to the development of the shipbuilding, shipping, offshore and related industries in the country by providing technical manpower of high quality and by carrying out research and development of international standard. Apart from basic research, the Department is also actively involved in various sponsored research and consultancy projects. The research areas can be classified into the three broad fields as below :

Design and Production: Computer Aided Design and Computer Aided Manufacture, Structural Reliability, Ship Design Optimization, Knowledge Based Systems, Different Welding Methods for Production, Design and analysis of Welded Joints, Methods for Calculation/Estimations of Welding Deformation and Residual Stresses.

Hydrodynamics: Resistance and Propulsion, Computational Fluid Mechanics, Water Wave Mechanics, Coastal Hydrodynamics, Motion of Floating Bodies, Wave loads on Coastal/Offshore Structures, Hydroelasticity.

Structural Engineering : Finite Element Method of structural analysis applied to ship and ocean structures such as stiffened plates, stiffened shells, submerged panels, offshore structures, articulated towers, etc., analysis of the fibre reinforced structures as applied to ocean, aerospace and general engineering systems.

Ocean Technology: Marine acoustics, coastal processes, sediment transportation, wave energy conversion devices.

DEPARTMENT OF PHYSICS AND METEOROLOGY

The Department started functioning from the very inception of the Institute in 1951. The Department, apart from teaching Physics to undergraduate students and offering 5-year integrated M.Sc. course and 2-year M.Sc. course in Physics, also offers M.Tech course in:

PH1 Solid State Technology

Course Content: The prime objective of the MTech course in Solid State Technology is to educate the post MSc and post BTech students, at advanced level, on such modern areas of solid state science and technology as have developed during the last five decades. To make the course better balanced and inter-disciplinary, the course curriculum and syllabus have been framed in cooperation with Department of electronics and electrical Communication Engineering, Materials Science Centre, and Cryogenic Engineering Centre and several related subjects from these Department and Centres have also been included in the curriculum

The outline course content is as follows:

Physics of materials, solid state devices, Analytical techniques, Science and technology of nanomaterials, Magnetic and superconducting properties of solids, Soft condensed matter, Physics of semiconductor devices, IC technology, Thin film technology, Surface science, Physics and technology of Optical fibers, Integrated optics, Optoelectronics, Computational methods and advanced experiments on solid state devices.

Areas of Research: The department is actively engaged in both experimental and theoretical research and many of these are of interdisciplinary in nature. A brief outline of the main areas is as follows:

Structure-property correlation of amorphous and crystalline materials, electrical transport, thermal, magnetic, and optical properties of materials. Phase transition phenomena in solids. Preparation of nanomaterials, semiconductor thin films, disordered solids, ferroelectric materials, polymer composites etc. X-ray diffraction, Raman spectroscopy, Laser spectroscopy, Impedance spectroscopy, and Crystal growth techniques. Device studies on photonic crystals, optical fibers, spintronics, fuel cells, solar cells, energy storage, memories etc. Theoretical research are in different areas which include high-T_c materials, correlated systems, high energy physics, astrophysics, cosmology, nuclear physics, non-linear dynamics, chaos etc.

ADVANCED TECHNOLOGY DEVELOPMENT CENTRE

The Advanced Technology Development Centre (ATDC) was thus established in July 1998 in IIT Kharagpur. The aim of this centre is to achieve excellence in research using latest technology at the global level and produce trained professional man power for the industry. Advanced Technology Development Centre is an interdisciplinary research centre carrying out research in emerging areas that typically involve researchers from multiple disciplines and niche academic programmes at the postgraduate level. Other than departments, several state-of-the-art research units of the Institute carry out research under the academic umbrella of ATDC. These include the Advanced VLSI Design Laboratory, MEMS Design Laboratory, Micro-science Laboratory, Advanced Laboratory for Plant Genetic Engineering, Communication Empowerment Laboratory, Kalpana Chawla Space Technology Cell, Centre for Theoretical Studies, Micro-fluidics Laboratory, GM CRL on ECS, P K Sinha Centre for Bio-Energy, Centre for Railway Research, etc. A large number of interdisciplinary research projects are carried out under ATDC.

Micromachining and MEMS are one of the major areas of research at the centre. Research and development in Bio-MEMS is also one of the thrust areas of the centre. Bio-MEMS devices like micro channel for cell culture, cell separation etc are being undertaken in the Centre. Several Govt. Dept. including NPSM/ADA, ISRO, DRDO, DST and BARC have funded projects to develop micro-sensors for special application. During the last few years the MEMS devices developed in the laboratory include silicon piezoresistive accelerometer, quartz based accelerometer, micro-thruster, micro-valve, micro-pump, and flow sensor. MEMS design laboratory, a national facility created under NPSM program is actively involved with design work on MEMS including micro fluidic devices. A number of students from various departments like ATDC, Electronics & ECE, Electrical, Mechanical, Bio-Technology, School of Medical Science, Civil engineering department, etc. are involved in the design centre for their project/thesis work. Research and development is also undertaken in the field of integrated optics. A number of thrust areas have now emerged based on core competency available in Advanced VLSI laboratory. This include analog and RF circuit, wireless communication and broadband processing, direct conversion receiver, power management circuits, processors and IP cores for embedded applications design for testability. Fifteen leading companies have joined AVLSI consortium and more than twelve ongoing collaborative research projects funded by Govt. of India and leading companies including National Semiconductor, Intel, Texas Instrument and General Motors. Integrated-optic design software has been developed and copyrighted. Fabrication and characterization of Ti in diffused Li niobate wave guide, directional coupler, power splitters, switches for fiber optic communication network have been performed. Research is being carried out in thin film nanostructure, semiconductor, ferroelectric and magneto-resistive films for microelectronics and sensor applications under various Govt. sponsored projects at Micro Science Laboratory under Dept. of Physics.

AT Embedded Controls and Software

Course Content:

Core Courses: Embedded Control Systems, Embedded Software Design & Validation, Software Design and Validation Laboratory, Embedded Controls Laboratory, Embedded Applications Laboratory, Seminar, Comprehensive Viva-Voce

Elective Courses : Embedded Systems, Logics for Computer Science, Testing and Verification of Circuits, Cryptography and Network Security, Artificial Intelligence, Advanced Graph Theory, VLSI System Design, Object-Oriented Systems, Control Theory, Estimation of Signals and Systems, Industrial Instrumentation, Digital Signal Processing, Intelligent Control, Digital Control, Modeling and Simulation, Process Monitoring and Fault Diagnosis, Embedded Systems Design, Modelling and Simulation of Dynamic Syst., Machinery Fault Diagnostics & Signal Proc., Automatic Control, Reliability Analysis & Prediction, Communication Systems and Networking, Embedded Low Power Systems, MEMS and Biosensors, Stochastic Process Simulation, MEMS and Applications, Wireless Adhoc and Sensor Networks, Intelligent Machines and Systems, Fluid Drives and Control, High Performance Computer Architecture, Real-Time Systems, Distributed Systems, Advanced Microprocessor Based Systems, Intelligent Systems, Advances in Operating Systems Design, Machine Learning, Fault Tolerant Systems, CAD for VLSI Design, Advances in Digital and Mixed Signal Testing, Advanced Control Theory, Adaptive and Learning Control, Advanced Estimation Theory, Discrete Event Systems, Real Time Systems, Advanced Digital Signal Processing, Optimal Control, Non-Linear Control, Adaptive Systems and Signal Processing, Mechatronics, Computer Controls of Machines and Processes, Robotics, Internet and Web based Technologies, Information and System Security, Software Reliability, Fault Diagnosis and Predictive Maintenance, Computer Process Control, Real Time Intelligent Process Systems, Process Dynamics and Control, MEMS and Microsystems Technology, Signal Processing / Telecommunication Ics, Multimedia Systems, Fluidic Instrumentation and Control, Electric Vehicles, Analog Signal Processing, Power System Dynamics and Control, Industrial Automation and Control, Biomedical System Engg. and Automation, Multimedia Systems and Applications, Audio Systems Engineering, Mechanical Drives, Air-conditioning and Ventilation, Biomedical Instrumentation, Mechanisms and Robot Kinematics, CAD of Cryogenic Process Plants, Reactor Stability and Control, Human Behaviour Systems, Development of Human Resources, Economic Efficiency & Human Resource Use, Industrial Relations, Project Engineering and Management, Human Behaviour and Management, Management Information Systems

Areas of Research

Current areas of research focus in laboratories directly under ATDC include VLSI Design and CAD, MEMS and BIO-MEMS, Nano-electronics and material sciences, MBE and MoCVD Technology, Bio-energy, Embedded Controls and Software, Plant Genetic Engineering, Communication Empowerment, High-speed and Heavy-Haul Technology for Railways, Reliability Analysis, Micro and nano-Fluidics, etc

CENTRE FOR EDUCATION TECHNOLOGY

The Centre is a leading presence in the field of Distance Education and E-learning in India with high-end Multimedia and CAL laboratories. The centre combines strong expertise in Information and Communication Technologies with Pedagogy and Instructional Systems.

It has 3 professional studio-cum-classrooms for recording full-semester courses of the institute. More than 100 full semester Video courses of the institute are digitized and stored in a bank of servers. All lectures of these courses are now available on the Internal LAN of IIT Kharagpur in the VOD mode.

Initial trials have been carried out successfully in tutorial classes of the course on "Networks signals and systems" at the UG level. With a valid ID, students can join a live tutorial classroom through the institute LAN connection. It allows students to pose questions and see and hear the responses of the teacher. They could interactively participate in the class from their Halls of Residence. It uses one-way (classroom to students) video and two-way audio / text transmission.

The on-going Virtual Laboratory project is aimed at reproducing the hands-on laboratory experience of selected courses very closely, on computer screens - through advanced modelling and simulation techniques. Ten experiments of 1st and 2nd year Electrical Engineering laboratory are now available in the web-enabled client-server mode. This tool allows a student to simulate and conduct experiments on a computer.

A software has been developed and implemented for conducting on-line tests for selection of paramedical personnel to NIOH

CET is also involved in the National Project in Technology Enhanced Learning (NPTEL) along with the other IITs and IISc, Bangalore. The first phase of the project has been completed - leading to a resource material generation of 240 video-based and web-based courses. The second phase is due to begin from 2007, with a target of producing 500 more such courses. All courses would be distributed free-of cost to all engineering colleges - with a bid to improving the standard of engineering education in the country.

CET also pioneered the first off-campus Distance Education Programme in various IT related areas between 1997 and 2003.

CET is also involved in the multi-crore project of MHRD on "Pedagogic Research" and "Standardization of Quality Assurance of web-based courses".

The Centre offers following specialization:

ET Media and Sound Engineering

Course Content :

Core Courses: Digital Image Processing and Applications, Digital Voice and Picture Communication, Media Systems Laboratory, Audio Systems Engineering, Multimedia Processing and Networking, Media Process Simulation Laboratory, Seminar, Comprehensive Viva-Voce

Elective Courses: Communication Systems and Networking, Data Warehousing and Data Mining, Cluster and Grid Computing, Geographical Information System, Advanced Database Systems, Applied Computer Vision, Pattern Recognition and Applications, Data Structure and Object Representation, Advanced Computer System Architecture, Computer Visualization and Solid Modelling, Information Theory and Coding Techniques, Digital Signal Processing and Applications, Satellite Communication Systems, Cryptography and Network Security, Cryptography and Security Issues, Artificial Intelligence, Speech and Natural Language Processing, Object Oriented Systems, Embedded Systems, Selected Topics in Video Systems Engineering (course content to be decided by the teacher offering the course), Instructional System Design, Project Engineering and Management, Strategic Management

The lecture classes are supported by well-planned laboratory demonstrations in Sound and Media engineering and lectures by renowned experts in the area.

Areas of Research: Teaching-Learning Pedagogy; Action Research; Distance Education and Blended Learning; Instructional Design; Speech and Video Processing.

CENTRE FOR OCEANS, RIVERS, ATMOSPHERE AND LAND SCIENCES

The Centre for Oceans, Rivers, Atmosphere and Land Sciences (CORAL) at Indian Institute of Technology, Kharagpur was established in March, 2005 for imparting quality teaching and advanced training in Earth System Sciences and Technology. The important mission of the centre is to identify and address the challenges of the Earth Systems Science such as climate changes, Natural Disasters triggered by Tsunamis, Cyclones, Earthquakes etc. Study of these events is highly multidisciplinary in nature and requires a coordination effort for prediction and mitigation.

At present the Centre is offering a two year Postgraduate Program i.e. Master of Technology in Earth System Science and Technology. It is coincident that the start of the master's program by CORAL almost coincides with the establishment of Ministry of Earth Sciences by Government of India. The Centre is equipped with an Advanced Computing and Visualization Laboratory for integration of numerical models and visualization of these products. The Centre is also actively participating in the multi-institutional coordinated national programme on "Severe Thunderstorms Observations and Regional Modelling (STORM)" supported by Department of Science and Technology, Govt. of India. With this humble start the centre has set up a advanced atmospheric observatory with all modern sensors along with a 50 meter meteorological tower. Besides teaching and research, this facility is also used as national facility for the studies of Nor'westers and monsoons.

The Department offers MTech degree in:

CL Earth System Science and Technology

Course Content:

The two year MTech in Earth System Sciences and Technology is designed to meet the trained manpower requirement in a very important area of sustainable future of mankind. The course is divided in four semesters with first two semesters having the course work of theory and laboratory. The third and the fourth semesters are mainly devoted to project work. The program is structured in line with the other M. Tech Programmes of the institute providing ample flexibility to the students to learn as per the course and the interest. The core subjects include; Advance Meteorology, Dynamics of Fluvial Systems, Ocean Dynamics, Global Tectonics and Climate with electives covering a set of vast topics from Advanced Instrumentation Techniques, Satellite Oceanography, Ocean Colour and Applications, Ocean Circulation and Wave Modelling, Marine Biotechnology, Polar Science, Modelling of Extreme Events, Carbon Cycle and Global Climate Change, Climate Modelling, Climate Risk Assessment in Agriculture, Neural Networks and Applications, Advanced Computational Hydraulics, Groundwater Modelling and Simulation, Integrated Watershed Management, Aqueous Environmental Geochemistry, Geoinformatics and Data Analysis to Environmental Hazard Management etc. The centre is also offering laboratory courses on Atmospheric and Hydrological Modelling, Ocean and Storm Surge Modelling and Data Analysis and Forecasting.

Areas of Research: The centre is involved in frontier research in oceanographic and atmospheric observational and modelling. In oceanography, the areas of present research activities include tsunami observations and modelling, wave modelling and ocean circulation. In atmospheric research, the present focus is on the observations and modelling studies of severe thunderstorms. Besides, the centre is also involved in mesoscale modelling of extreme weather events viz., tropical cyclone, heavy rainfall, and flash floods etc. The areas of specific interest in this direction are mesoscale data assimilation and micro-physical processes. The centre is also involved in observational modeling studies of urban boundary layer, regional climate modelling and impact assessment studies. Space based observations, retrievals; validation and assimilation of geophysical parameters of ocean, atmosphere and land are another area of research of the Centre. In view of India's active research in Antarctica, the Centre is also focusing on the remote sensing of sea-ice and southern ocean in relation to climate studies.

CRYOGENIC ENGINEERING CENTRE

The Centre was established in 1976 for carrying out research, and providing education and manpower training in the field of Cryogenic Engineering and related areas.

The Centre works in close collaboration with the other Departments/Centres of this Institute and with various national laboratories. Several research projects sponsored by different agencies e.g. CSIR, DST, DBT, CHT, BRNS, ISRO etc. have been successfully completed and are on-going. Teaching and research facilities of the Centre have been strengthened with the input of sophisticated and precision equipment through Indo-German Collaboration and FIST (MHRD) Programme. The Centre has strong industry-interaction through Consultancy and Short Term Training Programmes.

The Centre has very good liquefaction facilities and well equipped teaching and research laboratories. Available major facilities include Philips Nitrogen Liquefiers (MNP 12/1, PLN 430, PLN 106), test rig for cryogenic heat exchangers, gas chromatograph, gas separation and purification, Vapour-liquid Equilibrium measurement, thin film coating unit, microwave power meter and sweep oscillator, RF SQUID system, process simulators ASPEN PLUS, CHEMCAD, vacuum hot press furnace, superconducting magnets, computer aided facility for thermophysical properties of polymers, biocomposites and nanofluids, vibrating sample magnetometer, cryo-refrigerators, dielectric and ferroelectric test measurement unit. Besides this, the teaching laboratories of the Centre have excellent teaching modules for experiment on radial flow reaction turbine, thermal conductivity of liquids and gases, cross flow heat exchangers, superconductivity and vacuum techniques etc. Besides, an excellent vacuum technology laboratory has been created at the Centre through the Indo-German Collaboration Programme. The Centre offers M. Tech Degree in:

CR Cryogenic Engineering

Course content: The course contents include subjects like Cryogenic Air Separation, Cryogenic System, Cryogenic Heat Transfer, Mass Transfer and Separation Processes, Cryofuel Systems, Hydrogen Energy, Cryophysics, Vacuum Techniques, Design of Cryogenic Equipment and Accessories, Cryogenic Rocket Propulsion, Superconducting Materials Magnets and Devices, Superconductivity and Vacuum Technology Laboratories, Heat Transfer Laboratory etc. Students can also take up a few appropriate electives from other Departments/Centres.

Areas of Research: Current research activities of Centre focus on cryogenic refrigeration and liquefaction system; sorption cooling; fluid flow and heat transfer; porous media heat transfer; miniature heat exchangers and regenerators; gas-bearing; gas separation and purification by absorption; adsorption and membrane processes; modeling and simulation of separation processes; natural gas processing, liquefaction and utilization; carbon dioxide capture and sequestration, in-flight air separation; propulsion; process intensification; energy optimization; hydrogen energy; safety under oxygen rich environment; simulation of helium plant and cryogenic system for fusion reactor; nanostructured materials, nanofluids and bio-composites; dielectric and magnetic materials, thin films; gas and magnetic sensors; superconducting magnetic energy storage; superconducting magnets for nuclear fusion/electrical industry etc; high field / low temperature cryogen-free magnets; spintronics and magnetic nonmagnetic heterostructure, multiferroics and functional materials; vacuum technology and process applications; energy efficient system; thermoelectrics, spin freezing phenomena, spin glasses.

MATERIALS SCIENCE CENTRE

The Centre was established in the year 1971 with the objective of (i) developing interdisciplinary research, (ii) developing new materials and composites of technological importance and (iii) offering manpower training for scientists and engineers in the area of engineering materials. Excellent laboratory facilities have been built up in three areas of specialisation: Ceramics, Polymers, Semiconductors and allied materials which include Ultrasonic interferometers, Brabender Plasticorder extrusion graph, Plastic extruder, Rheometer, Mercury porosimeter, Tensile tester, Bridgman-Czochralski Crystal Growth system, R.F. Sputtering System, Liquid Phase Epitaxy reactor, Pulsed ruby Laser, Plasma enhanced CVD, Turbulent Flow Rheometer, Rheotest 11, Ultrasonic Pulse echo system, C-Matic Thermoconductometer, Dynamic Mechanical analyser and equipment for mechanical characterisation. MOCVD Reactor, Spray-CVD, C-V Analyser, Optical Microscope (Versamet), Crystal polisher (Multipole-2), Atomic Layer Beam Deposition Unit, High Temperature Controlled Atmosphere, Furnaces, Polymer mixing mill, Closed Cycle (10-300 K) Helium Cryostat, Electrical and Magnetic characterisation Facility, Hall Effect Set Up, Flocculator, Turbidity Meter and Clean Air Vertical Flow System, Photo luminescence set up, Double Crystal X-Ray diffraction. The Centre has undertaken large number of sponsored research projects and consultancy projects. Many of them have been successfully completed. The course emphasizes one of the following branches.

1. Ceramics
2. Polymers
3. Semiconductors and Allied materials.

The Centre offers MTech degree in:

MS Materials Science and Engineering

Course Content: The course consists of four compulsory subjects as an introduction to different types of materials, their preparation, characterisation, technology and applications. Students may specialize in their chosen areas by taking electives from subjects like: Principles of Polymer Systems, Rheology of Polymers, Process and Techniques of Polymer Manufacture, Polymer Reaction Engineering and Reactor Design, Fabrication and Processing of Polymers and Composites, Technology of Paints and Surface Coatings, Crystal Growth and Characterization, Compound Semiconductor Technology, Optoelectronic Materials, Solar Energy Materials, Semiconductor Technology, Semiconductor Surfaces and interfaces, Principles of Ceramic Fabrication, Preparation and Characterization of Ceramic Powders, Electrical, Optical and Magnetic Ceramics, Refractories, Glass Making Practice, etc. The project work is conducted usually in collaboration with industry.

Areas of Research: Special Ceramics and glasses, Ceramics for electrical, electronic and memory applications, Nanocrystalline Ceramics, Ceramic fabrication and processing Polyaramid fibers and Ceramic fiber composites, Heat resistant polymers, Conducting polymers and composites, Drag Reducing Polymers, Flocculating agents, Impact Modified Polymeric Systems, Synthetic resins, Novel plastics, Rubber -Rubber blends, Rubber Plastic blends, Rheology of Polymers and composites, Carbon black modification, Development of rubber chemicals, Adhesives and Surface Coatings, Rheology and Ultrasonics, Super absorbent Polymers, Biodegradable and barrier films, high performance thermoplastic based carbon fibers, Solar energy Materials, Compound Semiconductors,(LPE, MOVPE, Spray CVD) Luminescent Materials, Fiber optic sources and detectors, Laser and Plasma processing, Thin Film Crystal Growth, Sensor materials, Epitaxy, Semimagnetic Semiconductors, Semiconducting Silicides.

RELIABILITY ENGINEERING CENTRE

Reliability Engineering Centre, established in 1983, is the first and unique centre of excellence in India offering Masters' and research programs in Reliability Engineering. In the present scenario of global competition, Reliability Engineering plays a vital role in design, maintenance, safety/security and management of engineering systems. It is considered one of the most important performance assessment indexes for most of the industrial products, processes and services. Reliability Engineering is an inter-disciplinary area and plays an important role at different stages of product life cycle starting from conceptual design to detailed design, manufacturing, operation, maintenance, and disposal. It systematically designs, studies failure process, finds out the root causes, suggests improvements and quantifies the product performance over a period of its mission time.

The conventional engineering branches mainly focus on design of systems for certain specific functional requirements. But in Reliability engineering, students are trained on how to design, predict, estimate, and demonstrate performance of a product throughout its mission life for failure free operation, which is also safe and easy to maintain deriving maximum benefits. In a simple way one can say that the Reliability Engineering measures the REAL-ABILITY of engineering products. There is a great scope and demand of reliability engineers with B.E. / B. Tech. in Mechanical, Electronics, Electrical, Chemical engineering, Computer Science, and their allied areas. Students of the Centre are well placed in MNC's and reputed organizations like BARC, Bloom Energy, Crompton & Greaves, DRDO, Eton, ENTITY SOLUTIONS, GE, GM, Goodrich, HCL, Honeywell, IBM, INFOSYS, ISRO, LM Glass Fiber, Maruti Udyog, NPCIL, SATYAM, TATA Steel, TCS, Time Tooth, WIPRO, and many more. In short, the Centre focuses on overall improvement in engineering skills of students by exposing students to theory and practices in Reliability engineering through its academic programs, involving students in research and consultancy projects for Industries and R & D organizations, (BARC, DRDO, NPCIL, L&T, AERB, Vodaphone, Indian Army, ECIL, ISRO etc.), exposing students to life testing of engineering items, and encouraging for extracurricular activities etc. The Centre offers MTech degree in:

RE Reliability Engineering

Course Content: Reliability Analysis and Prediction, Maintenance Engineering, Reliability Design, Reliability Estimation and Life Testing, and Reliability Engineering Laboratory are the core subjects. To make the course more balanced and interdisciplinary, a number of other department elective subjects are included in the curriculum. All students have to take an elective subject in management. Besides this, the centre also offers a number of elective subjects including Statistical Methods in Reliability, Probabilistic Risk Assessment, Statistical Process Control, Environmental Testing and Reliability Demonstration, Failure Data Organisation and Analysis, Performance Engineering for Sustainability, Reliability Centred Maintenance, Maintenance Management, Fault Diagnosis and Predictive Management, Safety Engineering, Human Reliability, Software Reliability, and Reliability Management.

Areas of Research: The Centre is actively engaged in research in the areas of: Failure mechanism and failure analysis of electronic, electrical and mechanical component/devices, Reliability prediction and testing of components and devices, Hazard and safety analysis of systems and devices, condition monitoring and fault diagnosis of machines and plants, Design of cost optimal and performance based maintenance policies, reliability centred maintenance, quality engineering, network reliability, power system reliability, software reliability, Probabilistic risk assesment.

RUBBER TECHNOLOGY CENTRE

In the mid fifties (1955) the Ministry of Education, Govt. of India, decided to establish facilities for promoting rubber technology in the country and established a rubber technology laboratory at IIT Kharagpur in the Department of Applied Chemistry under the aid from Colombo Plan and Technical Collaboration Mission. Subsequently, an independent Rubber Technology Centre was established in the year of 1981 to cater to the need of country's growing technical manpower in the field of rubber technology and allied areas. After its establishment, the centre has earned an excellent reputation of its own

for promoting postgraduate teaching and research in different areas of rubber technology. Available facilities include Mixing Mills, Brabender Plasticorders, Press, Rheometer, Plastimeter, Mooney Viscometer, Impact Tester, Hounsfield UTM, Compression Set Apparatus, Dunlop Tripsometer, Abraders, Goodrich and DeMettia Flexometers, Ageing Ovens, Zwick UTM, Thermal Analyzer, Flammability Tester, Monsanto Processability Tester, Dynamic Mechanical Analyzer, Dielectric Thermal Analyzer, Compression Stress Relaxometer, FTIR Spectrophotometer, Optical Microscope, Brookfield Viscometer, LCR meter and Atomic Force Microscope, RPA. The centre works in close collaboration with other departments/centres of this Institute, Indian rubber industries, Rubber Board and government research establishments. Several research projects sponsored by different agencies like DST, CSIR, DRDO, DAE, BARC, MHRD and industries are in operation. This centre has successfully completed a UK Government collaboration program, and an Indo-UK and an Indo-French collaborative research programmes. The centre is also presently working on industry sponsored projects from India and abroad; for example, with TISCO, NICCO, Phoenix Yule, Goodyear Tire and Rubber Co. USA, EXXON MOBIL Chemical Co., USA, LANXESS, and Germany and so on. The centre has successfully organized three International Conferences so far. There is hundred percent placements every year. The Centre offers MTech degree in:

RT Rubber Technology

Course Content: Students are taught various aspects of rubber technology i.e. basic rubber science, industrial rubbers, compounding, testing, rheology and processing, component production and design, latex, tyre, adhesion technology, engineering design and characterization. In addition to the above-mentioned subjects, the students are allowed to opt for the subjects offered by other departments, i.e. computer software, management, chemical engineering and engineering drawing. The project work is carried out in different rubber and allied industries as well as in several R and D sectors in this country.

Areas of Research: Compounding and vulcanization, Polymer blends and alloys, Rubber based composites, Thermoplastic elastomers, Adhesion science and technology, Electrical and electronic applications of rubbers, Dynamic mechanical and thermal analysis, Failure mechanism, Rheology, Industrial rubber products, Modification of rubbers, Ionomers, Recycling of waste rubbers, Micro cellular rubber, Biomedical applications of rubbers, New techniques of Polymerization, Smart Polymers and polymer nano-composites. Research work in different types of Polymer, Polymer based Composites, nano Composites are also research interest of the Faculty members of the Centre.

SCHOOL OF INFORMATION TECHNOLOGY

The School of Information Technology was established in 2001. Since its inception, the focus of the School has been to provide advanced training in core sectors of Information Technology and to foster high quality interdisciplinary research in this field. The School offers MTech, MS, and Ph.D. programmes in Information Technology. The School also runs a PGDIT (Post Graduate Diploma in Information Technology) programme in distance mode at the extension centres of IIT Kharagpur located at Kolkata, Bhubaneswar, and Kharagpur Campus. The School has excellent facilities to support both teaching and research. The software laboratories are equipped with multiple high-end IBM servers running Windows and Linux, with a large number of thin clients connected to them. The servers are loaded with the latest software to support course and research activities. In addition, the School has a large number of high-end PCs. There is a separate FPGA laboratory for system prototyping. The resources are spread over multiple sprawling laboratories to support the research activities of the faculty and the research scholars. All the machines in the School are fully networked with 100 Mbps LAN, which in turn is connected to the Gigabit Ethernet backbone LAN of the Institute. Various government agencies and industrial partners sponsor the research activities of the School. The School offers MTech degree in:

The School offers MTech in :

IT Information Technology

Course Content:

The curriculum contains four core theory subjects, three laboratory subjects and six electives. The core of the MTech programme will focus on the areas of Internet and Web technologies, and building large information systems. However, a comprehensive, multi-disciplinary list of electives offers the students options to select subjects to cater to their special areas of interest. The subjects offered are listed below:

Core Courses: Foundations, Communication Systems and Networking, Internet and Web Based Technologies, Information System Design, Systems Design Laboratory, Computing Systems Laboratory, Internet Technologies Laboratory.

Electives Courses: Cluster and Grid Computing, Electronic Commerce, Data Warehousing and Data Mining, Information and System Security, Human Computer Interactions, Advanced Network Technologies, Advanced Topics in Speech Processing, Distributed Systems, Object Oriented Systems, Soft Computing Applications, Real Time Systems, Intelligent Systems, Embedded Systems, Information Theory and Coding Techniques, Digital Signal Processing and Applications, Software Engineering, Software Reliability, Algorithms for Bioinformatics, Quantum Computing, High Performance Computer Architecture, Project Engineering and Management, Supply Chain Management, Enterprise Resource Planning, Development of Economics and Applied Economics Problems, Development of Human Resources, etc.

Areas of Research: Networking, Distributed Systems, Internet Applications, Information and Systems Security, E-learning, Multimedia Databases, Computer Vision, Data Warehousing and Data Mining, Operating Systems, VLSI Design and Embedded Systems, Biometrics, Cluster and Grid Computing, Human Computer Interactions.

RANBIR AND CHITRA GUPTA SCHOOL OF INFRASTRUCTURE DESIGN AND MANAGEMENT

Infrastructure is recognized today as one of the most essential requirements for economic development of any country. Its importance has been increasingly appreciated by policy makers of different countries, including India which envisages a growth rate of nine percent during the eleventh plan period (2007-08 to 2011-12) for which about Rs. Two million Crores need to be invested in key infrastructure sectors during the eleventh plan period. Besides generating the necessary finances, it is very important to build necessary capacity to realize these ambitious targets. Large infrastructure projects require strong, interdisciplinary technical and management skills. It has therefore become imperative that Institutes bestowed with solid foundations in engineering, architecture, and management skills should initiate academic programmes to develop trained manpower in this upcoming area of infrastructure design and management.

Indian Institute of Technology Kharagpur has a vantage position with regard to its existing faculty and academic programmes in the areas of engineering, architecture and management. The institute, with its numerous academic departments, centers and schools with academic programmes in such wide ranging areas such as law, management, architecture and engineering, is in a uniquely advantageous position to contribute to the nation's goal of building world-class infrastructure.

The Ranbir and Chitra Gupta School of infrastructure Design and Management has been started by IIT Kharagpur in the year 2008. The school of Infrastructure Design and Management is the first such school to be set in the IIT system and also in the country.

The mission of the School is to prepare outstanding professionals capable of designing and delivering quality infrastructure projects efficiently and effectively with a comprehensive and fast-track approach. The Department offers MTech degree in:

ID Infrastructure Design and Management

The M.Tech programme has been designed with focus on planning, management, and effective delivery of large robust infrastructure projects in areas such as Transportation, Power, Utility Infrastructures and infrastructure facilities. The programme is multi-disciplinary in nature. Faculty members of different departments, schools and centers participate in the teaching and research activities of this programme.

Students joining this programme will have the option of selecting courses in such a way as to gain expertise relevant to the infrastructure sector of their interest.

The programme is currently designed for graduates in architecture, civil engineering, electrical engineering and mechanical engineering.

The programme has five theory subjects and three laboratories as core (compulsory) courses and five elective subjects, to be covered in the first year. The elective subjects are being so grouped (the groups being designated as *verticals*) as to enable the students to select appropriate electives depending on their background and interest.

Course Content:

The five core subjects And three laboratory components to be covered by all the students are Project Engineering and management, Financing Infrastructure Projects, Infrastructure Regulatory Issues, Quantitative Methods for Decision Making, Environmental Impact Assessment, Simulation Laboratory, Virtual Reality Laboratory, Project Management laboratory.

The **elective courses** have been grouped under the following four vertical groups:

Transportation : Urban Transportation Systems Planning, Airport Planning and Design, Bridges and Tunnels Engineering, Analysis and Design of Pavements, Traffic Engineering, Analysis and Evaluation of Transportation systems, Highway Construction Practice, Planning, Operation and Management of Transportation Facilities, Sea and Inland Port Infrastructure.

Public Utilities : Water Supply Systems, Waste Water Management, Solid Waste Management, Air Quality Management, Environmental Sanitation, Hazardous Waste Management,

Facilities Infrastructure : Transportation Planning and Traffic Engineering, Housing Infrastructure, Facility Programming and Specialized Building Design, Building Management Systems, Regional Infrastructure Development, Environmental Planning, Remote Sensing and DIS in Planning.

Power Systems : Thermal, Hydel and Nuclear Power Generation, Power Infrastructure : Generation, Transmission and Distribution, Internal Combustion Engine, Power Transmission Systems, Non-conventional Electrical Energy Systems, High Voltage and Insulation Engineering, Power Infrastructure : Economics, Management and Environment, Power System Planning and Reliability, Air-conditioning and Ventilation, Power Systems Transients and Protection, Opto-electronics based instrumentation, AI applications to Power Systems.

Areas of Research: Project management, infrastructure financing, Infrastructure planning and systems management, housing and community planning, Planning and management of rural an urban transport systems, pavement and airport management systems, environmental impact assessment, system analysis and water quality management, process

modification and pollution minimization, environmental life cycle assessment, power system analysis and operation, non-conventional energy sources, power system planning and reliability.

SCHOOL OF MEDICAL SCIENCE AND TECHNOLOGY

Innovations in Technology have led to spectacular advancements in modern medicine. To meet the challenges, there is a need to bridge the two disciplines by fusion of medical science with technology.

With this philosophy in mind, Indian Institute of Technology, Kharagpur established the School of Medical Science and Technology, the first of its kind in India where the physicians are trained in Technology in the well tested IIT style. The School of Medical Science and Technology also has a mandate to further research and development on diverse aspects of technology as applied to medicine.

Apart from the existing three years interdisciplinary **Master's Program in Medical Science and Technology (MMST)** for medical doctors and MS and PhD programs in Medical Science and Technology, the school is introducing a two year **'M.Tech in Medical Imaging and Informatics'** course.

The school has collaborations with many institutions and centres of excellence throughout our globe. Some of these are: Duke University Medical Centre, USA; University of Fukui, Japan; Brain Science Institute, RIKEN, Japan; National University of Singapore, Singapore; Scuola Superiore Sant' Anna, Pisa, Italy; United Bristol Healthcare, NHS Trust, UK; All India Institute of Medical Sciences, New Delhi; Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow; IPGIMER, Calcutta; Sree Chitra Tirunal Institute of Medical Science and Technology, Trivandrum

The M Tech students will be exposed to all kinds of Imaging Modalities - Microscopic and Macroscopic and advanced Image Processing Systems, Biomedical Signal processing, Biomedical Instrumentation and Embedded systems.

The students have access to some of the finest infrastructure available in the country for interdisciplinary research and development activities, some of which are:

Automated ECG and 12-channel EEG; PC based Spiro meter, Electronic stethoscope and Phonocardiogram; DSP trainer kit with FPGA; Electro-Acoustic Transducers; 8-channel biopotentials recorder, Ultrasonogram and Color Doppler, Ultra sound scanner, Digital Radiography, Analog X-Ray Machine; OCT, Live cell imaging and Apotome, Stereo-zoom microscope.

DNA finger printing; Southern and Western blotting apparatus; PCR; Dark/cold room/radio-isotope facilities; Software for protein analysis (RASMOL, RASWIN); ELISA reader, Scintillation counter; MALDI-ToF Mass Spectrometry; Fluorescence Activated Cell sorter, AFM, 2-D Gel.

Surface tension and contact angle measuring device; Universal Testing Machine; FT-IR and UV spectrophotometer, 3-D Laxrscanner, Electrospinning, Rheometer, CMC Machine, PCR.

Server and terminals; Video conferencing unit; Telemedicine software supporting live medical teleconsultation, PACS.

The M.Tech students have job opportunities in well known corporate houses in the field of medical imaging and instrumentations, like GE, Siemens, Wipro, Texus instruments, Philips research lab etc. They have also very good opportunity in carrying out research in the frontiers of Biomedical and Imaging sciences in India and abroad.

The Department offers MTech degree in:

SM Medical Imaging and Informatics

Course Content:

Core Subject: Digital Image Processing and Applications, Basic Human Anatomy, Physiology, and Pathology, Image Processing Laboratory, Biomedical Instrumentation, Molecular Imaging, Medical Informatics, Medical Imaging Laboratory, Telemedicine Laboratory Comprehensive Viva-Voce, Seminar-I, Seminar-II.

Elective Subjects :

MEMS and Biosensors, Biostatistics, Physics and Instrumentation of Medical Imaging, Digital Signal Processing, Fuzzy Sets & Applications, Telemedicine, Nuclear Imaging, Nuclear Magnetic Resonance (NMR) / Magnetic Resonance Imaging (MRI), Computational Molecular Biology, Biomedical System Engineering & Automation, Pathological Image Processing, Computer Vision, Internet & Web based Technologies

SCHOOL OF WATER RESOURCES

The M.Tech. and Ph.D Programme in Water Management aims at providing integrated and interdisciplinary approaches, involving hydrological, biophysical, chemical economic, institutional, legal, and policy-planning aspects, to solve the ever-growing set of water-related challenges in agriculture, industry, and domestic sectors. The Programme is intended for professionals and researchers from a wide range of backgrounds. It aims to develop knowledge, insight and skills required to design, implement and evaluate water management policies and strategies. Graduates will be able to promote the judicious use of water and achieve effective governance of water resources.

WM Water Management

Programme Structure:

The programme consists of foundation, specialization and integration phases. The foundation phase provides latest insights, context, and concepts in integrated water and environment management issues. In the specialization phase, the students choose to make in-depth study either in Rural and Urban Water Management or Agricultural Water Management. In the integration phase, the students are challenged to bring together and apply their cumulative learning process in the form of an M.Tech. thesis.

Core Courses: Integrated Water Resources Management, Water Distribution System, Wastewater Management, Water Management Laboratory, Geoinformatics Laboratory, Water Governance & Policy Issues, River Basin Management, Planning and Design of Water Resources Projects.

Electives: Geo-informatics for Land and Water Resources, Water Supply Systems, Climate Impact on Water Resources, Surface Water Hydrology, Advanced Groundwater Hydrology, Applied Hydrology, Computer Programming, Organizational Behaviour, Business Economics, System Dynamics and Policy Planning, Decision Modelling, Project Engineering & Management, Water Resources System Analysis, On-farm Water Management, Environment Impact Assessment, Non-point Source Pollution and Management, Industrial Water Pollution Control, Modeling and Simulation for Agricultural Water Management, Flood Assessment and Management, Land System Studies, Environmental Pollution and Stress, Integrated Watershed Management, Disaster Management, Geogenic-water Pollution and Control.

Areas of Research: Integrated water resources planning and management, River basin management, Conjunctive use planning of surface water and ground water, Water supply and distribution system, Waste water management, Remote sensing and GIS application in water resources, Water law and policy issues, Environmental impact assessment, Surface water and ground water hydrology, Water resources system analysis, Irrigation and drainage system planning, and Climate impact on water and environment.

GENERAL INFORMATION FOR APPLICANTS

Admission to the Joint MTech –PhD programme of the Institute is open to Indian Nationals under two categories:

- i. Regular applicants with assistantship
- ii. Sponsored applicants

Eligibility and Assistantship for Regular Applicants

1. Applicants under all categories must possess a Bachelor's degree in Engineering/ Technology/ Architecture or qualifications obtained through examinations conducted by professional societies recognized by UPSC/AICTE, e.g. AMIE or a Masters degree in Science/Arts.
2. Applicants must qualify in the paper appropriate to the discipline of their qualifying degree if a GATE paper is available in such a discipline. Only for those disciplines where there is no relevant GATE paper, XE/XL paper of the GATE examination is applicable. NET qualified applicants could be eligible for admission to MCP.
3. Candidates seeking admission to Joint MTech/MCP-PhD Programme of the Institute shall have to possess a minimum of 60% marks (or a CGPA of 6.5 in 10 point scale) for General/OBC categories and 55% marks (or a CGPA of 6.0 in 10 point scale) for SC/ST categories in the final qualifying examination.
4. Applicants qualifying in XE or XL paper in GATE and/or those with a professional qualification (AMIE, etc.) recognized by the AICTE will have to undergo an interview and/or test at IIT Kharagpur on **May 16, 2012** (for XE candidates) and **May 17, 2012** (for XL candidates). Before being considered for admission, the applicant has to qualify in the interview and/or test.
5. Admission to reserved category candidates will be done as per Government of India notification.
6. Applicants must be in good health. In case of any discrepancy found in the certificate of medical fitness to be submitted during registration, the opinion of the Institute Medical Officer will be final.
7. Persons with Physical Disability (PD) seeking admission to various postgraduate programmes are to appear before a medical board on **15th May 2012** at IIT Kharagpur.
8. **Selection of applicants whose results in the qualifying degree examination are yet to be declared will be provisional, subject to condition that all parts of the examination must be completed in all respects before the date of joining the Institute and the marks sheet/certificate as evidence of passing the qualifying examination to be submitted latest by 31 October, 2012.**
9. BTech graduates from IITs having CGPA score 8.00 or above (out of 10) are eligible for direct admission without having to appear in either GATE or personal interview.
10. Students in the two-year MTech/MCP Programme receive an assistantship of Rs. 8000 per month. Students permitted to continue with the PhD Programme will receive an additional assistantship of Rs. 4000 per month in the second year of their study and Rs. 18000 per month after enrolment for PhD. However, the additional assistantship will be paid retrospectively after the PhD registration.
11. An applicant admitted to a postgraduate programme with assistantship will not be eligible for admission with assistantship in any other programme at this or any other Institution on the basis of the same GATE scorecard.
12. Some Scholarships/fellowships are also available to the selected applicants by GE, DAE, DRDO, and DAAD (Germany).

Eligibility for Sponsored Applicants

1. An applicant who is employed in a recognized industry or any other recognized organization/institution and has at least two years of experience will be eligible for admission to the MTech/MCP programme as a sponsored applicant provided that his/her application is forwarded by his/her employer. The applicant should have at least 60% marks (or a CGPA of 6.5 in 10 point scale) for General/OBC categories and 55% marks (or a CGPA of 6.0 in 10 point scale) for SC/ST categories and 55% marks (or a CGPA of 6.0 in 10 point scale) for Master's degree holders in Arts or Social Science subjects in the qualifying degree examination. For a sponsored applicant, GATE score/NET qualification is not mandatory.
2. Sponsored applicants interested to apply in more than one Department should submit **separate application** for each Department.
3. A sponsored applicant will not be eligible for assistantship from the Institute.

Eligibility for NET Qualified Applicants

1. NET - Qualified applicants with Fellowship having MA or MSc. Degree in Economics, Sociology or Geography having studied mathematics at the higher secondary level are eligible to join MCP-PhD Programme.
2. For applicant with Master Degree in Science subject should have 60% or above (55% marks or equivalent CGPA for Master's degree holders in Arts or Social Science subjects).

Application Fee

The application fee is Rs. 500 for General/OBC and Rs. 250 for SC/ST/PD candidates to be paid through a Demand Draft drawn in favour of **IIT Kharagpur** on any nationalised bank payable at **Kharagpur, West Bengal**. Women candidates are exempted from payment of application fees.

Choice of Courses

To help the candidates give their choice of courses the following five tables are given

Table 1	GATE Main Paper
Table 2	GATE XE Sections (Engineering Sciences) Paper
Table 3	GATE XL Sections (Life Sciences) Paper
Table 4	Qualifying degree and their respective codes
Table 5	Qualifying discipline and their code
Table 6	Specialisations offered under different Department/School/Centre
Table 7	Eligibility for personal interview to different postgraduate programme based on GATE Paper and applicant's academic background for the year 2012-13
Table 8	Short-listing Policy followed for Personal Interview for the Joint MTech/MCP-PhD Programme 2011-12

- **Applicants are advised to give their choices carefully for the different courses after studying the information given in Tables 1 to 7. Choices of courses are to be given in order of preference.**
- If the course to which an applicant is offered admission does not eventually run for any reason, the applicant will be offered admission to some other suitable course depending upon the GATE score, interview marks and options entered in the application. Alternatively, the applicant is free to withdraw from the programme in which case the fees and deposits paid will be refunded and the GATE scorecard will be returned.
- As a guide to Regular applicants, the cut-off GATE marks for personal interview to the various courses offered last year are given in Table 8. The cut-off marks, however, differ from year to year and, therefore, **Table 8 is only for information and will have no direct relevance to the interview for the session 2012-2013.**

How to Apply (Regular Applicants)

Application for Joint MTech/MCP- PhD programme is to be submitted only by an ONLINE process by accessing the website <http://gate.iitkgp.ac.in/mtech> from **19 March 2012 to 13 April 2012**. The candidate should first pay the Application Fee by obtaining a Demand Draft drawn in favour of **IIT Kharagpur** on any nationalized bank payable at **Kharagpur, West Bengal**. The draft details are required while filling up the ONLINE application form. Candidates are required to take a print of the ONLINE application form after successful submission of data. The printed form, with candidate's signature and photograph along with the Demand Draft, copy of GATE Score card and relevant certificates for OBC/SC/ST/PD (as applicable) must be sent by speed post so as to reach

The Chairman , GATE, IIT Kharagpur, Kharagpur 721302 by 20 April 2012.

“**Joint MTECH/MCP- PhD Admission – 2012**” should be inscribed at the left hand top corner of the mailing cover.

The applicant is advised to keep a copy of the completed application form for his/her record.

How to Apply (Sponsored Applicants)

Sponsored candidate should download the application form (pdf file) from the website <http://gate.iitkgp.ac.in/mtech>. The candidate is required to pay the Application Fee by obtaining a Demand Draft drawn in favour of **IIT Kharagpur** on any nationalised bank payable at **Kharagpur, West Bengal**. Sponsorship certificate from employer should accompany the duly completed application form. The duly filled printed form, with the candidate's signature and photograph pasted at appropriate place, Demand Draft, and relevant certificates for OBC/SC/ST/PD (as applicable) should be sent by speed post so as to reach **The Chairman, GATE, IIT Kharagpur, Kharagpur 721 302 by 20 April 2012.**

“**Joint MTECH/MCP- PhD Admission – 2012**” should be inscribed at the left hand top corner of the mailing cover.

The applicant is advised to keep a copy of the completed application form for his/her record.

Important Dates

Regular Candidates

1	Commencement of online Application Form submission	19 March 2012 (Monday)
2	Website Closure for submission of online Application Form	13 April 2012 (Friday)
3	Last date for receipt of completed Application Form at the GATE office by Speed Post	20 April 2012 (Friday)
4	Web-release of short-listed candidates for all categories including PD and XE/XL Candidates	27 April 2012 (Friday)
5	Personal Interviews at IIT Kharagpur	8-17 May 2012
6	For PD Candidates' Personal Interview at IIT Kharagpur (Tentative)	15 May 2012 (Tuesday)
7	For XE Candidates' Personal Interview at IIT Kharagpur (Tentative)	16 May 2012 (Wednesday)
8	For XL Candidates' Personal Interview at IIT Kharagpur (Tentative)	17 May 2012 (Thursday)
9	Web-release of first list of selected candidates (Tentative)	25 May 2012 (Friday)

Sponsored Candidates

1	Commencement of Application Form Submission	23 March 2012 (Friday)
2	Last date for receipt of completed Application Form at the GATE office by Speed Post	20 April 2012 (Friday)

Table 1: GATE Main Paper

GATE Paper	Code
Aerospace Engineering	AE
Agricultural Engineering	AG
Architecture and Planning	AR
Biotechnology	BT
Civil Engineering	CE
Chemical Engineering	CH
Computer Science and Information Technology	CS
Chemistry	CY
Electronics and Communication Engineering	EC
Electrical Engineering	EE
Geology and Geophysics	GG
Instrumentation Engineering	IN
Mathematics	MA
Mechanical Engineering	ME
Mining Engineering	MN
Metallurgical Engineering	MT
Physics	PH
Production and Industrial Engineering	PI
Textile Engineering and Fibre Science	TF

Table 2: GATE XE Sections (Engineering Sciences) Paper

XE Sections	Code
Fluid Mechanics	B
Materials Science	C
Solid Mechanics	D
Thermodynamics	E
Polymer Science and Engineering	F
Food Technology	G

Table 3: GATE XL Sections (Life Sciences) Paper

XL Sections	Code
Biochemistry	I
Botany	J
Microbiology	K
Zoology	L
Food Technology	M

Table 4: Qualifying degree and their respective codes

Qualifying Degree	Qualifying Degree Code
B.E./B.Tech. or equivalent	A
B. Arch./B. Plan or equivalent	B
M. Sc. with Mathematics at +2 level	C
M. Sc. with Mathematics both at +2 and B. Sc. level	D
M. Sc. with or without Mathematics background	E
MCA with Mathematics both at +2 and B. Sc. level	F
NET qualified candidates for MCP	G

Table 5: Qualifying discipline and their code

Qualifying Degree	Code	Qualifying Degree	Code
Aerospace Engineering	A E	Life Sciences	L S
Agricultural Engineering	A G	Life Sciences (Veterinary /Animal Sc.)	L V
Agricultural Science	A S	Life Sciences (Botany)	L B
Architecture	A R	Life Sciences (Zoology)	L Z
Automobile Engineering	A U	Manufacturing Engineering	M F
Atmospheric Science	A T	Materials Science / Tech.	M S
Biochemical Engineering	B I	Mathematics/Applied Mathematics	M A
Bio-Chemistry	B Y	Mechanical Engineering	M E
Biomedical Engineering	B M	Metallurgical Engineering	M T
Bio-Physics	B P	Microbiology	M B
Bio-Science	B S	Mineral Engineering	M R
Biotechnology	B T	Mining Engineering	M N
Ceramic and Glass Tech.	C G	Mining Machinery	M M
Chemical Engineering	C H	Naval Architecture/ Marine Engineering	N A
Chemistry/Applied Chemistry	C Y	Operations Research	O R
Civil Engineering	C E	Exploration Geophysics/Marine Geophysics	O G
Computer Applications	C A	Paint Technology	P T
Computer Sc. and Engineering	C S	Petroleum Engineering	P E
Dairy Engg. / Technology	D T	Petroleum Technology	P C
Earth Sciences/Geological Sciences	E A	Pharmacy	P Y
Electrical Engineering	E E	Physics/Applied Physics/Solid State Phy.	P H
Electronic Sciences	E S	Plastic Technology	P L
Electronics and Comm. Engineering	E C	Polymer Technology / Polymer Sc.	P O
Energy Engineering	E N	Production Engg. / Prod. Engg. and Mgmt	P R
Engineering Physics	E P	Production and Industrial Engg.	P I
Environmental Engineering	E V	Radio Physics	R P
Food Technology	F T	Rubber Tech./Plastic and Rubber. Tech.	R T
Genetics	G N	Solid State Physics	S P
Geology/Geophysics/Applied Geology/Applied Geophysics	G G	Statistics/Applied Statistics	S T
Industrial Chemistry	C I	Textile Chemistry	T C
Industrial Engineering	I E	Textile Engg and Fiber Sc. and Engg.	T F
Information Technology	I T	Any discipline of Engg not mentioned above	Z E
Instrumentation	I N	Any discipline of science not mentioned above	Z S
Leather Technology	L T		

Table 6: Specialisations offered under different Department/School/Centre.

Department/Centre/School	Specialisation
Advanced Technology Development Centre	Embedded Systems and Software
Aerospace Engineering	Aerospace Engineering
Agricultural and Food Engineering	Farm Machinery and Power
	Land and Water Resources Engineering
	Food Process Engineering
	Agricultural Biotechnology
	Aquacultural Engineering
Agricultural Systems and Management	
Architecture and Regional Planning	City Planning
Biotechnology	Biotechnology and Biochemical Engineering
Chemical Engineering	Chemical Engineering
Civil Engineering	Hydraulic and Water Resources Engineering
	Transportation Engineering
	Environmental Engineering and Management
	Geotechnical Engineering
	Structural Engineering
Computer Science and Engineering	Computer Science and Engineering
Cryogenic Engineering	Cryogenic Engineering
Educational Technology	Media and Sound Engineering
Electronics and Electrical Communication Engineering	Fibre Optics and Light wave Engineering
	Microelectronics and VLSI Design
	RF and Microwave Engineering
	Telecommunication Systems Engineering
	Visual Information and Embedded Systems Engineering
Electrical Engineering	Machine Drives and Power Electronics
	Control System Engineering
	Power and Energy Systems
	Instrumentation and Signal Processing
Geology and Geophysics	Exploration Geosciences
	Computational Seismology
Industrial Engineering and Management	Industrial Engineering and Management
Information Technology	Information Technology
Infrastructure Design and Management	Infrastructure Design and Management
Mathematics	Computer Science and Data Processing
Materials Science	Materials Science and Engineering
Department/Centre/School	Specialisation
Mechanical Engineering	Manufacturing Science and Engineering
	Thermal Science and Engineering
	Mechanical Systems Design
Medical Science and Technology	Medical Imaging and Image Analysis
Metallurgical and Materials Engineering	Metallurgical and Materials Engineering
Mining Engineering	Mining Engineering
Ocean Engineering and Naval Architecture	Ocean Engineering and Naval Architecture
Ocean, Rivers, Atmosphere and Land Sciences	Earth System Science and Technology
Physics and Meteorology	Solid State Technology
Reliability Engineering	Reliability Engineering
Rubber Technology	Rubber Technology
School of Water Resources	Water Management

Table 7: Eligibility for personal interview to different postgraduate programme based on GATE Paper and applicant's academic background for the year 2012-13

Course Code	Specialization	GATE Paper	Qualifying Degree	Qualifying Discipline
AE	Aerospace Engineering	AE,XE-E, XE-D, XE-B,ME	A	AE, ME
AG1	Farm Machinery and Power	AG,ME	A	AG, ME
AG2	Land and Water Resources Engineering	CE,AG	A	AG, CE
AG3	Food Process Engineering	XE-G, AG, CH, ME	A	AG, ME, CH, BT, FT
AG4	Agricultural Biotechnology	BT, XL-I, XL-J, XL-K	A,C,D,E	LS, LB, AS, MB, GN, BT, BY, BS
AG5	Aquacultural Engineering	CH, CE, AG, XE-B, XE-D	A	AG, CE, CH, NA
AG6	Agricultural Systems and Management	AG, XL-I, XL-J, XL-K	A,C,D	AG, AS, LS, LB, BS, MB
AR	City Planning	AR	A,B,G	AR, CE
AT	Embedded Controls and Software	CS,EC,EE,IN	A	CS, EC, EE, IN
BT	Biotechnology and Biochemical Engg,	XL-I, CH, BT, XL-K	A,C,D	BI, BY, BP, BT, CH, MB
CE1	Hydraulic and Water Resources Engg,	CE	A	CE
CE2	Transportation Engineering	CE	A	CE
CE3	Environmental Engg, and Management	CE,CH	A	CE, CH
CE4	Geotechnical Engineering	CE	A	CE
CE5	Structural Engineering	CE	A	CE
CH	Chemical Engineering	CH	A	CH
CL	Earth System Science and Technology	XE-B, XE-D, XE-E, PH, MA, GG, CE, AG, AE	A,C,D	AE, AG, AT, CE, EA, EV, GG, MA, NA, PH
CR	Cryogenic Engineering	AE, AG, XE-B, XE-C, CH,XE-E, EE, ME, MT, PH	A,D	AE, AG, CH, EE, MS, ME, MT, PH
CS	Computer Science and Engineering	CS	A,F	CS
EC2	Microelectronics and VLSI Design	EC	A	EC, EE
EC3	RF and Microwave Engineering	EC	A	EC, EE
EC4	Telecommunication Systems Engg,	EC	A	EC, EE
EC5	Visual Information and Embedded Systems Engineering	EC	A	EC, EE
EE1	Machine Drives and Power Electronics	EE	A	EE
EE2	Control System Engineering	EC,EE,IN	A	EE, EC, IN
EE3	Power and Energy Systems	EE	A	EE
EE4	Instrumentation and Signal Processing	EE,EC,IN	A	EE, EC, IN
ET	Media and Sound Engineering	CS,EC,EE,IN	A,F	CS, EC, EE, IN
GG1	Exploration Geosciences	GG	C,D	GG, EA, OG

Course Code	Specialization	GATE Paper	Qualifying Degree	Qualifying Discipline
ID	Infrastructure Design and management	ME,EC,CE,AR	A,B	AR, CE, EE, ME
IM	Industrial Engineering and Mgmt,	AE, CE, MN, EE IN,CS,EC,CH, MT,ME,PI	A	Any Discipline
IT	Information Technology	CS	A,F	IT, CS, CA, EC
MA	Computer Science and Data Processing	MA, PH, EE, EC	A,D	MA, EE, EC, PH, ST
ME1	Manufacturing Science and Engg,	MT, PI, ME	A	ME, MF, MT, PR, PI
ME2	Thermal Science and Engineering	XE-B, XE-E,ME	A	EN, ME
ME3	Mechanical systems Design	ME, AE	A	AE, ME
MN	Mining Engineering	MN,CE,GG,ME ,MT,XE-B, XE- D, XE-E	A,C,D	MN, MM, MR, EA, ME, CE, GG, PI, OG
MS	Materials Science and Engineering	CY, XE-C, PH, BT,MT, XE-F	A,C,D	CY, PL, PO, RT, MS, BT, BM, BP, CG, MT, PH, ES, EP, SP, CA
MT	Metallurgical and Materials Engineering	MT, XE-C	A	CH, ME, MT, MF, MR, MS, PH, SP
OE	Ocean Engineering and Naval Architecture	PI,CE,AE,ME, XE-B, XE-D, XE-E	A	AE, CE, ME, MF, NA
PH1	Solid State Technology	PH,CY,EC	A,D	PH, SP, MS, EP, ES, EC, CY
RE	Reliability Engineering	AE,CE,CH,GG, ME, MN, MT, PI, XE-C, CS, EC, EE, IN	A	AE, AU, CH, CE, CS, EE, ES, EC, IE, IT, IN, MF, ME, PI, MT, OR, PR
RT	Rubber Technology	CH,ME,TF,CY, XE-F, XE-C	A,D	PL, PO, RT, TF, CH, CY, ME
SM	Medical Imaging and Informatics	CS, EC, BT, PH, IN, MA, EE	A,D	BM, BP, BT, CY, CS, EE, ES, EC, IT, IN, MS, MA, PH, RP, ST, CH
WM	Water Management	CE,AG	A	AG,CE

Table. 8: Short-listing Policy followed for Personal Interview for the Joint MTech/MCP-PhD Programme 2011-12

GATE Paper	GN	OBC	SC	ST	PD
AE	31.00	27.90	20.00	-	20.00
AG	25.00	19.33	16.67	16.67	16.67
AR	37.00	33.30	24.79	24.79	24.79
BT	60.67	53.00	40.65	28.33	28.33
CE	32.67	26.00	17.00	16.67	16.67
CH	26.33	23.70	17.64	17.64	17.64
CS	60.33	50.33	38.00	25.67	25.67
CY	28.33	19.00	18.00	18.67	18.00
EC	59.00	53.10	35.33	20.00	20.00
EE	48.33	43.50	32.38	26.00	26.00
GG	39.33	34.00	26.33	-	26.33
IN	38.33	31.00	24.33	18.33	18.33
MA	25.67	23.10	17.20	17.20	17.20
ME	57.33	51.60	37.33	24.33	24.33
MN	31.33	28.20	20.99	20.99	20.99
MT	34.00	30.60	22.33	22.78	22.33
PH	30.00	22.00	20.10	20.10	20.10
PI	37.67	33.90	25.24	19.00	19.00
TF	27.67	24.90	18.54	-	18.54
XE	28.67	25.80	19.21	19.21	19.21
XL	37.33	33.00	24.67	25.01	24.67

Important Note: The cut-offs vary from year to year and the figures given in the table should be used only as rough guidelines. No enquiry regarding the cut-off GATE scores will be entertained.

POST ADMISSION INFORMATION

Commencement of the Programme

1. Those who are offered admission are required to report to IIT Kharagpur on the date of registration, which is tentatively **3rd week of July 2012**.
2. They must bring with them a copy of the qualifying degree and mark sheet. In case the result of the final degree examination is not declared, at least all parts of the examination must be completed before the date of joining. In such a case, they will have to produce at the time of joining a course completion certificate from the Principal of the institution where the applicants studied.
3. Admission is also subject to the production of a medical fitness certificate and verification of academic transcripts at the time of registration or at any time during studies.
4. During registration, applicants must submit i) a bank draft as mess advance and mess overhead charges (to be intimated). (ii) a bank draft towards the refundable caution money (to be intimated)

Accommodation

1. Both Regular and Sponsored candidates, who are offered admission, will be provided with accommodation in the Halls of Residence. Candidates who wish to make alternative arrangements for accommodation must apply for permission to reside outside, in an area in close vicinity of the Institute.
2. There is an extreme shortage of family accommodation. Therefore no family accommodation is available in the Institute.

Fees and Deposits

Every MTech/MCP student is required to pay tuition and other fees as mentioned below:

Semester	Fee type	General / OBC / PD (Rs.)	SC / ST (Rs.)
First Semester	Non-refundable	11,050	6,050
	Refundable (caution money)	6,000	6,000
	Placement Service (not applicable for sponsored candidates)	500	500
	Insurance (yearly)	650	650
	Student Brotherhood Fund (yearly)	100	100
Each subsequent Semester	Non-refundable	8,750	3,750

In addition to the above, fee payable per semester is as follows:

Fee type	Amount (Rs)
Hostel overhead	8,250
Mess	9,000

(Note: Fee structure and amount are subject to change from time to time; the non-refundable fee has a tuition component of Rs 5,000 per semester which is waived in case of SC/ST category students)

Insurance

A compulsory insurance scheme, UNI STUDY CARE, with United India Insurance Company, Kolkata provides insurance cover against personal accident/loss of baggage, etc. for an annual premium of Rs. 650 to all the students of the Institute.

Contact Details

The Chairman
GATE, IIT Kharagpur
Kharagpur 721302
Phone: 03222-282091
Fax: 03222-278243
Email: gate@adm.iitkgp.ernet.in
Website: <http://gate.iitkgp.ernet.in/mtech>