M.Tech., M. Des. and Ph.D. Programmes

Information Brochure

2012

INDIAN INSTITUTE OFTECHNOLOGY KANPUR
KANPUR - 208 016

(website : www.iitk.ac.in/doaa/admissions.html)

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INTRODUCTION

The goals of the post graduate programmes at the Indian Institute of Technology Kanpur are:

The development of high quality scientific and engineering manpower with a broad grasp of the fundamental principles of sciences and the scientific methods, deep understanding of their areas of specialization, innovative ability to solve new problems, and the capacity to learn continually and interact with multi- disciplinary groups. Above all, the students should develop the capacity for free and objective enquiry, courage and integrity, awareness and sensitivity to the needs and aspirations of the society. The programmes are designed to impart knowledge, strengthen concepts and intellectual skills through course work, seminars and project/thesis work and thus cater to the needs of Industry, R &
D organizations and educational institutions.

These programmes are intended to prepare students to enter their professions with a perspective and breadth of knowledge related to the principal divisions of their respective fields of specialization through courses and research experience. A post-graduate student will typically be enrolled for three or four courses each semester until he/she has fulfilled all the course requirements. The thesis work is aimed at providing the research experience in the relevant field of specialisations.

This brochure provides general information sought by those seeking admission at IIT Kanpur in any of the following approved postgraduate programmes. For rules pertaining to any particular issue, decisions of the competent authority would be applicable.

M.TECH.: MASTER OF TECHNOLOGY (4 Semester Programme)

Aerospace Engineering
Biological Sciences and Bio-engineering
Chemical Engineering
Civil Engineering
Computer Science & Engineering
Electrical Engineering
Environmental Engineering & Management
Industrial & Management Engineering
Laser Technology
Materials Science & Engineering
Mechanical Engineering
Materials Science
Nuclear Engineering & Technology

M.DES.: MASTER OF DESIGN (4 Semester Programme)

Design Programme (Interdisciplinary)

Ph.D.: DOCTOR OF PHILOSOPHY (Engineering)

Aerospace Engineering
Biological Sciences and Bio-Engineering
Chemical Engineering
Civil Engineering
Computer Science & Engineering
Electrical Engineering
Mechanical Engineering
Materials Science & Engineering
Industrial & Management Engineering
Materials Science
Nuclear Engineering & Technology

Sciences

Chemistry
Mathematics & Statistics
Physics

Social Science

English/Linguistics
Economics
Philosophy
Psychology
Sociology

ELIGIBILITY REQUIREMENTS

The eligibility conditions given below are the absolute minimum. Departments may prescribe any requirements over and above these.

The 'specified minimum' marks/CPI (Cumulative Performance Index), referred to in subsequent sections, implies a minimum of 55 percent marks /5.5 (on a 10 point scale) as long as it is not less than the minimum pass marks/CPI; otherwise, the 'specified minimum' marks/CPI implies the minimum pass marks/ CPI.

M.Tech.: A Bachelor's degree in engineering or Master's degree in science with marks/CPI not below the prescribed minimum. For M.Tech in Biological Sciences and Bioengineering, candidates with MBBS, or B.Pharma Degree may also be considered .Valid GATE score is required for financial assistance. Graduate from IITs with a minimum CGPA of 8.0 are exempted from this requirement

M.Des.(Master of Design): A Bachelor's degree in Engineering, Design or Architecture (only) with marks/CPI not below the prescribed minimum. Students with Bachelor's degree in a Fine Art are not eligible. Valid GATE/CEED score is required for financial assistance.

Ph.D. in Engineering: The applicant must have a master's degree in engineering with marks/CPI not below the specified minimum. Appplicants with a bachelor's degree in engineering with a minimum of 75 percent marks/7.5 CPI, or master's degree in science or an allied area, satisfying each of the following criteria may also be considered :

(a) a minimum of 65 percent marks/6.5 CPI in the master's degree.

(b) first division in bachelor's degree, and

(c) JRF/95 percentile or higher in GATE.

For admission into Ph.D. in Biological Sciences and Bio-engineering, applicants having master's degree in pharmacy/medicine with marks/CPI not below the specified minimum, or bachelor's degree in pharmacy/medicine with a minimum of 75 percent marks/7.5 CPI, may be considered. However, valid GATE/UGC/ CSIR score is required for financial assistance, in such cases, except for graduates from IITs with a minimum CGPA of 8.0.

Ph.D. in Sciences: A Master's degree in the relevant subject or a Bachelor's degree in engineering with marks/CPI not below the prescribed minimum. Valid

GATE/UGC/CSIR score is required for financial assistance, in such cases, except for graduates from IITs with a minimum CGPA of 8.0

Ph.D. in HSS: A Master's degree in the relevant subject or a Bachelor's degree in Engineering or a Master's degree in sciences or in an allied field of HSS with marks/CPI not below the prescribed minimum. Valid GATE/UGC/CSIR score is required for financial assistance, in such cases, except for graduates from IITs with a minimum CGPA of 8.0. Applicants in Economics should have at least +2 Level mathematics background.

Ph.D. in Management: A Master's degree in Management/Arts/Commerce/ Science/Industrial Engineering/Production engineering/Operations research, or other relevant disciplines in Engineering/Technology, or a Bachelor's degree in Engineering/Technology with CPI not below the specified minimum. Valid GATE/UGC/CSIR score is required for financial assistance, in such cases, except for graduates from IITs with a minimum CGPA of 8.0

FINANCIAL ASSISTANCE

Financial aid (Assistantship/Scholarship) is available to the M.Tech., Ph.D. and M.Sc.-Ph.D. (Dual degree) Programmes.

Student is expected to carry out the assigned duties for teaching and Research Assistantship. The M.Tech. student currently carries a monthly stipend of Rs.8,000/- for 8 hours of work per week. For Ph.D. students the corresponding financial assistance is Rs.18,000/- (for engineering) and Rs.16,000/- (for Sciences/Social Sciences) for the first two years and there after its is raised to 20,000/- and 18,000/- respectively for another two years. A 50% tuition fee waiver for M.Sc.-Ph.D. (Dual degree) students is also available after the first semester.

In addition to this several attractive fellowships from Industries/DAE are also available

SELECTION CRITERIA

For both M.Tech. and Ph.D. programmes, some departments/programmes may call a selected number of candidates for test and/or interview in May/June for admission in first semester and in November for admission in second semester. Other departments/programmes may process the applications only on the basis
of earlier academic records and/or GATE/UGC/CSIR scores where the same be required and offer admissions directly. All students who are offered admission will be informed normally by the first week of June (for admission in first semester) or first week of December (for admission in second semester). There also exists a provision of walk-in interview for admission to the Ph.D. programmes round the year.

CONCESSIONS TO SC/ST/OBC CANDIDATES

In each discipline, 15% seats are reserved for SC candidates, 7.5% seats for ST candidates and 27% seats are reserved for OBC (for non creamy layer). SC/ST/OBC candidates must also satisfy the eligibility requirement for admission. However, while considering their cases, only suitability for the programme is ensured and the SC/ST/OBC candidates are not compared with those belonging to other categories.

CONCESSIONS TO CANDIDATES WITH PHYSICAL DISABILITY (PD)

In total, 3% reservation (horizontal) shall apply for candidates with physical disability as per Govt. of India norms (minimum 40% disability; an appropriate certificate must be furnished). Such candidates must satisfy the eligibility requirements for admission. However, while considering these cases, only suitability for the programme is ensured and the candidates are not compared with those belonging to other categories.

ADMISSION TO PART-TIME STUDIES

The Institute also offers part-time postgraduate programmes leading to the M.Tech/Ph.D. degrees for local professionally employed personnel such as working engineers, scientists and teachers who can, while employed, attend regular classes as per schedule of the Institute.

The applicant must be an employee of a recognized organization with at least two years of service at the time of admission and be engaged in professional work in the area to which admission is sought. An application for the part-time studies should be forwarded by the employer.

ADMISSION TO EXTERNAL REGISTRATION PROGRAMME FOR Ph.D.

A candidate working in an R & D establishment which is equipped with the necessary research and library facilities may be considered for admission only to the Ph.D. programmes in engineering. Such a candidate must be sponsored by his/her employer and must have been in employment with the sponsoring organization for at least 2 years at the time of admission. The employer must expressly undertake to pay full salary to the candidate and relieve him/her to stay on the campus to enable the candidate to complete his/her residence requirement.

A candidate applying for admission to the external registration programme must provide detailed information about the research facilities available at his/her organization and a certificate that these would be available to him/her for carrying out research. He/she should also provide the biodata of the prospective supervisor who would supervise the candidate's work at his/her organization.

An application for admission from a candidate working in the approved organization will be considered only if he/she wishes to work in the specified area.

ADMISSION OF SPONSORED CANDIDATES

A candidate who is sponsored by his/her employer and who meets the additional conditions specified below may be admitted through a separate selection committee appointed specifically for the purpose.

A sponsored candidate must have been in service of the sponsoring

organization for at least two years at the time of admission. The sponsoring organization must specifically undertake to provide full salary to the candidate and to relieve him/her to pursue the programme for its full duration.

Fulfillment of GATE eligibility requirement may be waived for such candidates. However, the sponsored candidates seeking admission to the M.Tech./M.Des/

Ph.D. programme who have not taken GATE/CEED will be called for interview and may in addition be asked to take a written test.

GENERAL INFORMATION

Each postgraduate student is required to register in every semester till he/she completes the requirements of his/her programme. These requirements are counted in terms of credits which roughly reflect the number of contact hours. Normal load in a semester is 16 credits. The minimum residence requirement for students registered in M.Tech. Programme is four semesters. They are required to complete a minimum of 64 credits of which at least 24 credits should be through course work and at least 28 credits would be through research work.

The minimum residence requirement for students holding M.Tech. degree registered for Ph.D. Programmes in engineering is four semesters. They are required to complete a minimum of 64 credits of which at least 16 credits must be in terms of postgraduate courses and at least 32 credits in terms of research work.

The minimum residence requirements for students holding B.Tech. degree registered for Ph.D. programmes in Engineering is six semesters. They are required to complete a minimum of 96 credits of which at least 40 credits must be through P.G. courses and at least 32 credits through research.

The minimum residence requirement for students holding M.Sc., MA., M.B.A. or M.Phil. degree registered for Ph.D. programmes in Sciences/HSS/

Management is five semesters. They are required to complete a minimum of 80 credits of which at least 24 credits must be in terms of postgraduate courses and at least 32 credits in terms of research work.

In order to graduate, students must obtain a minimum CPI of 6.50 at the Master's level and 7.00 at the Ph.D. level.

The institute, being residential, requires that all registered students must reside in the campus. The Institute has nine hostels for boys and two hostels for girls with capacities of 5000 and 500, respectively. Seventy Two (72) Single Bed Room Apartments (SBRA) have been earmarked for allotment to married students. The maried students are, however, advised to bring their family only after allotment of a SBRA.

FEE CONCESSIONS

Partial waiver of tuition fee may be extended to sponsor full time Ph.D. students facing severe financial difficulties on case-to-case basis.

Correspondence

All correspondence concerning admissions should be addressed to the concerned Department/Programme as follows:

The Convener DPGC

Department/Programme (Please write the name of Department/)_____

Indian Institute of Technology Kanpur

Kanpur 208 016

AEROSPACE ENGINEERING

The Department of Aerospace Engineering offers a comprehensive program of teaching and research at undergraduate and postgraduate levels leading to B.Tech, B.Tech-M.Tech dual degree, M.Tech and Ph.D degrees. Specializations are available in the two major streams: (i) Aerodynamics-Propulsion: focusing on High Speed Aerodynamics, Low Speed Aerodynamics, Hypersonics, Experimental Fluid Dynamics, CFD/High Performance Computing, Turbo machinery, Combustion, Micro Air Vehicles (ii) Structures-Dynamics-Controls: with focus on Composite Structures, Smart Structures and Optimization, Structural Dynamics and Aeroelasticity, Flight Dynamics and Control, Space Dynamics, Helicopter Dynamics, Autonomous Vehicles.

Various consultancy and sponsored research and development projects funded by agencies such as, Aeronautics R & D Board, Indian Space Research Organization, Aeronautical Development Agency, Department of Science & Technology, Hindustan Aeronautics Ltd., Delhi Metro Railways Corporation, NAL, Indo-French Centre for the Promotion of Advanced Research (IFCPAR),, TERI, PCRA, DRDO etc., have been undertaken by the Department. The major contributions of the faculty are in the design and development of high speed and low speed wind tunnels, flow measurements using hotwire and laser Doppler anemometry, PIV, reacting flow, CFD, industrial and wind energy aerodynamics, CFD including subsonic, transonic, supersonic and hypersonic flow computations, supersonic/ hypersonic similitude, unsteady aerodynamic modeling and parametric estimation techniques; satellite dynamics; (analysis and development of software in the areas of thermal problems in rocket propulsion) and flow through turbo-machines, structural dynamics, random vibration analysis, design and optimization of fibre reinforced composite structures for static, dynamic and random loading; adaptive finite element analysis; smart structures; multi scale modeling; damage in composite structures; behavior of adhesive joints; helicopter dynamics, aeroelasticity; modeling of advanced materials, micro/mini air vehicles, and insect flight.

FACULTY

Abhishek, Ph.D. (Maryland): Helicopter Aeromechanics, Multibody Dynamics, Micro Air Vehicles.

A K Ghosh, Ph.D. (IIT/K): Flight Mechanics, Neural Networks, Flight Testing.

A Kushari, Ph.D. (Georgia Tech.): Propulsion, Combustion, Liquid Atomization, Flow Control.

A Tewari, Ph.D. (Missouri - Rolla): Flight Mechanics, Aeroservoelasticity, Space Dynamics and Control.

Ashoke De, Ph.D(Louisiana State University):CFD, Turbulent combustion, Gas turbine propulsion, Stochastic combustion modeling.

B Eshpuniyani, Ph.D. (Purdue): Transition & Turbulence, CFD, Supersonic & Hypersonic Flows, Biofluid Mechanics.

C S Upadhyay, Ph.D. (Texas A&M): Computational Mechanics, Damage Mechanics.
C Venkatesan, Ph.D. (IISc Bangalore): Helicopter Dynamics and Aeroelasticity, Autonomous Helicopter, Smart Structures**D Das, Ph.D. (IISc. Bangalore)**: Theoretical and Experimental Aerodynamics, Aeroacoustics, Instability and Transition, Vortex Dynamics, Unsteady Aerodynamics, Bird and Insect Flight.
D P Mishra, Ph.D. (IISc Bangalore): Combustion, Atomization, CFD.
D Yadav, Ph.D. (IIT/K): Structural Dynamics, Stochastic Processes, Optimization.
E Rathakrishnan, Ph.D. (IIT/ Madras): Gas Dynamics.
K Poddar, Ph.D. (San Diego): Aerodynamics, Turbulence, Low and High Speed Flows.
P M Mohite, Ph.D. (IIT/K): Damage Mechanics of Composites, Composites, Material Characterization, FEM.
R Kitey, Ph.D. (Auburn): Solid Mechanics, Fracture Mechanics, Optical Metrology, Boundary Element Method.
R Kumar, Ph.D (Penn State): Hypersonics, Rarefied Gas Dynamics, Microfluidics, Molecular Dynamics, Heat Transfer & Thermal Design.
S Mahesh, Ph.D. (Cornell): Material Modeling, Fracture.
S Mittal, Ph.D. (Minnesota): CFD, Aerodynamics, Shape Optimization.
S Kamle, Ph.D. (Purdue): Experimental Stress Analysis, Smart Structures.
T K Sengupta, Ph.D. (Georgia Tech): Theoretical and Computational Fluid Dynamics, Transition and Turbulence, Aerodynamics.

PROGRAMMES

The M. Tech program is designed to acquaint the student with various aspects of Aerospace Engineering through several courses both introductory and in the specialized area followed by research, leading to a thesis on a topic in the area. M. Tech students have the opportunity to do experiments with the National Wind Tunnel Facility (NWTF) (See FACILITIES below) and acquire actual flying experience in the Flight Laboratory as a part of the curriculum. The Ph.D program is aimed at helping the student acquire proficiency in the chosen area through course work, followed by research leading to a Doctoral thesis.

Candidates for admission in the M.Tech program in Aerospace Engineering at IIT Kanpur must have a Bachelor's degree in Aeronautical/Aerospace, Mechanical, Civil, Chemical Engineering, Naval Architecture, Electrical, Electronics/Electronics and Communication, Automobile, Metallurgy/Metallurgy and Material Science. Those for admission in Ph.D must have a Master's degree in the respective disciplines, or a Master's degree in Sciences with a minimum of 3 years of relevant R & D experience in aerospace engineering for sponsored candidates and also a valid GATE/UGC/CSIR score for non-sponsored candidates.

Admissions in M.Tech and Ph.D programs are made to a particular stream, i.e. area of specialization in the department (as given in first para). Also note that problems of multidisciplinary nature can be suitably taken up for thesis.

A student in the M.Tech program is required to complete at a satisfactory level, a minimum of 8 courses and 32 units (two semester load) of research leading to a thesis. A Ph.D student is required to complete a minimum of 4 courses and 32 units (two semester load) of research subject to a minimum total academic load of 4 semesters. He is also required to pass the Ph.D comprehensive examination held on completion of his course work.

In the first semester, a student in the M.Tech program will be registered for 4 courses. At the time of admission he will be assigned to a field of specialization on the basis of his aptitude, background, and availability of the faculty. A thesis supervisor will also be assigned towards the end of first semester. In the second and third semesters, the student will take four or more elective courses and initiate his research. In the third and fourth semesters he/she will continue research work towards completion of his thesis.

A student in the Ph.D program will register for four elective courses, as advised by D.P.G.C. member belonging to his area of specialization, if thesis supervisor has not been decided at the time of registration. In other cases, he may register for thesis on the advice of supervisor. In the subsequent semester he registers for research and courses as advised by his supervisor. At the end of the course work the student will appear for the Ph.D comprehensive examination, and continue his research towards completion of his Doctoral Thesis.

COURSES

Introduction to Aerospace Engineering, Mathematics for Aerospace Engineers, Aerodynamics-I, Aerodynamics-II, Viscous Flows, Advanced Computational Methods in CFD, Boundary Layer Instability and Transition, Finite Element Methods for Fluid Dynamics, Introduction to Environmental Fluid Mechanics, Wind Engineering, Turbulence, Computational Fluid Dynamics, Turbulent Flows, Perturbation Methods in Fluid Mechanics, Transition and Turbulence, Advances in Turbulent Shear Flows, Continuum Hypersonic Aerodynamics, Advances in Wind Energy Conversion, Advanced Dynamic Stability, Space Dynamics-I, Space Dynamics-II, Introduction to Hypersonic & Trans-Atmospheric Flight, Control Theory, Flight Dynamics, Flight Stability and Control, Fundamentals of Aerospace Propulsion, Applied Combustion, Aircraft Propulsion, Thermal Turbo Machinery, Combustion Problems in Rocket Propulsion, Selected Topics in Turbo-Machines, High Speed Internal Flow Problems, Airbreathing Missile Propulsion, Transonic Aerodynamics, Aerospace Structural Analysis-I, Solid Mechanics, Rocket and Missile Structures, Advanced Aircraft Structural Analysis, Introduction to Finite Elements Methods, Aeroelasticity, Vibration Control, Theory of Vibrations, Non-Linear Oscillations, Reliability Analysis of Engineering System, Composite Materials, Analysis of Composite Structures, Random Vibrations, Aircraft Materials and Processes, Deterministic and Random Vibration, Helicopter Theory: Dynamics and Aeroelasticity, Aerospace Structural Analysis-II, Dynamics and Vibration, Introduction to the Theory of Smart Structures, High Temperature Gas Dynamics, Applied Mathematics for Engineers, Instrumentation, Measurement and

BIOLOGICAL SCIENCES AND BIO ENGINEERING

The Department of Biological Sciences and Bioengineering (BSBE) is one o fthe newer departments at IIT Kanpur that was founded on 14th September, 2001. The department offers both undergraduate (B.Tech) and postgraduate programs (M.Tech and Ph.D) and the faculty conduct research in diverse areas of basic and applied biology. Research inerests of the department include cell & molecular biology, genetics and developmenal biology, structural & computational biology, bioinformatics, biomaterials, tissue engineering, bioprocess engineering, biomechanics and bioelectronics. The depar tment has developed extensive research facility and infrastructure to support its teaching and research activities.

The department currently has twelve members in its faculty with expertise in diverse areas of research.

FACULTY

Amitabha Bandyopadhyay, Ph.D. (Albert Einstein College of Medicine, NewYork): skeletal development and differentiation; metabolomics.

Anupam Pal, Ph.D. (Pennsylvania State Univ.): Biomechanics; high performance computing; biomedical image processing and geometric modelling.

Ashok Kumar, Ph.D. (IIT Roorkee): Downstream processing, biomaterials, nanobiotechnology, affinity interactions and cell separation, bioprocessing, and tissue engineering.

Balaji Prakash, Ph.D. (IISc, Bangalore): Structural biology, bioinformatics, macromolecular crystallography.

Dhirendra S. Katti, Ph.D. (Bombay Univ.): Tissue engineering, biomaterials, drug delivery systems and nanobiotechnology.

Ganesh S, Ph.D. (BHU, Varanasi): Human molecular genetics, model systems for human disorders, neuroscience.

Jonaki Sen, Ph.D. (Albert Einstein College of Medicine, New York): Retinal development and differentiation; developmental neurobiology.

Pradip Sinha, Ph.D. (BHU, Varanasi): Cancer genetics, growth control & pattern formation in fruit fly, Drosophila model.

Experiments in Fluids, Introduction to Virtual Instrumentation, Nonlinear Finite Element Method, Molecular Gas Dynamics, Fundamentals of Liquid Atomization, Principles of Acoustics, Theory of Combustion.

FACILITIES

The department has several well established laboratories focusing on various research and academic activities. They are: High Speed and Low Speed Aerodynamics Lab, Propulsion Lab, Combustion Lab, Structures Lab, Aeromodelling Lab, Unsteady Aerodynamics Lab, Autonomous Helicopter Lab, CFD Lab, High Performance Computing Lab, Structural Analysis Lab, Flight Lab and National Wind Tunnel Facility. The experimental facilities include several low speed wind tunnels, a high speed blow down tunnel, high speed jet facility, half anechoic chamber for noise measurements, and hot wire and laser Doppler anemometry; facility for static and dynamic tests and composite materials behavior; cascade tunnel, continuous combustion unit and gas turbine test rig; Malvern Spraytech particle size analyzer, Gas Chromatograph. Flight laboratory, with four powered airplanes and several gliders and an operational aerodrome for flight research; NWTF (National Wind Tunnel Facility) which is a unique facility, with latest technology and automated instrumentation and a very large test section of 3m x 2.25m, capable of testing (aerodynamics) a full-scale model of car.

Sankararamakrishnan R, Ph.D. (IISc, Bangalore): Bioinformatics, molecular modelling of membrane proteins and bimolecular simulation.

Subramaniam K, Ph.D. (IISc, Bangalore): Developmental biology – germ cell development in C.elegans; Functional genomics using RNAi – plant-parasitic nematodes.

Mainak Das, Ph.D. (Univ. of Central Florida): Bioengineered retina, engineering prototype o photosynthetic machinery, and materials for bioelectronics.

Ashwani Kumar Thakur, Ph.D. (Inst. of Microbial Tech., Chandighar) : Protein aggregation in diseases and therapeutic design; sel assembly o proteins; and biopharmaceuticals.

FACILITIES

Computational Facility: SGI Fuel graphics workstation; Compaq ES45 Alpha machine with 4 processors; molecular modelling and graphics packages; bioinformatic tools.

Imaging Facility: Microscopic setup for confocal/fluorescence imaging, photodocumentation and image analysis software, Environmental Scanning Electron Microscope (ESEM).

Molecular Biology lab: Centrifuges, Gel-documentation system, PCR Machine, hybridization oven, transfer apparatus for nucleic acids and protein, automated DNA sequencer, and culture setup for bacterial and mammalian cells.

Facility for Protein Chemistry: peptide synthesizer, FPKC, CD spectropolarimeter and UV-VIS spectrophotometer

PROGRAMMES

M.Tech. in BSBE (4 Semesters)

WHO CAN APPLY?

Candidates who have a Master's degree in any area of science (Mathematics, Physics, Chemistry or Life Sciences) or Bachelor's degree in Technology/ Engineering, Medicine (MBBS), Pharmaceutical (B.Pharm), Agricultural or Veterinary Sciences are eligible to apply. Applicants should have secured a

minimum CPI of 6.6 (or 60 percent marks) in their qualifying degree (and should be at least seven percent higher than the minimum pass marks/CPI) and should either have a valid GATE score or ualified in the national level tests conducted by the UGC, CSIR, DBT, ICAR or ICMR. The requirement of a GATE score is waived for M.B.B.S. degree holders and for engineering graduates from IITs with an overall CGPA of 6.5 and a CGPA of 8.0 during the last two semesters. Candidates appearing in the final examinations of the qualiying degree are also eligible to apply.

Ph.D in BSBE

Ph.D. Program in BSBE is intended for students interested in carrying out distinguished scholarly activities. Excellence in research apart, the program enviages comprehensive development of students for leadership in science and engineering in both industry and academia. Therefore, the Ph.D. Program involves intense course work covering diverse areas of biology and bioengineering for competence in both analytical and quantitative skills.

WHO CAN APPLY?

Candidates should meet one of the following 4 conditions. Candidates appearing in the final examinations of the qualifying degree are also eligible to apply.

(1) Should have a master's degree in engineering (ME/M.Tech.), or medicine (MD) or M.Sc. (Agri) or equivalent with minimum of 55 percent marks/ 5.5 CPI (on a 10 point scale) as long as it is not less than the minimum pass marks/CPI.

Master of Technology (M.Tech) program in BSBE meets a variety of career objectives in research and industry. The program is also suppor ted by the Depar tment of Biotechnology (DBT), Govt. of India. The Program is for four semesters of which the last two semesters involve hands-on training and research. Midway through the program, students may apply for switchover to the Ph.D. Program of BSBE. The program is designed for students from bot biology and non-biology background.

OR

(2) Should have a bachelor's degree in engineering (B.E/B.Tech) or pharmacy (B.Pharm) with a minimum o 75 percent marks/7.5 CPI, and a valid GATE score or qualified in the JRF of UGC, CSIR, DBT, ICAR or ICMR.

OR

(3) Master's degree in sciences or an allied area (M.Sc.), satisfying each of fthe following criteria may also be considered.

(a) a minimum of 65 percent marks/6.5 CPI in the master's degree. (b) first division in bachelor's degree, and

(c) UGC, CSIR, DBT, ICAR or ICMR junior research followship (JRF) OR 95 percentile or higher in GATE.

OR

(4) MBBS degree holders with a minimum of 60% marks in the qualifying degree.

CHEMICAL ENGINEERING

The Department of Chemical Engineering offers academic programme leading to B.Tech., M.Tech. and Ph.D. degrees in Chemical Engineering.

The Department imparts graduate education with emphasis on chemical engineering fundamentals and applications. It prepares students for a high level of competence in the conventional areas like process engineering, process **simulation, optimization and control, separation processes, polymer engineering and transport phenomena, and in frontier areas of energy and environment, nanosciences, molecular simulations, biotechnology and biocomputations.**

Most of the graduate courses have a strong engineering science and state-of-the-art orientation. They are primarily intended to prepare students for careers in computer oriented design, simulation and controls, teaching, research and development. Our students find employment in renowned industrial and academic organizations. The department has a young and dynamic faculty who are recognized both nationally and inter nationally, who have received numerous awards and honours for excellence in research (e.g. Shanti Swarup Bhatnagar prize, Herdillia, Amar Dye-Chem and NOCIL awards of IIChE, of ISTE, Fellowships of Academies of Sciences and of Engineering, etc.). This research in diverse areas of Chemical Engineering is published in prestigious inter national journals. The depar tment faculty has also authored over 35 textbooks and research monographs through reputed publishers in India and abroad which reflects the faculty's commitment to teaching and research. A number of projects have been sponsored by various national funding agencies including DRDO, DST, AICTE, ARDB,CSIR, DBT and MEF, MHRD, Planning Commission, Centre for High Technology etc. The depar tment enjoys an excellent rapport and professional interaction with various industria organizations. A few faculty members engage in high level consultancy work in industry during summers, whereas some others undertake sponsored projects funded by industry (e.g. IPCL, GSFC, Duncans Industries, U.P. State Agro Industries, Engineers India Limited, IOC, CHT, Gas Authority of India Limited, Hindustan Lever, Bharat Petroleum Corporation Limited, etc.).

FACULTY

P Apte, Ph.D. (Ohio): Statistical Mechanics, Interfacial Ther modynamics, Nucleation.

P K Bhattacharya, Ph.D. (IIT/B): Membrane Separations, Pulp and Paper Technology, Environmental Engineering

R P Chhabra, Ph.D. (Monash): Non-Newtonian Fluid Particle Systems, Transport Properties of Liquid Metals and Molten Salts

S Garg, Ph.D. (Connecticut): Bio-informatics;Computer Aided Molecular Design; Flexibility Analysis

A Ghatak, Ph.D. (Lehigh): Adhesion and friction on soft interfaces, Fracture of soft thin sheets, Bio-inspired approaches in design of engineering materials.

Goutam Deo, Ph.D. (Lehigh): Heterogeneous Catalysis, Kinetics, Transpor t Phenomena

S K Gupta, Ph.D. (Pennsylvania): Simulation and control of Polymerization Reaction, Optimization

Y M Joshi, Ph.D. (IIT/B): Rheology, Polymer Science & Engineering, Fluid Mechanics

Ashok Khanna, Ph.D. (IIT/K): Process Control, Polymer Engineering, Two Phase Flow

Anil Kumar, Ph.D. (Carnegie-Mellon): Simulation and Control of Polymer System Process Design

Nitin Kaistha, Ph.D. (Tennessee): Process Monitoring & Control, Reactive Distillation

D Kunzru, Ph.D. (Pittsburgh): Catalyst Deactivation, Kinetics, Pyrolysis of Hydrocarbons, Petroleum Processing

Raj Ganesh Pala, Ph.D. (Utah): Sustainable energy, Heterogeneous catalysis, Photo chemical analysis, Quantum and classical simulation of condensed matter systems.

S Panda, Ph.D. (Houston): Chemical Sensors, Micro/ Nano Fabrication processing of electronic materials Microfluidics, Lab-on-a-chip.

V Shankar, Ph.D. (IISc B'lore): Stability of Fluid Flows, Dynamics and Rheology of complex fluids.

Ashutosh Sharma, Ph.D. (SUNY, Buffalo): Colloid and Interface Engineering, Nanotechnology, Thin Films.

Jayant Singh, Ph.D. (SUNY, Buffalo): Molecular Simulation, Statistical Thermodynamics, Structure, Dynamics and Phase Behaviour of Complex Fluid

Sri Sivakumar, Ph.D. (Victoria) : Synthesis and characterization of nanomaterials, Layer by layer assembly polymer capsules, Thin films, Drug delivery and photonic crystals

Nishith Verma, Ph.D. (Arizona): Adsorption, Environmental Pollution Control, Mathematical Modelling & Simulation,

Raghvendra Singh, Ph.D., (SUNY, Buffalo): Research Interests : Computational Biology, Gene Therapy, Embryonic and Adult Stem Cell, Tissue Engineering, Biomaterials.

Abhijit Chatterjee, Ph.D., (Detaware): Research Interests : Heteroepitaxial and thin film growth, Diffusion in metals and ionic materials, Design of multifunctional materials.

PROGRAMMES

The M.Tech. students are required to complete a minimum of 64 units of which at least 24 units (equivalent to 6 courses) must be in terms of advanced postgraduate courses and research work equivalent to minimum of 28 units. The students are required to take at least three compulsory courses, one each from the four areas : Applied Mathematics, Transpor t Phenomena, Thermodynamics and Chemical Reaction Engineering. Besides these, the students take additional courses from a wide range of electives. The electives reflect the broad spectrum of research interests of the faculty. The electives offered keep changing from time to time and they are the means through which both faculty and students keep abreast of the latest developments. The electives may be chosen either from the departmental or outside departmental courses.

Students holding B.Tech. degrees registered for Ph.D. are required to omplete a minimum of 96 units of which at least 40 units (equivalent to 10 courses) must be in terms of advanced post graduate courses. Students holding M.Tech. degree registered for Ph.D. are required to complete a minimum of 64 units of which at least 16 units (equivalent to 4 courses) must be in terms of advanced post graduate courses.

Research projects for M.Tech./Ph.D. thesis work are offered by the faculty in their fields of specialization.

ELECTIVE COURSES

New Separation Processes, Thermodynamics of Fluids and Mixtures, Principles of Hetrogeneous Catalysis, Applied Statistics for Chemical Engineers, Optimization, Hazard Analysis and Reliability, Plant Safety and Hazard Assessment, Petroleum, Mechanics of soft materials, Introduction to nanoscience and technology, Polymer science and technology.

Refinery Engineering, Reaction Engineering of Polymers, Principles of Polymer Processing, Molecular Theories of Polymeric Systems, Environmental Pollution and Control, Engineering Applns. of Rheology, Advanced Process Dynamics and Control, Computer Aided Processes Control, Two Phase Flow and Heat Transfer, Design of Fluid-Particle Systems, Colloid and Interface Science and

Engineering Modelling and Simulation in Chemical Engineering, Introduction to polymer physics and Rheology of Soft Matter, Introduction to Molecular Simulation.

Electrochemical energy conversion and storage, CFD of Multiphase Reactors, Nuclear Chemical Engineering, Structure and Rheology of Complex Fluids, Process Engineering Principles in Microelectronics Fabrication.

FACILITIES

Besides the central facilities, at the Institute level, the Chemical Engineering Department has its own workshop, library, GLCS, GPC, AAS, catalyst characterization facilities, centrifuges, fermentor, incubator-shaker, cryostats, IBM compatible personal computers, Magnetic flow meters, Ultrafiltration, Reverse Osmosis, AFM, Electrodialysis, Goniometer, Haake & Physica Viscometers and Rheometer, Parr Reactors, Laser Printer, Density meter, Dedicated NO gas analyzer,Ion chromatography, on line IR Gas analyser, Softwares such as MATLAB, SPEEDUP, ASPEN+, Langmuir-Biodegett depositions, Ellipsometr, Spin-coater etc. For more details visit www.iitk.ac.in

CIVIL ENGINEERING

Postgraduate education in —the Department is aimed at attaining an understanding of the basic scientific principles underlying various disciplines in Civil Engineering. In addition, the research component of the graduate programmes is meant to develop capabilities to undertake confidently independent analysis of complex field situations. Our graduates have gone on to become leaders in their profession and have significant contributions to the research and development. Keeping in view the needs of the society and the challenging problems faced by the profession, the postgraduate programmes have been developed in several fields of specialisation.

FACULTY

Purnendu Bose, Ph.D. (Univ. of Massachusetts, Amherst): Environmental Engg.: Physico-chemical processes for water and wastewater treatment, Advanced oxidation processes for water and wastewater treatment, Abiotic remediation of groundwater resources.

Partha Chakroborty, Ph.D. (Delaware): Transportation Engg.: Traffic flow theory and traffic engineering, Optimal transit system design, Transport system evaluation and management.

S K Chakrabarti, Ph.D. (Arizona): Structural Engg.: Interfaces and interactions in structural connections, Rehabilitation of structures, Advance concrete materials.

Sarvesh Chandra, Ph.D. (IIT/K): Geotechnical Engg.: Soil structure interaction, Ground improvement technique, Rock mechanics, Computer aided design and railway geotechnology.

Animesh Das, Ph.D. (IIT/Kh): Transportation Engg.: Pavement design, Pavement materials, Pavement evaluation and maintenance.

Onkar Dikshit, Ph.D. (Cambridge): Geoinformatics: DIP, GPS, GIS, Remote Sensing and Pattern recognition applications.

Priyanka Ghosh, Ph.D. (IISc): Geotechnical Engg.: Bearing capacity of foundations and Stability of slopes under both static and seismic cases, Method of characteristics, Upper bound limit analysis and Finite element analysis, Liquefaction analysis.

Anubha Goel, Ph.D (Maryland): Environmental Engg. Fate and transpor t of pollutants, Environmental modeling, climate change.

Saumyen Guha, Ph.D. (Princeton): Environmental Engg. : Anaerobic wastewater treatment, Bioremediation, Microbial ecology, Fate and transport of heavy metals in the subsurface, Nutrient uptake in plants.

Tarun Gupta, Sc.D. (Harvard): Environmental Engg.: Development of instruments for aerosol measurement, Engineering control of particles in ambient and indoor settings, Physico-chemical characterization of atmospheric pollutants, Personal exposure assessment and health effects of inhaled particles.

Vinay K Gupta, Ph.D. (S California): Structural Engg.: Random vibrations, Earthquake engineering.

Ashu Jain, Ph.D. (Kentucky): Hydraulics and Water Resources Engg.: Surface hydrology Rainfall-runoff modeling & Soft Computing.

Sudhir K Jain, Ph.D. (Caltech): Structural Engg.: Earthquake engineering, Structural dynamics.

Ashwini Kumar, Ph.D. (Waterloo): Structural Engg.: Nonlinear mechanics, Stability of structures, Mechanics of composite laminates.

Bharat Lohani, Ph.D. (Reading): Geoinformatics: Terrestrial and airborne laser scanning, Remote sensing, GIS, GPS, Electronic surveying, Terrain modeling, Geodata visualization, and Applications.

Javed N Malik, Ph.D. (Baroda): Engineering Geosciences: Active tectonics, Paleoseismology, Paleo-tsunami deposits, Geomorphology and sedimentology.

Sudhir Misra, Ph.D. (Tokyo): Structural Engg.: Durability and deterioration of concrete structures, Non-destructive testing, Concrete materials.

Sudib K Mishra, Ph.D. (Arrizona, Tucson): Structural Engg : Multi-scale, Multi-physics in materials and Mechanics, Stochastic optimization, Reliability analysis of structures, structural damage assessment.

P K Mohapatra, Ph.D. (IIT/K): Hydraulics and Water Resources Engg.: Computational hydraulics, Experimental hydraulics, Surface water hydrology, Frequency response in pipe.

Nihar R Patra, Ph.D. (IIT/Kh): Geotechnical Engg.: Pile foundations, Soil-structure interactions and ground engineering, Soil arching, Liquefaction potential evaluation.

Debajyoti Paul, Ph.D. (Cornell): Engineering Geosciences : Geochemistry, Petrology, Environmental geology, Paleoclimate.

Amit Prashant, Ph.D. (Tennessee): Geotechnical Engg.: Engineering properties of soils and other frictional materials, Numerical and constitutive modeling for granular materials, Soil dynamics and earthquake geotechnical engineering.

Durgesh C Rai, Ph.D. (Michigan): Structural Engg.: Experimental seismic behavior of structures, Seismic evaluation and strengthening, Energy dissipation devices, Masonry and Steel-RC composite members.

Samit Ray Chaudhuri, Ph. D. : (U.C. Irvine) Structual Engg : Structural dynamics, Ear thquake Engg. Pe r fo r mance - based design, structural rehabilitation, seismic soil structural interaction, structural health monitoring & structural testing.

Prishati Raychowdhury, Ph. D. (U.C. San Diego) : Geotechnical Engg. Soil dynamics, Geotectnical Earthquake Engineering, Seismic soil, soil structure interaction.

Rajesh Sathiyamoorthy, Ph.D. (IIT/B): Geotechnical Engineering: Numerical and Physical modeling, Geo-Environmental Engineering, Geosynthetics, Unsaturated soil mechanics, Railway Geotechnology

Mukesh Sharma, Ph.D. (Waterloo): Environmental Engg.: Air quality modeling and management, Fate processes of organic pollutants and parameter estimation.

Rajiv Sinha, Ph.D. (Cambridge): Engineering Geosciences: Fluvial geomorphology and sedimentology, Tectonic geomorphology, Remote sensing and GIS applications, Climate change.

Rajesh Srivastava, Ph.D. (Arizona): Hydraulics and Water Resources Engg.: Flow and transport through variably saturated porous media.

Vinod Tare, Ph.D. (IIT/K): Environmental Engg.: Water and wastewater treatment, modelling and simulation of environmental systems.

S N Tripathi, Ph.D. (Reading): Environmental Engg.: Aerosol optical properties, Aerosol microphysical properties, Cloud microphysical properties and cloud electrical properties, Fog vision, Electrical properties of Mars atmosphere.

Shivam Tripathi, Ph.D. (Purdue): Hyd. & Water Resource Engg. : Statistical hydrology, Sediment transport, Eco-hydrology.

Vinod Vasudevan, Ph.D. (University of Nevada): Transportation Engg. : Traffic safety, Pedestrian safety, Highway financing and policy analysis.

1. PROGRAMMES

Graduate programmes leading to the degrees of Master of Technology and Doctor of Philosophy are offered with specialisation in Engineering Geosciences, Environmental Engineering, Geoinformatics, Geotechnical Engineering, Hydraulics and Water Resources Engineering, Structural Engineering and Transportation Engineering.

For M.Tech. programme in Environmental Engineering, see under Environmental Engineering and Management Programme.

Admission to the M.Tech. programme in the above disciplines are offered

generally in the first semester of each academic year. However, admission to Ph.D. programme is offered in both semesters. Admission to Ph.D. programme is also offered throughout the year on walk-in interview basis.

2. ELIGIBILITY REQUIREMENTS

The following are the eligibility requirements for various programmes:

2.1 M. Tech. Programme

Engineering Geosciences: B.Tech./B.E. degree in Civil Engineering, or M.Sc. degree in Earth Science streams. Some candidates having M.Sc. degree in other science streams may also be considered. Candidates with M.Sc. degree must have mathematics as one of the subjects at B.Sc. level.

Geoinformatics: B.Tech./B.E. degree in Civil/Mining/Electrical/Computer Science/ Electronics Engineering/Information Technology, or M.Sc. degree in Earth Science streams/Geography/Physics/Mathematics/Environmental Sciences. Candidates with M.Sc. degree must have mathematics as one of the subjects at B.Sc. level.

Geotechnical Engineering: B.Tech./B.E. degree in Civil Engineering.

Hydraulics & Water Resources Engineering: B.Tech./B.E. degree in Civil/ Agr iculture Engineering. The candidates must have taken at-least one mathematics course at undergraduate level.

Structural Engineer ing: B.Tech./B.E. degree in Civil Engineering. Some candidates with Bachelor's degree in Architecture, Building Construction and allied subjects may also be considered.

Transportation Engineering: B.Tech./B.E. degree in Civil/Mechanical/Aerospace Engineering.

Notes:

1. In addition to above, a valid GATE score is also needed.
2. The GATE requirement is waived for B. Tech. graduates from IITs with a minimum overall CGPA/CPI of 6.5 and a minimum CGPA/CPI of 8.0 in the last two semesters in B. Tech. However, such students are entitled for Institute Assistantship if their overall CGPA/CPI is equal to or above 8.0.
3. Candidates with AMIE certificate are not eligible to apply.

2.2 Ph.D. Programme

Engineering Geosciences: M.Tech./M.E. degree in Civil Engineering/M. Tech. or M.Sc. degree in Earth Science streams.

Environmental Engineering: Master's degree in Civil/Environmental/Chemical/ Mechanical/ Metallurgical Engineering or in related engineering branch[1].

Geoinfor matics: M.Tech./M.E. degree in Civil/Mining/Electr ical/Computer Science/ Electronics Engineering/Information Technology, or M.Tech./M.Sc. degree in Earth Science streams/Geography/Physics/Mathematics/ Environmental Sciences[2].

Geotechnical Engineering: B.Tech./B.E. and M.Tech./M.E. degree in Civil Engineering.

Hydraulics & Water Resources Engineering: M.Tech./M.E. degree in Civil/ Aerospace/ Agriculture Engineering.

Structural Engineering: M.Tech./M.E. degree in Engineering. Some candidates with Master's degree in Architecture, Building Construction and allied subjects may also be considered.

Transportation Engineering: M.Tech./M.E. degree in Civil Engineering.

Footnotes:

1. Some bright and motivated candidates with M.Sc. degree may be considered under certain circumstances; however, they should provide documentary proof of having taken mathematics at 10+2 level and should have qualified GATE or CSIR-NET for JRF.
2. Candidates with M.Sc. degree must have Mathematics as one of the subjects at B.Sc. level.

3. COURSES

For M.Tech., the minimum total credits requirement is 64, out of which a minimum of 28 credits should be through research. The minimum total credits requirement for a Ph.D. student with M. Tech./M.E degree is 64. Out of this, a minimum of 16 credits should be through coursework and a minimum of 32 credits through research. The minimum credits requirement for a Ph.D. student with B. Tech./ B.E./M.Sc. degree is 96. Out of this, a minimum of 40 credits should be through coursework and a minimum of 32 credits through research. The various courses offered from time to time in each area of specialization are listed belo**w:**

Engineering Geosciences: Earth System Processes; Environmental Geology; Geological Hazards; Satellite Remote Sensing and GIS for Geo-resource Evaluation; Photogeology in Terrain Evaluation; Global Climate Change;

Paleoseismology and Tectonic Geomorphology; Laborator y Practices in Geoscience; Isotope Geochemistry and Applications.

Geoinformatics: Introduction to Remote Sensing; Machine Processing of Remotely Sensed Data; Instrumentation, Laboratory and Field Practices in

Geoinformatics; Global Positioning System; Geographical Information System; Precision Remote Sensing; Geospatial Data Processing.

Geotechnical Engineering: Rock Mechanics; Advanced Geotechnical Engineering; Foundation Analysis and Design; Reinforced Earth Structures; Ground Improvement Techniques; Foundation Dynamics; Geotechnical Ear thquake Engineer ing; Constitutive Modeling of Frictional Mater ials; Geotechnical Investigations for CE Projects.

Hydraulics and Water Resources Engineering: Hydraulic Structures; Engineering Hydraulics; Fluid Mechanics Laboratory; Sediment Transportation; Hydrologic Analysis and Design; Groundwater Systems Analysis; Water Resources Engineering; Introduction to AI Techniques; Transients in Pipes; Unsteady Open Channel Flow; Stochastic Hydrology; Water Resources Systems Engineering and Management; Management and Modeling of Environmental Systems; Groundwater Hydrology and Pollutant Transport.

Structural Engineering: Structural Dynamics; Engineering Mechanics; Stability of Structures; Experimental Methods in Structural Engineering; Advanced Structural Analysis; Masonary Structures; Advanced Design of Reinforced Concrete Structures; Advanced Design of Steel Structures; Durability of Concrete Structures; Earthquake Analysis and Design of Structures; Random Vibrations; Theory of Plates and Shells.

Transportation Engineering: Traffic Flow Modeling and Simulation; Analysis and Design of Pavement Systems; Analysis and Design of Transportation Infrastr ucture; Traffic Engineer ing; Urban Transpor tation System; Rail Transportation Systems Planning and Design; Airpor t Systems Planning and Design; Characterization of Pavement Materials and Analysis of Pavements; Laboratory Course in Transportation Engineering.

In addition, Advanced Mathematics for Civil Engineers is a compulsory course for M. Tech. programme in all the disciplines.

4. FACILITIES

In each of the area of specialization, the Department is equipped with well developed laborator y facilities. The state-of-the-art research facilities in the department include the following:

- Servo-hydraulic actuators and shake tables, eccentric mass shakers, pseudo-dynamic testing facility
- Advanced triaxial system including dynamic loading, bender elements, ring shear apparatus, SASW, pressure meter, dialatometer
- Integrated GPS-GIS receivers, Geodetic Quality RTK enabled DGPS, Motorized and robotic total station, Digital level and theodolite, Terrestrial laser scanner, Terrascan, Polyworks, LPS photogrammetric work station, ERDAS, Envi, ERMapper, ArcInfo, ArcView.
- Portable Seismic refraction unit, GPR, Drill Core Scanner, microscopes, Digital Flame Photometer, AAS, HPLC, Carbon analyzer, Scanning Mobility Particle Sizer, XRF.
- PV-11 Bed profiler, Water Level Follower, Nor tek Vectrino 3-D ADV, Acoustic Doppler Current Profiler (ADCP)
- Rotational viscometer, Profilograph, British pendulum tester, Radar based speed data collection device, Stone polishing machine, Fatigue testing of bituminous mix, Video data recording and processing unit, Thin film oven tester, Asphalt - ignition fur nace, GPS enabled instrumented vehicle.

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COMPUTER SCIENCE & ENGINEERING

The department offers academic programmes leading to B.Tech., M. Tech., M. Tech. dual degree (B.Tech. and M.Tech) and Ph.D in Computer Science and Engineering. These programmes are flexible and allow the students to choose courses from a number of elective courses offered by the department that cover a wide range of topics in Computer Science & Engineering.

RESEARCH ACTIVITIES

The department is actively involved in research in various fields of Computer Science. The domain of research ranges from abstract theory to problems of immediate interest to the industry. The areas in which research is being pursued
in the department is broadly classified into the following areas.

Algorithms: Parallel and Distributed Algorithms, Graphs and Combinatorics, Computational Geometry, Randomized Algorithms, Computational Number Theory, Computational Biology, Bioinformatics, Algorithms for Biometric Based Identification, Algorithms for streaming data.

Artificial Intelligence: Natural language processing, Machine Translation, Computer Vision, Cognition and Computation, Machine Learning, Pattern Recognition and Text Processing.

Computer Architecture Operating Systems and Hardware Design : Computer Architecture, General Purpose Operating Systems, Embedded systems Parallel and Distributed Computation, VLSI Design and Testing, Embedded Computing Design and Security.

Information System and Networks : Database Systems, Mobile Computing, Transaction Management and Processing, Distributed Systems, Workflow Systems, Software Fault Tolerance, and Hyper media, Protocols, Network performance and analysis, IPv6, Internet Technologies, Wireless and Mobile Networks, Low-cost Networking, Sensor Networks.

Software Engineering Compilers, Programming Languages: Metrics and Models for Software Architecture, Quantitative approaches to project-and process management, Design Methodologies, Formal Specification,

Programming Environments, Translators for Declarative and Functional Languages, Automatic Generation of Compilers, Compilers for Non conventional Architectures, Parallel Processing and Applications grid Computing, Code optimization.

Theoretical Computer Science: Complexity Theory, Logic in Computer Science, Functional Programming, Algorithmic information theory, Computational number theory, Cryptography, Computable real and complex analysis.

Computer Security: Network and OS Security, Cryptography, Biometrics

FACULTY

Sanjeev K Aggarwal, Ph.D. (IIT/K): Compiler Design, Compilers for Advanced Computer Architectures, Parallelizing Compilers, Tools for Compiler Generation, Semantics of Programming Languages, Grid Computing.

Manindra Agrawal, Ph.D. (IIT/K): Computational Complexity Theory, Randomized Algorithms, Cryptography, Computational Number Theory

Somenath Biswas, Ph.D. (IIT/K): Computational Complexity Theory, Logic, Randomized Algorithms, Computational Biology

Surendra Baswana, Ph.D. (IIT Delhi): Graph algorithms, Dynamic algorithms and Randomized algorithms.

M Chaudhuri, Ph.D. (Cornell): Computer Architecture

Sanjay G Dhande, Ph.D. (IIT/K): Computer Graphics, Computer Animation, Computer Aided Design, Robotics and Kinematics of Mechanisms

Sumit Ganguly, Ph.D. (UT Austin): Databases.

R K Ghosh, Ph.D. (IIT/Kh): Mobile Computing, Adhoc and Cellular Mobile Networks, Parallel and Distributed Computing, Web Services, Mobile

Commerce

Arnab Bhattacharya, Ph.D. (Uni. of California): Database, Data Mixing, Sensor Networks, Bioinformatics.

Phalguni Gupta, Ph.D. (IIT/Kh): Sequential and Parallel Algorithms,

Parallelization of Sequential Programs, Image Processing, Biometrics.

Ajai Jain, Ph.D. (McGill): VLSI Testing, Fault Tolerance, Computer Architecture, Parallel Processing, Operating Systems, Machine Translation.

Piyush P Kurur, Ph.D. (IMSc Chennai): Complexity Theory,computational Algebra,Quantum Computing.

Harish Karnick, Ph.D. (IIT/K): Machine learning, Cognitive Science,

Programming languages.

Shashank Mehta, Ph.D. (Nebraska): Computational Geometry, Graph Algorithms, VLSI Testing.

Rajat Moona, Ph.D. (IISc B'lore): Computer Architecture, Embedded Computing Hardware, Operating System, VLSI Design and CAD for VLSI.

Amitabh Mukherjee, Ph.D. (Rochester): Visual Surveillance, Natural Language Processing, Machine Learning, Cognitive Science.

T V Prabbakar, Ph.D. (IIT/K): Software Architecture, Knowledge Engineering, Internet Technologies

Dheeraj Sanghi, Ph.D. (Univ of Maryland): Computer Networks, Protocols at MAC/Network/ Transport layers, Ipv6, Wireless Networks, Internet Applications, Multimedia Applications

Sanjeev Saxena, Ph.D. (IIT/D): Parallel Processing, Algorithms and Data Structures, Heuristics, Computational Geometry, Graph Theory, VLSI and Architectures

Anil Seth, Ph.D. (TIFR/Mumbai): Logic in Computer Science

Krithika Venkatavamain, Ph.D. (CMU) : Pattern vecognition, machine learning, Biometrics, Video surveillance.

Satyadev Nand Kumar, Ph.D. (Iowa State) : Algorithmic Information Theory, Computability Real and Complex Analysis.

Amey Karkare Ph.D. (IIT Bombay) : Compilers, Program analysis and ophmization, Functional programming.

Subhajit Roy Ph.D. (IISc Bangalore) : Compilers, Program analysis and optimization.

Raghunath Tewari Ph. D. (Univ. of Nebraska) : Computational Complexity, Graph theory.

PROGRAMME

The department has a highly regarded undergraduate program. The course curriculum for the undergraduate program gives the flexibility to students to prepare for advanced specializations. The course structure provides a mix of compulsory and elective courses.

Admission to the B. Tech programs of all departments of IITs and some other Institutes is made once a year through a Joint Entrance Examination (JEE). The minimum academic qualification for appearing in the JEE is at least 60% aggregate marks from (10+2) school system or its equivalent with Chemistry, Mathematics, and Physics. The admissions are offered on the basis of a candidate's All India Rank in JEE. More information about admission into B. Tech programme is available from the institute's JEE office.

The M. Tech programme is oriented towards research and advanced training in Computer Science. It is designed for students who have a B. Tech./B.E. in computer science or equivalent degrees. The student may choose six or more

electives depending on his/her interests. Thesis work forms a major component of the programmer and begins after the second semester. Admission to the M. Tech. programme is open to candidates holding a B. Tech./B.E in any discipline or Masters degree in science, and have qualified GATE. GATE with CS stream is strongly preferred. The applicants with GATE in EE, EC and MATHS streams are also considered provided they have adequate CS background. Sponsored/Q.I.P. candidates need not qualify GATE, but must posses a good CS background.

The Ph. D. programme is designed for students with strong motivation for doing research in computer science. Admission is to Ph. D. open to candidates holding M. Tech./M.E. degree or equivalent. Outstanding candidates with strong CS background and having B. Tech/ B.E. or equivalent degree in any discipline and M.Sc in Maths, Statistics, Physics are also admitted to PhD. Normally a student with an M. Tech degree in CS has to complete four courses but a student with only B.Tech/BE/MSc must complete ten courses as a part of his/her PhD Programme. The students choose these course depending on their interest and on suggestion of the supervisor. Each student must also pass a comprehensive examination which tests the breadth of his/her knowledge as well as the ablility to do research.

All Ph. D. Students are provided with individual laptops, own office spaces and a shared telephone when they join. They also get office support for photocopying, laser printing, mailing, stationery, etc. Ph. D. students also get generous travel support to attend conferences inside the country and abroad. Ph. D. students reserve enhanced assistantships depending on his/her performance. A number of industry supported fellowships are also available to Ph.D. students.

LABORATORY

The department has its own well-equipped laboratory apart from state of the art Computer Centre which is a central facility. All systems are on fast Ethernet. This network is a part of the Institute-wide network with Internet connectivity. IIT Kanpur has one of the largest campus-wide networks in the educational sector in the nation. The Institute has 166 bps connectivity to the Internet. All students get e-mail, browsing and other internet facilities.

LIBRARY

The department library supplements the Central library by procuring proceedings of select conferences and some journals. The department publication cell is also run by the library.

ELECTRICAL ENGINEERING

The Department of Electrical Engineering offers M.Tech. and Ph.D. programmes in almost all the subdisciplines of Electrical Engineering. The areas include: Digital Communication Systems; Information and Coding Theory; Telecom Networks; Mobile and Wireless Communication Systems; Digital Systems and Microprocessors; Digital Signal and Image Processing; Computer Vision and Robotics; Signals and Systems Theory; Control Systems and Mathematical Control Theory; Fuzzy Logic, Neural Networks and their applications; Power Systems; Power Distribution Automation; High Voltage Engineering; HVDC Transmission; Power Electronics; Electric Drives; Active Power Filters and Static VAR Systems; Microelectronics and VLSI Systems; Semiconductor Device Modeling and Simulation; Solid State Devices; Organic Electronics; Transparent Semiconductors and Photovoltaics; Electronic Instrumentation and Virtual Instrumentation; Electromagnetics; RF Engineering and Microwaves; Antennas; Optoelectronics and Optical Communication; Photonic Networks and Systems.

PROGRAMMES

Specialization in the PG Programmes is possible in any of the following broad areas:

Microelectronics, VLSI and Display Technology

Power and Control

RF, Microwaves and Photonics

Signal Processing, Communications and Networks

In the application form, the applicants must specify their choice of the area(s) of specialization **from the above list only**. Eligibility for a specialization may depend on the candidate's choice of test paper in the GATE examination. For detailed information regarding eligibility and minimum qualifications, applicants should refer to the web-site of the Dean of Academic Affairs.

In the Master's programme, a student credits eight courses, some of which may be from a compulsory package for the area of specialization chosen, the rest being electives to be chosen in consultation with programme advisors. The programme culminates in a thesis that has to be defended in an oral examination before a thesis board.

In the Ph.D. programme, a student has to complete minimum of four courses. The most important part of the doctoral programme is the research work leading to a thesis. The research should represent an original investigation and is expected to make a significant contribution to the knowledge in the subject. The thesis is examined by a board of examiners appointed by the Institute and is also defended by the student in an oral examination before a thesis board.

PG students are encouraged to generate their own problems for research. They have freedom to choose their thesis supervisors from among the faculty members of the department and, if required, also from outside the department.

OPPORTUNITIES IN SPONSORED RESEARCH

Sponsored research and development activities are pursued in the department along with the Advanced Centre of Electronics Systems (ACES) - the R & D wing of the department. Work on currently relevant problems involving advanced technologies is carried out in many sponsored projects. Students are encouraged to choose problems that have relevance to these activities, thus enabling them to not only use some of the sophisticated facilities available, but also to work on state of art and practically meaningful topics.

In special cases it is possible for qualifying candidates to join projects as Research Associates and concurrently carry out both Research (which will usually be related to their thesis work) and course work. Such candidates are likely to get additional remuneration than the MHRD norms for PG scholarships.

FACULTY

Akhtar M J, Ph.D. (Magdeburg): Microwave imaging and nondestructive testing, Electromagnetic characterization, Electromagnetic scattering: direct and inverse problems, Microstrip Circuits, Computational electromagnetics.

Banerjee A, Ph.D. (Notre Dame): Cognitive radio; Error control coding; Wireless Communications; Optical Communications

Bansal R K, Ph.D. (Connecticut): Universal source coding algorithms and data compression; Ergodic theory and large deviation theory- applications; Robust detection; Sequential detection of a change in distribution.

Behera L, Ph.D. (IITD): Intelligent control; Soft computing; Quantum computing and Information; Applied nonlinear control.

Biswas A, Ph.D. (IITD): Electromagnetics; microwave and millimeter wave circuits and techniques; Optical guide structure and RFICs.

Chakraborti S, Ph.D (Newfoundland): Power system dynamics and stability, Power system state estimation; Synchrophasor applications in power systems; Power system reliability.

Chaturvedi A K, Ph.D. (IITK): Communication theory and systems; Mobile communications; Spread spectrum systems.

Das S P, Ph.D. (IITKGP): Power electronics; Electric drives; Electrical machines; Microprocessor and microcontroller systems.

Das Utpal, Ph.D. (Michigan): High speed photonic semiconductor devices and integrated optoelectronics.

Dutta Aloke, Ph.D. (Louisiana State): Semiconductor device modeling; IC fabrication technology; Analog/digital/mixed-signal VLSI circuits.

Ghosh B, Ph.D. (Texas): Devices simulation; Digital and analog circuits; VLSI

technology; Photo-voltaic systems; Spintronics.

Gupta N, Ph.D. (IISc): High voltage engineering; Dielectrics and electric insulation; Gaseous and plasma discharge process; Numerical techniques in electric and magnetic field computation.

Gupta S, Ph.D. (London): Digital Signal Processing; Image processing; Digital Video signal processing.

Harish A R, Ph.D. (IITK): Antennas; RF Engineering; Electromagnetics.

Hegde R M, Ph.D. (IITM): Multimedia information processing; Speech signal processing; Array Processing; Application of signal processing in wireless networks.

Iyer S S K, Ph.D. (Berkeley): Organic solar cells; Semiconductor devices.

Jagannatham A K, Ph.D. (UCSD): Wireless communications; Digital video processing; MIMO, OFDM, and CDMA technologies; Wireless sensor networks.

Joshi A, Ph.D. (Toronto): Power electronics and drives; Electronic circuits; Digital systems; Microprocessor based systems.

Kalra P K, Ph.D. (Manitoba): Power systems; Expert systems applications; HVDC transmission; fuzzy logic and neural networks applications.

Kumar Pradeep K, Ph.D. (IITM): Quantum and non-linear optics; Quantum cryptography and computation; Fiber optics.

Mazhari B, Ph.D. (Illinois): Semiconductor device modeling and fabrication; VLSI design; Transducers and Sensors.

Mishra S K, Ph.D. (Florida): Multiphase DC/DC power conversion; Power management circuits; Modeling and control of power electronics systems.

Naik Naren, Ph.D. (IISc): Reconstruction and analysis approaches to tomographic problems; Numerical solutions for wave propagation, sub-surface imaging.

Potluri R P, Ph.D. (Kentucky): Control systems; Optimization in control; Engineering applications of optimization and control.

Qureshi S, Ph.D. (Berkeley): Thin film transistors; Device physics & modeling; VLSI design; Nuclear radiation detectors and electronics.

Sachidananda M, Ph.D. (IISc): Antennas, Microwave & RF circuits; Computational electromagnetics.

Sensarma P S, Ph.D. (IISc): Power electronic converters; Power quality; FACTS devices; Renewable energy delivery systems; Motor drives.

Sharma G, Ph.D. (USC): Signal processing; Communication Systems; Video signal processing; Medical image processing.

Singh S N, Ph.D. (IITK): Power system restructuring; FACTS technology; Optical power dispatch and security analysis; Power system dynamics, operation and

control; Power quality; Application of genetic algorithms and artificial neural networks in power systems; Wind Power.

Singh Y N, Ph.D. (IITD): Telecommunication networks; Optical communications, networks and switching systems; Wireless networks; Wireless sensor networks; eLearning systems development.

Sircar P, Ph.D. (Syracuse): Signal processing and systems; Communication theory; Computational methods.

Srivastava Kumar Vaibhav, Ph.D. (IITK): RF Engineering, Microwave, Electromagnetics

Srivastava S C, Ph.D. (IITD): Power systems; Energy management system; Stability and security analysis; Technical issues in electricity markets; Wide area monitoring and control; Distribution management systems.

Vasudevan K, Ph.D. (IITM): Communication systems; Signal processing for communications.

Venkatesh K S, Ph.D. (IITK): Signal/System theory, Image and video processing; Computer vision applications.

Verma N K, Ph.D. (IITD): Data mining, Intelligent fault diagnosis, Fuzzy systems, Bioinformatics; Machine learning; GMM; HMM; Clustering algorithms; Color segmentation; Video image sequence recognition.

COURSES

The Department offers a rich set of PG courses from the following:

Digital Circuit Design; Architecture of Advanced Microprocessors & Microcomputers; Analog/Digital VLSI Circuits; VLSI System Design; Measurements, Parameter Extraction and VLSI tools in Microelectronics; Solid State devices I; Semiconductor Device Modeling; Fluctuation Phenomena in Microelectronics; Integrated Circuit Technology; High Frequency Semiconductor Devices and Circuits; Organic Electronics.

Economic Operation & Control of Power Systems; HVDC and Flexible AC Transmission Systems; Advanced Power System Stability; Simulation of Modern Power Systems; Electric Power System Operation and Management under Restructured Environment; Electrical Insulation in Power Apparatus and Systems.

Basics of Modern Control Systems; Control System Design; Optimal Control; Digital Control; Robust Control Systems; Nonlinear Systems; Linear Stochastic Dynamical Systems.

Basics of Power Electronics Converters; Power Electronics Applications in Power Systems; Control Techniques in Power Electronics; Modeling and Simulation of

Power Electronic Systems; Fundamentals of Electric Drives; Advanced Electric Drives; Special Topics in Power Electronics.

Advanced Engineering Electromagnetics; Computational Electromagnetics; The Finite Element Method for Electric and Magnetic Fields; Antenna Analysis & Synthesis; Smart Antennas for Mobile Communication; Radio Wave Propagation; Microwave Measurements and Design; Microwave Circuits; Monolithic Microwave Integrated Circuits; Fiber Optics Systems I and II; Optical Communication; Photonic Networks and Switching.

Mathematical Structures of Signals and Systems; Mathematical Methods in Signal Processing; Statistical Signal Processing; Advanced Topics in Digital Filtering; Image Processing; Architecture and Applications of Digital Signal Processors; Wavelet Transforms for Signal and Image Processing; Introduction to Signal
Analysis; Digital Video Signal Processing; Computer Vision and Document Processing; Speech Signal Processing.

Representation & Analysis of Random Signals; Communication Theory; Detection and Estimation Theory; Information and Coding Theory; Satellite Communications; Topics in Stochastic Processes; Topics in Cryptography and Coding; Digital Switching; Wireless Communications; Queuing Systems; Digital Communication Networks; Application of CDMA to Cellular Communication.

Knowledge based Man-Machine Systems; Computational Bio-Instrumentation & Neural Networks; Fuzzy Set, Logic & Systems and Applications; Neural Systems and Networks; Virtual Instrumentation.

FACILITIES

The department has excellent research laboratories and support facilities in several areas.

Micro fabrication lab with basic semiconductor processing capability for silicon as well as organic material based devices (OLED, organic solar cells, OTFT, etc.); Solar cell characterization lab; photo mask making facility; Semiconductor device lab with capability to synthesize organic materials for organic LEDs and solar cells; Integrated circuits simulation and VLSI design laboratory with all the modern EDA tools, (e.g. CADENCE, SYNOPSYS, Mentor Graphics, MAGMA, COWARE, XILINX based gate array design & programming tools, etc.) and adequate hardware in the form of servers and good number of workstations for research and course work.

Three teaching/training labs have been developed to train students in areas related to organic electronics. These are the organic electronics processing lab, the organic electronics characterization lab and the organic electronics simulation lab.

Robotics lab equipped with 7 DoF manipulators, mobile robots, and visual systems for autonomous navigation of mobile robots, multi-robot formation and control.

Modern high voltage laboratory with AC, DC and impulse test facilities, partial

discharge monitoring, electrometer for polarization and loss factor tests, outdoor insulation test bay; Power electronics and solid state drives laboratory; Power systems simulation laboratory; NAMPET laboratory with complete fabrication and testing facilities for research in power electronics including frequency response analyzer, solar photovoltaic panels.

RF and Microwaves lab having network analyzer up to 50 GHz, spectrum analyzers, signal generators, power meters, noise figure meter, shielded anechoic chamber for antenna and RCS measurements, microwave imaging and material testing facility over a wide frequency range, dielectric probe kit, rectangular waveguide and coax calibration kits for various frequency bands.

Fiber optics laboratory equipped with optical spectrum analyzer and interface development facility for fiber optic links, clean room for semiconductor optoelectronic device fabrication and photonic measurement laboratory.

Networks laboratory with scalable and configurable test-bed for simulating complex network topologies, 802.11 WiFi links, software radio, multiservice network and QoS, etc.

Speech processing and multi-modal information processing lab equipped with the state of art multi-channel audio visual data acquisition test bed along with dedicated data and voice server connected on E1 digital telephony line enabling research on multi-channel and multi-modal information processing and content delivery; Digital signal processing laboratory with multiple PCs and DSP hardware based on Texas Instrument's DSPs; Computer vision lab equipped with chroma keying, controlled illumination, structured light sources, various kinds of camera and associated computational resources.

Electronic equipment maintenance and calibration facility; Multilayer (up to six layers) PTH printed circuits fabrication facility, including CAD facility for printed circuits design and verification; Department library with a good collection of specialized books, research reports and data catalogues; An extensive campus wide LAN with a high speed internet connectivity.

The wide-ranging research facilities and various sponsored research activities ensure that the students are thoroughly exposed to modern trends in Electrical Engineering. The informal atmosphere and free discussions between the students and the teachers are a source of inspiration to both the sides and maintain the standards of academic progress.

INDUSTRIAL AND MANAGEMENT ENGINEERING

The Department of Industrial and Management Engineering at IIT Kanpur teaches management concepts, techniques and skills relevant to students with diverse backgrounds who may wish to subsequently pursue a career in academics or in different managerial positions. The Department covers all areas of management that include Services Management; Management of Technology, Innovation and Entrepreneurship; Marketing Management; Manufacturing; Operations and Supply Chain; Quantitative Methods & Decision Making; Organizational Behaviour; Human Resource Management; Business Economics; Infrastructure and Public Systems; Corporate Governance; Finance and Control Systems; Financial Markets and Models, Enterprise Information and Knowledge Systems; Leadership; Ethics; Strategic Management; Business Policy, etc.

The Department offers Ph.D., M.Tech. and MBA degrees. A Bachelor's degree in any branch of engineering is the minimum requirement for admission to either MBA or M.Tech. programs. While, Master's degree in Management, or equivalent/ related qualifications, or Masters in Science, Technology, Engineering is required for admissions to the Ph.D programme.

The process of admission to these PG programmes may include a written aptitude test and a personal interview. Moreover an appropriate score in a public examination like GATE, CAT, NET, and other examinations as stipulated will be preferred.

Ph.D Programme

Students in the Ph.D. program are required to take at least eight to ten courses. A student may be required to take additional courses depending on his/her background and research interest. At the end of the course work, the student appears for the Ph.D. comprehensive examination, which includes both written and oral parts. On successfully completing the comprehensive examination, he/ she will continue research towards completion of the doctoral thesis. Students are encouraged to carry out discussions and consultations with the department faculty members about the field of research and should identify their thesis supervisor by the time of their comprehensive examination.

M.Tech. Programme

M.Tech. students can select specialization, in Management Science and/or Information Systems or an appropriate domain in functional Business Streams. The management stream aims at developing quantitative modeling and analysis skills for solving management problems, as well as skills for use of Information Technology in Management. Business stream permits an in-depth study to understand and analyze one or more of the management disciplines such as Organization, Marketing, Finance, Strategy, Technology Management, Policy and Regulatory Systems. Students in the M.Tech Programme take a minimum of four courses per semester during the first two semesters. The last two semesters are dedicated mostly to a thesis.

MBA Programme

Students in the MBA program are required to take a set of compulsory courses. Along with that they are also supposed to do the requisite number of specialization and elective courses. In the III and IV semesters the students are supposed to do two special studies courses with an aim to give them an in-depth understanding in areas of management which is in line with the student¢s interests.

Facilities

The Department has state-of-the art facilities for computational business modelling and simulation, design prototyping, SAP, digital innovation & investigating and all spheres of business systems in an integrated smart building. The various laboratories provide, computational support both for academic teaching and for research. Different academic databases are also available for research as well as teaching purposes. Furthermore the department also has the state of the art class rooms, lecture rooms, video-conferencing facilities, etc.

FACULTY

Veena Bansal, Ph.D. (IIT Kanpur): Information Technology and Management, ERP systems, E-Commerce.

Jayanta Chatterjee, Ph.D. (IIT Delhi): Marketing, Entrepreneurship, Services Management, Management of Technology & Innovation, Management of Design and Media.

Peeyush Mehta, Fellow in Management (IIM Ahmedabad): Supply Chain and Operations Management, Quantitative Modelling.

Shashi Shekhar Mishra, Fellow in Management (IIM Lucknow): Marketing Strategy, New Product Development, Marketing Research.

Subhas Chandra Misra, Ph.D. (Carleton University): Information Systems, Analytics and Business Process Management.

A. K. Mittal, Ph.D. (Case Western University): Operations Research, Operations Management, TQM, IPR & Services Management.

B. V. Phani, Fellow in Management (IIM Calcutta): Entrepreneurship, Accounting & Finance, Financial Governance.

Deepu Philip, Ph.D. (MSU Bozeman): Operations Management, Decision Sciences, Business Games, System Simulation, Digital Innovation.

R. N. Sengupta, Fellow in Management (IIM Calcutta): Statistical Analysis, Risk Management, Quantitative Decision Techniques.

Kripa Shanker, Ph.D. (Cornell University): Production/Operations Management, FMS/CIMS; Quantitative Decision Modelling.

N. K. Sharma, Ph.D. (Delhi University): Consumer Behaviour, Marketing Management, Marketing Research.

R. R. K. Sharma, Fellow in Management (IIM Ahmedabad): Quantitative Methods for Management, Manufacturing Policy, Strategic Management.

Anoop Singh, Ph.D. (IGIDR, Mumbai): Infrastructure Policy & Regulations, Energy & Environment, Managerial Economics, Project Financing, Energy Economics.

Arun P. Sinha, Fellow in Management (IIM Ahmedabad): Strategic Management, Business Policy, International Business, Services Management.

S. V. Vanamalla, Ph.D. (IISc Bangalore): Applied Operations Research,Optimization and Game Theory.

Rahul Varman, Fellow in Management (IIM Ahmedabad): Personnel Management and Industrial Relations, Organizational Theory and Social, Political, Legal issues in Business.

Courses

Accounting for Management; Economic Analysis for Management; Financial Management; Measuring and Driving Corporate Programme; Financial Intermediates; Financial Institutions and Regulators; Financial Engineering; Management of Risk in Financial Systems; Commercial Banking; Risk Modeling & Risk Management; Entrepreneurial Finance; Security Analysis, Derivatives and Portfolio Management; Project Financing and Management; Energy & Carbon Markets: Economic Policy & Regulations; Organization Structure and Design: Managing Change in Organization; Organizing for Services; Human Resources Management; Social Political and Legal Environment of Business; Managerial Communication; Knowledge Strategies & Knowledge Systems; Manufacturing Strategy; Strategic Management; Corporate Innovation & Entrepreneurship, Infrastructure Regulation, Policy & Finance; Management of Technology; Managing High Technology; International Business Management; Marketing Management; Strategic Marketing: Contemporary Issues; Design of e-Marketing; Marketing Research; Consumer Behaviour; Marketing of Services; Advertising and Marketing Strategy; Business to Business Marketing; Computing for Management; Database Management; Simulation of Business Systems; Management Information Systems; e-Commerce; Software Quality Management; Enterprise Information Integration; Software Project Management; Enterprise & Integration with IT; Business Process Management; Quantitative Methods for Decisio n Making; Production and Operations Management, Total Quality Management; Supply Chain Management; Manufacturing Planning and Control; Project Management; Managing Service
Operations; Advanced Manufacturing Systems; Probability and Statistics; Introduction to Computing; Applied Design of Experiments; Operations Research for Management; Computer Aided Decision Systems; Network Flows; Production Systems; Operations Management; Algorithms; Combinatorial Optimization; Analysis and Control of Quality; Quality Assurance and Taguchi Methods; Stochastic Processes and their Applications; Software Engineering and Project Management; Computer Integrated Manufacturing Systems; Flexible Manufacturing Systems; Intelligent Manufacturing Systems; Advanced Statistical Methods for Business Analysis; Introduction to Game Theory; etc.

MATERIALS SCIENCE & ENGINEERING

The Department of Materials Science and Engineering was set-up at IIT Kanpur in 1960. With time, the department grew noticeably and established new areas of research and teaching in Materials Science, while retaining its strength in traditional areas in Metallurgical Engineering. In 1993, the name of the department was changed to the Department of Materials & Metallurgical Engineering (MME) to reflect department's new profile. In 2010, once again the depturement changed, its name to "Materials Science and Engineering". Since its inception, MSE Department has been very active in teaching, research, development and consultancy activities. Present research profile of the department covers a wide spectrum of materials science and metallurgy from extraction of materials to processing and development of a variety of materials and devices. The field of engineering materials has expanded enormously in past few decades and, in addition to traditional metal and alloys, the department is actively pursing computational and experimental research in the areas of modern ceramics and composites, biomaterials, intermetallics and electronic, magnetic and optical materials and devices.

This department has pioneered teaching and research and developed state-of-the art materials and processes for specialized applications. We are a leading department in the country in materials education and research.

The department offers both undergraduate (B.Tech.) and postgraduate (M.Tech. and Ph.D.) programmes. The undergraduate programme is aimed at providing basic understanding of the principles underlying metal extraction and refining, materials characterization, structure-property relationships, and processing of metals and alloys, ceramics and electronic materials. Students also undertake studies of their special interest through various departmental elective courses and project work. In addition to the fundamentals of materials engineering, the postgraduate programme is designed to provide an in-depth knowledge in the area of specialization of a student through Interdisciplinary course work and research. Currently, student population in the department consists of nearly 270 B.Tech., 40 M.Tech. and 55 Ph.D. students.

FACULTY

K. Balani, Ph.D. (Florida International University): Biomaterials; Nanomechanics; Tribology; Ab-initio molecular modeling; Carbon nanotube (CNT) reinforced composites.

B. Basu, **Ph.D. (Katholieke Universiteit, Leuven, Belgium)**: Structural ceramics; Biomaterials.

B. Deo, **Ph.D. (Burdwan)**: Automation; Process control and process optimization in iron and steelmaking; Artificial intelligence methods for metallurgical processes.

K. Biswas, Ph.D. (IISc Bangalore): Solidification; Electron microscopy; Phase transformations; Nanomaterials.

R. K. Dube, **Ph.D. (Wales)**: Mechanical processing; Powder metallurgical processing; Composite materials.

A. Garg, **Ph.D. (Cambridge)**: Thin films growth and characterization of materials; Ferroic materials; Organic solar cells.

D. Gupta, **Ph.D. (Berkeley)**: Organic Electronics (OLEDs, Displays, TFTs), Oxide and Transparent Semiconductors, Defects in Semiconductors, Modeling and Simulation of Materials and Processes..

Gouthama, **Ph.D. (IISc Bangalore)**: Electron microscopy; Surfaces and interfaces; Processing; Structure property correlations in materials.

M. Katiyar, **Ph.D. (Urbana-Champaign)**: Opto-electronic materials processing, characterization and applications.

Tanmoy Maiti, Ph.D. (Penn State) : Materials science, Electronic materials, devices.

D. Mazumdar, Ph.D. (McGill): Steelmaking; Process modeling; Heat, mass and momentum Transfer in materials processing.

S. P. Mehrotra, **Ph.D. (IIT Kanpur)**: Mathematical modeling and simulation of metallurgical and mineral processes; Process design and development; Extractive metallurgy.

K. Mondal, Ph.D. (IIT Kharagpur): Phase transformations; Corrosion; Oxidation; Non-equilibrium processing; Metallic glasses; Nanocrystalline alloys.

R. Shekhar, Ph.D. (Berkeley): Electrochemical processing and reactor design; Molten salt electrolysis; Aluminium electrolysis; Electrodeposition; Electrochemical remediation of contaminated soil.

Shobit Omar, Ph. D. (University of Florida) : Ceramic Processing solid state lonics, solid oxide Fuel cells, Electro used cells. Impedance spectroscopy, sensors.

Shashank Shekhar, Ph. D. (Pudue) : Grain boundaries and Triple Junction, Seveee plastic Deformation, Machining and Manufacturing, Structual Nanomaterials.

Sarang Ingole, Ph. D. (Purdue) : Semiconductors, Nano Materials, Renewable energy.

S. Sangal, Ph.D. (Manitoba): Mechanical properties of materials; Computational materials science.

R. C. Sharma, Ph.D. (McMaster): Phase equilibria; Thermodynamics and kinetics of phase transformations; Heat treatment of metals.

Anandh Subramaniam, Ph.D. (IISc Bangalore): Physical materials science; Nanomaterials; Quasicrystals; Amorphous materials; Metastable materials; Epitaxial systems; Defects & interfaces in materials; Symmetry; Crystallography; Transmission electron microscopy; Finite element modeling.

A. Upadhyaya, Ph.D. (Penn State): Materials processing; Liquid phase sintering; Structure-property correlationship; Alloy design; Metal matrix composites; Nano-crystalline alloys.

V. Verma, Ph. D. (Penn. State) : Protein patterning, hybrid synthetic devises, cellulosic materials, Microfabrication.

ADMISSION INTO THE POSTGRADUATE PROGRAMMES

The minimum qualification for admission to the M.Tech. programme is a Bachelor's degree in Metallurgy, Ceramic Engineering, Chemical Engineering, Mechanical Engineering or a M.Sc. degree in Chemistry, Materials Science or Physics with Mathematics at the B.Sc. level. Students with M.Tech. degree in Metallurgical Engineering / Materials & Metallurgical Engineering / Materials Science are eligible for admission to the Ph.D. programme.

A number of postgraduate courses are available for the Ph.D. and M.Tech. students covering various aspects of materials & metallurgical engineering. Students enrolled in the M.Tech. programme have to credit a minimum of 6 courses, while those for Ph.D. have to credit at least four courses. The Department also admits exceptionally bright students directly into the Ph.D. programme after B.Tech. and M.Sc. Such Ph.D. students are required to credit a minimum of 10 courses. The M.Tech. students are also allowed to take one undergraduate course. The courses are selected by the students in consultation with their respective thesis supervisors.

POST GRADUATE COURSES

Advanced thermodynamics, Display materials and technologies, Electrochemistry and corrosion, Non-equilibrium processing of materials, Surface phenomena in

chemistry and metallurgy, Computing applications in metallurgy, Computer application in mineral engineering, Soft computing methods in engineering problem solving, Hydrometallurgy, Electrochemical technology in materials processing, Physico-chemical behaviour of materials at high temperature, Advanced mineral engineering, Materials separation and purification, Advanced chemical metallurgy, Heat and mass transfer, Injection metallurgy, Application of transport phenomena
in metal processing, Physical and mathematical modelling of steel making processes, Advances in iron and steel making, Advances in alloy steel making, Analysis of particulate systems, Mineral and metallurgical wastes recycle and resource recovery, Mathematical modelling of metallurgical and mineral processes, Process control in metallurgy and mineral processing, Process metallurgy, Physical metallurgy, Solid state transformations, Order-disorder transformations, Quantitative microscopy, Theory of alloys, Physical metallurgy of steels, Interfacial phenomena in metals and alloys, X-ray crystallography-I & II, Electron microscopy and electron diffraction, Diffusion in solids, Deformation phenomena, Fundamentals of stereology and applications to microstructural analysis, X-ray crystallography II, Modern trends in metal forming processes, Texture in metals and alloys, Mathematical theory of dislocations, Engineering application of dislocation in materials, Process ceramics-i: crystal structure, phase equilibria and microstructure development, Process ceramics-ii: fabrication technology, Tribology of materials, Electrical and magnetic properties of ceramic materials, Science and technology
of magnetic materials, Selection and designing with engineering materials, Material for biomedical applications, Solidification processing, Analysis and application of solidification, Advanced structural ceramics, Sintering and sintered products, Design of sintered pro-ducts, Sintered tool materials, High temperature oxidation and corrosion, Grain boundary engineering, Nuclear materials, Thin film: physics and applications, Semiconductor devices and their processing, Physical metallurgy, processing and applications of refractory metals and alloys, Nanomaterials: processing and properties, Multifunctional oxides: thin films and devices, surface phenomera and characrization, Solar energy technologies and materials, Materials Science technologies for application in life sciences; self-assembly and self-organization.

FACILITIES

Conventional laboratory facilities for teaching and research in all the major areas exist in the department and in the Advanced Centre for Materials Science. These include, induction and arc melting units, material fabrication facilities, modern metallographic facilities, i.e., optical microscopes, transmission and scanning electron microscope and automatic image analyzer, atomic force

microscope,
computational facilities, X-ray diffractometers, mechanical testing units such as

Instron and MTS, differential thermal analysis and thermo-gravimetric equipments, ceramic fabrication facilities, hot press, mechanical attritor & cold iso-static press, corrosion and oxidation testing facilities, fretting wear tester, laser surface profilometer, microwave sintering, cryogenic wear tester, processing and special testing facilities for ceramics and composites, physical vapour and chemical thin film deposition systems, temperature dependent electrical, ferroelectric, optical and magnetic measurement systems and device fabrication facilities with clean room access, XRD units.

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MECHANICAL ENGINEERING

The Department of Mechanical Engineering is engaged in UG and PG teaching, research, developmental work and industrial consultancy. The PG program for M.Tech. and Ph.D. degree has four broad streams: Solid Mechanics and Design; Fluid Mechanics and Thermal Sciences; Manufacturing Science; and Robotics and Mechatronics (Ph.D only).

In the M.Tech. program, the emphasis is on the development of a broad background in a particular stream followed by a deeper study of a problem in the stream. Every student is required to take a minimum of 8 courses of which 3 or 4 (depending on the stream) are compulsory to be taken mostly in the first semester. In the second semester, the student takes mostly the elective courses and the remaining compulsory courses, if any. The elective courses are chosen in consultation with
the thesis supervisor to match the student's interest as well as his thesis requirements. The third and fourth semesters are dedicated for the thesis work.

The minimum qualification for admission to the M.Tech. program is a Bachelor's degree in Mechanical Engineering*. Candidates with a Bachelor's degree in Production Engineering* are eligible for admission to the Manufacturing Science stream. At the time of admission, the candidates are ranked according to the merit depending on their previous educational background, GATE score and their performance in the interview/written test. The stream is allotted according to the rank and the preference of the candidate.

The Ph.D. program is designed to equip the student with general proficiency in a stream through the course work. The student then proceeds to do fundamental creative investigation of a topic in the stream. A Ph.D., student is required to take a minimum of 4 courses. After completion of the course work and before proceeding to the thesis work, he/she is required to pass the comprehensive examination. This examination is in both the written and the oral form and is designed to judge the overall comprehension of the student in his major field (the field of the thesis topic) and two minor fields (fields related to the thesis topics).

The minimum qualification for admission to the Ph.D. program is a Master's degree in Mechanical Engineering*. In exceptional cases, candidates with B.Tech. (Mechanical)*, Master's degree in other branches of engineering* and M.Sc*. will be considered. Interview/written test will be conducted by the department and the admissions would be made as per the procedure detailed at http://www.iitk.ac.in/mech/.

*with minimum percentage/CPI specified by the Institute

FACULTY

Agarwal A K, Ph.D. (IIT Delhi): IC Engines, Alternate Fuels, Emissions, Laser Diagnostic Techniques, Micro-sensor Development, Lubricating Oil Tribology, Nano- particulates.

Basu S, Ph.D. (IISc Bangalore): Computational Micromechanics, Fracture Mechanics, Modeling of Materials across Length Scales, Finite Deformation Theories and Non-linear FEM.

Bhattacharya B, Ph.D. (IISc Bangalore): Smart Structures, Active and Passive Vibration Control, Flexible Manipulators and Smart Compliant Joints, Active Shape Control and Adaptive Structures.

Bhattacharya S, Ph.D. (University of Missouri, Columbia): Bio MEMS, Lab on Chip, Nano Technology, Microsystems Fabrication, MicroFluidics, Lithography processes, Nanoenergetics

Biswas G, Ph.D. (IIT/Kh): Computational Fluid Mechanics and Heat Transfer, Turbulence.

Choudhury S, K, Ph.D. (PLPF Moscow): Vibration Control of Machine Tools, Adaptive Control System, Metal Cutting, Hydraulic Control, Unconventional Machining.

Dasgupta Bhaskar, Ph.D. (IISc Bangalore): Robotics, CAD, Mechanisms, Machine Dynamics, Engineering Computation.

Das M, K, Ph.D. (Penn State): Electrochemical Energy Conversion, Chemically Reacting Systems.

Das S, L, Ph.D. (Cornell): Mechanics of Biological Membranes, Continuum Mechanics, Granular Mechanics.

Deb Kalyanmoy, Ph.D. (Univ. of Alabama): Optimization, Optimal Design, Computer Aided Design, Artificial Intelligence, Genetic Algorithms, Soft Computing.

Dhande S, G, Ph.D. (IIT/K): CAD/CAM, Rapid Prototyping and Rapid Tooling, Geometric Modelli.ng, Computer Graphics Simulation, Mechanisms.

Dixit P, M, Ph.D. (Minnesota): Metal Forming, Ductile Fracture, Elasto-plastic Impact/ Contact Problems, Finite Element Method.

Dutta Ashish, Ph.D. (Akita, Japan): Robotics, Intelligent Control systems, Microsensors and actuators, Bio-robotics.

Ghoshdastidar P, S, Ph.D. (South Carolina): Computational Heat Transfer, Rotary Kiln modelling, Non-Newtonian Flow and Heat Transfer, Simulation of Boiling Heat Transfer. Modelling of Microscale and nanofluids heat transfer, food drying and chilling.

Gupta A, Ph.D. (Berkeley): Dynamics of Defects in Solids, Waves in Solids, Mechanics of Thin films.

Gupta S, S, Ph.D. (Virginia Tech.): Linear/Nonlinear Structural Mechanics, Mechanics of Nanomaterials and their Characterization using Molecular Simulations

Hatwal H, Ph.D. (IIT/K): Vibrations, Dynamics of Ground Vehicles, Robotics.

Jain V K, Ph.D. (Roorkee): Advanced Machining Processes, Accelerated Cutting, CAM Machining of Advanced Engineering Materials.

Kalra M S, Sc D (MIT): Nonlinear Dynamics and Control; Kinetic Simulation of Fusion Plasmas; Boundary Element Techniques

Kar K.K, Ph.D. (IIT/Kh): Polymer, Polymer Blends, Alloys, & Composites, Polymer Processing & Rheology.

Khandekar S, Ph.D. (Univ. Stuttgart, Germany): Thermal Management, Passive heat Transfer, Heat Pipes, Energy systems.

Kishore N. N, Ph.D. (IIT/K): Composite Materials, FEM, Non-Destructive Testing.

Mahesh Sivasambu, Ph.D. (Cornell): Solid Mechanics, Composite Materials, Manufacturing Processes.

Munshi P, Ph.D. (IIT/K): Computer Tomography, Two-phase Flow, Non-destructive Testing.

Muralidhar K, Ph.D. (Delaware): Optical Techniques, Flow control, hierarchical transport phenomena, biological flows.

Panigrahi P.K, (LSU): Laser Based Instrumentation, Flow Control, CAD of Thermal Systems, Turbulence, Micro-fluidics and Heat Transfer.

Ramkumar J, Ph.D. (IIT/M): Micro/Nano-Fabrication & finishing, Nano Composites & Tribology.

Reddy N.Venkata, Ph.D. (IIT/K): Rapid Manufacturing, CAD/CAM, Metal Forming, Micro and Flexible Manufacturing Processes, Product and Process Design.

Saha A.K, Ph.D. (IIT/K): Turbulance, Chaos & Bifurcation, Vortex Dynamics, Hotwire Anemometry, Gas Hydrates, Experimental Fluid Dynamics and Heat Transfer, Computational Fluid Dynamics and Heat Transfer.

Sarkar S (IIT/M): Turbomachinery, Fluid Mechanics, Computational Fluid Flows, Turbulence, LES/DNS and Heat Transfer.

Saxena Anupam Ph.D. (U Penn): Compliant Mechanisms, Topology design, CAD, Robotics, MEMs, Optimization, Large Deformation Systems.

Sreenivasan B, Ph.D. (Cambridge): Fluid Mechanics, Magneto hydrodynamics, planetary dynamos.

Sharma B.L, Ph.D. (Cornell): Continuum Mechanics and Thermodynamics, Lattice Dynamics, Dislocations and Solid-Solid Phase transformation.

Sharma Ishan, Ph.D. (Cornell): Fluid/Solid mechanics; Contact mechanics; Granular media; Planetary/Space science; Waves and instabilities in continua; Fluid-structure interaction.

Tiwari Nachiketa, Ph.D. (Virginia Tech): Acoustics and Noise Control, Solid Mechanics, Composite Structures, Vibrations, Product Design, Automotive Systems, MEMS.

Venkitanarayanan P, Ph.D. (U Rhode Island): Experimental Solid Mechanics, Dynamic Fracture Mechanics, Functionally graded Composites.

Vyas Nalinaksh S, Ph.D. (IIT/D): Micro-Electro-Mechanical System (MEMS), Vibrations and Control, Rotor Dynamics, Instrumentation, Condition Monitoring

Wahi P, Ph.D. (IISc Bangalore): Nonlinear Dynamics, Vibrations.

COURSES

The compulsory courses for M.Tech. Programs are as follows

Solid Mechanics and Design: Mathematics for Engineers, Introduction to Solid Mechanics, Applied Dynamics and Vibration

Fluid Mechanics and Thermal Sciences: Mathematics for Engineers, Viscous Flow Theory, Conduction and Radiation, Convective Heat and Mass Transfer

Manufacturing Science: Mathematics for Engineers, Metal Cutting, Non-traditional Machining Processes, Metal Forming

Elective courses for M.Tech. and Ph.D. students are listed at http://www.iitk.ac.in/mech/

FACILITIES

The Department maintains the following laboratories for instruction and research: Experimental Stress Analysis, Vibration and Dynamics, Material Testing, Automation and Control, Fluid Mechanics, Energy Conversion, Heat Transfer, Refrigeration and Air Conditioning and Manufacturing Science. There are many specialized research laboratories and facilities and their details can be seen on http://www.iitk.ac.in/mech/

DESIGN

(Interdisciplinary programme)

About Design Programme

Design Programme aspires to develop and provide innovative solutions towards the betterment of society. The methodology adopted to achieve this aim involves encouraging creative minds to think out-of-the-box and synthesize varied knowledge domains. Design Programme at IIT Kanpur has come to be known for its broad-minded philosophy and multidisciplinary approach. The environment encourages interactivity among students, faculty and industry. The curriculum lays emphasis on functional, as well as aesthetic aspects of design. User-centered design principles are practiced, to keep pace with the ever-changing need and desires of people. Backed by state-of-the-art infrastructure, students are given freedom and encouragement to explore virtually any creative field of their interest.

Product Design

Product Design Projects at Design Programme deal with a wide spectrum of issues pertaining to appliances, lifestyle products, packaging design and transportation design. Special emphasis is given in understanding the user's need and aspirations, resulting in sensitive and effective solutions. Several of the projects taken up at Design Programme address special needs, such as products for defense purposes, spastics or age specific users for instance children. Students experiment with materials ranging from foam, wood and metals to plastics and FRP. They have access to sophisticated manufacturing facilities available at the 4i laboratory of IIT Kanpur, such as CNC Turning and Milling Centers, Rapid Prototyping Machine and Water jet Cutting Machine

Visual Communication

Students at Design Programme undertake a variety of projects that come under the domain of Visual Communication addressing informational as well as entertainment needs. Print media has an important share, with academic. On-screen design initiatives cover software interface, interaction Design and Web design. Design Programme also undertakes projects to design corporate identity for companies. Motion Graphics is one of the strengths of Design Programme-student project include documentary films, promotional advertisements videos and animation projects. Students extensively use the Media Technology Centre of IIT Kanpur, which houses state of the art facilities for recording and editing.

Life at Design Programme

The family of students at Design Programme is composed of people from varied backgrounds having unique talents. This diversity is threaded together by mutual understanding and cooperation, which characterizes the way of life here. Creativity at Design Programme is not limited to academic projects. Students regularly take up design work with other departments of IITK. Creative minds come together with enthusiasm to find innovative way of solving problems.

FACULTY

S G Dhande, Ph.D(IIT K): CAD/CAM, Rapid Prototyping and Tooling, Computer Graphics Simulation

B Bhattacharya, Ph.D(IISc): Design of embedded System, Intelligent System Design, Micro Electro Mechanical Systems (MEMS), Smart Composites, Axiomatic Design.

Satyaki Roy, Ph.D (Visva Bharati Univ.): Communication Design, Interaction Design, Media Studies, History of Art

Koumudi P Patil, MFA (Visva Bharati Univ.): Creative visualization, Communication Design, Form Development, Handicrafts

Jayanta Chatterjee, Ph.D (IIT Delhi) : Design Management

Munmun Jha, Ph.D(Glasgow): Social Anthropology, Indian Society.

Braj Bhusan, Ph.D(BRAB University): Cognitive Neuropsychology, clinical Psychology, Cognitive Engineering

Shatarupa Roy, MFA (Visva Bharati Univ.) : Design Theory, Art & Aesthetics, Print Media, Visual Communication

Nachiketa Tiwari Ph.D., (Virginia Tech); MBA, (Babson College) : Acoustics and Noise control, Solid Mechanics, Composite Structures, Vibrations, Product Design, Automotive Systems, MEMS.

J Ramkumar Ph.D., (IIT Madras) : Micro / Nano- Fabrication and finishing, Nano Composites and Tribology, Product Design.

Sameer Khandekar Ph.D (Uni-Stuttgart, Germany) : Thermal Management, Passive Heat Transfer, Heat Pipes, Energy System.

Manindra Agarwal, Ph.D (IIT Kanpur) : Complexity Theory, Computational Number Theory peripheral interest in Cryptography, Complex Analysis, and Combinatorics.

P Sensarma, Ph.D (Indian Institute of Science, Bangalore) : Power Electronic Applications to Power Systems, Power Quality, FACTS devices, Power Supplies, Utility Interfaces for Renewable Generation.

Ashutosh Sharma, Ph.D (State University of New York at Buffalo) : Mechanics and instabilities of soft visco-elastic interfaces, thin films and nano-systems Self-organized **meso-patterning** of polymers, ceramics, hydrogels and carbon Interfacial and colloidal **interactions Wetting and adhesion Smart and functional materials :** adhesives, catalytic, optical, super-hydrophobic and nano-composites **Biosurfaces** : surface chemistry of cornea and tear film; cell adhesion **Interfaces** in membranes and microfluidics

DESIGN CONSULTANTS:

A Chatterjee: Rapid Prototyping, Reverse Engineering, Digital Image Processing

A Kulkarni: Micro Fabrication, Physical Program of Educational Arts, Motion Control, Virtual Instumentation, Process Measurement, Sensor Based Applications

COURSES

Design Theory, Design Practice I, Design Practice II, Design Project I, Design Project II, Topics in Design, MDes Thesis, Topics in Motion Pictures, Special Studies in Design, interaction Design , Form & Style, 2D and 3D Visual Design, Elements & Principal of Design, Management of Design Innovation.

Students may choose courses as electives from other departments such as Knowledge Strategies and Knowledge Systems, High Performance Polymers & Composites, Introduction Strategies and Knowledge Systems, High Performance Polymers & Composites, Introduction to Virtual Instrumentation I, Introduction to Polymer Science & Technology, Reliability Based Analysis & Design, Introduction to Computer Graphics & Simulation, Fundamentals of Interactive Computer Graphics, Image Processing, Knowledge Based Man- Machine System, Ecological & Biological Principles, Ethics & Society, Consumer Psychology, Marketing Management, Organization Methods in Engineer ing Design, Finite Element Method, Modelling & Simulation, Composite Materials, Artificial Intelligence, MBA special projects Modern Art, Art Appreciation & Criticism, Video Production-Theory & Practice, Communication Design etc.

ENVIRONMENTAL ENGINEERING AND MANAGEMENT

(Interdisciplinary M. Tech. Programme)

Recognizing the emerging challenges for environmentally sustainable economic development a broad based programme in Environmental Engineering and Management was started in 1997. This is primarily to meet the growing human resources requirements of high quality to provide leadership in various sectors such as, environmental policy and planning, implementation and legal aspects sustainable industrial development, environment friendly infrastructure management, resource cleanup through remediation of land, water and air resources, over and above the traditional “end-of-the-pipe” pollution control measures. The need for an integrated approach to environmental issues that transcend the boundaries of traditional disciplines in social sciences, physical sciences, engineering sciences and management sciences has been recognised. This programme builds on the past rich experience in environmental engineering, and the available expertise and infrastructure across various branches of engineering, sciences and humanities in the Institute. This inter disciplinary M. Tech Program is administered by the Department of Civil Engineering.

The programme offers M.Tech (4 semesters) in Environmental Engineering and Management. A doctoral Programme in Environmental Engineering leading to a Ph. D degree is offered by the Civil Engineering Department. A bachelor’s degree in the following branches of Engineering: civil, mechanical, chemical, agriculture, biotech, environmental or equivalent, or a Master’s degree in most branches of sciences with mathematics till 10+2 level is the minimum requirement for admission to the M.Tech Programme.

The M.Tech students take a minimum of four courses in first semester. In second semester, students take a minimum of four courses. The summer term and the third and fourth semester are fully devoted for working on a thesis. Admission to the M. Tech Programme is generally in the semester beginning July/August, while Ph.D. admissions are offered in both semesters.

COURSES

Physiochemical Principles and Processes; Ecological and Biological Principles and Processes; Principal of Environmental Economics and Management: Environmental Quality and Pollution Monitoring Techniques; Principles and Design of Water supply and Treatment Systems; Principles and Design of Wastewater Treatment and Disposal systems; Air pollution and Its Control; Modelling of Natural systems. Environmental Management and Impact Assessment; Industrial Waste Management, Special topics in Environmental,

Engineering & Management, Environmental Audit and Atmospheric physics and chemistry. In addition, the students can take courses from other departments/ programmes depending on the background/ interest in consultation with programme advisor / thesis supervisor.

FACLIITIES

The environmental engineering laboratory is well equipped for routine and advanced analyses of water, air and solid samples. In addition, facilities are available for air, water and soil sampling, and for conducting laboratory, bench and pilot scale studies for water treatment and effluent/emission/ waste control, and air quality measurements.

FACULTY

Purnendu Bose, Ph.D. (Massachusetts, Amherst): Environmental Engineering and Management: Physico-chemical processes for water and wastewater treatment, Advanced oxidation processes, Environmental Systems modelling and management.

Saumyen Guha, Ph.D. (Princeton): Fate and transport of pollutant in natural environment, Biological processes and kinetics, Heavy metals in the environment, Bioremediation of Hazardous substances

Mukesh Sharma, Ph.D. (Waterloo): Environmental Engineering and

Management; Air Quality Modeling and Management, Fate Processes of Organic Pollutants and Parameter Estimation, Mitigation of Greenhouse Gases, Environmental Health and Risk Analysis.

S N Tripathi, Ph.D. (Reading): Environmental Engineering: Atmospheric Aerosol Modelling, Cloud Physics, Atmospheric Electricity, Fog Analysis, Aerosol Chemical and Optical Properties

Vinod Tare, Ph.D. (IIT/K): Environmental Engineering and Management: Water and Wastewater Treatment, Modelling and Simulation of Environmental Systems, Environmental Management - EIA and EA.

Tarun Gupta, Sc.D. (Harvard): Development of instr uments for aerosol measurements, Physiochemical characterization of atmospheric pollutants, Personal exposure assessment and health effects of inhaled particles, source apportionment of air pollution and risk assessment.

Anubha Goel, Ph.D. (Maryland)

Environmental engineering and management.

- Fate and Transport of Pollutants.

- Phase distribution of organic pollutants in atmospheres.
- Environmental modeling.
- Climate change.

LASER TECHNOLOGY

(Interdisciplinary Programme)

Since their invention in 1960s, LASERS are transforming the fields of science and technology. Laser activity started at IIT Kanpur in 1964 and by late1960s IIT Kanpur distinguished itself in the fabrication of lasers of various kinds. The Laser Technology Programme (LTP) at IIT Kanpur started in July 1988 with the aim and objective of training young Engineering and Science graduates for providing skilled manpower in the specialised field of lasers and photonics. It
is hard to imagine our lives without laser based optical communications and networks; compact disc payers; laser printers, laser -surgery; lasers-materials processing; and applications of laser spectroscopy in medicine and nano-materials. Today, IIT Kanpur has excellent facilities for research in the field of lasers and various laser applications. The curriculum has been designed to provide the necessary theoretical and experimental background in lasers, quantum optics, and various laser applications such as optical communications/ networks & switching, holography, material processing, materials and biomedical spectroscopy, flow/temperature & stress analysis, optical signal processing & computing and optoelectronic integration. Compulsory laboratory courses constitute an integral part of the curriculum. Each student is required to take-up a two semester long research project in any one of the laboratories associated with the laser technology programme. It is a unique interdisciplinary programme, which draws faculty from the departments of Aerospace Engineering, Chemistry, Electrical Engineering, Mechanical Engineering, Civil Engineering, and Physics to teach various core courses and guide/supervise M.Tech. thesis. The students make use of the facilities of the Centre for Laser Technology, which consolidates the research and developmental activities in this field. In addition to the usual classroom teaching, emphasis is given to hands-on experience on lasers. The compulsory courses on Laser Technology Laboratory Techniques facilitate the process. Depending on the problem chosen, students carry out their M.Tech. projects in the laboratories of the centre for Laser Technology (CELT) or in those of the departments stated above.

Candidates having a Bachelor's degree in all branches of engineering Engineering or Master's degree in Physics, Applied Physics, Applied Optics or Chemistry are eligible to apply for admission to the M.Tech. Programme in Laser Technology.

FACULTY

Ramesh C Budhani, Ph.D. (IIT/D): Experimental Condensed Matter Physics (on leave).

Utpal Das, Ph.D. (Michigan): Quantum structures, Semiconductor Optoelectronic Integration.

Debabrata Goswami, Ph.D. (Princeton): Ultrafast Pulses, Non-linear Spectroscopy, Quantum Computing, Coherent Control

Sudhir Kamle, Ph.D. (Purdue): Holography, Stress Analysis, Smart Materials

D.P. Mishra, Ph.D. (IISc. Bangalore) : CFD of Chemically Reacting Flows.

K Muralidhar, Ph.D. (Delaware): Fluid Mechanics, Heat Transfer

Pradipta K Panigrahi, Ph.D (Louisiana State): Holography, Laser Schlieren, Particle image velocimetry.

Asima Pradhan, Ph.D. (CUNY, N Y): Laser Spectroscopy, Medical Applications.

Yatindra N Singh, Ph.D. (IIT/D): Fiber Optic Networks, Optical Switching

Raj K Thareja, Ph.D. (Delhi): Laser Physics, Laser Plasma Interaction

Harshawardhan Wanare, Ph.D. (Hyderabad): Non-linear Optics, Quantum Optics, Light Interaction in Biological Tissues

Pradeep K. Kumar (IIT, Chennai) : Quantum cryptugraphy, Quantum optics, Non-linear Fiber optics, optical fiber communication

R. Vijaya (IIT Madras) : Fibre optics, non linear optics, photonic band gap structures.

B. Lohani : (ESSC, UK) : Laser ranging, Flash scanning Laser applications, Laser imaging and cross section.

Compulsory Courses:

Introduction to Lasers, Introduction to Coherent and Laser Optics, Laser Systems and Applications, Laser Technology Laboratory Techniques, One Course on Electronics, M.Tech. Thesis Research.

Electives

Lasers and their Applications, Fourier Optics and Optical Information Processing, Lasers in industry, Laser induced Processes in Spectroscopy, Fiber Optic Systems I & II, Semiconductor Lasers, Optical Communication Systems, Optical Computing, and Optical networks & Switching.

FACILITIES

Besides the central facilities at the Institute level, the Centre for Laser Technology has its own precision machine shop and library, which supports the Laser Technology Programme. Various state of the art facilities i.e. Ti-sapphire laser, CCD spectrograph system, micro-raman facility, spectro Fluorimeter, Polarimetry

system, PIV, Interferumetry, holography,, scnlieren, CO_2 laser, canfocal micros copy Tunable laser, optical bench and optical waveguiding setup, paused laser sources, MCT detectors and Lock-in-amplifier etc. are available.

MATERIALS SCIENCE

(Interdisciplinary Programme)

Materials are at the root of man's progress in the modern world. Advances in technology today are limited by the availability of newer materials with superior properties. Thus, the development of new solar cell materials would make greater use of solar energy feasible, new ceramic materials would make automobile and other engines lighter and more fuel efficient, new optoelectronic materials would revolutionize the communication industry, etc. For this, a thorough study of the existing materials and tailor making of new materials have to continue with ever increasing vigour. Such a task, however, requires an integrated approach to the subject employing established disciplines of science and engineering. Keeping this very objective in view and to provide focus and coordination for teaching, research and development, the Institute offers an Interdisciplinary Programme in Materials Science at the post-graduate level leading to M.Tech. and Ph.D. degrees. This provides an opportunity to young engineers and scientists to undergo an extensive training in different aspects of materials science and engineering. The courses of study are designed to demonstrate the application of fundamental principles to understand and utilize the properties of broad range of materials including metals and alloys, semiconductors, ceramics, glasses, composites, polymers, etc. Emphasis is given to various aspects of preparation, structural properties and applications of materials. Each student, besides undertaking course work, participates in research activities and submits his/her individual contribution in the form of a thesis to fulfil the requirements of the degree.

About two thirds of the graduates of the programme are placed in industries and research establishments in the country while others pursue doctoral or postdoctoral work at universities in India or abroad. Excellent infra-structure has been established for materials research at the Advanced Centre for Materials Science and at various other laboratories in the Institute. It includes a large number of modern sophisticated equipment for preparation, processing and characterization of materials.

Specialisation of the faculty members who are currently engaged on full time or half time basis in the activities of the Programme are given below. Besides these, several other faculty members from the engineering and the science departments of the Institute participate in the academic activities. Research is being conducted in the broad areas of electronic materials, ceramics, metals, composites, thin films, nano-materials, ferroelectrics, opto-electronic materials,
solid state ionics, energy storage materials, polymers, magnetic materials, magneto rehology, fuel cells, photovoltaies, phosphors and specialised techniques.

FACULTY

Rajeev Gupta, Ph.D. (IISc Bangalore): Optical Spectroscopy (Raman IR, Photoluminescence), Manganites, Nanotubes and Nanowires, Multi-ferroics, Ruthenates.

K K Kar, Ph.D. (IIT/Kh): Polymer, Processing and Rheology, Mechanical Properties, Magnetorheology, High performsance Plastics, Polymer blends-alloys

and composites, Carbon nano tubes, Functionally graded materials, FEA of polymer products, fuel cells.

Jitendra Kumar, Ph.D. (BHU): Nanosize Particles, Inorganic Membranes, Electronic, Magnetic and Hydrogen Energy Storage Materials, Thin Films, Electron Microscopy, Photovoltaics, Phosphors.

Y N Mohapatra, Ph.D. (IISc Bangalore): Electronic and Optoelectronic Materials. Physics of Semi-conductor Devices and Defects, Organic Semiconductors, Polymer Light-emitting diodes and photo electronic applications.

K Shahi, Ph.D. (Gorakhpur): Superionic/Fast-ion Conductors, Solid Electrolytes, High Energy Density Batteries.

EMERITUS FELLOW

D C Agrawal, D. Engg. Sc. (Columbia, New Yark) : Ceramic Processing, Structual Ceremics and Composites, Piezo electric and Ferroelectric Materials, Sol-gel processing.

PROGRAMMES

The eligibility requirements for admission to M.Tech. and Ph.D. programmes are:

M.Tech.: Master's Degree in Physics, Applied Physics, Chemistry, Materials Science with Mathematics and Physics or Chemistry at Bachelors level or B.Tech./B.E./B. Sc. (Engg.) in Ceramic/Chemical/Electrical/Electronics and Communication/Materials/ Mechanical/ Metallurgical Engineering or any equivalent branch of engineering/technology.

Ph.D.: M.E., M.Tech. or M. Sc. (Engg.) Degree in Materials Science or any equivalent branch of engineering/technology. or

B.Tech./B.E/B.Sc. (Engg.) in relevant branch of engineering/ technology or Master's degree in Science in an allied area with exceptional academic records.

The requirements for completion of the programmes are:

M.Tech.: At least seven courses and a research project leading to a thesis.

Ph.D.: At least four/ten (if entering with Master's degree in engineering or technology/Bachelor's degree in engineering or technology or Master's degree in sciences) courses, passing a comprehensive examination and a research project leading to a thesis.

COURSES

Structural and Magnetic Properties of Materials; Electrical and Dielectric Materials; Mechanical Properties of Materials; Characterization of Materials; Materials Engineering; Electronic Ceramics; Materials for Energy Conversion and Storage; Electron Microscopy and Microanalysis; Crystal Growth - Theory and Practice; Engineering Polymers; Principles of Ceramic Processing; Electronic Materials; High Performance Polymers and Composites, Introduction to nano-materials and nanotechnology; Any relevant course from other department/programme.

NUCLEAR ENGINEERING TECHNOLOGY

(Interdisciplinary Program)

Nuclear Engineering and Technology is an interdisciplinary postgraduate program offering M.Tech. and Ph.D. degrees. The interdisciplinary nature of the program is reflected in the eligibility of students for admission to M.Tech. Program: graduates in engineering, primarily Mechanical, Electrical, Electronics, Instrumentation, Chemical, and M.Sc. in Physics. M.Tech. in Nuclear Engineering (or a related area) is required for admission to Ph.D. Selection of students is through interview and scores in GATE and qualifying examination.

FACULTY

M S Kalra, Sc. D. (MIT): Nonlinear Dynamics, Fusion Plasmas, Boundary Element Methods.

P Munshi, Ph.D. (IIT/K): Radiation Imaging and Tomography, Thermal Safety Analysis

S Qureshi, Ph.D. (Berkeley): Radiation Detectors, VLSI

Om Pal Singh, (Visiting Faculty) Ph.D. (IIT Delhi): Reactor Physics, Risk Analysis

ASSOCIATED FACULTY

A Khanna, Ph. D. (IITK): Nuclear Chemical Engineering.

P. Wahi, Ph.D. (IISc Bangalore): Non-linear Dynamics

COMPULSORY COURSES

Mathematics for Engineers, Nuclear and Reactor Physics, Nuclear Power Engg I, Nuclear Power Engineering II, Nuclear Measurements Laboratory, Safety Analysis of Nuclear Power Plants.

ELECTIVE COURSES

Advanced Reactor Physics, Neutron Transport Theory, Nuclear Fusion, Radioisotope Applications in Engineering, Computerized Tomography, Nondestructive Evaluation, analysis, Interaction of Radiation with Matter, Nuclear Power Engineering III, Nuclear Chemical Engg, Fast Reactor Technology

FACILITIES

The nuclear engineering laboratory is well equipped with radiation detectors, radioisotope gauges, PC-based multi-channel analyzer, signal correlator, 5 Ci Pu-Be neutron source, 1.7 MeV Tandetron accelerator, and a single-detector CT system using Cs-137 source.

1. Radiation Imaging and Tomography
2. Non-linear Dynamics (fusion and fission)
3. Thermal Safety and Probabilistic Analysis

CHEMISTRY

The Department of Chemistry has programmes designed to train chemists at all levels, to pursue research of both fundamental and applied nature, and also to interact with other programmes of this Institute in a meaningful manner. The Department believes that the training to the students to a high level of professional competence for academic and industrial careers can be done best only in an environment where active research of high quality is being carried out. Accordingly, research forms one of the major activities of the Department.

The department consists of twenty nine faculty members, about three hundred sixty students at the master's and doctoral levels, several post-doctoral and project research associates.

The Department offers a two-year programme leading to a Master's degree for those with a Bachelor's degree from other Institutions admitted via "Joint Admission Test to MSc (JAM)" and a five-year integrated programme leading to a Master's degree for those entering after (10+2) level studies (i.e.intermediate) through the Joint Entrance Examination (JEE). The five- year M.Sc. programme is unique in that it combines the best of the engineering science curriculum with that of the chemistry curriculum. The graduates of this programme have been acclaimed as well-trained chemists in India and abroad.

FACULTY

G Anantharaman, Ph.D. (Goettingen Univ.): Organometallic Chemistry, Coordination Chemistry.

Jitendra K Bera, Ph.D. (IISc Bangalore): Coordination Chemistry, Inorganic Materials, Supramolecular chemistry, Electronic properties and theoretical calculations.

P K Bharadwaj, Ph.D. (IIT, Kharagpur): Supramolecular Chemistry, X-ray Crystallography.

A Chandra, Ph.D. (IISc Bangalore): Statistical Mechanics, Computer Simulations.

V Chandrasekhar, Ph.D. (IISc Bangalore): Polymers, Main Group Inorganic Chemistry.

N S Gajbhiye, Ph.D. (IISc Bangalore): Chemistry of Nanomaterials, Solid State Chemistry.

M K Ghorai, Ph.D. (Univ. Poona): Organic Asymmetric Synthesis, Bio-Organic Chemistry.

M. Ranganathan, Ph.D. (Stanford Univ.) : Statistical Mechanics of Crystals & Polymers.

D Goswami, Ph.D. (Princeton Univ.): Quantum Computing.

R Gurunath, Ph.D. (IISc Bangalore): Bio-chemistry, Bio-organic Chemistry.

F A Khan, Ph.D. (Univ. Hyderabad): Organic Synthesis, New Synthetic Methods, Metalloorganic Chemistry, Chemical Synthesis in Ionic Liquids.

S Manogaran, Ph.D. (IISc, Bangalore): Molecular Conformation and Electronic Structure using Spectroscopy and Molecular Orbital Calculations including Macromolecular Structure and Dynamics using 2D-NMR and Computational Methods.

R N Mukherjee, Ph.D. (Calcutta Univ.): Biomimetic Inorganic Chemistry: Synthesis, Structure and Reactivity.

J Narasimha Moorthy, Ph.D. (IISc Bangalore): Organic Photochemistry and Organic Supramolecular Chemistry.

S P Rath, (IACS, Calcutta): Bioinorganic Chemistry, Metalloporphyrin Chemistry, NMR of Paramagnetic Systems and X-ray Crystallography.

S Sarkar, Ph.D. (Gorakhpur Univ.): Synthetic & Structural Aspects of Homo and Heteronuclear Metal Clusters of Biological Relevance, Functional Model of Oxomolybdo-enzyme, NO-Synthase, Fullerenes and Carbon nanotubes, Environmental Chemistry.

N Sathyamurthy, Ph.D. (Oklahoma State Univ.): Theoretical Molecular Reaction Dynamics.

V K Singh, Ph.D. (M.S. Univ., Baroda): Synthetic Organic Chemistry with Particular Emphasis on Enantio-selective Reactions, Synthesis of Biologically Active Molecules.

S Sundar Manoharan, Ph.D. (IISc, Bangalore): Nanomaterials,Spintronics, Organic L.Eds and Biodegradable Polymers for drug Delivery.

Y D Vankar, Ph.D. (BHU): Synthetic Carbohydrate Chemistry of Biological relevance, Asymmetric Synthesis, Total Synthesis of Natural Products.

V K Yadav, Ph.D. (M.S. Univ., Baroda): Synthetic Organic Chemistry with Particular Emphasis on (a) the Synthesis of Structurally and Biologically interesting Molecules (b) the Development of New Synthetic Protocols (c) Free Radical Cyclization and (d) the Use of Metals as Templates for Organic Reactions.

K Srihari, Ph.D. (Univ. Calif., Berkeley): Semi classical Methods in Chemistry (Theory).

S Verma, Ph.D. (Univ. Illinois, Chicago): Bioinspired Molecular Scaffolds for Nucleic Acid and Protein Clevage, Modeling of Prebiotic Catalysis and Drug design.

M L N Rao, Ph.D. (Univ. Hyderabad): Organometallic Method for Organic Synthesis, Green chemistry, Combinatorial Chemistry, Organic Synthesis, Heteroatom chemistry.

Nisanth Nair (Univ.of Hanover, Germany): Computational Chemistry.

D. H. Dethe, Ph. D. (IISC Bangalore) : Total Synthesis of bioactive natural synthesis new synthetic methods.

Pratik Sen, Ph.D. (IACS Kolkata): Ultrafast Laser Spectroscopy Fluorescence Spectroscopy, Interface selective non-linear Spectroscopy.

Ramesh Ramapanicker (IISc Bangalore): Synthetic organic Chemistry, Bioorganic Chemistry, Bioconjugation Chemistry.

Shridhar R. Godre (IIT Kanpur) : Theoretical and computational quantum chemisty.

PH.D. PROGRAMME

The postgraduate programme leading to the Doctorate degree was started in September 1963. The Ph.D. programme includes an integrated sequence of course work and research. A student is admitted to the candidacy of the Ph.D. programme only after successful completion the comprehensive (written and oral) examinations. The importance of post-doctoral training is being increasingly recognised, particularly for those planning academic careers. Opportunities for post-doctoral research exist in the Department in the various branches of chemistry.

COURSES

Compulsory: Two courses are to be taken as compulsory: (i) Modern Physical Methods in Chemistry or Applications of Modern Instrumental Methods, (ii) Principles of Physical Chemistry or Principles of Inorganic chemistry or Principles of Organic Chemistry, as advised by thesis guide.

Elective Courses: Four courses from the following electives with the consent of thesis guide should be taken. Course are: Scientific Instrumentation, Modern Instrumental Methods for Structure Determination, Principles of X-ray Crystallography, Advanced Organic Chemistry I & II, Chemical Binding, Chemical Thermo-dynamics, Physical Organic Chemistry, Electronics for Chemists, Advanced Inorganic Chemistry I & II, Basic Biological Chemistry, Mathematics for Chemistry, Chemistry of Natural Products, Organic Reaction Mechanisms, Stereochemistry, Organic Photochemistry, Electrocyclic Reactions, Chemistry of Organometallic Compounds, Frontiers in Molecular Biology, Molecular Reaction Dynamics, Chemical Kinetics, Valence Bond and Molecular Orbital Theories, Chemistry of Ionized Gases, Solid State Chemistry, Quantum Chemistry I & II, Ligand Field Theory, Enzyme Reaction Mechanisms and Enzyme Kinetics, Symmetry and Molecular Structure, Physical Photo-chemistry, Physical Inorganic Chemistry, Bio-inorganic Chemistry Statistical Mechanics and its Application to Chemistry,

Molecular Modelling in Chemistry, Statistical Mechanics and its application to chemistry, Molecular Modelling in chemistry,Computer Simulations in Chemistry, Lasers in Chemistry and Biology, Chemistry of Drug Design and Metabolism, Supramolecular Chemistry, Special Topics of Current Interest in Organic, Physical and Inorganic Chemistry.

Besides courses from the above list of compulsory courses which are not taken in the slots of compulsory courses can be taken as electives if so advised by the thesis guide.

FACILITIES

The Department is equipped with excellent instrumental facilities normally required for research and training. These include infrared, ultra-violet/visible and near infrared spectrophotometer, various solid-state dye lasers, supersonic jet fluorecence spectrometer, magnetic resonance equipment (nuclear, electron-spin), and single crystal X-ray diffractometer with liquid nitrogen facility, various types of chromatographs, polarographs, light scattering photometer, cyclic voltammetric equipment, steady-state spectrofluorimeter, time-correlated single photon counting spectrofluorimeter, stopped flow-spectrometer, high speed centrifuge, ultracentrifuge, electrophoretic equipment facilities for doing protein and model chemistry and photochemistry reactors. The department has acquired a state-of-the-art 400 and 500 MHz multinuclear NMR spectrometers, ESI Mass spectrometers, Bruker EPR spectrometer, FT-IR spectrometer, CHNSO analyser and CCD defractometer to augment research activities. The department has also recently acquired thin film deposition chamber for Nanostructured devices and CEM microwave reactor for organic scale-up processes. A Molecular Modelling Laboratory and PC clusters are also now available in the department. Some equipment like the powder X-ray difractometer, DTA & TGA etc. are also available. The department also has access to the Institute's Computational facility, low-temperature laboratory, glass blowing and machine shops.

In order to keep abreast of the latest developments in chemistry and allied subjects, and also to provide a forum for discussions about research in progress, the department holds weekly lectures/seminars, where active researchers are invited to deliver lectures on topics of current interest.

HUMANITIES AND SOCIAL SCIENCES

The Department consists of five major disciplines Economics, English Literature and Linguistics, Philosophy, Psychology and Sociology and each of these disciplines has a Ph.D. programme. The department has a Fine-Arts component as well which offers only undergraduate courses. The Ph.D. programme of the department is committed to producing research work of high quality in theoretical and applied fields and in interdisciplinary areas. Several doctoral dissertations produced in the department have received encomiums in India and abroad. The department has an under graduate Programme in Economics. Anirban Mukherji, Tanika Chakraborty

FACULTY

Bagad, Prashant, Ph.D. (Southampton) : Aesthetics, Philosophy of Literature, Plato, Existentialism.

Bhushan, Braj, Ph.D. (BRAB Univ.): Clinical Psychology, Cognitive Neuropsychology, and Engineering Psychology.

Chakrabarti, Anindita, Ph.D. (Delhi Univ.): Sociology of Religion, Social Movements, and Urban Sociology.

Chakraborty Tanika Ph. D. (Washington University) : Development Economics, Labor, Applied Micro-economics, Decision making

Chandran Mini, Ph.D. (Kerala): Modern British Literature, European Literature, Indian Literature & Aesthetics.

Dixit, Shikha, Ph.D. (Agra): Cognitive Psychology, Social Cognition, Application of Psychology to Armed Forces and Health Psychology.

Guha, Nirmalya, Ph.D. (Lancaster University, U.K.) : Indian Epistemology and Logic, Western Philosophy of language, Formal Semantics, Logic, Cognitive science.

Jha Munmun, Ph.D. (Glasgow): Indian Society, Human Rights, Social Movements, Design Anthropology.

Krishnan, Lilavati, Ph.D. (McMaster, Canada): Experimental Social Psychology, and Cross-Cultural Psychology.

Kulshreshtha Praveen, Ph.D. (Cornell): Microeconomics, Industrial & Financial Economics, Econometrics, Governance and Business Ethics.

Kumar Vimal, Ph. D. (Univ. of California, Irvine). : Game Theory, Growth & Technology, Political Economics.

Mathur Somesh K, Ph.D. (JNU): Quantitative Methods,International Economics, Efficiency and Productivity Analysis, New Trade and Growth Theories, WTO issues like TRIPS and IT Policy.

Mathur Suchitra, Ph.D. (Wayne State, USA): Indo-Anglian Literature, Postcolonial Theory and Literature, Women's Studies, Cultural Studies.

Mukherjee, Anirban, Ph. D. (University of British colombia, Canada) Economic History, development Economics, institutional economics.

Neelakantan G, Ph.D. (IIT/K): Twentieth-Century American Literature, Modernism and Post-Modernism, American Jewish Literature, Literary Theory.

Prasad, P.M. Ph.D. (Univ. Hyderabad): Law and Economics, Microeconomic Theory, Environmental Economics, Intellectual Property Rights.

Patil Koumudi, (MFA, Visva-Bharati Univ.): Art history, Installation Art, Participatory/ Community Arts.

Pattnaik B K, Ph.D. (Pune Univ): Social Studies in Science and Technology, Sociology of Development, Sociology of Voluntary Sector and Social Movements.

Priya, Kumar Ravi, Ph.D. (Delhi Univ.): Disaster Psychology and Disaster Management, Cultural Psychology, Health Psychology and Alternative Paradigms of Psychology.

Puttaswamy, Chaithra, Ph.D. (SOAS, London) : Language Documentation and Description, Historical Linguistics, Language Typology, Language contact, Dravidian Linguistics.

Raina A.M., Ph.D. (IIT/K): Cognitive Linguistics, Computational Linguistics, Communication Theory and Practice, Language Acquisition and Learning.

Ravichandran T, Ph.D. (Pondicherry Univ.): Postmodern American Literature, Literary Theory, Cyberpunk Literature, Indian Writing in English, English Language Teaching.

Rath Binayak, Ph.D. (IIT/K): Project Evaluation/Appraisal, Development Economics, Economics of Energy and Water Resources, Environmental Economics and EIA.

Roy Satyaki, Ph.D. (Visva Bharati Univ.): Art History, Visual Communication, Graphics, Media Studies.

Saha, Sarani, Ph.D. (Univ. of California, Santa Barbara) Environmental Economics, Public Economics, Political Economy, Applied Micro-economics.

Sarma, A V Ravishankar, Ph.D. (IIT Bombay): Logic; Philosophy of Science.

Saxena K K, Ph.D. (Udaipur): Input-Output Analysis, Regional Economics, Macroeconomic Analysis.

Sharma A K, Ph.D. (IIT/B): Social Demography, Rural Development, Sociology of Health and Illness, HIV Studies.

Sinha, Arvind K, Ph.D. (Patna): Organizational Behaviour and Social Psychology

Sinha, Surajit, Ph.D. (McMaster): Macro-Money, Money and Banking.

Sahu Sohini, Ph.D. (State University of New York at Albany): Macroeconomics, Econometrics.

Sahu Vineet, Ph.D. (University of Hyderabad): Philosophy of Mind

Shatarupa Thakurta Roy (MFA, Visva-Bharti Univ.) : History of Art, Graphics, Design Theory.

PH.D. PROGRAMME

The Ph.D. programme includes both course work and dissertation. The two-semester course work consists of a minimum of six advanced level courses. The courses are designed to enhance the students' knowledge of their own disciplines and to expose them to new areas. After successful completion of the course work, but not later than the fifth semester, a student has to pass the Comprehensive Examination which is a necessary requirement for submission of the Ph.D. dissertation. The entire programme is expected to extend over eight to nine semesters. At present about 65 Ph.D. scholars may be taken in the department in various programmes. The following are among the important areas of specialisation offered by the department.

ECONOMICS

Industrial Economics, Project Evaluation/Appraisal, Input-output Economics, Development Economics, Environmental Economics, Macroeconomic analysis, Econometrics, Microeconomic Theory, Energy Economics, Monetary Economics, Law and Economics, Environmental Impact Assessment, Game Theory, Political Economics .

ENGLISH (Qualifying degree: Masters in English Literature/Linguistics)

British and American Literature, Postcolonial Literature, Indian Literature, Feminist Theory and Literature, Postmodern Theory and Literature, Indian Writing in English, Critical Theory, Linguistic Theory, Cognitive Linguistics, Communication, Computational Linguistics, Sociolinguistics, Language Documentation and description, Language Typology.

PHILOSOPHY

Ethics, Social & Political Philosophy, Philosophy of Mind, Metaphysics, Philosophical Aesthetics, Existentialism & Phenomenology, Hermeneutics, Philosophy of Social Sciences, Philosophy of Language, Philosophy of Cognitive Science, Logic and Philosophy of Science.

PSYCHOLOGY

Cognitive Psychology, Engineering Psychology, Organizational Behaviour, Personality and Developmental Psychology, Social Psychology, Consumer Psychology, Social Cognition, Organizational Cognition, Health Psychology, Neuropsychology, Disaster Psychology and Disaster Management, (Cross) Cultural Psychology, Alternative Paradigms of Psychology, Applications of Psychology to Armed Forces.

SOCIOLOGY

Sociological Theories, Research Methods and Social Statistics, Social Stratification and Social Change, Sociology of Development and Underdevelopment, Social Demography, Urban Sociology, Industrial Sociology, Sociology of Environment,

Participatory Rural appraisal, Sociology of Science and Technology, Rural Sociology, Human Rights, Third sector (NGO) Research, Sociology of Religion, Political Sociology.

FACILITIES

The Department has full access to the Computer Centre of the Institute. In the Department there are three academic laboratories. The Language Laboratory is a sophisticated one containing 32 booths. The Psychology laborator y is well- equipped for demonstration of various experiments and also has a good collection

of psychological tests. The Fine Arts Studio provides facilities to the students to develop their artistic creativity. It has adequate equipment and studio space for this purpose. The Studio has built an infrastructure in the area of design development and design and aesthetics. Emphasis is being given to the modernization of these laboratories and provide them with latest equipment and facilities.

Eligibility Requirements for Ph.D.

Ph.D. in HSS: A Master's degree in the relevant subject or in sciences or a Bachelor's degree in Engineering with marks/CPI not below the prescribed minimum and a valid JRF/NET/GATE/UGC/CSIR score.

MATHEMATICS & STATISTICS

The department, which started as the Department of Mathematics in 1960, got its new name as the Department of Mathematics and Statistics in 2004. It has always shared the vision of the Institute in striving for excellence in research and teaching and has succeeded in this endeavor to a large extent. Over the years, the department has evolved as one of the premier departments in the country providing excellent teaching and research in Mathematical Sciences and Statistics. The vibrant academic environment is nur tured by strongly motivated faculty and provides an opportunity to pursue research in frontline areas of basic sciences as well as in interdisciplinary areas of science and technology.

The department currently has 35 faculty members who are engaged in research and teaching in various areas of Pure Mathematics, Applied Mathematics and Statistics. The faculty of the department aims to achieve high quality research and teaching standards in various disciplines of Mathematics and Statistics with flavor of unified approach towards both pure and applied aspects. The faculty of the department has also responded enthusiastically to the growing demands of research and teaching. As Mathematics and Statistics have penetrated many areas of human endeavors, an updating of the curricula is regularly undertaken to keep abreast with the latest developments and to bring innovations. The contributions by the faculty of the department in research and teaching have won recognition by the scientific community in the form of various prestigious awards and distinctions. A number of sponsored research projects funded by national agencies are under taken by the faculty.

FACILITIES

The Computer Centre of the institute provides E-mail, Web, DNS, FTP, Internet access, high performance computing and other services 24 hours and 365 days a year. Computer Centre has a number of state of the art servers, high end Linux and Windows labs and application software. The state of the art parallel and multi-processor computer servers cater to the computational needs of the academic community. In addition, the department also has its own high-end Linux and Windows labs that provide computing and remote access facilities exclusively to the department students. Apart from this, the department has one Parallel Computing laboratory and an Advanced Digital Imaging Solution (ADIS) laboratory.

IIT Kanpur has a large Central Library named after late Professor P.K. Kelkar, the founding director of the institute. This library is one of the best libraries of its kind in India, with an excellent collection of books and periodicals. There is a generous allocation from the Institute towards Library funding for Mathematics and Statistics. The library is fully automated and provides CD-Rom computer aided referral services. In addition, the Central Library has the special status of being an NBHM (National Board of Higher Mathematics) Regional Library, thereby

looking after the needs of mathematicians in the geographic region. Towards this, NBHM has been providing us with a sizeable annual grant. The Department maintains its own library with a good collection of text books and reference books. It is run by the students of the department and the collection in this library has come from retired faculty members, gifts from visitors, and complimentary copies of books from publishers.

Ph.D. PROGRAMME

In addition to a five year integrated M. Sc. Program in Mathematics & Scientific Computing (From the academic session 2011-12, Five Year M.Sc. (Integrated) programme in Mathematics and Scientific Computing has been replaced by a more flexible Four Year BS programme in Mathematics and Scientific Computing) and two parallel two-year M.Sc. programs in Mathematics and in Statistics, the department also offers two parallel Ph.D. programs in Mathematics and in Statistics. Admissions to these Ph.D. programmes require a valid GATE score or a JRF from UGC/CSIR/NBHM. The admissions are done through a written test & interview. These programs attract good students from all over India. Research work leading to the Doctorate Degree in Mathematics/Statistics is carried out in various areas indicated under faculty specialization. In the first two semesters, every Ph.D. student is required to do at least six courses. These courses are intended to familiarize the students with the modern aspects of Mathematics/Statistics and initiate the students to the chosen area of research. Apart from training related to the fundamental principles of Mathematics and Statistics, the scope of these comprehensive and flexible programs includes interaction with allied areas from other departments of the Institute. Such an interaction, while maintaining the identity of the department, is unique to the curricula. The doctoral programs aim to prepare motivated researchers in frontline areas. The department has so far produced over 315 Ph.D. students who are now associated with reputed educational institutes and R&D organizations across the globe. Many of our Ph.D. students are also doing extremely well placed in private sector industries. Currently the department has about 60 research scholars working in state of the art research areas. Regular seminars keep everyone charged and updated. The Ph.D. students also actively participate in the teaching of core courses of U.G. Program (B. Tech, B.Tech-M.Tech Dual Degree, M.Sc. Integrated and Four Year BS programmes). This helps them in tuning their communication and teaching skills.

FACULTY AND THEIR AREAS OF RESEARCH SPECIALIZATIONS

Akash Aanand, Ph.D. (Univ. of Minnesota, Twin Cities): Numerical analysis, Scientific computing, Partial differential and integral equations.

D Bahuguna, Ph.D. (IIT/K): Differential Equations, Non-linear Analysis, Theory of Semi-groups.

Malay Banerjee, Ph.D. (Calcutta Univ): Mathematical Ecology and Eco-

Epidemiology, Stochastic Stability Analysis and Chaos in Related Areas, Nonlinear Dynamics.

Mohua Banerjee, Ph.D. (Calcutta Univ): Mathematical Logic and Rough Set Theory.

Peeyush Chandra, Ph.D. (IIT/K): Mathematical Modeling, Fluid Mechanics, lubrication, Biomechanics.

Sameer Chavan, Ph.D. (Pune Univ): Operator Theor y, Subnor mals and Operators Close to Isometrics;

Aparna Dar, Ph.D. (SUNY Stonybrook): Differential Geometry, Algebraic Topology, Knot Theory.

I D Dhariyal, Ph.D. (Ohio State): Estimation, Ranking and Selection Procedures

Pravir K Dutt, Ph.D. (UC Los Angeles): Numerical Analysis, Fluid Mechanics

J Dutta, Ph.D. (IIT/Kgp): Non-smooth Optimization/Abstract Convexity and Global Optimization.

S.Dutta, Ph.D. (ISI Kolkata): Functional Analysis.

S Ghorai, Ph.D. (Univ. of Leeds): Computational Fluid Dynamics, Mathematical Biology,Adaptive Unstructured grid.

Manjul Gupta, Ph.D. (IIT/K): Functional Analysis, Operator Theory.

M K Kadalbajoo, Ph.D. (IIT/B): Numerical Analysis.

G P Kapoor, Ph.D. (IIT/K): Convex Analytic Dynamics and Fractals , Computational Complex Analysis.

B V Rathish Kumar, Ph.D. (Sri Sathya Sai Instt.): Computational Fluid Dynamics, Finite Element Analysis, Parallel Numerical Algorithms.

D Kundu, Ph.D. (Penn State Univ): Statistical Signal Processing, Non-linear Regression, Survival Analysis, Statistical Computing.

A K Lal, Ph.D. (ISI Delhi): Coding Theory.

Shobha Madan, Ph.D. (IIT/K): Harmonic Analysis, Hp-Spaces, Wavelets.

A K Maloo, Ph.D. (Bombay Univ./TIFR): Commutative Algebra.

Neeraj Misra Ph.D. (IIT/K): Statistical Inference, Reliability Theory, Ranking & Selection Problems, Nonparametric Entropy Estimation.

Amit Mitra, Ph.D. (IIT/K): Statistical Signal Processing, Data Mining of Financial/ Economic Time Series.

Sharmishtha Mitra, Ph.D. (IIT/K): Order Statistics, Survival Analysis, Econometrics.

P Mohanty, Ph.D. (IIT/K): Harmonic Analysis.

T. Muthukumar, Ph. D. (IISc, B'lore) : Homogenization and variational methods for PDE's, Elliptic PDE's, Optimal Controls.

Nandini Nilakantan, Ph.D. (IISc B'lore): Combinatorial Theory, Computational Geometry.

V Raghavendra, Ph.D. (IIT/K): Non-linear Analysis, Differential and Integral Equations.

R K S Rathore, Ph.D. (IIT/D; D Sc (Delft)) : Approximation Theory, Numerical Analysis, Computer Aided Tomography.

Rama Rawat, Ph.D. (ISI B'lore): Harmonic Analysis.

S K Ray, Ph.D. (ISI Kolkatta): Harmonic Analysis on Lie groups.

G Santhanam, Ph.D. (IITB/TIFR): Differential Geometry.

Rekha Santhanam, Ph.D. (Univ. of Illinois at Urbana - Champaign) : Algebraic topology, Homotopy theory.

Shalabh, Ph.D. (Lucknow Univ): Econometrics, Regression Modelling, Statistical Inference, Sample Surveys.

P Shunmugaraj, Ph.D. (IIT/B): Functional Analysis, Approximation and Optimisation.

Prawal Sinha, Ph.D. (IIT/B): Lubrication Theory, Biomechanics, Environmental Pollution, Epidemiology.

PHYSICS

The Department of Physics at IIT Kanpur is reputed for its high quality academic programme and research in front-line areas of both fundamental and applied importance. The Department has at present 32 members in the Faculty, including one Visiting Faculty, and is assisted by a team of Research Associates and Postdoctoral Fellows as par t of the academic staff. There are around 100 Ph.D. scholars engaged in doctoral research.

The Department participates in the undergraduate Core courses in the B.Tech. programme and runs an exclusive Five-year (Integrated) M.Sc. course in Physics, making effective use of the features of the undergraduate Core programme, which includes basic and engineering sciences, workshop practices, courses on computation as well as courses on humanities and social sciences. The Department has Two-year M.Sc. programme as well as a Ph.D. programme with specialization in many major areas of Physics. The Physics Department offers a unique time-saving M.Sc./Ph.D. (Dual Degree) programme for those seeking to take advantage of our M.Sc. training to accelerate their progress in doctoral work. Further, there is a large variety of courses offered by the Physics Faculty that are of interest to a number of inter-disciplinary programmes of the Institute. The Physics Department par ticipates in the Laser Technology and the Materials Science programmes of the Institute. A brief description of the course structure for various programmes and courses is given in this bulletin.

The Department actively participates in front-line research in several major areas of Physics. The largest group is working in the physics of Condensed Matter in all its aspects, viz. strongly-correlated systems, biophysics, the physics of plasmas. Interests are more or less evenly divided between theoretical and experimental work, with strong cross-pollination of ideas between theory and experiment. This is particularly true in the developing fields of Nanotechnology, Bio-materials and Biological systems. There is an active group involved in applying Nuclear Physics techniques to the study of materials and applications of ion beans in science and engineering. The High Energy Physics group has a wide-range of expertise ranging from the subtleties of renormalization in quantum field theories to numerical simulation of experimental processes and the analysis of vast quantities of statistical data. The Laser Physics and Quantum Optics group has interests ranging from laser ablation and laser synthesis of materials to quantum optics, and medical applications of lasers.

FACULTY

S Banerjee, Ph.D. (TIFR, Mumbai), Condensed Matter Physics (Experiment)

S Bhattacharjee, Ph.D. (RIKEN, Japan), Condensed Matter Physics (Experiment)

K Bhattacharya, Ph.D. (SINP, Kolkata), Cosmology and Quantum Field Theory

R C Budhani, Ph.D. (IIT, Delhi), Condensed Matter Physics (Experiment)

D. Chakrabarti, Ph.D. (Jadavpur, Kolkata), High Energy Physics, QCD (Theory)

D Chowdhury, Ph.D. (IIT, Kanpur), Condensed Matter & Statistical Physics (Theory)

A Dutta, Ph.D. (SINP, Kolkata), Condensed Matter Physics (Theory)

T K Ghosh, Ph.D. (IMSc, Chennai), Condensed Matter Physics (Theory)

A K Gupta, Ph.D. (Kentucky), Condensed Matter Physics (Experiment)

R Gupta, Ph.D. (IISc Bangalore) Condensed Matter Physics (Experiment)

M K Harbola, Ph.D. (CUNY), Condensed Matter Physics (Theory)

Z Hossain, Ph.D. (TIFR, Mumbai), Condensed Matter Physics (Experiment)

P Jain, Ph.D. (Syracuse), High Energy Physics (Theory)

K Krishnacharya, Ph.D. (MPI Goettingen), Condensed Matter Physics (Experiment)

Y N Mohapatra, Ph.D. (IISc, Bangalore), Condensed Matter Physics (Experiment)

S Mukherji, Ph.D. (IOP, Bhubaneswar), Condensed Matter & Statistical Physics (Theory)

S Mukhopadhyay, Ph.D. (SINP, Kolkata), Condensed Matter Physics (Experiment)

A Pradhan, Ph.D. (CUNY), Laser Spectroscopy & Medical Applications (Experiment)

R Prasad, Ph.D. (Roorkee), Condensed Matter Physics (Theory)

K P Rajeev, Ph.D. (IISc, Bangalore), Condensed Matter Physics (Experiment)

S A Ramakrishna, (RRI, Bangalore), Condensed Matter Physics & Optics (Theory)

V Ravishankar, Ph.D. (Mysore), High Energy Physics (Theory)

D Sahdev, Ph.D. (Case Western), High Energy Physics (Theory)

T Sarkar, Ph.D. (IMSc, Chennai), High Energy Physics (Theory)

G. Sengupta, Ph.D. (IOP, Bhubaneswar), High Energy Physics (Theory)

K Shahi, Ph.D. (Gorakhpur), Condensed Matter Physics (Experiment)

A Singh, Ph.D. (Urbana-Champaign), Condensed Matter Physics (Theory)

V Subrahmanyam, Ph.D. (TIFR, Mumbai), Condensed Matter Physics (Theory)

R K Thareja, Ph.D. (Delhi), Laser Physics (Experiment)

H C Verma, Ph.D. (IIT, Kanpur), Nuclear Physics (Experiment)

M K Verma, Ph.D. (Maryland), Turbulence & Plasma Physics (Theory)

H Wanare, Ph.D. (Hyderabad), Nonlinear Optics (Theory)

R. Vijaya, Ph.D. (IIT Madras), Laser Physics (Experiment)

PH.D. PROGRAMME

The Department of Physics offers many subdisciplines in the Ph.D. programme. The requirements in the various programmes are prescribed to ensure that the scholars acquire enough professional maturity to enable them to deal with a wide range of research problems in their respective fields of specialization.

The research interests of the department include topics in Condensed Matter Physics, Ion Beams and Nuclear Physics techniques, Dynamical Systems and Statistical Physics, Quantum Field Theory, High Energy Physics, Lasers and Laser Spectroscopy imaging and Bio-physics and a substantial degree of inter-disciplinary activity.

Students with good academic record and strong motivation for a career in Physics after earning Master's degree can apply for admission to the Ph.D. programme. The programme combines course work, guided research, independent study and teaching assignments, all designed with a view to making the scholar a professional physicist. The compulsory courses consist of review of mathematical physics, classical mechanics, quantum mechanics, statistical mechanics, solid state physics and nuclear physics while the elective courses cover the ongoing research areas in the department.

ELECTIVE COURSES

Advanced Quantum Mechanics, Group Theory and Application to Quantumechanics, Advanced Statistical Mechanics, Special Topics in Quantum Mechanics, Non-equilibrium Statistical Mechanics, Physics of Soft and Bio-materials, Condensed Matter II, Magnetism in Materials, Computational Methods in Physical Sciences, Computer Simulations in Physics, Electronic Structure of Materials, Topics in Semiconductor Physics and Technology of Thin Films, Disordered Systems, Physics of Semiconductor Nanostructures, Low Temperature Physics, Nuclear Techniques in Solid State Studies, Elements of Bio and Medical Physics, Lasers and Laser Spectra, Quantum Electronics, Coherence Optics, Nuclear Physics I, Quarks, Nucleons and Nuclei, General Relativity and Cosmology, Atmospheric Science I, Particle Physics, Special Topics in Field Theory and Particle Physics, String Theory, Special Topics in Physics,

Measurement Techniques, Digital Electronics for Scientists, Mean Field Theories in Random Alloys, Advanced Low Temperature Physics, High Energy Physics II.

FACILITIES

Condensed Matter Physics: Nitrogen and Helium Liquefiers, Superconducting magnets (up to 14 Tesla), Closed cycle Helium Refrigerators (down to 1.3 K), Experimental Setup for Resistivity, Hall Effect and Magnetic Susceptibility, Magnetoresistance, Specific Heat, Thermoelectric Power, Tunneling Conductance, Magnetostriction, Ultra high vacuum scanning probe microscope, superconducting quantum interference device (SQUID) based Magnetic Properties Measurement System (MPMS) with 10^{-6} emu resolution and 1.7K - 350K temperature range and magnetic field up to 5 Tesla. We also have a Physical Properties Measurements System (PPMS) with a 14 tesla superconducting magnet and helium–3 fridge with 300 mK base temperature. Scanning electron microscope (SEM) with electron beam lithography for nano-scale patterning will soon be installed.

Some homemade facilities like variable temperature (8K - 300K) scanning tunneling microscope (STM) with atomic resolution and conductance imaging, magneto-optic Kerr effect (MOKE) imaging of magnetic surfaces, Pulsed Excimer Laser ablation facility for synthesis of magnetic, superconducting and dielectric superlattices, high frequency measurements of vortex dynamics in superconductors, Raman and micro-Raman Spectroscopy set-up for correlated systems.

Well equipped facilities have been setup for opto-electronic characterization of semiconductor materials and devices. State of the art research facilities for organic semiconductors are available. The Department participates in major projects on Organic Electronics through Samtel Centre for display Technologies. For microfluidics, we have contact angle goniometer, fluorescent microscope and high speed (10,000 fps) camera.

Laser Laboratories: ND:YAG lasers, Excimer Laser,Double Monochromators, Photon Counters, Box Car Averagers, Vibration free tables. Facilities exist for High Resolution Spectroscopy, Raman and Micro-Raman Spectroscopy, Laser based pump-probe measurements, Laser-Plasma Studies and Nonlinear Optics, diode Lasers, Biological imaging system, optical spectrum analyzers and fibre optics system, optical lithography set-up.

Ion Beam and Nuclear Techniques Laboratory: Mossbauer Spectrometer, Tendem particle accelerator, focused ion beam (FIB) with SEM column (Nova Lab 600) for Nano Microfabr ication down to nm scales, modern 1.7 MeV Tandertron accelerator with capabilities of producing ion beams of almost all elemental species. The facility is equipped with a nuclear microprobe station for science and engineering applications such as proton and heavy ion beam writing, RBS, PIXE and ion Channeling E-beam deposition, Positron Annihilation, Mossbauer Studies at Low Temperatures.

Computational Facility: CHAOS cluster (264 cores and 1/2 Terabytes of RAM), Several high-end graphics workstations with three-dimensional visualization capabilities, GPU workstations, a new cluster with 396 cores and 1 Terabytes of RAM will also be installed soon. In addition the Computer Centre, a central facility at the Institute also has two super computers (IBM-SP2, PARAM) accessible to the department.

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