Information Brochure

for

Admissions in Post Graduate Programme

"Master of Science (MS) By Research"

Academic Session: 2015-16, Semester: I

INDIAN INSTITUTE OF TECHNOLOGY KANPUR
KANPUR-208016
UTTAR PRADESH (INDIA)

The Department of Chemical Engineering offers academic programme leading to B.Tech., M.Tech. and Ph.D. degrees in Chemical Engineering. From the academic session 2015-2016 a new academic programme "MS by Research" is being started.

The Department imparts graduate education with emphasis on chemical engineering fundamentals and applications. It prepares students to a high level of competence in the conventional areas like process engineering, process simulation, optimization and control, separation processes, polymer engineering and transport phenomena, as well as 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 technological 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 internationally, who have received numerous awards and honours for excellence in research (e.g. Infosys Prize, J. C. Bose Fellowship, Shanti SwarupBhatnagar prize, Herdillia, Amar Dye-Chem and NOCIL awards of IIChE, of ISTE, Fellowships of Academies of Sciences and of Engineering, etc.). This research done by the M.Tech and PhD students and faculty in diverse areas of Chemical Engineering is published in prestigious international journals. The department 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 department enjoys an excellent rapport and professional interaction with various industrial 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 Thermodynamics, 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.

GoutamDeo, Ph.D. (Lehigh): Heterogeneous Catalysis, Kinetics, Transport Phenomena.

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.

R K Gupta, PhD (NUS Singapore): Nanomaterials, self-assembly, nanostructures for energy applications.

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

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.

S. Dalal, Ph. D. (Michigan, Ann Arbor), Modelling and simulation of the dynamics of polymer chains in flow, complex fluids, flow induced effects in biomolecules.

V Shankar, Ph.D. (IIScB'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.

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

Naveen Tiwari, Ph.D., (University of Massachusetts, USA): Transport Phenomena, Instabilities in micro-scale free surface flows, Flow through porous media.

AnuragTripathi, Ph.D (IIT Bombay): Mechanics and rheology of granular flows and complex fluids.

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

FACILITIES

Besides the central facilities, at the Institute level, the Chemical Engineering Department has its own workshop, library, SEM, XRD, FACS, BET, 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-Blodegett depositions, Ellipsometr, Spin-coater etc. For more details visit www.iitk.ac.in

MS BY RESEARCH PROGRAMME (CHEMICAL ENGINEERING)

Department of Chemical Engineering has been successfully offering M. Tech programme for last several years in which we admit students having chemical engineering background. Since a lot of research carried out in the department focuses on various interdisciplinary areas (e.g. complex fluids, process engineering, reaction engineering, nanomaterials, computational fluid dynamics, etc) an academic programme for students having science (chemistry, physics, biology, mathematics, etc.) and other engineering (mechanical, materials, etc.) background is the need of the hour. The current M. Tech. programme does not cater to these students and hence the department has started a new postgraduate programme (MS by research) to admit non-chemical engineering students. The broad guidelines for the MS by Research programme are outlined below.

1. *For whom this program is meant for:* We envisage two pools of students who will benefit from such a program: (i) People working in industries related to chemical engineering, who would like to enhance their skill-set by studying at IIT Kanpur, and (ii) Students with B.Tech in Chemical and allied engineering disciplines, as well as students with M.Sc in physics/chemistry/mathematics who would like to get a Master's degee in chemical engineering, with significant research component in the thesis, who are otherwise ineligible to apply to the M.Tech program because of their non-chemical engineering background.

2. *Eligibility for admission:* B.Tech/M.Scdegree with a minimum of 55% marks in their qualifying exam, and a valid GATE score (for B.Tech degree holders) or valid CSIR-NET score (for M.Sc degree holders). Sponsored candidate should possess a minimum of 55% marks in their qualifying exam; no gate score is needed for them.

3. *Number of seats and Financial Assistance*: Up to 10 seats. Institute assistantship may be provided to some selected candidates having valid GATE score. Others must be sponsored through project funding from their thesis supervisors (or) financial sponsorship must come from their parent industrial organization.

4. *Course work requirements:* 27 credits from PG compulsory courses

5. *Minimum residence requirements:* Four semesters

6. *Minimum credits required to graduate:* Course – 36, Thesis – 72, Total = 144 credits

7. *Minimum CPI requirement:* 6.5/10.0.

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 confidently undertake an independent analysis of complex field situations. Our graduates have gone on to become leaders in their professions and have significantly contributed to research and development. Keeping in view the needs of the society and the challenging problems faced by the profession, we offer programmes leading to B.Tech., M.Tech. and Ph.D. degrees in Civil Engineering. From the academic session 2015-2016 a new academic programme "MS by Research" is being started.

FACULTY

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

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

Sekhar K Chakrabarti, Ph.D. (Arizona, Tucson): Structural Engg.—Behavior and Design of of Steel-Concrete Interface in Composite Construction, Structural Connections, Structures Health monitoring and Rehabilitation of Structures.

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/KGP):TransportationEngg.—Pavement design, Pavement materials, Pavement evaluation and maintenance.

Arghya Das, Ph.D. (University of Sydney):Geotechnical Engg.—Constitutive modeling of Geomaterials. Micromechanics of granular materials. Bifurcation & instability analysis in Geomaterials. Numerical & physical modeling in Geotechnical Engineering.

OnkarDikshit, 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.

AnubhaGoel, Ph.D. (Maryland): Environmental Engg.—Fate and transport of pollutants, Environmental modeling, climate change.

SaumyenGuha, Ph.D. (Princeton):EnvironmentalEngg.—Fate and transport of pesticides, Uptake of nutrients and heavy metals by plants, pathogens in water, Industrial wastewater treatment.

Tarun Gupta, Sc.D. (Harvard): <u>Environmental Engg.</u>—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. (Southern California): <u>Structural Engg.</u>—Random vibrations, Earthquake engineering.

Ashu Jain, Ph.D. (Kentucky): <u>Hydraulics & Water Resources Engg.</u>—Surface hydrology, Rainfall-runoff modeling & Soft Computing.

Sudhir K Jain, Ph.D. (Caltech): <u>Structural Engg.</u>—Earthquake engineering, Structural dynamics.

Bharat Lohani, Ph.D. (Reading): <u>Geoinformatics</u>—Terrestrial, Mobile and airborne laser scanning, Remote sensing, GIS, GPS, Electronic surveying, Algorithm development, Terrain modeling, Geodata visualization, and Applications.

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

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

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

B. Nagarajan, Ph.D. (Ohio): <u>Geoinformatics</u> - Geodesy, Satellite altimetric and gravimetric studies, Earth rotation and polar motion, photogrammetry and remote sensing, Topographical surveying and mapping, Regional Geoidal models

Syam Nair, Ph.D. (Texas A&M): <u>Transportation Engg.</u>—Stabilization of pavement subgrade soils and base materials, Post-stabilization swelling in expansive soils, Characterization and performance prediction of cementitious materials, Use of recycled materials and by-products in pavementconstruction, Surface properties of aggregates and interactionwith binding materials.

RichaOjha, Ph.D. (Purdue University): <u>Hydraulics & Water Resources Engg.</u>—Flow and transport through unsaturated porous media.

Nihar R Patra, Ph.D. (IIT/KGP): <u>Geotechnical Engg.</u>—Pile foundations, Soil-structure interactions, Ground engineering, Soil arching, Liquefaction potential evaluation.

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

Samit Ray Chaudhuri, Ph.D.(California,Irvine):<u>Structural Engg.</u>—Structural dynamics, Earthquake Engg., Performance-based design, structural rehabilitation, seismic soil-structural interaction, structural health monitoring & structural testing.

PrishatiRaychowdhury, Ph.D. (California,San Diego): <u>Geotechnical Engg.</u>—Soil dynamics, Geotectnical Earthquake Engineering, Seismic soil-structure interaction.

Rajesh Sathiyamoorthy, Ph.D. (IIT/B): <u>Geotechnical Engg.</u>—Numericaland Physical modeling, Geo-Environmental Engineering, Geosynthetics, Unsaturated soil mechanics, Railway Geotechnology.

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

Abhas Singh, Ph.D. (Washington, Saint Louis):<u>Environmental Engg.</u>—Environmental geochemistry of heavy metals and inorganic contaminants, Inorganic contaminant fate and transport through surface complexation and flow-through reactor modeling, Contaminant remediation in natural as well as engineered environments.

Rajesh Srivastava, Ph.D. (Arizona, Tucson): <u>Hydraulics & Water Resources Engg.</u>—Flow and transport through variably saturated porous media.

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

SachchidaN Tripathi, Ph.D. (Reading): <u>Environmental Engg.</u>—Laboratory measurements of aerosol absorption and hygroscopic properties, Fog processing of aerosols, Aerosol climate impacts, Electrical properties of aerosols, Development of new techniques to measure carbonaceous aerosols.

ShivamTripathi, Ph.D. (Purdue): <u>Hydraulics & Water Resources Engg.</u>—Statistical hydrology, Sediment transport, Eco-hydrology.

Vinod Vasudevan, Ph.D. (Nevada, Las Vegas): <u>Transportation Engg.</u>—Traffic safety, Pedestrian safety, Highway financing and policy analysis.

Harish K Venkatanarayanan, Ph.D. (Clemson): <u>Structural Engg.</u>—Microstructure of cement-based material, Material characterization techniques, Advanced cementitious materials, Sustainable construction materials, Repair and rehabilitation of concrete structures.

FACILITIES

In each of the areas of specialization, the Department is equipped with well-developed laboratory facilities. The state-of-the-art research facilities in the Department include the following:

- Exploration Seismograph, GPS, GPR Survey Instrument, Petrological Microscopes.
- Inductively Coupled Plasma Mass Spectrometry (ICP-MS) and Atomic Emission Spectrometry (ICP-OES), Microwave Plasma Atomic Emission Spectrometry (MP-

AES), Ion Chromatograph (IC), High Performance Liquid Chromatograph, AAS, TOC, CHNOS Analyzer, GC-ECD-FID, Weather Monitoring Station, UV Visible Spectrometer, HDTLC, GC-MS, Optical Particle Counter, Scanning Mobility Particle Sizer, Aerosol Mass Spectrometer, Micro-Orifice Uniform Deposition Impactors, Aerodynamic Particle Sizer, Cloud Condensation Nuclear Counter, Particle Soot Absorption Photometer, Particle Absorption Soot Photometer, Cloud Combination Probe, Condensation Particle Counter, Fog Chamber, Optical Particle Sizer, Micro Pulse Lidar, Sun photometer, Gas Analyzers (Ozone, Sulfur Dioxide, Carbon Mono Oxide, Nitrogen Oxides), Scanning Mobility Particle Sizer, High Performance Computing Clusters

- Robotic and Motorized Total Stations, Digital and Auto Levels, Digital Theodolites, Single and Dual Frequency Geodetic Quality Differential GPS Receivers, Navigational GPS Receivers, Permanent GPS Reference Station for Engineering and Scientific Applications, Terrestrial Laser Scanner, Range Camera, Integrated GPS and INS system, Digital Photogrammetric Workstation, Software for Geospatial Applications: ERDAS lmagine, ERMapper, Arclnfo and ArcView, AutoDesk and Bentley Microstation Suites, Terrascan, Terramodeller, Polyworks, Leica Photogrammetry Suite.
- Advanced Cyclic Triaxial Testing Facility, In-situ Testing, SCPT Plate Load Test Facility, Spectrum Analyzer for Surface Waves, Seismic Down-Hole Testing Facility, Geotechnical Digital System (GDS), Geosynthetics Testing Facility for Geogrids and Geonets.
- Complete Infrastructure for Physical Modelling of Rivers for Studying Scour Patterns and River Training Works, Facility for Hydraulic Testing of Pipes, Fluid Friction Apparatus, Momentum Measurement Apparatus, Apparatus to Calculate Sudden Losses in Expansion, Contraction and Bends, Hydrology System, Hydro-Metrological Observatory.
- Pseudo Static Cyclic Testing Facility, Shake Table Test Facility for Small Scale Models, Accelerometer-Based Wireless Measurement System, Fibre Optic-Based Strain and Temperature Measurement System, State-of-the-Art Teaching Laboratory for Structural Dynamics, Construction Materials Testing Facilities including NDT equipment, Equipments for Properties of Fresh and Hardened Concrete, Vibration Survey System (including eccentric mass shaker) for In-situ Measurement of Dynamic Properties of Existing Structures.

Centrifuge Bitumen Extractor, Marshall Test, Fatigue Test for Bituminous Mixes, Profilograph, Rotational Viscometer, British Pendulum Tester, Driver Testing Equipment, Traffic Speed Measurement Radar, Stone Polishing Machine, Thin Film Oven Test, Asphalt Content Tester by Ignition Method, GPS Set-up, Vehicle Detection and Classification System.

MS BY RESEARCH PROGRAMME (CIVIL ENGINEERING)

Department of Civil Engineering has been running a successful Master of Technology (M.Tech.) programme for several years in the following specializations: (i) Geoinformatics, (ii) Geotechnical Engineering, (iii) Hydraulics & Water Resources Engineering, (iv) Structural Engineering, (v) Transportation Engineering. This programme does not however cater to the aspirations of the personnel employedin the industry and those employed in research projects and having non-Civil Engineering background. The department has therefore decided to start a new post-graduate

programme, called as Master of Science by Research (MS by research), in the Department starting from July, 2015.

1. ***For whom this program is meant for:*** Admissions under the MS by Research programme will be open to both full-time and part-time students. The non-sponsored students admitted on full-time basis will be required to have a valid GATE score (unless they have graduated from an IIT with a minimum CPI of 8.0). Some of them may be offered Institute or Project Assistantships, as in the case of the M.Tech. students.

2. ***Eligibility for admission:*** BTech/BS (4-year)/MSc or equivalent with 55% marks/5.5 CPI, and a valid GATE score (GATE to be waived for sponsored and part-time candidates)

3. ***Number of seats and Financial Assistance***: Up to 12 seats. Institute assistantship may be provided to some selected candidates having valid GATE score. Other candidates must be sponsored through project funding from their thesis supervisors (or) financial sponsorship must come from their parent industrial organization.

4. ***Course work requirements:*** In consultation with his/her thesis supervisor, without any restrictions on the courses taken or the semesters in which the courses are taken.

5. ***Minimum residence requirements:*** Four semesters

6. ***Minimum credits required to graduate:*** Course – 36, Thesis – 72, Total = 144 credits

7. ***Minimum CPI requirement:*** 6.5/10.0

ELECTRICAL ENGINEERING

The department of Electrical Engineering offers M.Tech and Ph.Dprogrammes in almost all the sub-disciplines of Electrical Engineering. The areas include: Digital Communication Systems; Information and Coding Theory; Telecom Networks; Mobile and Wireless Communication Systems; Digital Signal and Image Processing; Computer Vision; Inverse Problems and Tomography ; Signals and Systems Theory; Control Systems and Robotics; Path Tracking and Electric Vehicle Control; Electronic and Virtual Instrumentation; Fuzzy Logic; Neural Networks and their applications; Power Systems; Smart Grid and Synchrophasors; Power Electronics; Electric Drives; Active Power Filters and Static VAR Systems; Renewable Energy Interfaces; Microelectronics; VLSI System Design; Analog and Digital Circuit Design;Semiconductor Device Modeling and Simulation; Solid State Devices; Nano-electronics and Nano-scale Devices;Spintronics;Organic Electronics; Photovoltaics; Electromagnetics; RF Engineering and Microwaves; Metamaterials, MMIC, RF and Microwave Sensors, RFID, Microwave Imaging, ElectromagneticTomographic Imaging, Quantum Dots, Optoelectronics, Optical Communications; Quantum Cryptography and Quantum Optics, Spin waves, Photonic Networks and Systems. From the academic session 2015-2016 a new POST GRADAUTE academic programme "MS by Research" is being started.

OPPORTUNITIES IN SPONSORED RESEARCH

Sponsored research and development activities are pursued in 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.

Anand S, Ph.D. (IITB): Renewable sources based DC microgrid and power electronic converters for solar PV systems.

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.

Chauhan Y S, Ph.D. (EPFL): Nanoelectronics; Compact modeling of semiconductor devices: Bulk/SOI/FINFET/Tunnel FET/Nanowire/Power devices; DC/CV and RF Characterization of MOSFET

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. (LouisianaState): Semiconductor device modeling; IC fabrication tehnology, Analog/digital/mixed-signal VLSI circuits.

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 Shilpi, Ph.D. (UMCP): Nanophotonics; Nanoplasmonics; Quantum optics.

Gupta Sumana, 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 cell; semiconductor devices.

Jagannatham A K, Ph.D. (UCSD): Wireless communication; 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.

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.

Mohapatra A, Ph.D. (IITD): Power system security;Uncertainitymodelling;Stochastic analysis and optimization;Robust and efficient system operation and planning;Renewable integration in power systems;Deregulation.

NaikNaren, 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 system theory; Practical applications of control theory; Electric vehicles.

Pradeep Kumar K, Ph.D. (IITM): Quantum and non-linear optics; quantum cryptography and computation; Optical communications, Spin Waves.

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

Rajawat K, Ph.D. (Minnesota): Sensor networks; Cross-layer optimization; Distributed network control; Network monitoring; Network coding.

Rajshekhar G, Ph.D. (EPFL): Biomedical Optics; Light Microscopy; Optical Metrology; Digital Holography.

Sahoo S R, Ph.D. (IITB): Nonlinear Systems; Multi-agent systems and their coordinated control.

Sensarma P, 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; Optimal 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, PhD. (IITD): Power systems; Energy management systems; 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/Systems theory, Image and video processing; Computer vision applications.

Verma N K, Ph.D. (IITD): Big Data; Internet of Things/Cyber physical systems; Intelligent Data Mining Algorithms and Applications; Diagnosis and Prognosis of Rotating Machines; Soft-Computing in Modelling and Control; Machine Learning Algorithms; Computer Vision; Bioinformatics; Smart Grid; Intelligent Agents and their Applications; Intelligent Informatics; Fuzzy Controllers; Image frame generation; Brain Computer/Machine Interface.

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, Synopsis, Mentor Graphics, 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 with provision to fabricate chips at different technology nodes.

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. Control system lab with facilities for multi-motor coordination, control networks and intelligent vehicle 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. Power management lab with solar simulator, frequency response analyzer, electronic loads and fabrication facility

RF and Microwaves lab having network analyzer up to 67 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.

In addition, Advanced Fiber optics laboratory has WDM optical components, single-mode standard and nonlinear fibers, Optical and Sampling oscilloscope to enable experiments on 40G optical links.

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.

MS BY RESEARCH PROGRAMME (ELECTRICAL ENGINEERING)

Department of Electrical Engineering at IIT Kanpur has been successfully running M.Tech. and Ph.D. programmes. However these programmes do not cater to the aspirations of the personnel employed in industry and those employed in the research projects . Therefore from the academic session 2015-16, a new post-graduate programme, known as Master of Science by Research Programme, is being started by the department.

1. *For whom this program is meant for:* Admissions to MSbyResaerch Programme will be open to full-time (non-sponsored) candidates as well as the Project sponsored candidates through the Department level admission committees. The non-sponsored students admitted on full-time basis will be required to have a valid GATE score.

2. *Eligibility for admission:* BTech/BS (4-year)/BE or equivalent with 55% marks/5.5 CPI, and a valid GATE score (GATE to be waived for sponsored and part-time candidates)

3. *Number of seats and Financial Assistance*: Up to 30 seats. Institute assistantship may be provided to some selected candidates having valid GATE score. Other candidates must be sponsored through project funding from their thesis supervisors (or) financial sponsorship must come from their parent industrial organization.

4. *Course work requirements: 36 credits*

5. *Minimum durations:* Four semesters

6. *Minimum credits required to graduate:* Course – 36, Thesis – 72, Total = 216 credits

7. *Minimum CPI requirement:* 6.5/10.00

ENVIRONMENTAL ENGINEERING AND MANAGEMENT
(Interdisciplinary Programme)

An integrated approach to address emerging environmental challenges that transcend the boundaries of traditional disciplines in physical sciences, engineering sciences, social sciences, and management sciences is necessary. Recognizing the challenges to environmentally sustainable economic development, a broad based programme in Environmental Engineering and Management (EEM) was started in 1997 to meet the growing human resources requirements for providing leadership in various sectors such as environmental policy and planning, implementation and legal aspects of sustainable economic development, environment friendly infrastructure management, environmental cleanup through remediation of land, water and air resources, over and above the traditional "end-of-the-pipe" pollution control measures. This programme builds on the past rich experience available in the Institute in Environmental Engineering, and the available expertise and infrastructure across various branches of Engineering, Sciences and Humanities in the Institute. This interdisciplinary M. Tech Program is administered by the Department of Civil Engineering. The programme offers M.Tech. degree in Environmental Engineering and Management. A doctoral programme in Environmental Engineering leading to a Ph. D degree is offered by the Civil Engineering Department.

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. A list of analytical instruments is given below:

Inductively Coupled Plasma Mass Spectrometry (ICP-MS) and Atomic Emission Spectrometry (ICP-OES), Microwave Plasma Atomic Emission Spectrometry (MP-AES), Ion Chromatograph (IC), High Performance Liquid Chromatograph (HPLC), TOC, CHNOS Analyzer, GC-ECD-FID, Weather Monitoring Station, UV Visible Spectrometer, HDTLC, GC-MS, Optical Particle Counter, Scanning Mobility Particle Sizer, Aerosol Mass Spectrometer, Micro-Orifice Uniform Deposition Impactors, Aerodynamic Particle Sizer, Cloud Condensation Nuclear Counter, Particle Soot Absorption Photometer, Particle Absorption Soot Photometer, Cloud Combination Probe, Condensation Particle Counter, Fog Chamber, Optical Particle Sizer, Micro Pulse Lidar, Sun photometer, Gas Analyzers (Ozone, Sulfur Dioxide, Carbon Mono Oxide, Nitrogen Oxides), Scanning Mobility Particle Sizer, High Performance Computing Clusters

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.

SaumyenGuha, 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 Modeling, 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, Modeling and Simulation of Environmental Systems, Environmental Management - EIA and EA.

Tarun Gupta, Sc.D. (Harvard): Development of instruments 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.

AnubhaGoel, Ph.D. (Maryland): Indoor and ambient air quality, vehicular emissions, size segregated distribution of pollutants on particles, agriculture and air quality, Fate and transport of pollutants, Solid waste management, Environmental modeling, Climate change.

Abhas Singh, Ph.D. (Washington, St. Louis): Environmental geochemistry of heavy metals and inorganic contaminants, physical and chemical processes such as adsorption, precipitation, and reduction-oxidation occurring at mineral-water-microbial interfaces, inorganic contaminant fate and transport through surface complexation and flow-through reactor modeling, developing tools to target contaminant remediation in natural as well as engineered environments.

P. Murali Prasad, Ph.D. (Hyderabad): Microeconomics, Law and Economics, Environmental Economics, Development Banking

MS BY RESEARCH PROGRAMME (ENVIRONMENTAL ENGINEERING AND MANAGEMENT)

Although the M.Tech. programme in Environmental Engineering and Management (an Interdisciplinary Programme) has been successfully running for last several years it is realized that this M.Techprogrammedoes not cater to the aspirations of the personnel employed in the in industry and those employed in research project. Hence a new interdisciplinary post-graduate programme, called as Master of Science (MS) by Research, is being started from July, 2015. This programme will be open to two different types of students.

(Type - I)

1. ***For whom this program is meant for:*** Admissions will be open to both full-time and part-time students. The non-sponsored students admitted on full-time basis will be required to have a valid GATE score (unless they have graduated from an IIT with a minimum CPI of 8.0).

2. ***Eligibility for admission:*** BTech/BS (4-year)/MSc or equivalent with 55% marks/5.5 CPI, and a valid GATE score (GATE to be waived for sponsored and part-time candidates) .

3. ***Number of seats and Financial Assistance***: Up to 5 seats. Institute assistantship may be provided to some selected candidates having valid GATE score. Other candidates must be sponsored through project funding from their thesis supervisors (or) financial sponsorship must come from their parent industrial organization. .

4. ***Course work requirements:*** Three compulsory courses (total credits: 27) and minimum one course (credits: 9 or more) taken by each student in consultation with his/her thesis, without any restrictions on the courses taken or the semesters in which the courses are taken.

5. ***Minimum duration:*** Four semesters.

6. ***Minimum credits required to graduate:*** Course – 36, Thesis – 72, Total = 144 credits.

7. ***Minimum CPI requirement:*** 6.5/10.00.

(Type - II)

1. ***For whom this program is meant for:*** Admissions will be open to both full-time and part-time students. The non-sponsored students admitted on full-time basis will be required to have a valid GATE score (unless they have graduated from an IIT with a minimum CPI of 8.0). Some of them may be offered Institute or Project Assistantships, as in the case of the M.Tech. students.

2. ***Eligibility for admission:*** B.Sc. (3-year) or equivalent with 75% marks/7.5 CPI. It may be noted that only those applicants, who have taken Mathematics in 10+2, will be considered eligible to apply.

3. ***Course work requirements:*** In addition to the three compulsory courses (total credits: 27) there will be 2 electives from the PG basket taken by each student in consultation with his/her thesis, without any restrictions on the courses taken or the semesters in which the courses are taken.

5. ***Minimum duration:*** Six semesters

6. ***Minimum credits required to graduate:*** Course – 36, Thesis – 72, Total = 216 credits

7. ***Minimum CPI requirement:*** 6.5/10.00

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). From the academic session 2015-2016, a new post graduate academic programme "MS by Research" is being started.

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 Sumit, 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 J., Ph.D. (University of Michigan, Ann Arbor): Renewable energy storage, thermal management of portable energy sources, energy storage materials, computational material science, thermodynamic analysis of energy harvesting and storage, heat transfer, low cost energy options

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

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

Chatterjee Anindya, Ph.D. (Cornell University): Dynamics and Vibrations.

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.

De Santanu, Ph.D. (IISc Bangalore): Turbulent Combustion, Flame Stabilization, Droplet and Spray Combustion, Soot Formation and Emission

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.

Guha Anirban, Ph.D. (University of British Columbia): Hydrodynamic instabilities, wave mechanics, vortex dynamics, chaotic flows, transport and mixing, gravity currents, flow over topography

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.

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.

Kumar Arvind, Ph.D (IISc Bangalore): Manufacturing (casting, joining, welding, electron/laser beam melting/welding, layered and micro manufacturing, photovoltaic silicon

growth); Heat transfer, Computational fluid dynamics (CFD); Multiscale and multiphysics modelling − coupling of heat transfer with electric/magnetic fields, thermal stress etc; Solid-Liquid phase change (Melting/solidification); Laser/plasma assisted surface coating technologies; Phase change energy technologies; Flow interaction with cells and tissues.

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

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

Prasad Shikha, (University of Michigan, Ann Arbor): Radiation detection, radiation shielding, radiation transport methods, reactor safety analysis

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

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

Sarkar S., Ph.D. (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.

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.

Sinha Neeraj, Ph.D (U Waterloo, Canada): Nanotechnology, Bioengineering, Manufacturing system

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.

FACILITIES

The Department maintains many specialized research laboratories and facilities and their details can be seen on http://www.iitk.ac.in/mech/

MS BY RESEARCH PROGRAMME (MECHANICAL ENGINEERING)

Although the M.Tech. programme in Mechanical Engineering has been successfully running for last several years it is realized that this M.Tech programme does not cater to the aspirations of the students aspiring for a research career, personnel employed in the industry, research laboratories and those employed in research projects. Therefore, the department of Mechanical Engineering at IIT Kanpur has started a post-graduate programme, called Master of Science (MS) by Research.

1. *For whom this program is meant for:* Admissions under the MS by Research Programme will be open to full-time (non-sponsored) candidates as well as the sponsored candidates. The non-sponsored students admitted on full-time basis will be required to have a valid GATE score.

2. *Eligibility for admission:* BTech/BS (4-year) or equivalent in Mechanical Engineering and Production Engineering (For Manufacuring Sciences Stream only) with 55% marks/5.5 CPI, and a valid GATE score (GATE to be waived for sponsored and part-time candidates).

3. *Number of seats and Financial Assistance*: Up to 40 seats. Institute assistantship may be provided to some selected candidates having valid GATE score. Other candidates must be sponsored through project funding from their thesis supervisors (or) financial sponsorship must come from their parent industrial organization.

4. *Minimum course work requirements:* 45 credits

5. Minimum research credit requirements: 72credits

5. *Minimum durations:* Four semesters

6. *Minimum credits required to graduate:* 144 credits

PHOTONICS SCIENCE AND ENGINEERING

(Inter-disciplinary Programme)

Laser activity started at IIT Kanpur in 1964 and by late 1960s, 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 Engineering and Science graduates for providing skilled manpower in the specialized field of lasers and photonics. The name of the programme was changed to Photonics Science and Engineering in the year 2012. It is hard to imagine our lives without laser-based optical communications and networks; compact disc payers; laser printers, laser surgery; lasers-based 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. 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 to guide / supervise M.Tech theses. The students make use of the in-house facilities of the Centre for Lasers and Photonics, which consolidate 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 course on Photonics Science & Engineering Laboratory Techniques facilitates the process.

The programme offers M.Tech. and Ph.D. degrees. From the academic session 2015-16, a new post-graduate programme named "M.S by Research" is introduced.

FACULTY

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

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

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

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

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

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

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

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

Asima Pradhan, Ph.D. (CUNY, N Y): Biophotonics, Laser Spectroscopy and Imaging

G. Rajshekhar, Ph.D (EPFL Switzerland): Optical Metrology, Digital Holography, Biomedical Imaging, Applied Signal Processing.

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

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

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

FACILITIES

Besidesthecentralfacilitiesat theInstitutelevel,theCentrefor Lasers and Photonics (CELP) has its own precision machine shop and library, which supportthe Photonic Science and EngineeringProgramme.Variousstate-of-the-artfacilitiesi.e.Femto-second laser, Ti-sapphire laser, CCD – spectrograph system, micro-Raman facility, spectro fluorimeter, Polarimetry system, PIV, Interferometry, Holography, Schlieren, CO_2 laser, confocal microscopy, Tunable laser, optical wave guiding setup, pulsed laser sources, diode lasers, MCT detectors, laser scanners, Photon counters and Lock-in amplifier are available. The programme also shares a semiconductor optoelectronic device fabrication facility with other departments.

MS BY RESEARCH PROGRAMME (PHOTONICS SCIENCE AND ENGINEERING)

Centre for Lasers and Photonics (CELP) has been offering a successful Master of Technology (M.Tech.) programme in Photonics Science and Engineering (PSE) for several years in topics related to Lasers and Photonics. However this programme does not cater to the aspirations of the personnel employed in industry, the sponsored research projects in CELP and to those with an undergraduate degree but highly research-oriented. Hence a new postgraduate programme, called as Master of Science (MS) by Research, in CELP is being started July, 2015. This new programme will be open to two different types of students. Total number of students to be admitted is 05.

(TYPE – I)

1. *For whom this program is meant for:* Admissions will be open to full-time (non-sponsored) candidates as well as the Project sponsored candidates through the Department level admission committees. The non-sponsored students admitted on full-time basis will be required to have a valid GATE score.

2. *Eligibility for admission:* BTech/BS (4-year)/MSc or equivalent with 55% marks/5.5 CPI, and a valid GATE score (GATE to be waived for sponsored and part-time candidates)

3. *Financial Assistance*: Institute assistantship may be provided to some selected candidates having valid GATE score. Other candidates must be sponsored through project funding from their thesis supervisors (or) financial sponsorship must come from their parent industrial organization.   .

4. *Course work requirements:* Only one course (credits: 9) is compulsory out of the basket of five PSE courses in order to earn the degree. (PSE 601: Introduction to Photonics, PSE 602: Principles of Lasers and Detectors, PSE 603: Numerical methods in Optics, PSE 604: Photonic Systems and Applications, PSE 605: Photonics Laboratory Techniques)

5. *Minimum durations:* Four semesters

6. *Minimum credits required to graduate:* Course – 36, Thesis – 72, Total = 216 credits

7. *Minimum CPI requirement for graduation:* 6.5/10.00

(TYPE - II)

1. *For whom this program is meant for:* Admissions under the proposed M.S. by Research programme will be open to both full-time and part-time students. The non-sponsored students admitted on full-time basis will be required to have a valid GATE score (unless they have graduated from an IIT with a minimum CPI of 8.0). Some of them may be offered Institute or Project Assistantships, as in the case of the M.Tech. students.

2. *Eligibility for admission:* BSc (3-year) or equivalent with 75% marks / 7.5 CPI.

3. *Course work requirements:* Only one course (credits: 9) is compulsory out of the basket of five PSE courses in order to earn the degree. (PSE 601: Introduction to Photonics, PSE 602: Principles of Lasers and Detectors, PSE 603: Numerical methods in Optics, PSE 604: Photonic Systems and Applications, PSE 605: Photonics Laboratory Techniques)

4. *Minimum durations:* Six semesters

5. *Minimum credits required to graduate:* Course – 72, Thesis – 72, Total = 216 credits

6. *Minimum CPI requirement for graduation:* 6.5/10.00