

Information Brochure

for

Admissions in Post Graduate Programme

MS (Research)

Academic Session: 2015-16, Semester: II



INDIAN INSTITUTE OF TECHNOLOGY KANPUR

KANPUR-208016

UTTAR PRADESH (INDIA)

CHEMICAL ENGINEERING

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 (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 Swarup Bhatnagar prize, Herdillia, Amar Dye-Chem and NOCIL awards of IChE, 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, GSF, 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.

Goutam Deo, 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. (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.

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.

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

Nishith Verma, 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 (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 (Research)) to admit non-chemical engineering students. The broad guidelines for the MS (Research) programme are outlined below.

1. **For whom this programme is meant for:** We envisage two pools of students who will benefit from such a programme: (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 degree in chemical engineering, with significant research component in the thesis, who are otherwise ineligible to apply to the M.Tech programme because of their non-chemical engineering background.

2. **Eligibility for admission:** B.Tech/M.Sc degree 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.

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 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 (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 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.

Sekhar K Chakrabarti, Ph.D. (Arizona, Tucson): Structural Engg.—Behavior and Design 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): Transportation Engg.—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.

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 transport of pollutants, Environmental modeling, climate change.

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

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. (Southern California): Structural Engg.—Random vibrations, Earthquake engineering.

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

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

Bharat Lohani, Ph.D. (Reading): Geoinformatics—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): Structural Engg.—Durability and deterioration of concrete structures, Non-destructive testing, Concrete materials.

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

B. Nagarajan, Ph.D. (Ohio): Geoinformatics - 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): Transportation Engg.—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 pavement construction, Surface properties of aggregates and interaction with binding materials.

Richa Ojha, Ph.D. (Purdue University): Hydraulics & Water Resources Engg.—Flow and transport through unsaturated porous media.

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

Durgesh C Rai, Ph.D. (Michigan, Ann Arbor): 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. (California, Irvine): Structural Engg.—Structural dynamics, Earthquake Engg., Performance-based design, structural rehabilitation, seismic soil-structural interaction, structural health monitoring & structural testing.

Prishati Raychowdhury, Ph.D. (California, San Diego): Geotechnical Engg.—Soil dynamics, Geotechnical Earthquake Engineering, Seismic soil-structure interaction.

Rajesh Sathiyamoorthy, Ph.D. (IIT/B): Geotechnical Engg.—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.

Abhas Singh, Ph.D. (Washington, Saint Louis): Environmental Engg.—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): Hydraulics & 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.

Sachchidan Tripathi, Ph.D. (Reading): Environmental Engg.—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.

Shivam Tripathi, Ph.D. (Purdue): Hydraulics & Water Resources Engg.—Statistical hydrology, Sediment transport, Eco-hydrology.

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

Harish K Venkatanarayanan, Ph.D. (Clemson): Structural Engg.—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 Imagine, ERMapper, ArcInfo 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 (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 employed in 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 MS (Research), in the Department starting from July, 2015.

1. **For whom this programme is meant for:** Admissions under the MS (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

COMPUTER SCIENCE & ENGINEERING

The department offers academic programs leading to B.Tech., M.Tech., M.Tech. dual degree (B.Tech. and M.Tech) and Ph.D in Computer Science and Engineering. The department has felt the need for another postgraduate programme which caters to the needs of two groups of students: (i) Those who are employed in research projects, and (ii) those who are research oriented. Hence it is proposed to start a new postgraduate programme, called Master of Science MS (Research), in the Department of Computer Science & Engineering starting from December, 2015.

(TYPE – I)

1. For whom this program is meant for:

Research engineers employed in a project being carried out in the Institute.

2. Eligibility for admission:

- B.Tech/BE/BS(4yrs)(CS or IT)/MCA/MSc(CS) with $CPI \geq 6.00$ or $\geq 60\%$, valid GATE CS score.
- B.Tech/BE/BS(4yrs)(any discipline) with $CPI \geq 7.5$ or $\geq 75\%$, valid GATE CS score.
- B.Tech/BE/BS(4yrs)/MSc in EC/EE/Electronics/Math, GATE score in EE/EC/Math should be in top 1.0% and $CPI \geq 7.5$ or $\geq 75\%$ in eligibility degree.
- All degrees should be in non-distance mode.
- Part-time or sponsored candidates do not need GATE qualification

3. Number of seats: 10 (05 with Institute assistantships)

4. Course work requirements: 36 PG course work-all electives. Additional course work may have to be done if recommended by the thesis supervisor/DPGC.

5. Minimum durations: Four semesters

6. Minimum credits required to graduate: Course – 36, Thesis – 108, Total = 144 credits

7. Minimum CPI requirement: 6.5/10.00

(TYPE - II)

1. For whom this program is meant for:

Those students who have a 3-year or 4-year bachelors degree in CS or related fields or in Mathematics or Physics.

2. Eligibility for admission:

- 3-years Bachelors degree in CS/IT/Computer Applications/Math/Stat/Phy with a $CPI \geq 7.5$ or 75%

- Degrees should be in non-distance mode.

3. **Number of seats:** 10 (At most 10 after the first year. First year will in self-financed mode. In the second and third years they can be paid institute assistantship if they qualify in GATE/NET/JRF in CSE)

4. **Course work requirements:** Minimum 90(i.e., 10 courses) credits of course work which includes 6 compulsory courses: CS210, CS251, CS252, any three from the basket: {CS220, CS245, CS315, CS330, S335, CS340, CS350, CS365, CS422, CS425} and 4 PG electives. Courses in the basket may be amended from time to time.

4. **Minimum durations:** Six semesters

5. **Minimum credits required to graduate:** Course – 90, Thesis – 108, Total = 216 credits

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

7. **Admission:** Will be done through written test and interview at IIT Kanpur. To keep numbers manageable the cut-off norms for shortlisting may be stricter than the eligibility conditions and may involve cut-offs at class 10 and class 12 levels

The sponsored students admitted on full-time basis and the students admitted on part-time basis (with a minimum of one year of project support from the date of admission, in the case of those employed on sponsored research projects in the Institute) will not be required to satisfy the GATE requirement. The (part-time) students employed on sponsored research projects in the Institute will not be supported by the DPA of the Department, in case they fail to get project funding in their second year of the programme. Such students may be offered Institute Assistantship, as in the case of the M.Tech. students, for a maximum of one year, provided they have a valid GATE score and their case is considered favourably by the DPGC of the Department.

Applications for admissions under the M.S. by Research programme will be invited independent of those for the M.Tech. programme and thus those interested to apply in both programmes will need to make separate applications. The merit list for each specialization for admissions under the proposed M.S. by Research programme will be prepared by following the same process as for the MTech programme, but the cut-off GATE scores (used for short-listing for the purpose of interview/written test) for the two programmes will be independent of each other.

FACULTY

Manindra Agrawal, Ph.D. (IIT, Kanpur): Computational complexity theory, randomized algorithms, cryptography, computational number theory.

Surender Baswana, Ph.D. (IIT, Delhi): Graph algorithms, dynamic algorithms and randomized algorithms.

Arnab Bhattacharya, Ph.D. (Univ. of California, Santa Barbara): Database systems, data mining, bioinformatics.

Somenath Biswas, Ph.D. (IIT, Kanpur): Computational complexity theory, logic, randomized algorithms, computational biology.

Mainak Chaudhuri, Ph.D. (Cornell Univ.): Computer architecture, cache coherence protocols.

Sumit Ganguly, Ph.D. (Univ. of Texas, Austin): Database systems, streaming algorithms.

R K Ghosh, Ph.D. (IIT, Kharagpur): Mobile computing, adhoc and cellular mobile networks, parallel and distributed computing, web services, mobile commerce.

Phalguni Gupta, Ph.D. (IIT, Kharagpur): Biometrics, image processing, sequential and parallel algorithms, parallelization of sequential programs.

Ajai Jain, Ph.D. (McGill Univ.): Machine translation, VLSI testing, computer architecture, parallel computing.

Amey Karkare, Ph.D. (IIT Bombay): Compilers, Program Analysis and Optimizations, Functional Programming, Intelligent Tutoring Systems.

Harish Karnick, Ph.D. (IIT, Kanpur): AI, machine learning, cognitive science, programming languages, computational biology.

Piyush P Kurur, Ph.D. (IMSc, Chennai): Complexity theory, computational algebra, quantum computing.

Shashank Mehta, Ph.D. (Univ. of Nebraska): Graph and Geometry Algorithms, Approximation Algorithms

Rajat Mittal Ph.D. (Rutgers University): Quantum computing, Complexity, Combinatorics.

Rajat Moona, Ph.D. (IISc, Bangalore): Computer architecture, embedded computing hardware, operating systems, VLSI design and CAD for VLSI.

Amitabh Mukherjee, Ph.D. (Univ. of Rochester): Visual surveillance, natural language processing, machine learning, cognitive science.

Satyadev Nandakumar, Ph.D. (Iowa State Univ.) : Algorithmic information theory, computable real and complex analysis.

Vinay P. Namboodri, Ph.D. (IIT Bombay): Computer Vision, Machine Learning, Image Processing, Computer Graphics

T V Prabhakar, Ph.D. (IIT Kanpur): Software architecture, Knowledge Engineering, Cloud Computing, Big Data Architectures..

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

Dheeraj Sanghi, Ph.D. (Univ of Maryland) On leave: Computer networks, protocols at MAC/network/transport layers, Ipv6, wireless networks, internet applications, multimedia applications

Nitin Saxena, Ph.D. (IIT Kanpur): Computational Complexity Theory, Algebra, Number theory, Algebraic-Geometry.

Sanjeev Saxena, Ph.D. (IIT Delhi): Parallel processing, algorithms and data structures, heuristics, computational geometry, graph theory, VLSI and architecture.

Sandeep Shukla, Ph.D. (SUNY, Albany): Cyber security of cyber physical systems, formal methods, formal verification, software engineering, embedded systems.

Sunil Simon, Ph.D. (IMSc, Chennai): Algorithmic aspects of game theory, Logic, automata and games, theory of distributed systems.

Anil Seth, Ph.D. (TIFR, Mumbai): Logic in computer science.

Raghunath Tewari, Ph. D. (Univ. of Nebraska): Computational complexity theory, graph theory.

LABORATORY

The department has its own well-equipped laboratories apart from a state-of-art Computer Centre that is a central facility. IIT Kanpur has one of the largest campus-wide networks in the educational sector in the nation with 3Gbps 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.

ELECTRICAL ENGINEERING

The department of Electrical Engineering offers M.Tech and Ph.D programmes 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 Synchronphasors; 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, Electromagnetic Tomographic 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 GRADUATE academic programme “MS (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 Alope, Ph.D. (LouisianaState): Semiconductor device modeling; IC fabrication technology, 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; Uncertainty modelling; Stochastic analysis and optimization; Robust and efficient system operation and planning; Renewable integration in power systems; Deregulation.

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 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.

Rajshekhhar 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, Ph.D. (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 (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 MS (Research) Programme, is being started by the department.

1. **For whom this programme is meant for:** Admissions to MS by Research 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

MECHANICAL ENGINEERING

The Department of Mechanical Engineering is engaged in UG and PG teaching, research, developmental work and industrial consultancy. The PG programme 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 (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 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.

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.

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.

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.

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.

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

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.

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

Sinha Sujeet K., Ph.D (Imperial College, London UK): Nanotribology of microsystems, Tribological coatings, Lubrication, Polymer tribology, Bio-inspired surfaces for Tribology.

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

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.

FACILITIES

The Department maintains the following laboratories for instruction and research: Experimental Stress Analysis, Vibration and Control, Material Testing, Machines and Mechanisms, 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/>

MS (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 personnel employed in the industry and those employed in research projects and have a non-Mechanical Engineering background. Therefore the department of Mechanical Engineering at IIT Kanpur has started a new interdisciplinary post-graduate programme, called MS (Research).

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

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 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. ***Course work requirements:*** 36

5. ***Minimum durations:*** Four semesters

6. ***Minimum credits required to graduate:*** Course – 36, Thesis – 90, Total = 144 credits

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