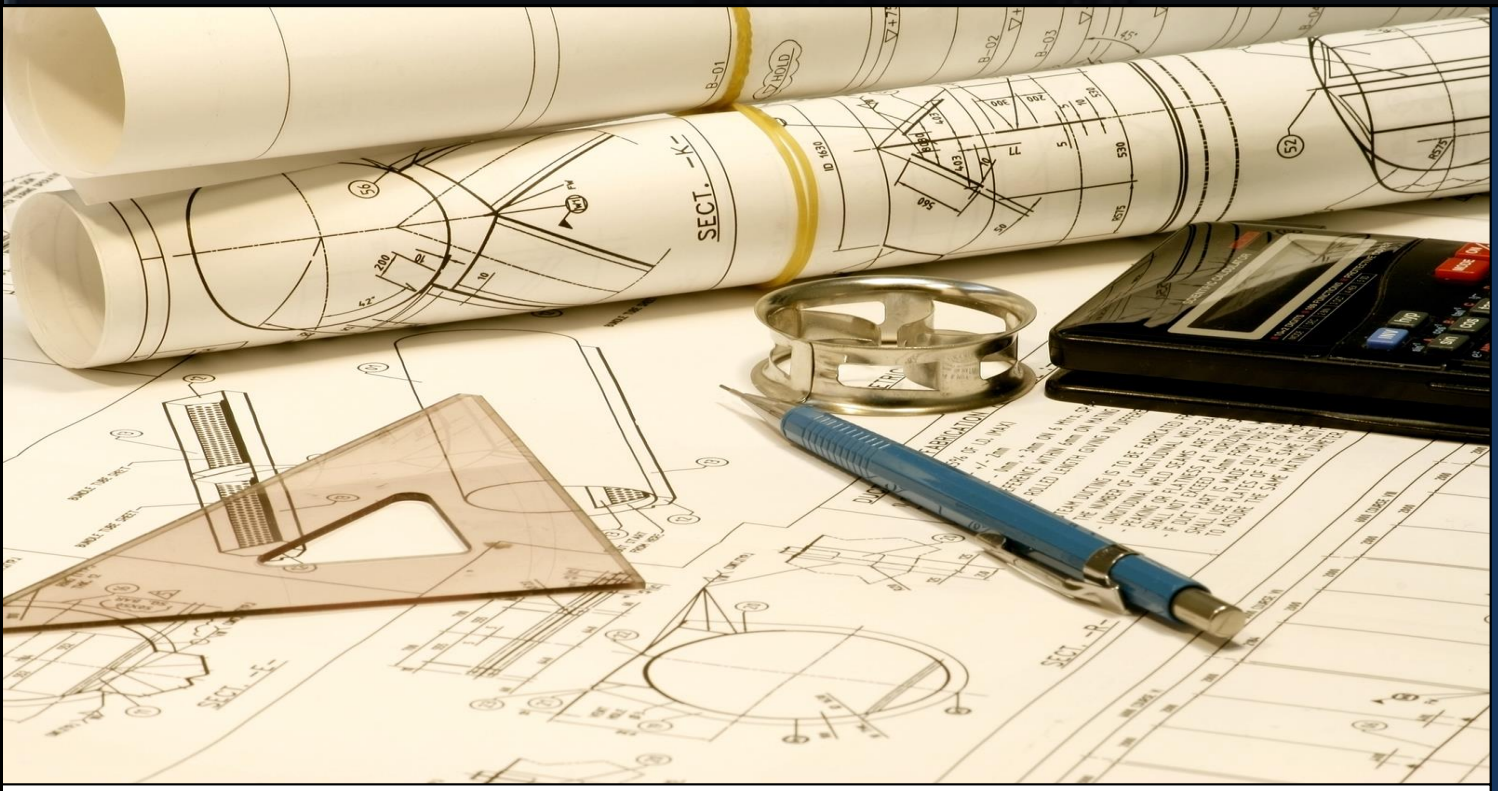
DEPARTMENT OF Mechanical Engineering



Mechanical Engineering has been one of the broadest and the most fundamental branches of engineering that involves application in every possible field starting from the minutest engineering scales known to mankind to the biggest astronomical scales man has ever covered.

The Mechanical Engineering Department of Indian Institute of Technology, Kanpur, has a legacy of its own and is one of the most prestigious departments in India with extensive contribution to ground breaking research works occurring in the country. Nurturing the best minds of the nation, both in the form of faculty and students, is one of the key mottos of the department. The department has been sought after by the biggest of the firms for consultation owing to a proficient and dedicated faculty, the big names including the likes of Indian Railways, DRDO and ISRO.

The Department offers one of the best academic exposures to students with its complete program including extensive course-works, state of the art laboratory facilities and one of the best faculties on the nation who are dedicated to make a difference in terms of a greater contribution to the scientific society.

With such a background, the students completing their tenure from this department have one of the best trained minds of the nation, if not in the world. Setting standards for other institutes to follow, this department has produced the best creative thinkers and promises to do so in future.

CONTACTS

Placement Coordinator (Under Graduate)	Placement Coordinator (Under Graduate)	Placement Coordinator (Post Graduate)	Placement Coordinator (Faculty)
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Visit us at http://www.iitk.ac.in/me/

ABOUT DEPARTMENT

The department of Mechanical Engineering was established as one of the founding departments when the Indian Institute of Technology, Kanpur was setup in 1964 as a part of the Indo-US program.

Ever since, the department is dedicated to its contribution to the scientific and industrial society and has evolved continuously.

The department played a leading role in devising the Engineering Science based curriculum and served as a model for many engineering institutes in the country.

The Department of Mechanical Engineering trains students in the methods of engineering science and in the application of these methods to conceive, analyse and design engineering systems.

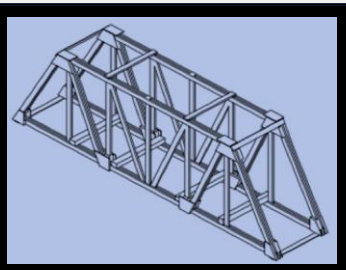
The professional programme of the department includes a deeper study of a number of engineering, theoretical and experimental solution of physical problems, and design of systems relevant to the contemporary industrial world. The areas introduced by the department include energy conversion and power systems, heat transfer and fluid mechanics, mechanics of solids and stress analysis, manufacturing science, industrial engineering, automatic controls and engineering design and optimisation. Laboratory experience is considered an important part of the Mechanical Engineering programme. There are course-oriented state of the art laboratories where a student does experimental work leading to a better understanding of physical phenomena.

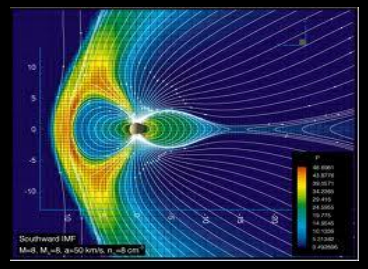
The department of mechanical engineering has postgraduate programmes leading to M. Tech. and PhD degrees in four broad streams, viz., Solid Mechanics and Design, Fluid Mechanics and Thermal Sciences, Manufacturing Sciences and Mechatronics. Within these streams, new areas which receive vigorous attention include fracture mechanics, experimental mechanics, flow control, optical measurements, alternative fuels, computer aided manufacturing, computational fluid dynamics and heat transfer, genetic algorithms, smart materials, rapid prototyping, micro-scale transport, micro measurements and sensors, nano-mechanics, and mechatronics. In the postgraduate programme, the emphasis is on the development of a broad background in a particular stream followed by a deeper study of a research topic.

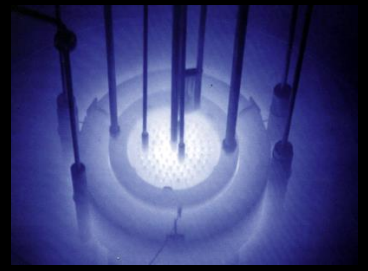
Over the years, industrial interactions and emphasis on applied engineering and research have increased many folds. This department has supplied the best evolved minds of the country to the industry and research centres.

The present streams of study in the department can be broadly categorized as;

- **Solid Mechanics And Design**
- **Fluid Mechanics And Thermal Sciences**
- **Manufacturing Sciences**
- **Mechatronics**







RESEARCH ACTIVITIES AND INDUSTRY INTERFACE

The institute has a reputation of devout contributions in the field of Research and Development. The following points briefly highlight the key areas of research activities being carried out here at the Department of Mechanical Engineering, IIT Kanpur:

Research Topics

1. **Solid Mechanics and Design**
   - i. Solid Mechanics
   - ii. Finite Element Methods
   - iii. Vibration Dynamics
   - iv. Fracture and Fatigue
   - v. Optimization Techniques
   - vi. Computer Aided Design

2. **Fluid Mechanics and Thermal Sciences**
   - i. Computational Fluid Dynamics and Heat Transfer (including turbomachines)
   - ii. Experimental Fluid Dynamics and Heat Transfer
   - iii. Internal Combustion Engines and Alternate Fuels
   - iv. Fuel Cells
   - v. Refrigeration and Air Conditioning

3. **Manufacturing Sciences**
   - i. Advanced Manufacturing Processes
   - ii. Computer Aided Manufacturing
   - iii. Micromachining
   - iv. Finite Element Methods
   - v. Solid Mechanics
   - vi. Production System

4. **Mechatronics**
   - i. Production Systems
   - ii. Automation
   - iii. Mechanisms
   - iv. Robotics
   - v. Computer Aided Design

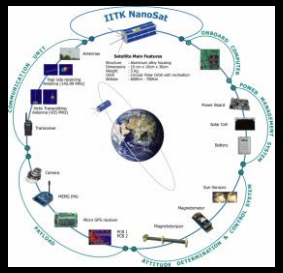
Industrial Liaisons

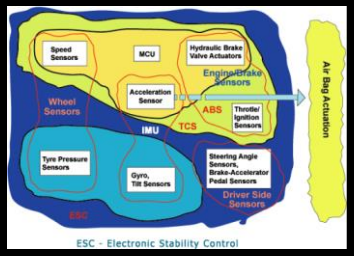
- **Indian Railways:**
  Wheel Impact Load Detection System (WILD),
  Derailment Detection Devices,
  Measuring Wheel Technology,
  Onboard Diagnosis,
  Bogie Design,

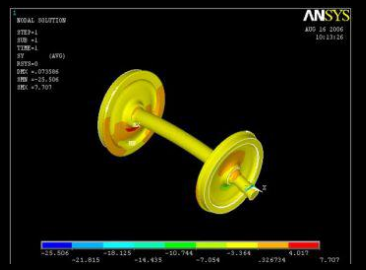
- **ISRO:**
  IITK NanoSat - JUGNU
  Chandrayan II

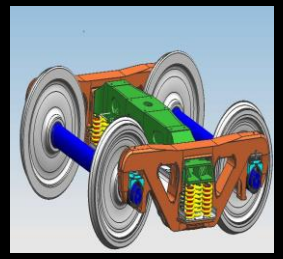
- Other firms include **DRDO, HAL, MHRD, DST, CDAC, NAL, ADA** etc

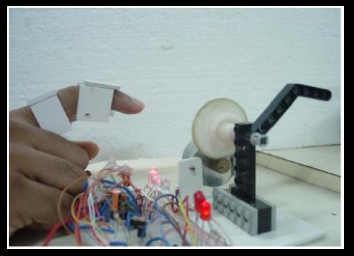
- A few others among the numerous sponsored projects include;
  MEMS based electronic stability programme for automobile applications
  Tele-operated finger robot
  Micro-flight test bed
  Fused deposition modelling
  Injection moulding machine
  Electrochemical spark machining

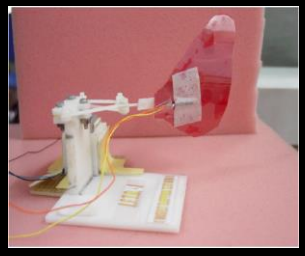












LABORATORY FACILITIES

The Department has the best of the laboratory facilities in the nation which provide state of the art facilities to the students and faculty. The laboratories have been designed keeping in mind the crucial aspect of training the students with a modern industry outlook ,as well as, serve the demanding research requirements.

- **4i Laboratory**
  The lab houses the state-of-art tools with latest capabilities in modelling and prototyping that significantly expand the domain of geometrical shapes which can be realized for any product.

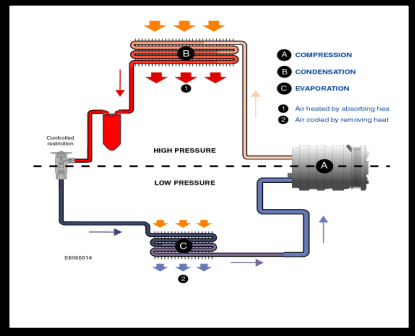
- **Control Laboratory**
  Research area includes sensors and actuators, mechatronics system, feed-forward and feedback control system, vision and shape control.

- **Experimental Stress Analysis Laboratory**
  Research topics include composites, FEM, NDT, Dynamic fracture, high-strain rate deformation, photo-elasticity, molecular modelling, coupled field analysis.

- **Fluid Mechanics Laboratory**
  Research areas of interest of the lab are Particle Image Velocimetry(PIV), comparisons of computational results for YAG and silicon in Czochralski process, visualization of natural convection in a Czochralski crucible using Liquid Crystal Thermography (LCT), interferometry, Schlieren, shadowgraph, rib-turbulators applications, smoke flow visualization, flow visualisation behind a cylinder.

- **Heat Transfer and Refrigeration & Air-Conditioning Laboratory**
  Research areas include liquid-vapour phase change phenomena, heat pipes/ pulsating heat pipes/ thermosyphons, flow and heat transfer in narrow channels, drop-wise condensation, energy systems, nanofluids.

- **Materials Testing Laboratory**
  Research to understand advanced polymeric composites, functionally graded composites, smart particulate composites, nano-composites.



LABORATORY FACILITIES *(continued)*

Apart from the aforementioned undergraduate laboratories, the department has some advanced laboratorial facilities for off the edge research facilities and to acquaint the students with hi tech research environment.

Advanced Laboratories

- **Advanced Nano Engineering Materials Laboratory**
  Research areas of interest of the lab are carbon nanotube, nanomaterial, carbon-carbon composites, functionally graded composites.

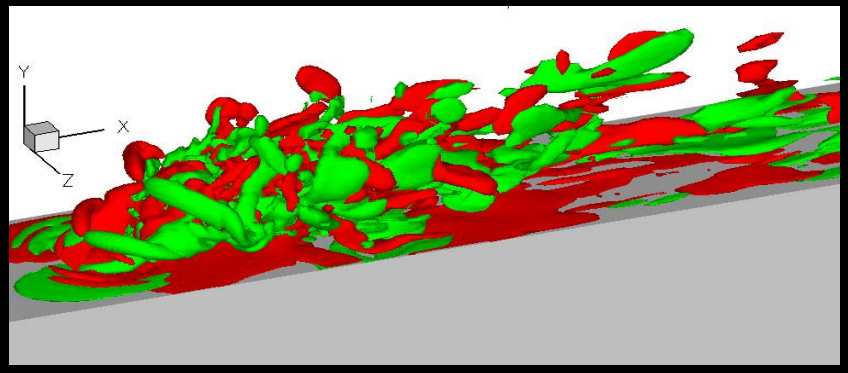
- **CAD and Rapid Prototyping Laboratory**
  Major areas of research are engineering design & manufacturing, reverse engineering, rapid prototyping & rapid tooling, CAD/CAM, computer graphics & computational geometry, kinematics & dynamics of mechanisms.

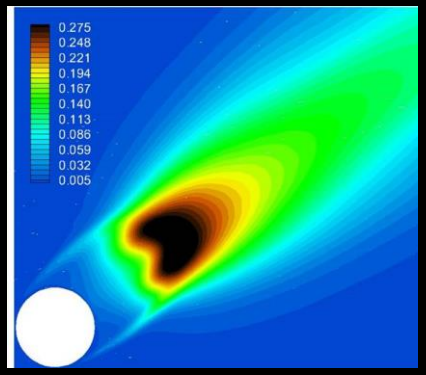
- **CAM and Manufacturing Sciences Laboratory**
  The lab has extensive research areas including metal cutting, metal forming, manufacturing automation, tool wear monitoring, unconventional machining processes, accelerated cutting, CAPP, CAM, machining of advanced engineering materials, die and mould design, condition monitoring, tribology, micro electromechanical systems, nanofabrication.

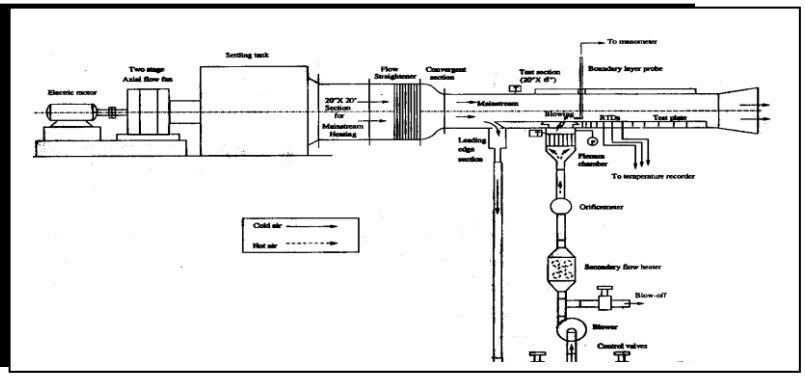
- **Centre for Mechatronics**
  Research area includes robotics, machine dynamics, optimization, scientific computing, bio-robotics, intelligent control systems, biomechanics and sensors.

- **Computational Fluid Dynamics Laboratory**
  The research is concerned with the flow past bluff bodies, large-eddy simulation, flow and heat transfer in impinging slot jet, mixed convective flow studies, natural convection in anisotropic porous enclosures, CFD in food processing, flow structure and heat transfer in heat exchanger applications.

- **Computational Mechanics Laboratory**
  Major area of research are multiscale modelling of materials mechanics of thin films, thermo-mechanics of deformation and fracture in glassy polymers, dynamic fracture mechanics, computational techniques for the simulation of contact and impact, finite element techniques for large deformation, elastoplasticity.







LABORATORY FACILITIES *(continued)*

The advanced laboratories provide progressive facilities which are among the main reasons why top notch research centres of India line up for consultation.

Advanced Laboratories (contd.)

- **Computational Turbomachinery Laboratory**
  Research in this lab focuses on computational fluid dynamics applied to turbomachinery: flow analysis through blade passages, film cooling of turbine blades, wake-induced unsteady flows, les for complex transitional and turbulent flows, DNS and flow instability, development of efficient flow solvers, turbulence modelling of compressible flows.

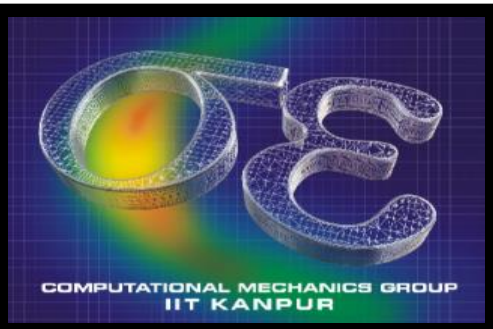
- **Advanced Fluid Mechanics Laboratory**
  Research areas of interest of the lab are Particle Image Velocimetry(PIV), comparisons of computational results for YAG and silicon in Czochralski process, visualization of natural convection in a Czochralski crucible using Liquid Crystal Thermography (LCT), interferometry, Schlieren, shadowgraph, rib -turbulators applications, smoke flow visualization, flow visualisation behind a cylinder.

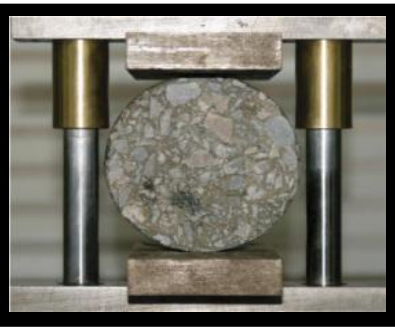
- **Internal Combustion Engines Laboratory**
  Major areas of research are IC engines, combustion and emissions, biodiesel development and characterisation, lubricating oil tribology, laser diagnostic techniques and microsensor development for IC engines.

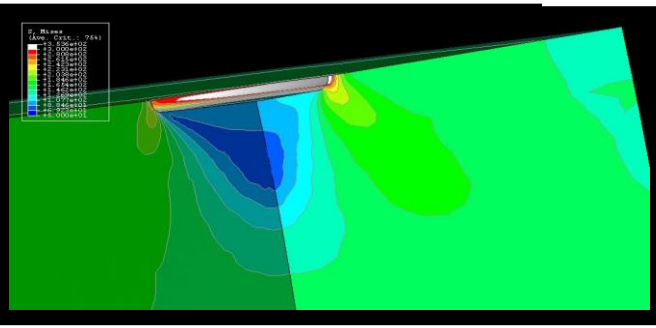
- **Kanpur Genetic Algorithms Laboratory**
  Research area includes multi-objective evolutionary algorithms, non-dominated sorting genetic algorithm, Innovization (innovation through optimization), real-parameter genetic algorithms, constrained nonlinear optimization.

- **Smart Materials Laboratory**
  The lab has extensive research areas including active vibration control, non-contact energy dissipation, energy harvesting & energy scavenging sensors & actuators, terfenol-d, PZT and EAP based smart composites, shape memory alloy based actuators, robotic grasping mechanism, and space antenna shape control.

- **Vibration Laboratory**
  The research of the vibration laboratory mainly focuses on conditioning monitoring, kinematics, design of mechanisms, dynamics of machinery, non linear vibration, and robotics.







ADMISSION PROCEDURE

Admission to Indian Institutes of Technology is in itself famous for its ultrafine filtration method that ensures recruitment of the most agile creative minds in the nation. IIT Kanpur has the distinction for enrolling the best of the best candidates in all categories and all programmes. The department hence ensures the most competitive brains available.

B.Tech and B.Tech-M.Tech (Dual Degree) Students

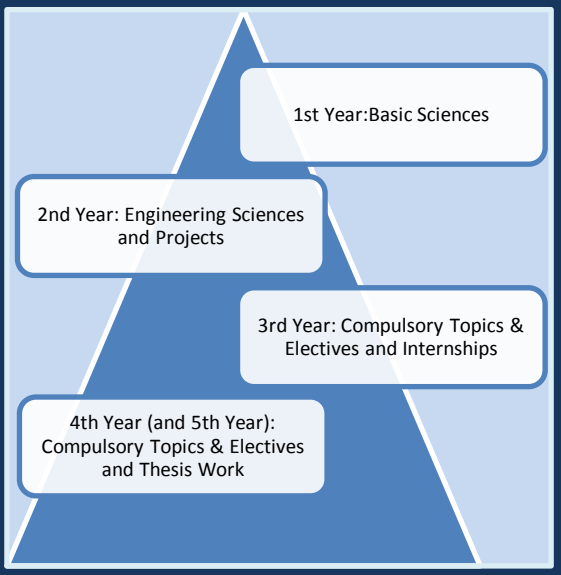
The B.Tech degree students are enrolled on the basis of their performance in Joint Entrance Examination (JEE). Nearly 5,20,000 students write the JEE examination each year, out of which only around 10,000 get admission to IITs. IIT Kanpur is one of the most sought after IITs for its outstanding reputation both in India and abroad, be it in the industrial sector or in the field of academics. Only handfuls, about 100, are enrolled for admission to the B.Tech curriculum. In one word, IIT Kanpur has the agglomeration of the most agile young minds of the society in the concerned disciplines. The current passing-out batch comprises of Dual Degree students also, a breed that will soon be extinct.

M.Tech Degree Students

The M.Tech degree students are enrolled on the basis of their performance in GATE examination. More than 1 lakh students wrote the GATE 2012 examination in this discipline out of which a only a 100 are selected for admission to the programme. The admission process involves a two tier filtration, in which the candidates are first required to clear GATE examination with a certain cut-off marks. Students with exceptional academic performance in UG curriculum and GATE examination are awarded direct admission. The rest are interviewed by panels of judges. A weighted average of UG results, GATE score and interview performance is used as the criteria for selection to the programme. In short, the best research oriented minds are accepted.

COURSE STRUCTURE

Undergraduate Courses:



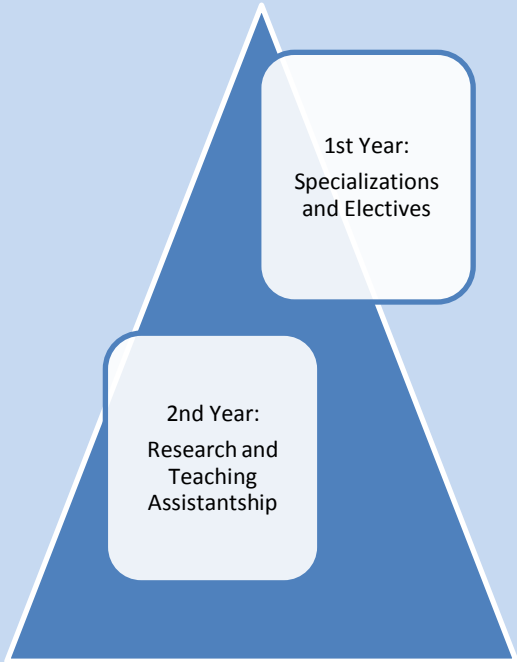
➢ The major undergraduate courses offered in the department are

Major Compulsory Courses	Major Elective Courses Offered	
Fluid Mechanics	*Refrigeration and Air Conditioning*	*Introduction to Tribology*
Heat and Mass Transfer	*Internal Combustion Engines*	*Dynamics Of Rotating Machinery*
Energy Systems I & II	*Measurement and Control of Flows*	*Numerical Control of Machine Tools*
Mechanics of Solids	*Power Systems*	*Automotive Mechanics*
Advanced Mechanics of Solids	*Direct Energy Conversion*	*Tool Design*
Design of Machine Elements	*Numerical Fluid Flow and Heat Transfer*	*Computer Aided Engineering Design*
Dynamics of Vibrations in Machinery	*Solar Energy Thermal Processes*	*Interactive Computer Graphics & Design*
Manufacturing Technology	*Analysis and Synthesis of Linkages*	*Composite Materials*
Automation and Control	*Finite Element Methods*	*Manufacturing Design*
Graphics in Mechanical Design	*Optimization Techniques*	*Computer Aided Manufacturing*
Theory of Mechanisms and Machines	*Fracture Mechanics*	*Convective Heat And Mass Transfer*

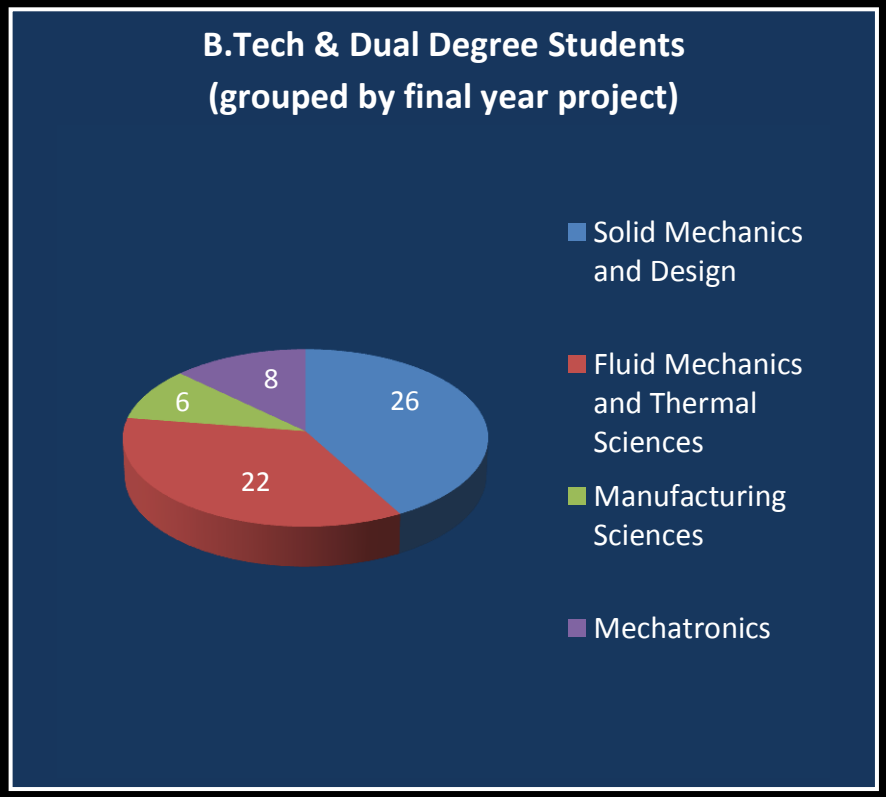
Post Graduate Courses:

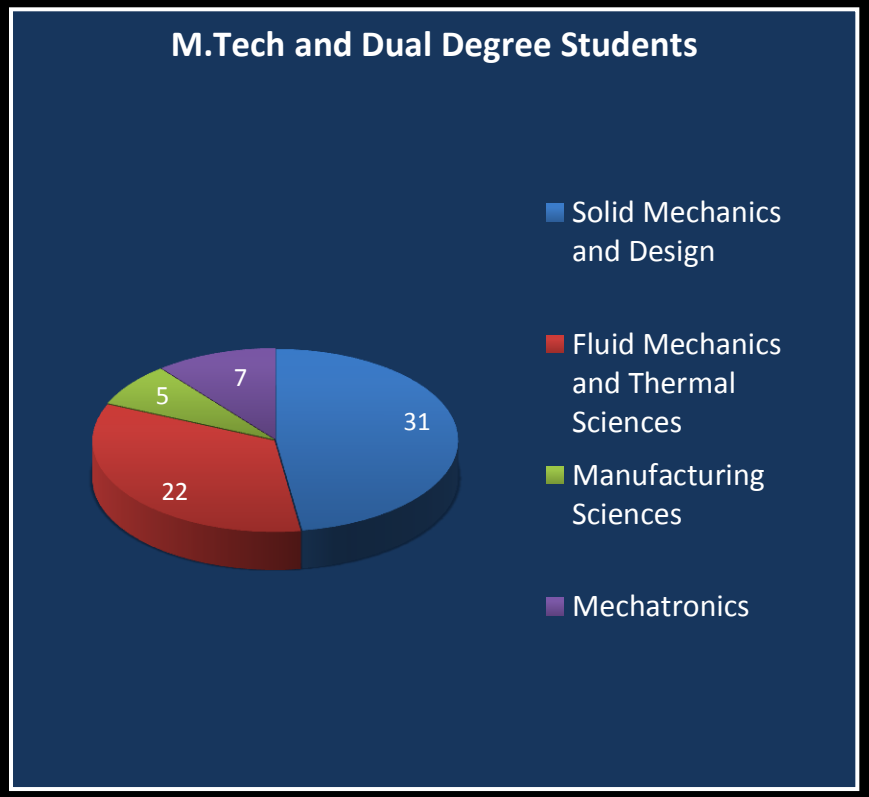
➢ The major postgraduate courses offered in the department are

Solid Mechanics and Design	Fluid Mechanics and Thermal Sciences	Manufacturing Sciences
Introduction to Solid Mechanics	*Numerical Fluid Flow and Heat Transfer*	*Metal Forming*
Applied Dynamics and Vibration	*Conduction and Radiation*	
Acoustics	*Convective Heat and Mass Transfer*	*Advanced Machining*
Wave Propagation in Solids	*Viscous Flow Theory*	
Optimization in Engineering Design	*Turbulent Fluid Mechanics*	*Fabrionics*
Finite Element Methods	*Advanced Theory of Turbo-machinery*	
Non Linear Vibration	*Engine Management*	*Computer Aided Manufacturing*
Fracture Mechanics	*Alternate Fuels in IC Engines*	
Computer Aided Engineering Design	*Boiling and Condensation*	*Machining Science*
Vibration Control	*Fuel Cells*	



STUDENTS' STATISTICS: RESEARCH ORIENTATION





STUDENTS' PRACTICAL EXPOSURES: INTERNSHIPS AND PROJECTS

Compulsory Internships

Post completion of the sixth semester, undergraduate students need to undergo a mandatory internship during the summer vacation that spreads over three months. The internships are primarily of two types, industrial and academic.

- Many of the students opt for industrial internships to widen their knowledge of technological applications in field and also try out their knowledge to the real life applications.
- Some students are selected on the basis of their academic performance for the SURGE programme which is an institute initiative that allots a student under a guide for two months to work on a research topic. This program aims to train the students in an active research stimulating environment and prepare his/her mindset for a definitive goal.
- The widespread reputation of IIT Kanpur allows meritorious students to attract internships from foreign universities. Students visit top ranked universities across the globe and work under the stalwarts in their respective disciplines.
- There are many student exchange programs where several top ranked foreign universities like Caltech and others have tie ups with IIT Kanpur which allows an invaluable exposure to a research kindling environment.

Major Academic Projects

Apart from the compulsory internships there are several other programs that require individuals to be part of exciting research projects.

- **Summer Projects**: These are done by students during the 3 months summer holidays, from May to July. This involves projects of various clubs at IIT Kanpur, like aero-modelling, programming, robotics and astronomy club. These expose students to practical lab work and analysis of real systems. Students can personally approach professors and associate themselves with ongoing projects and research stuffs.

- **Semester Projects**: Students take up semester wise projects under guidance of professors which give them exposure to the practical aspects of engineering. These projects provide students with unparalleled opportunity to gain in depth knowledge and apply it to research problems outside the curriculum.

- **B.Tech Projects**: This project is undertaken for the last 2 semesters in the undergraduate curriculum and is supposed to be the culmination of the efforts at understanding of engineering concepts and their application to real life problems.

- **M.Tech Thesis**: This project is basically meant for the introduction of research and analytical work in specialized field in mechanical engineering, like solid mechanics, design, fluid and thermal science, manufacturing, robotics, optimization, etc., at the end of which the student comes out with an innovative and meticulous body of research work that he/she has done over a year.

- **PhD Thesis**: This project is undoubtedly a highly detailed research activity. PhD programs emphasize the in-depth study emphasize the exhaustive study of a highly-focused topic in a tightly-defined field in mechanical engineering. PhD experience prepares individuals with the perfect composition required to achieve breakthroughs in core research & development sectors. And eventually such an outlook prepares them to become frontrunners in the concerned disciplines.

DEPARTMENTAL RECRUITMENT HISTORY

Some of the biggest names in the industry have relied on the department over the years and it goes without saying that their trust has been more than reimbursed beyond the extent of satisfaction with the quality of students the department has nurtured. Some of those giants are as follows.

DISTINGUISHED ALUMNA'S PROFILE

A part of the widespread respect and stature of Indian Institute of Technology, Kanpur comes from the noted alumni of the institute via their achievements. Some of the many noteworthy alumni of the department are

1. **Anil K. Rajvanshi, Director of Nimbkar Agricultural Research Institute**
2. **Late Anil Agrawal, Former Director of Centre for Environment, New Delhi**
3. **Sanjay G. Dhande, Director of Indian Institute of Technology, Kanpur**
4. **Shantanu Srivastava, Technical Consultant for promotion of India-Vietnam economic relations**
5. **Rakesh Gangwal, President and Chief Executive Officer of United States Airways**
6. **David B. K. Thomas, known for his selfless services towards women empowerment**
7. **Yashwant Kanetkar, Entrepreneur and pioneer of Information Technology education in India**
8. **Pawan Kumar Goenka, Chief Operating Officer of Mahindra and Mahindra**
9. **Ravi Sethi, President of Avaya Laboratories**
10. **Late Lalit Kishore Chaudhary, Plant Director of Fairfield Atlas**
11. **Arun Shukla, Chairman, Mechanical Engineering, University of Rhode Island**
12. **Mahesh Gupta, Founder of Kent Water Purification Systems**