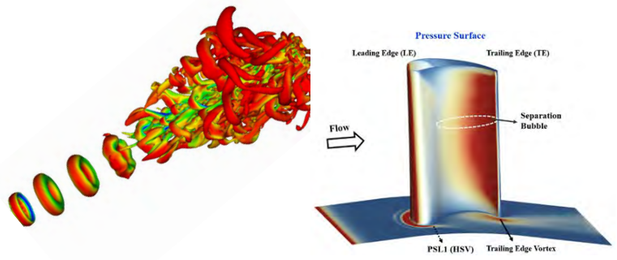
Mechanical Engineering
IIT Kanpur

www.iitk.ac.in/me
+91 512 259 7627 (Office)
+91 512 259 7408 (Fax)



The Department

Mechanical Engineering is a fundamental branch in Engineering from which much of modern technological innovation originates. Mechanical engineers routinely find themselves at the forefront of biomedical, energy, aerospace, manufacturing, nuclear and robotics research. The department of Mechanical Engineering at IIT Kanpur aims at creating highly-trained technical manpower, providing technical solutions to societal and industrial challenges, and engaging in frontier engineering research.

Doctoral (Ph.D.) Program

Our doctoral program brings together faculty members and motivated graduate students to research and innovate in some of the most challenging problems of engineering science. We are committed to developing researchers and academicians capable of independent and original research of high-quality. Interdisciplinary research is actively encouraged. In addition to research, Ph.D. students through required coursework develop a broad knowledge in at least one of the four research areas: Fluid & Thermal Sciences; Manufacturing Science, Robotics & Automation; Solid Mechanics & Design.

Admissions are made twice a year, in July and December. The minimum qualification for admission to the Ph.D. program is a Master's degree in Mechanical Engineering from a recognized University with minimum percentage/CPI specified by the Institute. Candidates with B.Tech in Mechanical Engineering, Master's degree in other branches of Engineering and Sciences with minimum percentage/CPI specified by the Institute are also considered.

Direct Ph.D. Program

We offer direct Ph.D. admission to final year B.Tech./B.E. students who qualify GATE examination based on written test and personal interview. Outstanding applicants holding a Bachelor's degree in Engineering with not less than 75% marks or a CPI of 7.5 are considered for admission.

Students from NITs and other Centrally Funded Technical Institutions with CPI of at least 7.5 (or marks > 75%) may apply for direct PhD program without requiring a GATE score.

Research

We conduct fundamental and applied research in broad areas of Mechanical Engineering, reaching well beyond traditionally identified domains. Current projects have an impact both at national and international level, cutting across boundaries of different disciplines. With its signature research programs of national and international distinction, the department aims to make a positive contribution towards securing environmental, industrial, and societal sustainability. Researchers are engaged in extremely diverse, and often inter-disciplinary projects that include probing the mysteries of a tiny cell to deciphering the Earth's geophysics; designing microfluidic sensors to developing the next-generation gas turbines; optimizing fuel cells to controlling nuclear plasmas to meet the nations' energy demands; estimating the strength of tangled polymer chains to employing sturdy composites for aerospace structures; harnessing the solar power to designing cleaner combustion devices for a pollution-free environment; understanding human origins to building humanoid robots. The opportunities and challenges are endless!

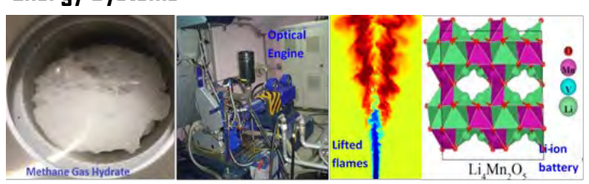
A few thrust areas are mentioned below:

Biomedical Engineering

Fluorescence images of translation of dyed DNA samples on S10 surface

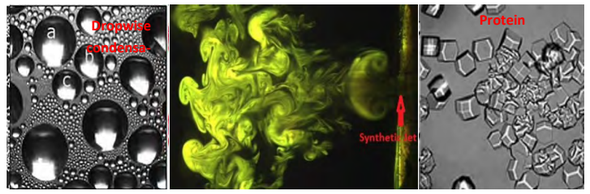
Biomedical engineering is the application of engineering principles and techniques to the medical field. It associates the design and problem-solving skills of engineers with medical and biological sciences to improve healthcare diagnosis and treatment. In this fast-emerging field, the department is involved at several levels. Examples include developing MEMS sensors for pathogen identification, traces-less diagnosis of bio-molecules, researching biological membranes to ultimately help cure disorders like certain cancers and Alzheimer's disease, and formulating a predictive model for arterial aneurysms.

Energy Systems



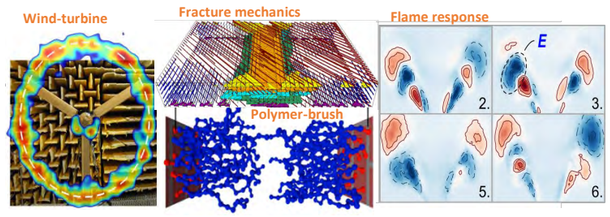
Technologies for efficient energy conversion, storage and utilization, which aim to meet the urgent challenge of a safe, reliable and sustainable energy supply in the face of ever-growing demand and increasing geo-political uncertainty. Overall, our research spans the following technical areas spanning from conventional to renewable energy systems: micro gas turbines; energy harvesting and storage, battery technology, thermal management of portable energy sources, energy storage materials, computational material science, electrochemical energy conversion, combustion and gasification, gas hydrates; hydrogen energy; nuclear power; solar and wind energy.

Imaging and non-destructive techniques



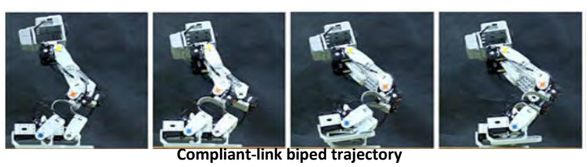
Non-invasive techniques are essential, whether it be for imaging the brain, identifying flaws in an aircraft's fuselage or a nuclear reactor, probing fluids without physical interference, locating impurities in nuclear plasmas, or thermally imaging crystal growth. The department is in forefront of development of several theoretical and experimental tools to meet this end. Our research encompasses optical techniques such as fluorescence, liquid-crystal thermography, infrared thermography, holography, particle image velocimetry, photoelasticity, digital image correlation, ultrasonics, computational tomography, and error estimation.

Multiscale Mechanics



Characterizing and innovating newer and better materials is essential for building futuristic micro-/nano– sized machines, sensors, and structures that, in turn, have significant impact in the aerospace, automotive, biomedical, defense and energy sectors. The subject is also extremely relevant to geophysics where multiple scales are ubiquitous. This calls for understanding how finer length and time scales in a material or a process, affect its macroscopic behaviour, and this constitutes the subject of multiscale mechanics.

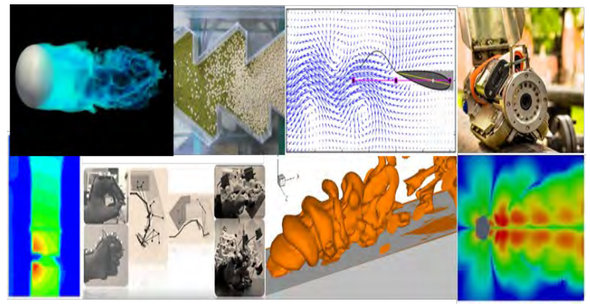
Robotics and Mechanisms



Compliant-link biped trajectory

The Robotics and Mechanisms area seeks to promote research and develop technologies that enable systems to exhibit intelligent, goal-oriented behavior, and developing innovative instruments to monitor, manipulate, and control systems. Overall, our research spans the following areas: humanoid robots, intelligent control systems, flexible manipulators, mechanism theory, microsensors and actuators, and compliant mechanism. We focus on enabling technologies that necessitate novel design solutions in terms of development of new methods of synthesis, analysis & optimization of novel robots and mechanisms.

Research Summary



Applied mathematics: Engineering computation; Variational methods; Asymptotic and perturbation methods; Inverse problems

Fluid mechanics: Computational fluid dynamics; Turbulence; Experimental techniques; Multi-phase flows; Fluid instability and transition; Flow in porous media; Granular flows; Non-Newtonian fluids; Wind turbines

Geophysics: Magnetohydrodynamics; Planetary dynamos; Asteroids; Sand dunes; Satellites

Manufacturing technology: Advanced machining processes; CAM; Metal forming; Micro-/Nano-fabrication; Nanocomposites; Die and mould design; Tribology; Rapid prototyping; Additive manufacturing

Micro– and nano-scale technology: Bio-MEMS; Micro-fluidics; Microsensors; Micro-actuators; Carbon nanotubes; Nanopolymers

Nonlinear dynamics and control: Time-delayed systems; Stability; Bifurcation & chaos; Pattern formation; Vibration control; Acoustics; Noise control; Structural vibration; Non-smooth systems

Optimization and design: Genetic algorithms; Topology optimization; Constrained nonlinear optimization; CAD; Product design; Reverse engineering

Robotics and multibody dynamics: Automotive systems; Parallel manipulators; Humanoid robots; Intelligent control systems; Flexible manipulators; Mechanism theory; Compliant mechanisms

Solid mechanics: Composite mechanics, Polymers; Dislocation dynamics; Plasticity; Fracture mechanics; Impact mechanics; Finite element method; Material modeling; Experimental techniques; Continuum thermodynamics; Lattice dynamics; Phase transformation; Defects; Thin films; Contact mechanics; Elastodynamics; Fluid-structure interaction; Smart materials

Thermal sciences: Computational heat transfer; Boiling; Condensation; Convection; Thermal management; Heat pipes; Solar energy; Combustion; Energy storage; Batteries and fuel cells; IC Engines; Alternative fuels; Gas turbines