



भारतीय प्रौद्योगिकी संस्थान कानपुर  
Indian Institute of Technology Kanpur

# AEROSPACE ENGINEERING

POST GRADUATE PROGRAM

# AEROSPACE ENGINEERING

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Established in 1964, Aerospace Engineering department is a premier teaching and research centre today. The department is engaged in engineering science instruction, in-flight laboratory work, aerodynamic testing, and indigenous design and fabrication of advanced facilities and instruments. The department specializes in aerodynamics, flight mechanics, propulsion, structures and structural dynamics, computational mechanics and aero-thermal sciences. It has a unique flight laboratory with four powered aircrafts, four gliders and a 1000 m runway. All other academic institutions in the country make use of this facility. The Gliding and Soaring centre attached to the department has significantly contributed to the aviation awareness amongst the young through its glider pilot training program.

The department has completed and is currently involved in a large number of sponsored and consultancy projects for the agencies like AR&DB, ARMREB, ADA, ADE, ADRDE, ASTE, AICTE, DST, DMRL, DRDL, GTRE, VSSC, ISRO, CSIR, HAL, MHRD, ARDE, HEMRL, CEMILAC and Indian Railways. The expert faculty has designed and developed high-speed and low-speed wind tunnels, measurement methods using hot wire and laser Doppler anemometry, industrial and wind energy aerodynamics, subsonic and transonic flow computations, hypersonic flow computations for re-entry vehicles, and the design and optimization of the fiber-reinforced composite structures for static, dynamic and random loadings, and multi-scale models for variety of applications.

Over the years the department has also developed excellent collaborative relationship leading to work on several advanced projects of national importance with a large number of aeronautical establishments including NAL, ASTE, GTRE, HAL, DRDL, ADE, ARDE, ADA, IA, IAF, CHESS, and ISRO.

In addition to long running premiere MTech program in Aerospace Engineering, the department is launching a new MTech program in Unmanned Aerial Systems Engineering, to give specialized training in Drone / Unmanned Aerial Systems. This is first such program in India.

# POST-GRADUATE PROGRAMMES OFFERED

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- **M.Tech in Aerospace Engineering:**
  - (I) Aerodynamics,
  - (ii) Propulsion,
  - (iii) Flight Mechanics,
  - (iv) Structures, Structural Dynamics and Aeroelasticity
  - (v) Computational Mechanics and
  - (vi) Aero-Thermodynamics and Thermal Sciences.
- **MS(R) in Aerospace Engineering:**
  - (I) Aerodynamics,
  - (ii) Propulsion,
  - (iii) Flight Mechanics and
  - (iv) Structures, Structural Dynamics and Aeroelasticity.
- **M.Tech in Unmanned Aerial Systems Engineering:**
  - (i) Aeromechanics and Design, and
  - (ii) Autonomy
- **Ph.D. in**
  - (I) Aerodynamics,
  - (ii) Propulsion,
  - (iii) Flight Mechanics,
  - (iv) Structures, Structural Dynamics and Aeroelasticity
  - (v) Computational Mechanics and
  - (vi) Aero-Thermodynamics and Thermal Sciences

# LABS/FACILITIES

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- High Speed and Low Speed Aerodynamics Lab
- Propulsion Lab
- Combustion Lab
- Advanced Combustion and Acoustics Lab
- Fire Lab
- Computational Propulsion Lab
- Structures and Advanced Materials Characterization Lab
- Structural Analysis Lab
- Aeromodelling Lab
- Unsteady Aerodynamics Lab
- Helicopter and VTOL Lab
- CFD Lab
- High Performance Computing Lab
- Fluid Mechanics Lab
- Flight Lab
- National Wind Tunnel Facility (3 m x 2.25 m test section).

# FACULTY LIST

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- **Alakesh Ch. Mandal**, Experimental Aerodynamics, Flow instability and transition, Turbulent Shear flow.
- **A. Tewari**, Flight Mechanics, Aeroservoelasticity, Space Dynamics and Control.
- **A. Kushari**, Propulsion, Combustion, Liquid Atomization, Flow Control.
- **Abhishek**, Rotorcraft aeromechanics, futuristic VTOL/STOL systems, aerial vehicle design, Unmanned Aerial Systems, Inverse flight dynamics and wind turbines.
- **Ajay Vikram Singh**, Combustion and Reacting Flows, Combustion Generated Functional Nanoparticles, Soot Formation and Oxidation, Fire Dynamics, Detonations and Explosions.
- **Arnab Samanta**, Fluid Mechanics, Aeroacoustics, Hydrodynamic Stability, Flow Control, Wave Motion.
- **Arun Kumar P**, Subsonic and Supersonic jets, Flow control, Jet acoustics.
- **Ashoke De**, CFD, High Speed Flows, Flow-Acoustics Coupling, Fluid-Structure Interaction, Turbulence Modeling, Multiphase flows and Combustion, Energy Harvesting.
- **C. S. Upadhyay**, Computational Mechanics, Damage Mechanics.
- **D. Chaitanya Kumar Rao**, Evaporation and combustion of fuel droplets, Laser-induced evaporation and atomization of droplets, Pulse laser-induced atomization of droplets, Femtosecond laser-induced bubble dynamics.
- **D. P. Mishra**, Combustion, CFD of Chemically Reacting Flows, Propulsion, Heat Transfer. (On leave)
- **Debopam Das**, Theoretical and Experimental Fluid Dynamics, Aeroacoustics, Instability & transition, Vortex Dynamics. Unsteady Aerodynamics, Bird's and Insect's Flight.
- **Dipak K. Giri**, Spacecraft Dynamics and Control, Space Explorations: On-orbit Servicing, Space Debris Removal, Orbital Infrastructure Design in LEO, MEO, GEO.
- **G. M. Kamath**, Structural Health Monitoring, Composite Materials and Structures, Structural Dynamics, Condition Monitoring, Machine Learning, Aeroelasticity.
- **Kamal Poddar**, Aerodynamics, Turbulence, Low and High Speed Flows.
- **Mangal Kothari**, Optimal Control, Nonlinear and Adaptive Control, Flight Vehicle Guidance and Control, State Estimation, Motion Planning and Cooperative Control.
- **Mohammed Ibrahim Sugarno**, Experimental Hypersonic Aerothermodynamics, High Enthalpy Test Facilities, Shock Waves. Navrose, Fluid Mechanics, Fluid-Structure Interaction, Optimization, Flow Stability and Control Pradeep Moise, CFD, Vortex breakdown in swirling flows, Swirl in cardiac flows, tornadoes and wind turbines, Transonic buffet, Resolvent analysis.
- **Pritam Chakraborty**, Mesoscale mechanics for plasticity, fatigue, creep and fracture; FEM; Multi-scale methods.
- **P. M. Mohite**, Damage Mechanics of Laminated Composites, Composites, Finite Element Analysis.
- **R. Kitey**, Fracture Mechanics, Composite Materials, Experimental Stress Analysis, Optical Metrology, Thin Films, Finite Element Method.
- **Raghavendra P. Kukillaya**, Aircraft and Airship Flight Dynamics and Control, Systems Modelling, Simulation and Design, Optimal Control, Biomechanics.

# FACULTY LIST

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- **Rajesh Ranjan**, CFD, Turbomachinery Flows, Applied Aerodynamics, Transitional and Turbulent Flows, Stability and Flow Control, HPC.
- **Rakesh Kumar**, Hypersonics, Rarefied Gas Dynamics, Microfluidics, Molecular Dynamics, Heat Transfer & Thermal Design.
- **Sanjay Mittal**, Unsteady Aerodynamics, CFD, FEM, Low speed Wind-Tunnel Testing, Bluff Body Flows, Shape Optimization, Sports Balls, Flows in air intakes.
- **Sanjay Kumar**, Fluid Mechanics - bluff body wakes, shock-accelerated flows, shock waves, shock tubes.
- **Sathesh Mariappan**, Fundamentals of thermoacoustic interactions, Application of dynamical systems' theory to thermo fluid systems, Optical flow diagnostics, Acoustic measurements.
- **S. Saderla**, Online System Identification, UAV Design and Flight tests, Experimental Flight dynamics.
- **Tanmoy Mukhopadhyay**, Mechanical metamaterials, Advanced multi-functional composites, Deployable materials and structures, 2D materials and hetero structures, Multi-scale mechanics, Nano-mechanics, Stochastic analysis, Uncertainty quantification and reliability analysis, Surrogate modelling, Machine learning, Artificial intelligence, Computational additive manufacturing, Structural mechanics, Optimization, Homogenization
- **Tufan K Guha**, Experimental Aerodynamics and Fluid Mechanics, Active and Passive Flow Control.
- **Vaibhav Arghode**, Combustion, Heat Transfer, Fluid Mechanics, Experimental Methods, Computational Fluid Dynamics.



# BROAD RESEARCH AREAS

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- Experimental Aerodynamics
- CFD and High-performance computing
- Transition and Turbulence
- Hypersonic Aerodynamics
- Microfluidics
- Acoustics
- Aeromechanics
- Avionics
- Wind energy and design
- Fluid-Structure interactions
- Design & Control
- Missile Guidance & Control
- Flight Testing
- Instrumentation & Parameter Estimation
- Unmanned & Autonomous Air Vehicle
- Space Dynamics
- Experimental and computational Combustion
- Emissions
- Intake Aerodynamics
- Internal Flow Control (Active & Passive)
- Flow Diagnostics
- Turbo machinery
- Thrust vectoring
- Electric propulsion
- Liquid atomization and spray combustion
- Material Characterization
- Composite Materials and Smart Structures
- Structural Dynamics and Stochastic Modeling
- Aeroelasticity
- Helicopter Theory (Dynamics & Aerodynamics)
- Structural Design & Optimization
- Damage Modeling
- Design and Dynamics of Autonomous Micro and Mini Air Vehicles
- Multiscale modelling
- Plasticity, fracture and fatigue



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# AEROSPACE ENGINEERING DEPARTMENT

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## CONTACT

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