

### भारतीय प्रौद्योगिकी संस्थान कानपुर Indian Institute of Technology Kanpur



# AEROSPACE ENIGINEERING

## **POST GRADUATE PROGRAM**

Website: www.iitk.ac.in/aero

## **AEROSPACE ENGINEERING**

Established in 1964, the Aerospace Engineering department of IIT Kanpur is a premier teaching and research centre today. The department specializes in the core domains of aerodynamics, flight mechanics, propulsion, structures and structural dynamics, and the multi-disciplinary areas such as computational mechanics, aero thermal sciences, and unmanned aerial systems. Over the years, the department has engaged with a large number of organizations including NAL, GTRE, HAL, DRDL, ADE, ARDE, ADA, ADRDE, ISRO, IAF, USAF, BARC, DMRL, DLJ, Boeing, Pratt and Whitney, Airbus and GE for scientific and engineering research. Among the world. class experimental and computational facilities, it includes the unique Flight Laboratory with three powered aircrafts and a moto glider along with a 880m long runway and DGCA-approved maintenance facilities. IIT Kanpur is proud to house the National Wind Tunnel Facility with a 3m x 2.25m test section which has supported leading national and international organizations for their testing needs.

The faculty expertise encompasses a wide range of domains and specializations which include but are not limited to computational and experimental subsonic, transonic, supersonic and hypersonic flows; design and optimization of the composite materials and structures for static, dynamic and impact loadings; multi scale material modelling; combustion-related computations and experiments; novel propulsion systems; space and satellite dynamics and control; guidance, navigation and control of aerospace vehicles.

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

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## POST-GRADUATE PROGRAMMES OFFERED

#### M.Tech in Aerospace Engineering:

- i. Aerodynamics
- ii. Propulsion
- iii. Flight Mechanics
- iv. Structures, Structural Dynamics and Aeroelasticity
- v. Computational Mechanics
- vi. Aero-Thermodynamics and Thermal Sciences

#### MS(R) in Aerospace Engineering:

- i. Aerodynamics
- ii. Propulsion
- iii. Flight Mechanics
- iv. Structures, Structural Dynamics and Aeroelasticity

#### M.Tech in Unmanned Aerial Systems Engineering:

- i. Aeromechanics and Design
- ii. Autonomy

#### Ph.D. in:

- i. Aerodynamics
- ii. Propulsion
- iii. Flight Mechanics
- iv. Structures, Structural Dynamics and Aeroelasticity
- v. Computational Mechanics
- vi. Aero-Thermodynamics and Thermal Sciences

# LABS/FACILITIES

- \* Advanced Combustion and Acoustics Lab
- Aeromodelling Lab
- CFD Lab
- Combustion Lab
- Computational Propulsion Lab
- Fire Lab
- Flight Lab
- Fluid Mechanics Lab
- Helicopter and VTOLLab
- High Performance Computing Lab
- High Speed and Low Speed Aerodynamics Lab
- Hypersonics Experimental Aerodynamics Lab
- National Wind Tunnel Facility
- Propulsion Lab
- Structural Analysis Lab
- Structures and Advanced Materials Characterization Lab
- Unsteady Aerodynamics Lab

## FACULTY LIST

- Abhishek, Rotorcraft aeromechanics, futuristic VTOL/STOL systems, aerial vehicle design, Unmanned Aerial Systems, Inverse flight dynamics and wind turbines.
- A. Kushari, Propulsion, Combustion, Liquid Atomization, Flow Control.
- Ajay Vikram Singh, Combustion and Reacting Flows, Combustion Generated Functional Nanoparticles, Soot Formation and Oxidation, Fire Dynamics, Detonations and Explosions.
- Alakesh C. Mandal, Experimental Aerodynamics, Flow instability and transition, Turbulent Shear flow.
- Arnab Samanta, Fluid Mechanics, Aeroacoustics, Hydrodynamic Stability, Flow Control, Wave Motion.
- **Arun Kumar P**, Subsonic and Supersonic jets, Flow control, Jet acoustics.
- **Ashish Tewari**, Flight Mechanics, Aeroservoelasticity, Space Dynamics and Control.
- 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. Chaitanya Kumar Rao, Evaporation and combustion of fuel droplets, Laserinduced 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.
- 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, Inflatable and Deployable Space Structures, load bearing Radar Absorbing structures.

## FACULTY LIST

- Raghavendra P. Kukillaya, Aircraft and Airship Flight Dynamics and Control, Systems Modelling, Simulation and Design, Optimal Control, Biomechanics.
- Rajesh Kitey, Fracture Mechanics, Composite Materials, Experimental Stress Analysis, Optical Metrology, Thin Films, Finite Element Method.
- 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 Kumar, Fluid Mechanics bluff body wakes, shock-accelerated flows, shock waves, shock tubes.
- Sanjay Mittal, Unsteady Aerodynamics, CFD, FEM, Low speed Wind-Tunnel Testing, Bluff Body Flows, Shape Optimization, Sports Balls, Flows in air intakes.
- Sathesh Mariappan, Combustion-driven oscillations, Machine learning methods to develop accurate low-order models, Optical flow diagnostics, and Acoustic measurements, Thermoacoustic machines, and Rotorcraft aerodynamics
- Subrahmanyam Saderla, Online System Identification, UAV Design and Flight tests, Experimental Flight dynamics.
- Tanmay Dutt Mathur, Rotorcraft drive systems, Power gearbox for geared aero engines, wind turbines, and farm machinery, Design, testing, and reliability analysis of rotating machinery, Contact mechanics and tribology, Rotordynamics, Supercritical CO2 based turbomachinery, FEM, BEM, and multiscale methods for structural analysis
- 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 (On leave)
- Tufan Kumar 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**

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



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## CONTACT

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