

# DEPARTMENT OF AEROSPACE ENGINEERING

## INDIAN INSTITUTE OF TECHNOLOGY, KANPUR

The department of Aerospace Engineering at Indian Institute of Technology, Kanpur, is a leading provider of cutting edge education in Aerospace Engineering. The department has faculty with vast expertise in the broad areas of Aerodynamics, Structural Analysis, Propulsion and Combustion, Flight Mechanics and Control. The ambience of research in the department is highlighted by several bold research initiatives like industrial wind-tunnel testing , autonomous rotary vehicles, micro air vehicles, advanced materials and damage, fire safety, atomizers and combustion, supersonic and hypersonic flows, advanced computational mechanics, aircraft stability and control, amongst others. The culture of research percolates down to the undergraduate and post-graduate curriculum of the department.

The curriculum is a vibrant mix of mathematics, modelling of physical phenomenon, analysis and strong hardware based validation. We continue to innovate, and have been leaders in implementing cutting-edge hardware-based learning through initiatives like the flight laboratory and the aeromodelling laboratory. Aerospace graduates have a rigorous training that is a unique blend of mathematics, solid and fluid mechanics, thermodynamics, aircraft propulsion, flight stability and control, and experimental techniques, which is capped off with a comprehensive training in design. This training makes them amenable for employment in the aerospace, automobile, engineering analysis and design software, and allied engineering fields.

I believe that the Aerospace engineering curriculum at IIT Kanpur is one of the most challenging and prepares the students for handling a varied set of engineering jobs and challenges. Our graduates have performed exceedingly well in varied professions. Several of our graduates have become technocrats, with many innovative products. Our students have excelled in the aerospace, mechanical, defence, automobile, and engineering software sectors all over the world. I am certain that our graduates will turn out to be some of the most productive recruits for any organization.

I wish luck to the graduating batch of 2014.

Sincerely,

Dr. C.S. Upadhyay

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# DEPARTMENT OF AEROSPACE ENGINEERING

INDIAN INSTITUTE OF TECHNOLOGY, KANPUR

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## MESSAGE BY FACULTY COORDINATOR

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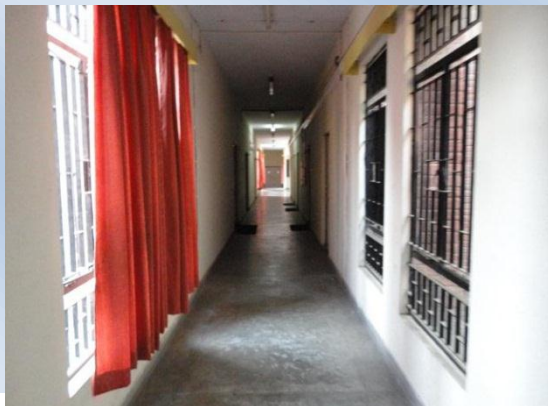
Sincerely,  
Dr. C.S. Upadhyay

# THE DEPARTMENT

Established in 1964 during the Kanpur Indo-American Program, the Department of Aerospace Engineering is a premier center for engineering science instruction, leading-edge research, indigenous design and development of state-of-art facilities.

The department has faculty with international experience who undertake both sponsored and consultancy projects of national and international importance from various aeronautical establishments and the aerospace private sector.

Department has collaborations with several foreign universities (like, internship collaborations with Texas A&M University). The Department also undertakes projects in collaboration with Indian aerospace organizations like HAL, ISRO, ADE, ADA, NAL, DRDO, ARDB, etc. and with MNCs such as GE, Airbus and Pratt & Whitney.



## RESEARCH AREAS

### Aerodynamics

- Subsonic, Transonic, Super-sonic and Hypersonic flows
- Turbulent and transitional flows
- Computational Fluid Dynamics (CFD)

### Aerospace Structures

- Structural Dynamics, Fracture Mechanics, Aeroelasticity
- Structural Optimization and Smart Structures
- Composite Structure and Finite Element Methods (FEM)

### Propulsion

- Combustion: spray combustion & liquid atomization
- Turbo machinery, Electric propulsion & thrust vectoring
- Flow diagnostics & internal flow control

### Flight Mechanics

- Conventional flight mechanics and control & guidance
- Space Dynamics
- Aircraft design development & fabrication of scaled models

### Inter-disciplinary

- Bio fluid mechanics
- Industrial noise control
- Wind energy

## FACILITIES

### Labs of National Importance

- National Wind Tunnel Facility (NWTF)
- Autonomous Helicopter Lab
- Flight Lab

### Departmental Labs

- High Speed Aerodynamics Lab
- Low Speed Aerodynamics Lab
- Unsteady Aerodynamics Lab
- High Performance Computation Lab (HPCL)
- Propulsion Lab
- Combustion Lab
- Design LAB
- Structural Analysis Lab
- Structures Lab

### Facilities

- Aeromodelling Lab
- Aero Workshop
- Departmental Library

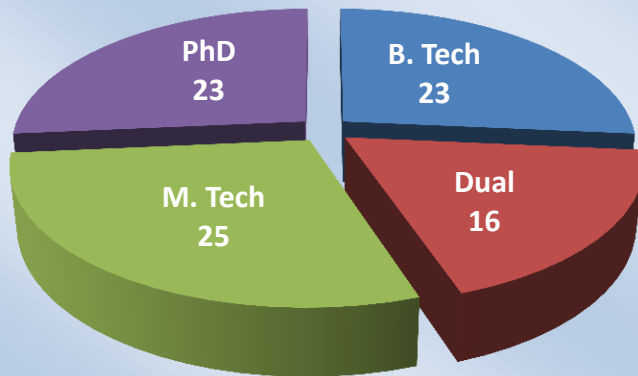
## INDUSTRIAL PROJECTS

The department has completed, and is currently involved in, a large number of sponsored and consultancy projects for the agencies **AR&DB, ARMREB, ADA, ADE, ADRDE, ASTE, AICTE, DST, DRDL, GTRE, VSSC, ISRO, CSIR, HAL, MHRD, ARDE, HEMRL, CEMILAC, Indian Railways.**

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 **National Aeronautics Lab (NAL), Aircraft & Systems Testing Establishment (ASTE), Gas Turbine Research Establishment (GTRE), Hindustan Aeronautics Lab (HAL), Defense Research & Development Lab (DRDL), Aeronautical Development Establishment (ADE), Armament Research & Development Establishment (ARDE), Aeronautical development Agency (ADA) and Indian Space Research Organization (ISRO).**



# STUDENT PROFILE



## ACADEMIC PROGRAMMES

### **B.TECH (4 years)** selected through *JEE*

- Basic Engineering Courses
- Compulsory Departmental Courses
- Electives (UG)
- B.Tech Project (BTP)

### **DUAL (5 years)** selected through *JEE*

- Basic Engineering Courses
- Compulsory Departmental Courses
- Electives (PG & UG)
- M. Tech Thesis

### **M.TECH (2 years)** selected through *GATE*

- Compulsory Departmental Courses
- PG electives
- M. Tech Thesis

### **Ph.D. (4 years)** selected through *interview*

- Ph.D. electives
- Ph.D. Thesis

# COURSE STRUCTURE

## Aerodynamics

Aerodynamic  
Design of an  
aircraft

Gas Dynamics

Incompressible  
Aerodynamics

Experiments in  
Aerodynamics

## Flight Mechanics

Aerodynamic  
Design of an  
aircraft

Stability and  
Control

Basic Flight  
Mechanics

Experiments in  
Flight Mechanics

## Propulsion

Aerodynamic  
Design of an  
aircraft

Combustion,  
Rocket Engines

Jet engine cycles  
& Turbo  
machinery

Experiments in  
Propulsion

## Aerospace Structures

Structural Design  
of an aircraft

Structural analysis

Buckling analysis

Experiments in  
Structures

## ELECTIVES

### DEPARTMENTAL ELECTIVES

- Computational Fluid Dynamics (CFD)
- Finite Element Methods (FEM)
- Space Dynamics
- Wind Engineering
- Transition & Turbulence
- Advanced Computational Methods in CFD
- Avionics and Navigation Systems
- Advanced Dynamic Stability & Control
- Control Theory
- Thermal Turbo-machinery
- Air-breathing Missile Propulsion
- Aero-elasticity
- Composite Materials
- High Temperature Gas Dynamics
- Fracture and Fatigue
- Helicopter Design

### INTER-DISCIPLINARY ELECTIVES

- Computer Aided Manufacturing (CAM)
- Advanced Manufacturing Processes
- Thermodynamics
- Courses on Economics
- Courses on Design
- Theory of Computation
- Signal Processing
- Courses on Psychology, Philosophy, Sociology and Art.





# PRACTICAL EXPERIENCE

1

## • Internship

Third year undergraduate students undertake internships with several companies and universities. This allows them to gain an experience in current developments in the field of Aerospace Engineering on a global level.

In the past, students have gone to universities like Mc Gill University, Texas A&M University, University of British Columbia, Ecole Polytechnique, etc.

Students have also worked with companies like GE, Airbus, Boeing, Adroit Design & Solutions, NAL, HAL, etc. Sometimes they are also offered pre-placement offers from these companies.

2

## • B.Tech Project

The B.Tech Project (BTP) is a part of the curriculum for B.Tech program at IIT Kanpur. Each student works on a topic, either decided by himself/herself or by the mentor for one whole year and is graded based on his/her performance. It is compulsory to pass in B.Tech project in order to complete the graduation.

The topics chosen are of importance both to the engineering and the research world. Some students even get their BTP's published.

3

## • M.Tech Thesis

This is a part of the academic curriculum for M.Tech and Dual programmes. Thesis allows students to specialize in a particular field of their choice. Thesis can also be interdisciplinary.

In thesis, student works on a research topic 1½ or 2 years. He/she is required to study the relevant literature in detail and formalize the entire problem.

Thesis provides a first experience of research to a student. It involves a very detailed of the chosen topic and it's formalization from the very beginning.

4

## • Other Projects

Students also do projects related to their respective courses. These course projects usually involve design of software, design of aircraft models (aerodynamic, structural and RC), case studies of general topics or development of codes simulating several situations, or fabricating and testing composites, etc.

Students also do projects under the different clubs of the Science & Technology Council like Aeromodelling club, Robotics club, Electronics club, etc

Some students undertake projects under professors during their semesters and summer/winter vacations.

