“The Applied Mechanics department offers a unique combination of courses in its M Tech. programme.

The students get a firm grounding in the fundamentals related to the areas of Fluid Mechanics, Materials Science and Solid Mechanics along with rigorous training in the use of current analytical, experimental and computational tools. This equips them to analyze complex engineering systems and undertake their design with proficiency.”

“...among the brightest in the nation and are well trained in various cutting-edge technology domains. They have achieved top positions in various leading organizations in the past and are always highly sought-after by leading organizations worldwide owing to the level of skills they acquire at IIT Delhi.

I welcome the recruiters for the campus placement, and I am confident that you will find exceptionally talented engineers for your organization.”
Department of Applied Mechanics was established in 1964 with a perspective of being a specialized branch involving teaching, research and consultancy works.

Various national and international collaborative projects are being undertaken by the faculty of the department.

Students of the department can deal with a wide range of technical and on-field challenges through the experience that they gain from our industrially-oriented projects.

Programs offered

1. Master of Technology in Engineering Analysis and Design
2. Master of Science (Research) in Applied Mechanics
3. PhD

Admission Criteria

- Students with a minimum of 99 percentile in GATE are shortlisted followed by a separate written test.
- The two-stage rigorous selection process ensures that only the best and the brightest make it to the department.
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<th>Fluid Mechanics</th>
<th>Machine Learning</th>
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<td>• Finite Element Analysis</td>
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<td>• CAD &amp; CAM</td>
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<td>• Product Reliability</td>
<td>• Modelling &amp; Analysis</td>
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<td>• Failure Analysis and</td>
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<td>• Prevention</td>
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<td>• Flow diagnostics</td>
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Department of Applied Mechanics

MTech
(Engineering Analysis and Design)

MSR

PhD
Academics/MTech
This stream has been consistently attracting bright students and is one of the most popular M. Tech. programs among the students as well as recruiters.

Product design is becoming increasingly interdisciplinary, requiring the knowledge of electronics, instrumentation etc. in addition to solid mechanics, fluid mechanics and material science.

Students take a wide range of specialized elective courses which enable them to successfully design and develop products.

“The design is not just what it looks like and feels like. The design is how it works.”

– Steve Jobs

**Important courses**

- Product Design & Feasibility
- Product Reliability & Maintenance
- Design Optimization
- FEM, CFD
- Modelling and Analysis of Mechanical Systems
- Fracture Mechanics
- Properties & Selection of Materials
- Continuum Mechanics
- Advanced Fluid Mechanics
- Mechanics of Composite Material
- Advanced Dynamics
- CAD
Ongoing Projects

- Design optimization of a novel medical implant
- Material design using Deep Learning
- Simultaneous design of Structure and Material using ML
- Mechanisms to reduce angular acceleration of head with helmets.
- Design of stiffened shell under underwater explosion
- Dynamic analysis of electric Motorcycle body
- Mechanisms to reduce angular acceleration of head with helmets.
- Design of a smart material based artificial muscle actuator.
- Design of a shower head
• Design and fabrication of a circular load cell
• Design and fabrication of an autonomous underwater vehicle
• Modeling and simulation of human foot
• Design and Fabrication of Energy Harvester Based on Vortex Induced Vibrations
• Design of water tunnel to study vortex induced rotation
• Ejector of near quiescent bubbles in zero gravity
• Design and performance evaluation of a Coriolis Flowmeter
• Design and performance evaluation of an Ultrasonic Flowmeter
• Design and performance evaluation of a Gas Flowmeter
• Analysis and design of wind turbine blades
• Novel evaporative room cooling methods
A broad area of Applied Mechanics, which focuses on research, analysis and development of computational and experimental tools for solving problems in areas of solid mechanics and fluid mechanics.

Students of the department are equipped to deal with a wide range of technical and on-field challenges through the experience that they gain from the research as well as our industrially-oriented projects.

“Science is about knowing, engineering is about doing.”
- Henry Petroski

The research and project works are intended at giving thrust to the development in the areas of:

**Solid Mechanics**
- Dynamics and Vibration
- Nonlinear Finite Element Analysis
- Light Weight Structural Materials
- Failure Analysis

**Fluid Mechanics**
- Turbulence Modelling
- Computational Fluid Dynamics
- Pipeline Engineering
- Fluid Structure Interaction
Important courses

• Finite Element Analysis
• Advanced Finite Element Method
• Theory of Plates and Shells
• Advanced Dynamics
• Advanced Solid Mechanics
• Applied Elasticity and Plasticity.
• Physics of Turbulence
• Continuum Mechanics
• Computational Fluid Dynamics
• Advanced Fluid Mechanics
• Turbulence & its Modelling
• Fracture Mechanics
• Mechanics of Composites
Ongoing Projects

- Machine learning based digital twin for dynamical systems
- Data-driven reduced order models in stochastic mechanics
- Space-time-variant reliability analysis of buried energy pipelines
- Stability of fluid flow over a flexible substrate
- Stability of fluid flow over a porous medium
- Enhancement of PANS method using non-linear eddy viscosity and machine learning
- Numerical simulations of flow past vertical-axis wind turbines
- Computational Study on Characteristics of Wind Turbine Rotor
• Machine learning applications in stratified turbulent flows
• Theoretical and Computational Modeling of Wind Farms
• Development of Numerical Solvers for Multi-Phase Fluid Flows
• Acoustic wave propagation and scattering in the presence of mean flow
• Numerical calculations of low-speed, three-dimensional inviscid flows using panel method
• Role of viscoelasticity in impact and fatigue of polymers and composites: (Simulation dominated but may have to perform experiments)
• Modeling and analysis of an electro-magneto-elastic soft actuator
• Structural analysis of composite airframes for drones
• Dynamic Analysis of shape memory polymer plates
• Dynamic response of viscoelastic cylindrical shells
• Stress analysis of airborne drone structure using FEM
• Peri dynamic analysis of plate-type structures
• Structural health monitoring using Lamb waves
• Mechanics of growth in slender structures
• Variational formulation for photoelasticity with application to photoelastic actuators
• Interaction of vortex ring with droplets
• Origin of hydraulic jump in a 2-D channel flow
• Stability of Thin-walled beams under follower loads
• Vibration of Rotating beams
• Comparative analysis of different surface tension models used in meshless methods
• Simulating large deformations of near incompressible solids using meshless methods
• Scaling of compressible turbulence
• Beyond second law efficiency: Implications for sustainable engineering
• Heat transfer analysis of battery pack of an electric vehicle using CFD
• POD analysis of fluid flows
• Topics in (theoretical & experimental) biomechanics
• Topics related to soft actuator/soft robotics/Nonlinear Polymer Mechanics
• Multiscale finite element modelling of sandwich panels’
• Thermal shock in functionally graded carbon nanotube reinforced composites
• Design and development of isotropic turbulence facility
• Drag reduction in turbulent flows
• Turbulence modelling using AI
New way forward

“Data has always helped take better decisions, and the application of Machine Learning and Artificial Intelligence on the data has opened up a new way to look at the problems in Mechanics.

Students in our Department (in both Design and Engineering Analysis domain) are doing projects which makes use of Machine Learning, Deep Learning and Artificial Intelligence in the areas of Solid and Fluid Mechanics.

“In God we trust, all others must bring data.”
- W. Edwards Deming

Ongoing Projects

- Machine learning based digital twin for dynamical systems
- Data-driven reduced order models in stochastic mechanics
- Space-time-variant reliability analysis of buried energy pipelines using Machine Learning
- Machine learning applications in stratified turbulent flows
- Turbulence modelling using AI
- Material design using Deep learning
- Simultaneous design of structure and material using ML
• Development of biophysical model for shape change cause due to atrophy in Alzheimer disease and simulation of MR images
• Particle dispersion in turbulent flows’
• Elastoplastic analysis of cross section in a special cosserat rod
• Design, development of fabric pneumatic actuator for rehabilitation and mobility support.
• Study of flow past vertical axis wind turbine
• Machine Learning application in turbulent fluid flows
Research facilities

- Computational Fluid Dynamics Laboratory
- Fluid Mechanics Laboratory
- Strength of Materials Laboratory
- 3D Printers
- Laser Cutter Machine
- Gas Dynamics Laboratory
- Stress Analysis Laboratory
- Experimental Method and Analysis Laboratory
- Impact Mechanics Laboratory
- Computational Laboratory
- Well-equipped Workshop
Patents

Students of the department are quite active in developing technologies helpful for the society and many of them have been patented. Some of them are:

“Multi functional bed to assist bedridden individuals for side turning and postural adjustment”

“Integrated 8 Stationed Open Gym”

“Channelized, Grouped Pneumatic Controlled Cushion Cum Mattress for Prevention of Bed-Sores”
Softwares

Students are familiar with, and using them extensively:
Past Recruiters
Notable Alumni

Gautam Acharya, General Manager & PCC Head (Godrej Properties Limited, 2005, M.Tech.)

Anil Sharma, Joint Director, Ministry of Defence (2001, M.Tech)

Aashish Bhatia, President, VisteonIndia (2000, M.Tech)

Dr. AS Prakash, Executive Vice President, MoleTech Technologies Ltd (1997, M.Tech & PhD)


Praveen Agrawal, Director, Sulzer Technika Pvt Limited (1991, M.Tech)

Dr. KG Bhatia, CEO, DiCAD Technologies (1982, PhD)

Sushil Gupta, CEO, Smaac Net Solutions P. Ltd. (1988, M.Tech)
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