

**DEPARTMENT OF MECHANICAL ENGINEERING**

**NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA,  
SURATHKAL**

**Srinivasnagar, P.O. Mangaluru - 575025  
Karnataka, India**



**Master of Technology  
in  
Mechanical Design**

## About Mechanical Design Program

Master's program in Mechanical Design was started in the academic year 2013-14 as Design and Precision Engineering and it was revised later in 2019-20. This program emphasizes teaching fundamental principles for designing simple to complex components and structures for various applications. This program develops the students' design skills based on theory, experimentation and numerical modelling in designing new products or assessing the performance of existing equipment. The program facilitates "Design to Prototype Modelling" in mechanical solid products and facilities. The engineering courses integrate advanced engineering techniques with hands-on learning in various laboratories to provide essential skills desired by the industries and R&D organizations. Students are encouraged to follow their projects and internship in industries and R&D organizations for their early exposure to various mechanical design practices in Industries and research laboratories.

The Mechanical Design program is a Full-Time Two Years Program. Usually, the program starts each academic year in July. Admission to the program open to Indian nationals who have passed the prescribed qualifying examination with minimum eligibility. Students are type: GATE qualified, Industry or other organization sponsored, Self-financed and Internal Registrants. During the course work, students will develop advanced technical skills in Mechanical Design that will enable them to pursue a career in both general and specialized design engineering industries. Theory courses are taught in the first year, and MTech Dissertation Work or Major Project will be in the second year.

### Vision:

- To Create globally competent mechanical design engineers capable of working in an interdisciplinary environment, contributing to society through innovation, entrepreneurship and leadership.

### Mission:

- Produce Mechanical Design Engineers with a strong theoretical and practical knowledge. to contribute to society with high moral and ethical values.
- Nurture students with a global outlook for a sustainable future and sound health.
- Enable to be productive members of interdisciplinary teams, capable of adapting to changing environments of engineering, technology and society.
- Inculcate critical and deep-thinking abilities among students and develop entrepreneurial skills, innovative ideas and leadership qualities.
- Create facilities for continued education, training, research and consultancy.

## **Programme Educational Objectives:**

- PEO-1 Prepare graduates to have knowledge in mathematics, science and engineering to develop problem solving skills necessary for the career advancement in mechanical and allied disciplines
- PEO-2 Organize graduates to have strong practical and theoretical knowledge in Mechanical Engineering, contributing through interdisciplinary research, innovation, entrepreneurial skills, and leadership to design and develop products
- PEO-3 Inculcate teamwork, communication, interpersonal skills and ethical approach adapting to changing environments of engineering, technology and society
- PEO-4 Impart critical thinking skills with deep concentration to develop initiatives and innovative ideas for R&D, Industry and societal requirements

## **Programme Specific Outcomes:**

- PSO-1 Understand and apply the concepts of science and engineering principles to provide solutions to problems associated with mechanical engineering
- PSO-2 Use experimental methods and computational tools to develop products, workable solutions and processes

## **Mechanical Design Laboratories**

- Mechanical Dynamics Lab
- Stress Analysis Lab
- Materials Characterization Lab
- Aerospace Research Lab
- Robotics and Kinematics Lab
- Applied Solid Mechanics Lab
- Polymer Composites Lab
- CNC Machine Tools Lab
- Virtual Instrumentation Lab
- Vibration and Condition Monitoring Lab
- Vehicle Dynamics Lab
- CAD/CAM Lab

## **Current Research Areas**

- Advanced Materials and Light weight Alloys
- Bio-Composites, Biomechanics
- Dynamic Analysis of Polymer Composite/Smart Structures
- Engineering Design
- Fracture Mechanics and Fatigue
- Fuel Cells & Batteries Design
- Impact Biomechanics
- Brain Injury Biomechanics
- Implants and Soft Tissue Engineering
- CAD/CAM
- Computational Mechanics
- Vibration Condition Monitoring
- Vibro-Acoustics
- Vehicle Dynamics
- Rotor Dynamics
- Kinematics and Mechanism
- Wing Morphing
- Compliant Structures

## Course of Study

The current course plan details are available on the institute website. The latest curriculum is available for M.Tech (Mechanical Design) is





### Programme Core (PC) Mandatory

Semester	Code: Title	(L-T-P) Credit
<b>FIRST</b>	ME710 Mathematical Methods for Engineers	(3-0-0)3
	ME711 Applied Elasticity	(3-0-0)3
	ME712 Engineering Fracture Mechanics	(3-0-0)3
	ME713 Mechanical Systems Lab	(0-0-3)2
<b>SECOND</b>	ME714 Advanced Mechanism Design	(3-0-0)3
	ME715 Applications of FEM in Design	(3-0-0)3
	ME716 Theory of Vibration	(3-0-0)3
	ME717 Dynamics and Stress Analysis Lab	(0-0-3)2
	ME884 Seminar	2
<b>THIRD</b>	ME885 Practical Training/ME897 Minor Project	2
	ME886 Major Project	4
<b>FOURTH</b>	ME887 Major Project	8

### Program Electives:

ME816 Lubrication and Bearing Design ME817 Experimental Stress Analysis ME818 Advanced Materials for Design ME819 Mechanics of Polymer Composites ME820 Dynamic Analysis of Rotating Systems ME821 Engineering Acoustics ME822 Design of Plates and Shells ME823 Design for Fatigue ME824 Design of Aircraft Structures ME825 Machine Diagnostics ME826 Mechanics of Viscoelastic Materials ME831 Smart Structures and Materials ME862 Virtual Instrumentation ME864 Computational Fluid Dynamics ME865 Robotics: Mechanics and Control ME866 Optimization Techniques ME867 Product Design and Development ME869 Theory and Practice of sensors and actuators ME870 Biomechanics and Materials ME871 Mechanical Systems and Signal Processing ME872 Machine Tool Design
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## FACULTY MEMBERS

<p><b>G.C. Mohan Kumar, Ph.D. (IIT Madras)</b> Professor (HAG) <b>Research Interests:</b> Mechanical Design Engineering, Biomechanics, Green Composites, Tissue Engineering, Experimental &amp; Numerical Stress Analysis. Mobile: +919480065648 Mail-id: mkumargc@nitk.edu.in Detailed CV: <a href="https://mech.nitk.ac.in/faculty/g-c-mohan-kumar">https://mech.nitk.ac.in/faculty/g-c-mohan-kumar</a></p>	
<p><b>Ravikiran Kadoli, Ph.D. (IIT Madras)</b> Professor <b>Research Interests:</b> Structural mechanics, Mechanics and applications of advanced materials, Fluid- Structure Interaction and other coupled problems like heat and mass transfer, Computational dynamics. Mobile: +919844400659 Mail-id: <a href="mailto:rkkadoli@nitk.edu.in">rkkadoli@nitk.edu.in</a> Detailed CV: <a href="https://mech.nitk.ac.in/professor/ravikiran-kadoli">https://mech.nitk.ac.in/professor/ravikiran-kadoli</a></p>	
<p><b>S.M. Murigendrappa, Ph.D. (IIT Bombay)</b> Professor <b>Research Interests:</b> Machine Dynamics and Vibrations, Fracture Mechanics and Fatigue, Stress Analysis, Finite Element Method, Advanced Materials Mobile: +91-9343889072 Mail-id: <a href="mailto:smm@nitk.edu.in">smm@nitk.edu.in</a> Detailed CV: <a href="https://mech.nitk.ac.in/faculty/s-m-murigendrappa">https://mech.nitk.ac.in/faculty/s-m-murigendrappa</a></p>	
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<p><b>P. Jeyaraj, Ph.D. (IIT Madras)</b> Professor <b>Research Interests:</b> Dynamic Analysis of Polymer Composite Structures, Computational Mechanics, Structural Acoustics Mobile: +91-7795858559 Mail-id: <a href="mailto:jeyaraj@nitk.edu.in">jeyaraj@nitk.edu.in</a> Detailed CV: <a href="https://mech.nitk.ac.in/faculty/p-jeyaraj">https://mech.nitk.ac.in/faculty/p-jeyaraj</a></p>	

### **Subhaschandra Kattimani Ph.D. (IIT Kgp)**

Professor

**Research Interests:** Smart Materials & Structures, Composite structures, Vibration and Control, Magneto electro-elastic Solids and Structures

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### **Sharnappa Joladarashi, Ph.D. (IIT Madras)**

Professor

**Research Interests:** Dynamics and Vibrations Smart Materials & Structures, Composite structures, Vibration and Control, Functionally Graded Material, Polymer Matrix Composites, Composite coatings, Finite Element Analysis.

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### **Poornesh Kumar K, Ph.D. (Inha University)**

Associate Professor

**Research Interests:** Solid Mechanics, Constitutive Modeling, Computational Mechanics, Fuel Cells, Functional Materials, Biomechanics and Materials

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### **T. Somasekhara Rao, Ph.D. (IISc Bangalore)**

Assistant Professor

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### **Saurabh Chandraker, Ph.D. (NIT Rourkela)**

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**Research Interests:** Rotordynamics, Vibration, Composites, Solar Energy, Tribology, High Entropy Materials

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### **Abhilash Singh (IIT Roorkee)**

Assistant Professor

**Research Interests:** Brain Injury Biomechanics, Road Traffic Accidents, Sports Injury, Solid Mechanics, Experimental Mechanics, Injury Prevention during Impact - Ballistic - Blast Loading, Developing Safeguards, Finite Element Modelling, and Computational Mechanics.

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### **Deepak Kumar (IIT Madras)**

Assistant Professor

**Research Interests:** Wing Morphing, Corrugated Structures, Mechanical Metamaterials, Compliant Structures, Composite Structures, Finite Element Modelling, and Computational Mechanics.

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## **Faculties Achievements:**

### **Completed R&D projects:**

- Virtual Lab Phase III, NMEICT (2018), 100 Lakhs.
- Design and fabrication of helicopter tail rotor shaft system using carbon fiber reinforced composite, ECR-SERB-DST, 2018, 23.8 Lakhs.
- Design of Oil skimming Application with super hydrophobic sponge, MRPL (2019), 44 Lakhs.
- Design of Magneto Rheological damper for Vehicular applications, SPARC-MHRD, (2019), 60.35 Lakhs.
- Development of Brushless DC (BLDC) Motors for an Automotive Power Window Application, Dept. of Heavy Industries + M/s Aditya Auto (2020), 375 Lakhs
- Investigation on radiolucent composite sandwich materials for biomedical imaging systems under hygrothermal environment" AISTDF-SERB (2020), Rs 37.08 Lakhs.
- E Mobility, NITK + NITK Alumni (2021), 15 Lakhs.
- Development of biodegradable micro perforated panel with non-uniform cross-section through 3D printing for sound absorption applications", Core Research Grant, SERB-DST, (2021), Rs. 36.22 Lakhs.
- Development of convertible and a cost-effective mechanism for Smart-flower type solar panels, SERD-DST, 2021, 54 Lakhs.
- Semi-active damping using controllable orifice for four-wheeler automobile, DST, SERB, (CRG), (2022), 28.18 Lakhs.
- Design of Magneto Rheological Mount for Helicopter Seat Vibration Control, ARDB, DRDO, (2022), 32 Lakhs.

## Ongoing Projects:

Sl. No.	Project Title	Principal Investigators and Co- Principal Investigators	Grant (INR) Lakhs	Funding Agency
1.	Rare Earth Magnet-Free Axial Flux Synchronous, Radial Flux Switched Reluctance Motor and their Controllers for EV Applications	Prof. K V Gangadharan and Prof. Jeyraj P.	1033	ANRF (90%) +7 Industries (10%)
2.	Synthesis of Intelligent Nanostructured Materials via a Plasma Source based Digital Nanomanufacturing Method and their Characterization.	Dr. Ranjeet Kumar Sahu and Prof. Hemantha Kumar,	30.23	DST-SERB
3.	Performance evaluation of HVAF sprayed NiAl intermetallic based composite coatings for aerospace repair and manufacturing applications	Prof. M. R. Ramesh and Prof. Sharnappa Joladarashi	30.2	CRG-SERB
4.	Low weight fuel cell stack development	Dr. Poornesh Kumar Koorata	99.9	Petronet LNG Ltd
5.	Design and Development of Hybrid-FRP based Composites for Low-cost and Sustainable Mobile Shelter Houses	Dr. Saurabh Chandraker and Dr Ranjeet Kumar Sahu	31.56	SEED, DST
6.	Indigenous Development of AI-Optimized Functionally Graded Composites using Additive Manufacturing for Strategic Impact-Resistant Applications	Prof. Sharnappa Joladarashi and Dr. Arun Kumar Shettigar	42.5	ANRF
7.	Design of Shock Mounts for typical LRU of aircraft using conventional shock mounts and Magneto Rheological Shock Mounts.	Prof. Hemantha Kumar and Prof. Arun M.	32.54	ARDB, DRDO

## Strategic Consultancy Sectors:

### Automotive & EV

- Vehicle dynamics, NVH (Noise, Vibration, Harshness), and rotor monitoring.
- Structural design for fuel cells and EV battery packs.

### Aerospace & Defense

- Morphing wings and UAV architectures.
- Fatigue, fracture, and lightweight alloy/composite optimization.

### Biomedical & Safety

- Implant design and soft tissue engineering.
- Helmet design and brain injury safety assessments.

### Design & Industrial Systems

- Advanced FEM analysis and CAD/CAM support.
- Kinematics and precision mechanism design.

### Smart Materials

- Shape Memory Alloys (SMA) and piezoelectric.
- Bio-composite material development.

## Selected Publications:

- Singh, Rohit Kumar, Khyati Verma, GC Mohan Kumar, and Mallikarjun B. Jalageri. "Potential of Graphene-Functionalized Polymer Surfaces for Dental Applications: A Systematic review." *Journal of Biomaterials Science, Polymer Edition* 36, no. 2 (2025): 191-211.
- Dhere, Siddhant, Suryakant Gupta, GC Mohan Kumar, and Vamsikrishna Reddy. "Technical Study for the Development of Air Brake Compressor in Electric Commercial Vehicles." *SAE International Journal of Commercial Vehicles* 17, no. 02-17-02-0013 (2024): 213-220.
- MB, Santosh, Mohan Kumar GC, and Jeyaraj Pitchaimani. "Acoustic characterization of natural areca catechu fiber-reinforced flexible polyurethane foam composites." *Journal of Applied Polymer Science* 141, no. 4 (2024): e54866.
- Doddamani, Saleemsab, Satyabodh M. Kulkarni, Sharnappa Joladarashi, Ashish Kumar Gurjar, and TS Mohan Kumar. "Development of rubber-sand composite for enhanced impact resistance: Implications of vulcanization." *Engineering Science and Technology, an International Journal* 51 (2024): 101631.
- Bhaktha, Sandesh, Satyam Sarma, M. Vamshik, Jeyaraj Pitchaimani, and K. V. Gangadharan. "Driving cycle-centric design optimization and experimental validation of high torque density outer rotor 8/18 MTSRM for an E-Bike." *Computers and Electrical Engineering* 123 (2025): 110180.
- Patil, Mukund A., Suvarna Saraf, Ravikiran Kadoli, and Susmita Naskar. "Investigation of moving load-induced vibrations in layered functionally graded Terfenol-D beams: a differential quadrature method and analytical approach." *Mechanics Based Design of Structures and Machines* 52, no. 12 (2024): 10256-10272.
- Patil, Mukund A., and Ravikiran Kadoli. "Engineers guide to Terfenol-D actuators: design, performance, and real-world applications." *Sensors and Actuators Reports* 8 (2024): 100236.
- Chetan, H. C., Subhaschandra Kattimani, and S. M. Murigendrappa. "Simulation of delamination propagation in laminated composites under Mode-I and Mixed-Mode bending with LCZ-Based R-curve cohesive zone modeling." *Theoretical and Applied Fracture Mechanics* 139 (2025): 104995.
- Suman, M. L. J., S. M. Murigendrappa, and Subhaschandra Kattimani. "Characterisation of fatigue delamination growth in plain woven hybrid laminated composites subjected to Mode-I loading." *Theoretical and Applied Fracture Mechanics* 129 (2024): 104236.
- Bhat, Shrivatsa H., Abinesh A, Shivarama Naveen, Hemantha Kumar, and Arun M. "Experimental investigation of rotor wound multi disc magneto-rheological fluid brake." *Journal of Intelligent Material Systems and Structures* 36, no. 6 (2025): 398-410.
- Kariganaur, Ashok Kumar, Hemantha Kumar, and Arun Mahalingam. "Experimental investigation on thermal stability of dual particle magnetorheological fluid and performance." *Heat Transfer Engineering* 45, no. 17-18 (2024): 1606-1618.

- Pitchaimani, Jeyaraj, and Subhaschandra Kattimani. "Non-linear thermal stability and free vibration behavior of sandwich beams with auxetic re-entrant aluminum cores and graphene origami-enhanced facings." *Composite Structures* (2025): 119564.
- PP, Mohamed Shafeer, Jeyaraj Pitchaimani, and Mrityunjay Doddamani. "A short banana fiber—PLA filament for 3D printing: Development and characterization." *Polymer Composites* 46, no. 6 (2025): 4863-4880.
- Patil, Huchhanagouda H., Jeyaraj Pitchaimani, and M. A. Eltaher. "Buckling and vibration of beams using Ritz method: effects of axial grading of GPL and axially varying load." *Mechanics of Advanced Materials and Structures* 31, no. 16 (2024): 3861-3874.
- Shada, Sai Kumar, Subhaschandra Kattimani, and M. R. Ramesh. "Nonlinear Transient Dynamics of Skew Porous Graded Composite Plates supported on Multi-Parameter Elastic Foundations: Winkler-Pasternack/Kerr models." *International Journal of Structural Stability and Dynamics* (2026).
- Murugan, S. Senthil, and Subhaschandra Kattimani. "Effect of piezoelectric ceramic on natural frequency, structural, and thermal properties of additively manufactured PLA/BTO composite structure." *Ceramics International* (2025).
- Aprameya, C. R., Sharnappa Joladarashi, and M. R. Ramesh. "Surface enhancement of SS304 for high-temperature wear resistance using laser cladded Mo-alloyed stellite 6 coatings." *Surface and Coatings Technology* 513 (2025): 132457.
- Chandramouli, T. V., Sharnappa Joladarashi, M. R. Ramesh, and Mohammad Rizwanur Rahman. "Microstructure, mechanical properties, and tribological properties of Fe-based composite coatings reinforced with WC-Co and Cr<sub>3</sub>C<sub>2</sub>." *Journal of Materials Engineering and Performance* 34, no. 11 (2025): 10323-10338.
- Naik, Vibha Vinayak, Poornesh Kumar Koorata, and Suhas Nuggehalli Sampathkumar. "A review on transport properties and performance of commercial and novel membranes for anion exchange membrane water electrolyser." *International Journal of Hydrogen Energy* 184 (2025): 151891.
- Varshney, Sachin Kumar, and Poornesh Kumar Koorata. "Enhanced hydronium ion diffusion in proton exchange membranes reinforced with multilayer graphene oxide: new insights into water retention and ion mobility using molecular dynamics simulation." *Materials Advances* 6, no. 24 (2025): 9465-9475.
- Satishkumar, P., Arun M. Isloor, Somasekhara Rao Todeti, and Ramin Farnood. "Engineering High Flux 2D Titanium MXene Incorporated Membranes For Broad Spectrum Pollutant Rejection." *Current Research in Green and Sustainable Chemistry* (2026): 100506.
- Majumder, Anubhab, Somasekhara Rao Todeti, and Amaresh Chakrabarti. "Empirical studies on conceptual design synthesis of multiple-state mechanical devices." *Research in Engineering Design* 34, no. 4 (2023): 477-495.

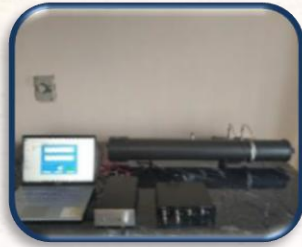
- Chandrakar, Rituraj, Saurabh Chandraker, Anil Kumar, and Ankur Jaiswal. "Effect of metalloid element on the microstructural and mechanical properties of AlCoCrCuFeNi high-entropy alloys." *Materials Technology* 39, no. 1 (2024): 2417295.
- Chandrakar, Rituraj, Saurabh Chandraker, Anil Kumar, and Ankur Jaiswal. "Investigation of phase transformation and mechanical properties of silicon addition on AlCrFeMnNi high entropy alloys." *Materials Research Express* 11, no. 11 (2024): 116512.
- Soni, Harsh Harikrishnan, Pranjal Sharma, Mervin Joe Thomas, C. M. C. Krishnan, and Abhilash Singh. "Recent advancements in soft ankle/knee exoskeletons technologies: systems, actuation and control." *Robotics and Autonomous Systems* 193 (2025): 105092.
- Singh, Abhilash, Devendra Kumar, and Shailesh Ganpule. "Biomechanical response of head surrogate with and without the helmet." *Journal of biomechanical engineering* 146, no. 3 (2024): 031001.
- Kumar, Deepak, Shaikh Faruque Ali, and A. Arockiarajan. "Theoretical and experimental studies on large deflection analysis of double corrugated cantilever structures." *International Journal of Solids and Structures* 228 (2021): 111126.
- Dhileep, K., D. Kumar, PN Gautham Vigneswar, P. Soni, S. Ghosh, S. Faruque Ali, and A. Arockiarajan. "Aerodynamic study of single corrugated variable-camber morphing aerofoil concept." *The Aeronautical Journal* 126, no. 1296 (2022): 316-344.

### Petent Publications:

Sl. No.	Title	Issue Date	Author(s)
1.	A helmet with anti-rotational pads	541869, Awarded, June 14, 2024	Dr Abhilash Singh



Impact testing Machine



Impudence Tube



UTM



Transmission Polariscope



Vibration Test Rig with environmental Chamber



UTM- 2kN



Polymer composite - Preparation and testing



Fatigue Testing Machine



Optical Microscope



Quarter Car Test Rig



Dual Rotor shaft Test Machine



Rheology



Hydrogen Fuel Cell and Electrolyser Lab (A)



Hydrogen Fuel Cell and Electrolyser Lab (B)



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