

**Master of Technology**  
**in**  
**MECHANICAL DESIGN**



**DEPARTMENT OF MECHANICAL ENGINEERING**

**NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA, SURATHKAL**

**Srinivasanagar, PO MANGALURU-575 025,**

**Karnataka State, INDIA**

**<http://mech.nitk.ac.in/>**

## **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:**

- 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
- Implants and Soft Tissue Engineering
- CAD/CAM
- Computational Mechanics
- Vibration Condition Monitoring
- Vibro-Acoustics
- Vehicle Dynamics
- Rotor Dynamics
- Kinematics and Mechanism

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

## FACULTY MEMBERS

|   |   |
|---|---|
| <p><b>G.C. Mohan Kumar, Ph.D. (IIT Madras)</b><br/>Professor (HAG)<br/><b>Research Interests:</b> Mechanical Design Engineering, Biomechanics, Green Composites, Tissue Engineering, Experimental &amp; Numerical Stress Analysis.<br/>Mobile: +919480065648<br/>Room No: ME-111<br/>Mail-id: mkumargc@nitk.edu.in<br/>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>K.V. Gangadharan, Ph.D. (IIT Madras)</b><br/>Professor<br/><b>Research Interests:</b> Machine Dynamics, Vibration and Control, Virtual Instruments, Vibration and Condition Monitoring<br/>Mobile: +919448478752<br/>Room No: ME-415<br/>Mail-id: kvganga@nitk.edu.in<br/>Detailed CV: <a href="https://mech.nitk.ac.in/faculty/k-v-gangadharan">https://mech.nitk.ac.in/faculty/k-v-gangadharan</a></p>  |    |
| <p><b>S.M. Murigendrappa, Ph.D. (IIT Bombay)</b><br/>Professor<br/><b>Research Interests:</b> Machine Dynamics and Vibrations, Fracture Mechanics and Fatigue, Stress Analysis, Finite Element Method, Advanced Materials<br/>Mobile: +91-9343889072<br/>Room No: ME-104<br/>Mail-id: smm@nitk.edu.in<br/>Detailed CV: <a href="https://mech.nitk.ac.in/faculty/s-m-murigendrappa">https://mech.nitk.ac.in/faculty/s-m-murigendrappa</a></p>          |   |
| <p><b>Hemantha Kumar, Ph.D. (IIT Madras)</b><br/>Associate Professor<br/><b>Research Interests:</b> Dynamics and Vibrations, Vehicle Dynamics, Condition monitoring, MR Fluid based Devices<br/>Mobile: +91-8762709897<br/>Room No: ME-314<br/>Mail-id: hemantha@nitk.edu.in<br/>Detailed CV: <a href="http://mech.nitk.ac.in/faculty/hemantha-kumar">http://mech.nitk.ac.in/faculty/hemantha-kumar</a></p>   |  |
| <p><b>P. Jeyaraj, Ph.D. (IIT Madras)</b><br/>Associate Professor<br/><b>Research Interests:</b> Dynamic Analysis of Polymer Composite Structures, Computational Mechanics, Structural Acoustics<br/>Mobile: +91-7795858559<br/>Room No: ME-404<br/>Mail-id: jeyaraj@nitk.edu.in<br/>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)**

Associate Professor

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

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Detailed CV: <https://mech.nitk.ac.in/professor/subhaschandra-kattimani>**Sharnappa Joladarashi, Ph.D. (IIT Madras)**

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**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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Detailed CV: <https://mech.nitk.ac.in/professor/sharnappa-joladarashi>**T. Somasekhara Rao, Ph.D. (IISc Bangalore)**

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**Research Interests:** Engineering Design, Mechanisms and Machines Theory

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Detailed CV: <https://mech.nitk.ac.in/professor/somasekhara-rao-todeti>**Poornesh Kumar K, Ph.D. (Inha University)**

Assistant Professor

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

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Detailed CV: <https://mech.nitk.ac.in/professor/poornesh-kumar-k>**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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**Khyati Verma, Ph.D. (IIT Delhi)**

Assistant Professor

**Research Interests:** Impact Biomechanics, Head Trauma, Mechanical behaviour of soft tissues under impact, Tissue biomechanics, Constitutive modelling, Finite Element Modelling

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Mail-id: kverma@nitk.edu.in

Detailed CV: <https://mech.nitk.ac.in/professor/khyati-verma>**Faculties Acievement:****Ongoing Projects:**

- Development of Cost Effective Magneto-Rheological (MR) Fluid Damper in Two wheelers and Four Wheelers Automobile to Improve Ride Comfort and Stability, MHRD, Ministry of Road Transport and Highways, IMPRINT-2017, 355 Lakhs.
- Virtual Lab Phase III, NMEICT (2018), 100 Lakhs.
- Design and fabrication of helicopter tail rotor shaft system using carbon fibre reinforced composite, ECR-SERB-DST, 2018, 23.8 Lakhs.
- Fight Against CoVID19 – Face Shield, ONGC, NMPT, OMPL, MRPL, Stratasys, 40 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, Ongoing
- Explore – Experiential Learning Reengineered, IITMAA (2020), 25 Lakhs.
- Investigation on radiolucent composite sandwich materials for biomedical imaging systems under hygrothermal environment” AISTDF-SERB (2020), Rs 37.08 Lakhs.
- E Mobility, NITK+NITKAlumni (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.
- Design and Development of Semi-Active Prosthetic Knee using cost-effective Magneto Rheological Brake to assist Trans-Femoral Amputees, DST, Board – SEED/TIDE, (2022), 23.98 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.

## Selected Publications:

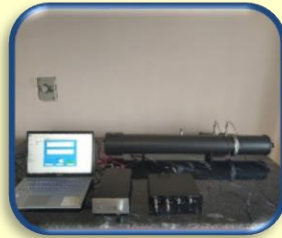
- G C Mohan Kumar, Nagamadhu M., Jeyaraj P., Influence of Glutaraldehyde Cross-linker on Dynamic Properties of Polyvinyl Alcohol, Polymer Emerging Materials Research, Volume 9 Issue 1, pp. 1-13, March 2020.
- B. Y. Santosh Kumar, Arun M. Isloor, G. C. Mohan Kumar, Inamuddin, & Abdullah M. Asiri, Nanohydroxyapatite Reinforced Chitosan Composite Hydrogel with Tuneable Mechanical and Biological Properties for Cartilage Regeneration Scientific Reports, Nature 9:15957, 2019.
- Poojary, U.R., Gangadharan, K.V. Material modeling of frequency, magnetic field and strain dependent response of magnetorheological elastomer. Journal of Material Science 56, 15752–15766, 2021.
- Ravikumar, KN; Madhusudana, CK; Kumar, Hemantha; Gangadharan, KV, Classification of gear faults in internal combustion (IC) engine gearbox using discrete wavelet transform features and K star algorithm, Engineering Science and Technology, an International Journal, 2021.
- MLJ Suman, SM Murigendrappa, Subhaschandra Kattimani, Effect of similar and dissimilar interface layers on delamination in hybrid plain woven glass/carbon epoxy laminated composite double cantilever beam under Mode-I loading, Theoretical and Applied Fracture Mechanics, 114, 2021.
- Ratnesh Kumar Singh, Pranay Biswas, S.M.Murigendrappa and S. Kattimani, An experimental evaluation of the microstructure, mechanical and functional fatigue properties of the boron-doped Cu-Al-Be SMA wires, Materials & Design, 210, 2021.
- Radhe Shyam Saini Tak, Hemantha Kumar and Sujatha Chandramohan, Optimal design of Inverted rotary MR brake with waveform boundary using a novel combined magnetostatic approach, Volume 29, Number 10, Smart Materials and Structures, 2020.
- K.N. Ravikumar, C.K. Madhusudana, Hemantha Kumar, K.V. Gangadharan, Classification of gear faults in internal combustion (IC) engine gearbox using discrete wavelet transform features and K star algorithm, Engineering Science and Technology, an International Journal, 2021.
- Effect of temperature and moisture on free vibration characteristics of skew laminated hybrid composite and sandwich plates, V Kallannavar, B Kumaran, SC Kattimani, Thin-Walled Structures, 157 2020.
- Static Analysis of stepped functionally graded magneto-electro-elastic plates in thermal environment: A finite element study. Vinyas, M. and S C Kattimani, Composite Structures, 178: 63-86, 2017.
- Priyanka, R., Twinkle, C.M. & Pitchaimani, J. Stability and dynamic behavior of porous FGM beam: influence of graded porosity, graphene platelets, and axially varying loads. Engineering with Computers, 2021.
- Priyanka, R., & Pitchaimani, J. Static stability and free vibration characteristics of a micro laminated beam under varying axial load using modified couple stress theory and Ritz method. Composite Structures, 281, 115028, 2022.



- Dasari Rajkumar, Vishwas Mahesh, Sharnappa Joladarashi and Satyabodh M Kulkarni, A Novel Flexible Green Composite with Sisal and Natural Rubber: Investigation under Low-Velocity Impact, *Journal of Natural Fibers*, 2022.
- Rakesh Patil, Sharnappa Joladarashi and Ravikiran Kadoli, Bending and vibration studies of FG porous sandwich beam with viscoelastic boundary conditions: FE approach, *Mechanics of Advanced Materials and Structures*, 1-20, 2022.
- Mithun Kumar, Somasekhara Rao T., Arun M. Isloor, G.P. Syed Ibrahim, Inamuddin, Norafiqah Ismail, Ahmed Fauzi Ismail, Abdullah M. Asiri. Use of cellulose acetate/polyphenylsulfone derivatives to fabricate ultrafiltration hollow fiber membranes for the removal of arsenic from drinking water, *International Journal of Biological Macromolecules*, 129, 715–727, 2019.
- Mithun Kumar, Arun M. Isloor, Somasekhara Rao Todeti, G. P. Syed Ibrahim, Inamuddin, Ahmed Fauzi Ismail, Abdullah M. Asiri, Improved separation of dyes and proteins using membranes made of polyphenylsulfone/cellulose acetate or acetate phthalate, *Environmental Chemistry Letters*, volume 18, pages 881–887, 2020.
- Poornesh K Koorata, SD Bhat, Compressive cyclic response of PEM fuel cell gas diffusion media, *Int J Hydrogen Energy*, 46 (7), 5570-5579, 2021.
- P Padavu, Poornesh K Koorata, SD Bhat, Numerical investigation on the improved reactant mass transport with depth-dependent flow fields in polymer electrolyte fuel cell under inhomogeneous gas diffusion layer compression, *International Journal of Heat and Mass Transfer*, 2021.
- Rakshith B Sreesha, Deepak Kumar, Saurabh Chandraker, “Optimization of Tribological Parameters to Enhance Wear and Friction Properties of Ti6Al4V Alloy using Taguchi Method”, *Proceedings of the Institution of Mechanical Engineers, Part J: Journal of Engineering Tribology*, 2021.
- H. Roy, and S. Chandraker, Dynamic Study of Viscoelastic Rotor: Modal Analysis of Higher Order Model Considering Various Asymmetries, Published in the *Journal of Mechanism and Machine Theory*, Elsevier, Vol. 109, pp. 65-77, 2017.
- Gaur, P., Verma, K., Chawla, A., Mukherjee, S., Lalwani, S., Malhotra, R., Mayer, C., Ghosh, P., Chitteti, RK. High rate failure properties of Human aortic tissue under longitudinal extension. *International Journal Experimental and Computational Biomechanics*, Vol4, pp. 125-151, 2018.
- Gaur, P., Verma, K., Chawla, A., Mukherjee, S., Jain M., Mayer, C., Chitteti, RK., Ghosh, P., Malhotra, R., A., Lalwani, S. A bilinear structural constitutive model for strain rate dependent behavior of human diaphragm tissue. *International Journal of Crashworthiness*. ISSN:1358-8265, Vol-25, 284-298, 2019.



Impact testing Machine



Impedence Tube



UTM



Transmission Polariscope



Furnace



UTM- 2kN



Polymer composite –  
Preparation and testing



Fatigue Testing Machine



CNC Turning Center



Quarter Car Test Rig



Dual Rotor shaft Test  
Machine



5-Axis CNC Machine



Wire EDM



Rheology



CNC Milling Center

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Optical Microscope