DEPARTMENT OF MECHANICAL ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA
SURATHKAL
Srinivasnagar, P.O. Mangaluru - 575025
Karnataka, India

Master of Technology
in
MECHATRONICS ENGINEERING

Mechatronics Engineering

The first interdisciplinary Master's program in the department was started in Mechatronics Engineering in the year of 2008 with the annual intake of 27 students. The program emphasizes on fundamental principles of Mechanical, Electrical, Electronics and Computer Engineering required in the field of Mechatronics Engineering for various applications. Students are encouraged to do projects in their course work to get experiential learning. Many of the courses are attached with laboratory to give a "Do It Yourself" experience to the students. Students undergo training in various industries during internships, and get exposure of various avenues in Mechatronics Engineering applications. The program has traversed path of knowledge dissemination and the generation as well as delivering the well qualified mechatronics engineering post graduates to the nation.

VISION AND MISSION OF THE DEPARTMENT

Vision

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

Mission

- Produce Mechanical 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.

Program Educational Objectives (PEOs)

1. Create ability in students to design, develop products and applications involving mechatronics and be able to use engineering tools that will enhance their productivity.
2. Inculcate to review the fundamentals of Mechanical, Electrical, electronics and communication, computer science and their integration to develop mechatronics systems.
3. Prepare students to be effective engineers with good analytical and problem-solving skill to innovate, research and develop in multidisciplinary environment.
4. Create awareness of societal and the environmental implications and make them suitable for engineering career in industrial environs as well as for pursuing higher academics.

Program Outcomes (Pos)

1. An ability to independently carry out research /investigation and development work to solve practical problems
2. An ability to write and present a substantial technical report/document
3. Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

Current Research Areas

- Mechatronics System Design
- Cyber Physical Systems
- PLC Automation
- MEMS
- AI Applications in Manufacturing
- Applications of ANN
- Micro Machining
- Industrial Automation
- Impact Biomechanics
- Cable-Driven Robotics
- Musculoskeletal Simulations
- Biomedical Devices
- Wearable & Rehabilitation Robotics
- Constitutive Modelling
- Biomedical Implants
- Mobile Robots
- Soft Robotics
- Exoskeletons
- Modelling and Control of Robotic Systems
- Human-Robot Interaction

Course of Study

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

Semester	Code: Title	(L-T-P) Credit
FIRST	ME 720 Introduction to Mechanical Systems	(3-0-0) 3
	ME 721 Sensors and Signal Conditioning	(2-0-2) 3
	ME 722 Actuators and Control	(2-0-2) 3
	ME 723 ADE and Microcontroller Lab	(0-0-3) 2
SECOND	ME 724 Control Engineering	(3-0-0) 3
	ME 725 Micro-Electro-Mechanical Systems Design	(3-0-0) 3
	ME 726 FMS and Simulation Lab	(0-0-3) 2
	ME 888 Seminar	2
THIRD	ME 889/ME 898 Practical Training/ME896 Minor Project	2
	ME 890 Major Project	4
FOURTH	ME 891 Major Project	8
Program Electives		
	ME831 Smart Structures & Materials ME832 Intelligent Systems ME833 Nano Technology ME834 Digital Systems Design ME835 Modeling and Simulation of Mechatronics Systems ME836 Electronic Measurement and Instrumentation ME837 Embedded System Design ME838 Modern Control Engineering ME839 Smart Sensor and Actuator ME840 Automation System and Internet of things ME841 Automotive Electronics ME861 Finite Element Method ME862 Virtual Instrumentation ME863 Design for Manufacturing ME864 Computational Fluid Dynamics ME865 Robotics: Mechanics and Control ME866 Optimization Techniques ME867 Product Design and Development ME868 Design of Thermal Systems ME869 Theory and Practice of Sensors & Actuators ME870 Biomechanics and Materials ME871 Mechanical Systems and Signal Processing ME872 Machine Tool Design ME873 Applied Cyber Physical Systems MA702 Design and Analysis of Experiments	

Faculty Members (Mechatronics Engineering)

S.M. Kulakarni, Ph.D. (IISc Bangalore)
Professor
Research Interests: Mechanisms and Machine Design CAD, Composite Materials, Product Development and MEMS
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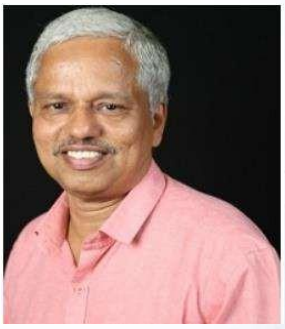

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Navin Karanth P, Ph.D. (NITK - Surathkal)
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Arun Kumar Shettigar, Ph.D. (NITK-Surathkal)
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Mruthynjaya Swamy K.B., Ph.D. (IIT-Kharagpur)
Assistant Professor

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Khyati Verma, Ph.D. (IIT-Delhi)
Assistant Professor

Research Interests: Impact Biomechanics, Head Trauma, Mechanical behavior of soft tissues under impact, Biomedical Devices, Product Design and Development, Constitutive modelling, Finite Element Modelling

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Mervin Joe Thomas, Ph.D. (NIT-Calicut)
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Research Interests: Robotics, Mechanism Synthesis, Parallel Manipulators, Mobile Robots, Medical Robots, Soft Robots, Exoskeletons

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Sanjeevi Nakka, Ph.D. (IIT-Gandhinagar)
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Ongoing Sponsored Research Projects

SL NO	Project Title and Funding Agency	Amount (Lakhs)
1	Rare Earth Magnet-Free Axial Flux Synchronous, Radial Flux Switched Reluctance Motor and their Controllers for EV Applications [NITK+IITM+IITH+CDAC(TVM)], ANRF+7 Industries	1033
2	Smart Sensor Based Responsive Mattress for Off Loading and Treating Pressure Ulcers [KMC+ Manipal School of Architecture and Planning + NITK], ICMR	153
3	Development of hand-held compact non-optical sensor device for soil analysis- GPS/GIS, Ministry of MSME, DC + M/s Bellare GIS Consultancy OPC Private Ltd	25
4	Green Waves: Electrifying Cochin Port and Harit Sagar Transformation, International Sustainable Energy Foundation	125
5	Moo-Ving Forward: Electrifying Karnataka's Milk Industry, International Sustainable Energy Foundation	101
6	Artificial intelligence-based modeling and assessment of saltwater intrusion phenomenon in west-flowing rivers of coastal Karnataka using multimodal data sources, SERB	28.79
7	Electrification of Indian Seaports and research-based policy recommendation, International Sustainable Energy Foundation	180
8	Virtual Lab Phase IV, NMEICT, MOE	376.93
9	Design and Execution of Modernization of Research and Instructional Fish Farm for new Aquaculture Technologies, Rashtriya Krishi Vikas Yojana (RKVY) & College of Fisheries, Mangalore	719
10	Indigenous Development of AI-Optimized Functionally Graded Composites using Additive Manufacturing for Strategic Impact-Resistant Applications, ANRF-ARG	42.5
11	Design and development of device to measure head kinematics during an impact (Ongoing) funded by Design Innovation Center (DIC), IISC Bangalore	10
12	Development of NITHRA: NITK Humanoid Assistant, NITK/KREC Endowment Fund	13.78
13	Wristband Design Solution with Emergency Alerts for Lifeguards, Ministry of MSME, DC + M/s. Lateral Education	19
14	Development of Wing-in-Ground Effect airplanes for fast commuting, SEED Grant	10
15	Enhancing Disaster Management Capabilities through Amateur Radio Communication, Manipal Dot Net (CSR Project)	5.9
16	Tri cycle – Design and Development for PWD students, M/s. Boeing, India	5

PROMINENT PUBLICATIONS

[1] Gurjar, A. K., **Kulkarni, S. M.,** Joladarashi, S., & Doddamani, S. (2025). Experimental and numerical investigation of the performance of luffa fiber-reinforced natural rubber composites with process parameter optimization using DOE. *Fibers and Polymers*, *26*(12), 5737-5757.

[2] Gurjar, A. K., **Kulkarni, S. M.,** Joladarashi, S., Doddamani, S., & TS, M. K. (2025). Enhancing energy absorption of luffa–cenosphere-reinforced epoxy composite: Influence of surface modification of reinforcements. *Journal of Reinforced Plastics and Composites*, 07316844261419874.

[3] Sathya, N. N., **Herbert, M. A., Shettigar, A. K**., & Vatnalmath, M. (2026). Impact of tool rotational speed on friction stir welded joints of AA2014-T6/AA5052-H32: synthesis, microstructural, mechanical and fractographic behaviour. *Fracture and Structural Integrity*, *20*(75), 1-12.

[4] Prabhakar, D. A. P., **Shettigar, A. K., Herbert, M. A.,** Korgal, A., & Adiga, K. (2025). INVESTIGATION OF THE EFFECT OF PROCESS PARAMETERS ON THE MECHANICAL PROPERTIES OF FRICTION STIR ADDITIVE MANUFACTURED (FSAM) OF AA8090 ALLOY. *Results in Engineering*, 107680.

[5] Reddy, T. N., Kumar, N., Ponnappa, N. P., Mohana, N., Vinod, P., **Herbert, M. A., & Rao, S. S.** (2025). Intelligent GD&T symbol detection in mechanical drawings: a comparative study of YOLOv11, Faster R-CNN, and RetinaNet for quality assurance. *Journal of Intelligent Manufacturing*, 1-19.

[6] Patel GC, M., BS, A., Jagadish, **Shettigar, A. K**., & Samuel, O. D. (2025). Experimentation, Modelling, and Analysis of Biodiesel Conversion and Their Engine Performance and Emission Characteristics. In *Biofuel Production, Performance, and Emission Optimization: A Comprehensive Approach to Modelling and Optimization* (pp. 71-141). Cham: Springer Nature Switzerland.

[7] Manvi, M., & **Swamy, K. M.** (2024). Comprehensive simulation study on AlN, ZnO, and PZT-5H piezoelectric materials for microcantilever-based MEMS energy harvesters: Mechanical and electrical insights. *Proceedings of the Institution of Mechanical Engineers, Part E: Journal of Process Mechanical Engineering*, 09544089241290635.

[8] Manvi, M., & **KB, M. S**. (2024). Evaluating the efficacy of lead-free piezoelectric materials in microcantilever based vibration energy harvesters. *Engineering Research Express*, *6*(4), 045330.

[9] Suman, S.K., **Verma, K.** Effect of trunk angle on lower limb joint moment in different strategies of sit-to-stand-to-sit motion with healthy subjects.Medical & Biological Engineering & Computing, 2025.https://doi.org/10.1007/s11517-025-03451-6.

[10]Singh, R.K., **Verma, K.,** Mohan Kumar, G.C. et al. Optimizing dental implant design parameters through orthotropic properties of bone: a DOE-based approach. Int J Interact Des Manuf (2025).

[11] George, S.P., **M. J. Thomas**, Meby Mathew, Naveen Gangadharan and Arun K. Varghese; Development, optimization, and prototyping of a simplified sit-stand mechanism for lower limb impairments. Medical & Biological Engineering & Computing, vol. (ahead of print), 2025, https://doi.org/10.1007/s11517-025-03455-2

[12] Tahsin Khan, and **M. J. Thomas**; "Soft autonomous mobile manipulators in agricultural automation – a review", Industrial Robot – The International Journal of Robotics Research and Application, vol. (ahead of print), 2025;

[13] H. H. Soni, P. Sharma, **M. J. Thomas**, C. M. C. Krishnan, and A. Singh, "Recent Advancements in Soft Ankle/Knee Exoskeletons Technologies: Systems, Actuation and Control," Robotics and Autonomous Systems, vol. 193, 105092, 2025.

[14] Suman, S.K., **Verma, K.** Investigation of lumbar and cervical lordosis variation in sit-to-stand-to-sit movement with different strategies in healthy subjects. Journal of Back and Musculoskeletal Rehabilitation May 2025.

[15] Alapati, S., Seth, D., **Nakka, S.**, & Aoustin, Y. (2025). Feasibility study of a 4-DOF cable-driven exosuit for elbow and wrist rehabilitation. *Multibody System Dynamics*, 1-24.

[16] **Nakka, Sanjeevi**, and Vineet Vashista. "External dynamics dependent human gait adaptation using a cable-driven exoskeleton." *IEEE Robotics and Automation Letters* 8.9 (2024): 6036-6043.

SOME GRANTED PATENTS:

[1] Dr. Gopinath Thilak P.S., **Dr. Khyati Verma, Dr. K. V. Gangadharan**, "Oral fixed prosthesis as a preventive measure for mandibular deviation following hemimandibulectomy (Resection of lower Jaw), " Application No. 202441046773

[2] **Dr. Khyati Verma**, Dr. Siddharth R, Dr. Ajay Rai E, Raghvendra Pandurang Jadhav, Dhiren V Bhandary, **Dr. Ganagadharan K V**, Dr. Rohan Mascarenhas, "An automated ergonogauge device for measuring three-dimensional spatial data," Application No. 202541029107

[3] Dr. Priyalakshmi, **Dr. Khyati Verma**, Dhiren V Bhandary, Raghvendra Pandurang Jadhav, **Dr. Ganagadharan K V**, Dr. Praveena Shetty, Dr Greeshma Kannan, "Orthodontic Appliances to Prevent Tongue Thrusting Habit", Application No. 202541032533

[4] **Dr. Khyati Verma**, Dr. Rajeev Aravindakshan, Vedangi Nishane, Dr. B R Jayalekshmi, **Dr K.V.Gangadharan**, "Self-Sampling Cup for Pap (or Pap Smear) and Human Papillomavirus (HPV) Testing, " Application No.202541032535

[5] Vashista, Vineet, **Nakka, Sanjeevi**, Singh, Yogesh, Balashaeb Shinde, Akshayraj, "Cable Actuation and Routing unit for Exosuit (CARE)", Application No. 202321058498

[6] Akash Korgal, **Arun Kumar Shettigar, Navin Karanth P**, Shrivathsa TV; Chakrapani Mahabala; Padmanabha, "Synthesis of Spherical Hybrid Nanoparticle using Non-Traditional Micro Grinding (NTMG) Technique", Application No. 20241036271

[7] **Shrikantha S Rao, Navin Karanth P**, Shrivathsa TV, **Arun Kumar Shettigar**, Akash Korgal, "Intelligent Prediction System for Coronary Artery Disease with the application of Multi-Dimensional Approach", Application No. 202441052187

[8] **Mruthyunjaya Swamy K. B.**, Mahammad Rafeeq Manvi, Harshal Sukumar Nejkar, Chauthmal Shashank Subhash, "Piezoelectric Spring-Mass System for Vibrational Energy Harvesting at Various Mode Shapes", Design No.: 414710-00

[9] **Navin Karanth P,** Vijay H Desai, Antonio Dylan Do Rosario Carvalho, "A Modular System and Apparatus for Pneumatic Muscle Actuation in Medical Rehabilitation Exoskeleton Robots", Application No. 202141004899

[10] **Navin Karanth P,** Vijay H Desai, Antonio Dylan Do Rosario Carvalho, "A System for Operating an Exoskeleton with a Novel Pronation Supination Mechanism", Application No. 202241057878

Facilities

Name of Laboratory	Equipment and Software
Mechatronics Studio	Microprocessor kits, PLC and Robot kits, Servo Drives, Lead screws, spindle drives. NI Elvis board III, HMI pannel, Micro machining.
CAD Laboratory	AUTOCAD, ANSYS, ADAMS, DEFORM, EES, NIST-REFPROP, SIMPACK,
Bosch Automotive Electronics Laboratory	LabCAR, Engine ECU EDC17C55 With ETK, Break out box, Engine: 2.2L 103kW Hawk XUV 500 BS4 mHawk140, CRDI engine 5th generation, Variable Geometry Turbo charger (VGT) with eddy current Dyno
Micro-System Laboratory (Design Innovation Center)	FDM based Rapid Prototyping Machine, Laser engraving Machine, 20Sim Software,
Automation Laboratory 1	Multi function sensor development tool XDK kit (05 Nos)
	Table top programmable 4 axes CNC turning and milling machine (01 Nos.)
	Flexible Manufacturing System Module
	Desktop Computer with Factory I/O
	Vision based Quality Inspection Camera, Component Inspection Platform, Inspection Interface Unit
	Robot mobile training cell
	Standard Robotic cell
	Automation Studio software and Automation Studio I/O Interface Box
	Ethernet KRL 2.2
	Robot Sensor Interface 3.3
	Fused deposition modeling setup for Robotic 3D printing
Automation Laboratory 2	Hydraulic Control Module
	Pneumatic Control Module, Fluidic muscle with fittings
	Electro-pneumatic pressure regulator (EPR), Accessories, Air Pressure, Distribution
	IoT Controller Kit with Software
	IoT Sensors, Pressure, Flow, Temperature, Aqua Sensors with manifold and couplings
	Sensorics module
	Thermal Imager
	Laser Distance sensor
	ModBus Data Logger with Software and Wifi Transmission
	NI DAQ for analog input, output, bridge and chassis
	Delta controller - with IO capabilities, communication port: built in RS232, RS485
Bosch Power tools Laboratory	Bosch power tools for metal, wood and concrete working
Center for System Design	NI Elvis board II, NI Data Acquisition cards, modules, NI- Virtual Instrumentation software, Kistler Cutting Tool Dynamometer, shakers, BLDC, Stepper, Servo, Piezo, Magnetostrictive, actuators

SIEMENS Centre of Excellence in Automation

Name of Laboratory	Equipment and Software
Product & Process Digitalization Lab	NX Academic Perpetual License Core
Advanced Analysis Lab - Software	Simcenter 3D Academic Bundle, Simcenter STAR CCM
Advanced Analysis Lab - Hardware	PCB 356A02 Triaxial, General Purpose ICP Accelerometer
Factory Automation Lab	S7 1200 PLC & S7 1500 PLC with HMI, PLC Software
Mechatronics Lab	Mechatronics Modular Manufacturing System consisting of: Feeder Station, Inspection Station, Buffer Station, Sorting Station, Processing Station, Compressor Tool Kit, SIMATIC S7 – 1200 PLC and Siemens TIA Portal Software
Prototype Lab	3D Scanner, Coordinate Measuring Machine

Facilities

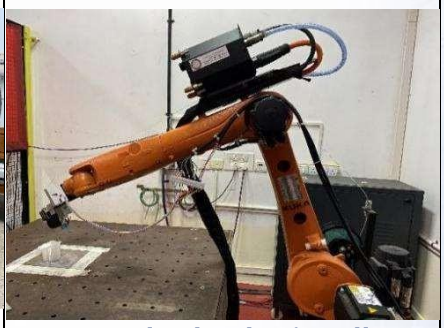
AGV based FMS Module from MTAB Engineers (P) Ltd.

Component Inspection Platform

Sensorics Module from Pepperl & Fuchs (India) Pvt. Ltd

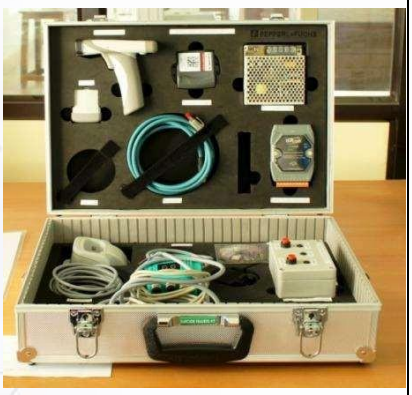
Hydraulic Control Module from Bosch Rexroth (India) Pvt. Ltd

Pneumatic Control Module from Bosch Rexroth (India) Pvt. Ltd



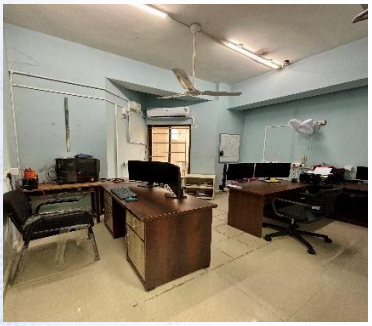
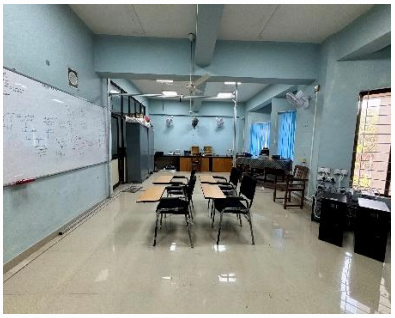
Standard Robotic cell intergrated with complete MIG welding unit from KUKA robot

Robot mobile training cell- Full module from KUKA robot



Barcode Readers

Positioning System

 Sensors Kit	 Position Guide Vision Kit	 Radio Frequency Identification Kit
 HPC Facility	 Robotics Lab	 Multi Material 3d Printer

Consultancy Potential

- System modeling of mechatronic applications
- Artificial intelligence and Machine learning for manufacturing and medical applications
- Device development for biomedical applications
- Micro machining applications for MEMS devices
- Computer Aided Design and Manufacturing solutions
- Virtual Instrumentation, Condition monitoring and Diagnostics
- Robot motion control and path planning solutions
- Vibration analysis of machineries and equipment

MOUs Partners

- National Instruments India (NI)
- Volvo India, Bangalore (Academic Preferred Partner) *NITK is the only partner in India and 8th partner globally*
- Moog India Technology Centre Bangalore (MITC)
- ProSIM R&D Ltd Bangalore
- Larsen & Toubro Limited (L&T Construction), India
- AB Volvo Group Sweden
- Robert Bosch Engineering and Business Solutions Limited (RBEI), Bangalore
- Mercedes-Benz Research and Development Indian Private Limited (MBRDI), Bangalore
- Institute National DE LA Recherche Agronomique (INRA), France
- Council of science and industrial research: Center for glass and ceramics research institute (CSIR-CGCRI), Kolkata
- Bhabha Atomic Research Center (BARC), Mumbai
- National Aerospace Laboratories (NAL), Bangalore
- Central Power Research Institute (CPRI), Bangalore
- Central Manufacturing Technology Institute (CMTI), Bangalore

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