

**DEPARTMENT OF MECHANICAL ENGINEERING**  
**NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA,**  
**SURATHKAL**

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



**Master of Technology**  
**in**  
**Thermal Engineering**

## **THERMAL ENGINEERING**

The first Master program in the department was started in Heat Power Engineering in the year of 1971, and it was renamed as M. Tech. in Thermal Engineering in the year of 2008. The Program emphasizes on fundamental principles of Thermal Engineering for various applications, which includes Theory and design of internal combustion engines, Computational fluid dynamics, Measurement in thermal systems, Advanced fluid mechanics, Combustion, Refrigeration and Cryogenics, Air-Conditioning Systems, Turbo machines, Renewable & Sustainable energy, etc. Students are also encouraged to do their projects in industries, wherever there are chances of exposure to various avenues in Thermal Engineering. The program has traversed the path of knowledge dissemination and generation as well as delivered more than 600 Thermal Engineering post graduates to the nation.

## **VISION AND MISSION STATEMENT OF THE DEPARTMENT**

### **VISION**

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

### **MISSION**

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

## **PROGRAM EDUCATIONAL OBJECTIVES (PEOs)**

**PEO-1** Prepare graduates with good analytical, computational and experimental skills to design and develop energy efficient systems for sustainable development.

**PEO-2** Prepare graduates with technical competency combined with research and complex problem solving ability to generate innovative solutions in thermal engineering.

**PEO-3** Pursue lifelong learning for career and professional growth with a concern for society and environment

**PEO-4** Inculcate teamwork, communication and interpersonal skills adapting to changing environments of technology

### **PROGRAM OUTCOMES (POs)**

**PO-1:** An ability to independently carry out research/investigation and development work to solve practical problems.

**PO-2:** An ability to write and present a substantial technical report/document.

**PO-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**

- Emission Studies on Engines, Combustion of Premixed Flames
- Microchannel Flows
- Multi-Phase flow, Nanofluids
- Computational Fluid Dynamics
- Alternate Refrigerants and Alternate Refrigeration Methods
- Alternate Fuels
- Renewable Energy Systems, Solar Energy, Wind Energy
- Natural Circulation Loops
- Inverse Heat Transfer, Pool Boiling
- Turbomachines
- Lattice Boltzmann Method
- Immersed Boundary Method
- Microfluidics, Biological Fluid dynamics
- Transitional and Turbulent flows
- Experimental Aerodynamics

## COURSE OF STUDY

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

<b>Semester</b>	<b>Code: Title</b>	<b>(L-T-P) Credit</b>
<b>FIRST</b>	ME730 Advanced Fluid Mechanics	(3-0-0) 3
	ME731 Heat and Mass Transfer	(3-0-0) 3
	ME732 Refrigeration Systems	(3-0-0) 3
	ME733 Thermal Engineering Lab	(0-0-3) 2
<b>SECOND</b>	ME734 Design of Renewable Energy Systems	(3-0-0) 3
	ME735 Measurements in Thermal Systems	(3-0-0) 3
	ME736 Combustion	(3-0-0) 3
	ME737 Thermal Computational Lab	(0-0-3) 2
	ME892 Seminar	2
<b>THIRD</b>	ME893 Practical Training/ME899 Minor Project	2
	ME894 Major Project	4
<b>FOURTH</b>	ME895 Major Project	8
<b>Program Electives</b>		
	ME845 Transport Phenomena in Porous Media	
	ME846 Industrial Pollution Control	
	ME847 Design and Analysis of Solar Energy Systems	
	ME848 Nuclear Engineering	
	ME849 Turbomachinery	
	ME850 Multiphase Flows	
	ME851 Advanced Thermodynamics	
	ME852 Theory & Design of IC Engines	
	ME 853 Design of Air Conditioning Systems	
	ME854 Cryogenic Technology	
	ME855 Gas Dynamics	
	ME856 Alternative fuels for IC Engines	
	ME857 Sustainable Energy Technologies	
	ME858 Wind Energy	
	ME859 Nanoscale Fluid Flow and Heat Transfer	
	ME860 Applied Computational Methods in Thermal Engineering	
	ME864 Computational Fluid Dynamics	
	ME866 Optimization Techniques	
	ME868 Design of Thermal equipment	
	MA702 Design and Analysis of Experiments	

## FACULTY (THERMAL ENGG.)

**Kumar G.N., Ph.D. (IIT Delhi)**

**Professor**

**Research Interests:** Alternative fuels for IC engines, Simulation of I.C. engines, Heat Transfer

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**Veershetty Guntapure, Ph.D. (IIT Madras)**

**Professor**

**Research Interests:** Renewable energy, Solar energy conversion

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**Sathyabhama A., Ph.D. (NITK Surathkal)**

**Professor**

**Research Interests:** Boiling heat transfer, Refrigeration, Wind turbine aerodynamics

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**Anish S., Ph.D. (IIT Madras)**

**Professor**

**Research Interests:** CFD, Turbomachines, Aerodynamics, Biomedical flows, Solar energy

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**Arun M., Ph.D. (University of Greenwich)**

**Professor**

**Research Interests:** CFD, Turbulence, Heat and mass transfer, Combustion, Multi-phase flows, Fire safety engineering

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**Vasudeva M., Ph.D. (IIT Bombay)**

**Associate Professor**

**Research Interests:** Gasification of biomass for power and CHP, Polygeneration, Environmental impacts and Sustainability assessment of bioenergy

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**Arumuga Perumal D, Ph.D. (IIT Guwahati)**

**Assistant Professor (Grade - I)**

**Research Interests:** Lattice Boltzmann method, CFD, Microfluidics (MEMS) and Numerical heat transfer.

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**Ranjith M, Ph.D. (Dong-A University, Busan, South Korea)**

**Associate Professor**

**Research Interests:** CFD, Fluid-structure interaction, Microfluidics, Biofluidynamics, Solar energy

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**Parthasarathy, Ph.D. (KIT Germany)**

**Assistant Professor**

**Research Interests:** Fluid Flow and Heat Transfer in Porous Media, Porous media injectors for cryogenic engines, Solar Fuels.

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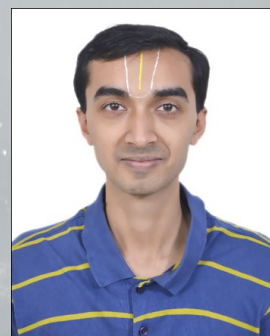
**S. Raghuram, Ph.D. (IISc Bangalore)**

**Assistant Professor**

**Research Interests:** Transitional and Turbulent Flows, Aerodynamics, Experimental Fluid Dynamics, Computational Methods, Heat Transfer injectors for cryogenic engines, Solar Fuels.

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## COMPLETED R&D PROJECTS

- 1 Design analysis and demonstration of the porous injector concept for throttling of liquid rocket engine - ISRO-Respond – Dr. Parthasarathy
- 2 Design and testing of robust, high efficient, low polluting LPG porous burners for household applications – DST – Dr. Parthasarathy
- 3 Evaluation of macroscopic properties of ideal porous media for their use in solar reactors and low emission combustors with help of experiments and CFD simulations – SERB – Dr. Parthasarathy.
- 4 An investigation in to the effects of induced helicity in the carotid bifurcated arteries on patient specific models – SERB – Prof. S. Anish (16.15 Lakhs)
- 5 Investigation of enhanced pool boiling methods for cooling of micro-electronic devices – DST SERB – Prof. A. Satyabhama
- 6 Experimental and Numerical Investigation of Effect of Leading edge Protuberances on the Performance of Wind Turbine Blade – DST SERB – Prof. A. Satyabhama
- 7 Visualization of boiling heat transfer on grooved surface – CSIR – Prof. A. Satyabhama
- 8 Development of ternary mixture based solar absorption refrigeration system - KSTePS, VGST Karnataka – Prof. A. Satyabhama
- 9 An investigation in to the effects of induced helicity in the carotid bifurcated arteries on patient specific models – SERB CRG – Prof. S. Anish
- 10 Development of a solar based humidifier/dehumidifier linked with ground water – DST CERI – Prof. S. Anish
- 11 An investigation in to the aerodynamic and aeroelastic behavior of a compressor cascade in a droplet laden flow – DST SERB – Prof. S. Anish
- 12 Design and development of a novel “swirl generator” to minimize the plaque formation (blockage) in cardiovascular systems - NITK (KREC) Alumni Funds – Prof. S. Anish
- 13 Experimental investigation on pulsating synthetic jet micromixers to determine the injection dynamics of insulin in hydrogels for subcutaneous drug delivery - 32.67 Lakhs – Dr. D. Arumuga Perumal
- 14 An affordable therapeutic solution for rehabilitation of cerebral palsy children with crouch gait – DST SERB – Dr. Ranjith M.
- 15 Investigations on the dynamic behavior of bacterial helical flagellar filaments under axial flow – DST SERB – Dr. Ranjith M.

## ONGOING R&D PROJECTS

Sl. No.	(Principal Investigator/ Coordinator)	Project Title	Grant (INR) Lakhs	Funding Agency
1.	Dr. A. Sathyabhama	Investigation into the effect of water on the boiling heat transfer coefficient of $\text{NH}_3/\text{LiNO}_3$ mixture	47.08	ANRF - CRG
2.	Dr. M. Ranjith	Investigations on inertial migration dynamics of aerosol particles	25.20	DST-SERB
3.	Dr. S. Raghuram	Resolving the Hydrodynamic Origins of Secondary Heat Transfer Peaks in Confined Micro-Jet Impingement	56.54	ANRF-ARG

## PROMINENT PUBLICATIONS

Sl. No.	Title	Journal	Author(s)
1.	State-of-the-art assessment-based review of boiling heat transfer and friction factor correlations for NH <sub>3</sub> -H <sub>2</sub> O, NH <sub>3</sub> -LiNO <sub>3</sub> and NH <sub>3</sub> LiNO <sub>3</sub> -H <sub>2</sub> O mixtures in a plate heat exchanger	Scientific Reports, v15:36144, 2025.	Vikash Kumar Singh Chauhan, <b>A. Sathyabhama</b> & Ramakrishna N. Hegde
2.	Effect of salt on the performance of ammonia absorption refrigeration cycle: A simulation study	International Communications in Heat and Mass Transfer, 157 (2024) 107730	Ganesh Kolapkar, <b>A. Sathyabhama</b>
3.	Numerical study of the atomization performance of coaxial and porous injectors in rocket engine applications	International Journal of Engine Research 27, 3 – 18, 2026	Shyam Raj, P., <b>Parthasarathy, P.</b> and Paramasivan, Ganesh
4.	A numerical study comparing the performance of a self-aspirating domestic LPG porous burner and that of a conventional LPG burner	Energy, 308, 2024	Ranjan, Sushanth and <b>Parthasarathy, P.</b> and Ratna Kishore, V.
5.	Simulation of RBC dynamics in oscillatory flow using smoothed particle hydrodynamics	Journal of Mechanics in Medicine and Biology 25 (01), 2450029, 2025	J Antony, <b>R Maniyeri</b>
6.	Numerical simulation of inclined filament under biomagnetic fluid flow	Computer Assisted Methods in Engineering and Science 32 (1), 25-41, 2025	DK Ravada, <b>R Maniyeri</b>
7.	Energy and exergy analysis of solar air heater with non-uniform porous medium under varying solar intensity and radiation effects: a 3-D CFD study	International Journal of Ambient Energy 46 (1), 244755, 2025	K Nidhul, A Joshi, AK Yadav, <b>S Anish</b>
8.	A Computational Study on Swirl Generator Designs for Carotid Arteries by Inducing Helical Flow	Journal of Applied Fluid Mechanics 19 (2), 117-128, 2025	L Rakesh, K Arun, CP Anees Fahim, K Prakashini, <b>S Anish</b>
9.	Design and development of small-scale steam biogas reformer for hydrogen generation from decentralized food waste-based biogas plants	Biomass and Bioenergy 206, 108602, 2026	NS Sudeep, <b>V Madav</b>
10.	Thermal studies of a MEMS-based pressure sensor for	Heat transfer 54 (1), 375-388, 2025	BG Krishna, KR Murthy, KZ Khan, <b>V</b>

	aerospace applications		<b>Madav, TP Ashok Babu</b>
11.	Numerical and experimental investigation with Response Surface Methodology optimization of melting behavior of nanoparticle-dispersed PCM in horizontal shell and spiral coil latent heat thermal energy storage system	Results in Engineering, 108849, 2025	L Naik, <b>V Gumtapure</b>
12.	Numerical Investigation on Shear-Induced Migration of Erythrocytes in Irregularly Curved Coronary Stenosed Arteries	Journal of Mechanics in Medicine and Biology, 2530005, 2025	S Vasmate, <b>V Gumtapure</b>
13.	Design and Development of Multi-Mode Magneto-Rheological Fluid Mount for Structural Vibration Isolation	Journal of Intelligent Material Systems and Structures 36 (6), 398-410, 2025	SH Bhat, A A, S Naveen, <b>H Kumar, Arun M</b>
14.	Experimental investigation of rotor wound multi disc magneto-rheological fluid brake	Journal of vibration engineering and technologies 13 (6), 439, 2025	RVV Shrivatsa H. Bhat, <b>Hemantha kumar, Arun M.</b>
15.	Experimental investigation and MORIME-ARAS-based optimization of a hydrogen-enriched pure n-propanol fuelled SI engine with prediction modelling using ANFIS-PSO	International Journal of Hydrogen Energy 202, 152981, 2026	KR Kirankumar, KV Sandeshgowda, <b>GN Kumar</b>
16.	Effect of fuel injection timing on engine characteristics with an equal volume of 1-heptanol/diesel blend in a CRDI CI engine	Results in Engineering 26, 104632, 2025	KB Bhumula, <b>GN Kumar</b>
17.	Recent Progress on Air, Liquid, PCM, Heat Pipe and Hybrid Modes of Thermal Management in Lithium-Ion Batteries	Recent Patents on Mechanical Engineering 19, 1, 2026	Arjun Puthenpurayil Sundaresan, <b>Dharmaraj Arumuga Perumal, Rajesh Kanna Parthasarathy</b>
18.	A holistic machine learning-lattice Boltzmann approach for data prediction in two-dimensional cavity flows in a square domain	Fluid Dynamics Research, Vol. 57 (6), 065503, 2025	S. Anbalagan, Kartik Mandar Kale, Anushka Tonk and <b>Arumuga Perumal D</b>

19.	Bursting phenomenon in turbulent wall-bounded flows	Physics of Fluids 37 (2), 2025	<b>S Raghuram</b> , ON Ramesh
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## PATENTS GRANTED

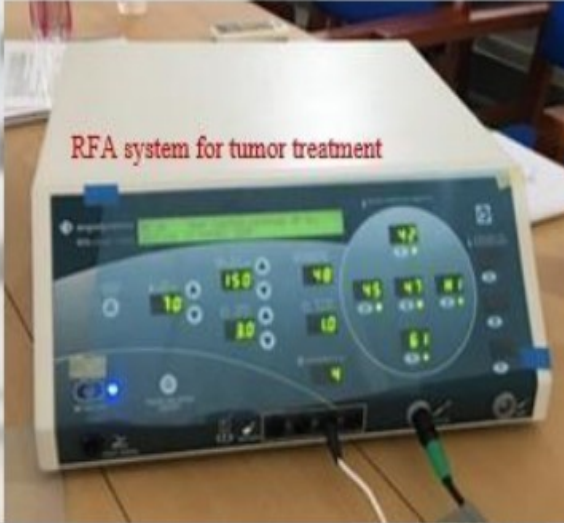
Sl. No.	Title	Issue Date	Author(s)
1.	A passive leading edge micro protuberance strip	Patent number 515403	<b>Sathyabhama. A</b> , Raghavendra. S
2.	Suction sealing for turbocharger	US Patent number 13/ 687053	S Gupta, PI Mulani, PZ John, <b>Anish Surendran</b> , Anish Gupta, SS Nambi and Santosh V

## CONSULTANCY POTENTIAL

- Engine Performance Testing, Combustion
- Refrigeration and Air Conditioning System
- Microchannels Flow, Cryogenics, CFD
- Heat Transfer, Turbomachinery
- Renewable Energy Systems, Energy Auditing
- Pumps and Piping Engineering

MAJOR FACILITIES	MAJOR LABORATORIES
<ul style="list-style-type: none"> <li>➤ Liquid Nitrogen Plant with Nitrogen Generator</li> <li>➤ 3D Particle Image Velocimetry, Micro PIV</li> <li>➤ Computerized IC Engine Test Rigs</li> <li>➤ Emission Testing Equipment</li> <li>➤ Ref. &amp; A/C Test Equipment, Simulation Chamber</li> <li>➤ Pool Boiling Setup</li> <li>➤ CRDI Engine</li> <li>➤ Solar Simulator with Thermal Collectors</li> </ul>	<ul style="list-style-type: none"> <li>❖ Heat Transfer Laboratory</li> <li>❖ I.C. Engines Laboratory</li> <li>❖ CFD Laboratory (ANSYS 14.5, EES, NIST-REFPROP, AVL FiRE &amp; BOOST, COMSOL)</li> <li>❖ Wind Turbine Laboratory</li> <li>❖ Aerospace Computational Laboratory</li> <li>❖ Aerospace Research Laboratory</li> </ul>

- Wind Tunnel
- Optical Microscope
- Premixed Flame Setup





**Contact:**

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