UG Program (B.Tech Mechanical Engineering)

The key objectives of this program are:

a. To enable students to have fundamental understanding of the core concepts of Mechanical Engineering
b. To integrate analytical and computational ability with experimental skills to create individuals competent in professional engineering practices
c. To stimulate critical thinking towards application of mechanical engineering concepts in interdisciplinary problem solving
d. To expose students to advanced concepts like AI & ML, Industry 4.0 and IoT for product and system design
e. To inculcate an attitude towards commitment to engineering ethics, leadership qualities and professional development.

Graduates of B.Tech program in Mechanical Engineering will have:

1. Strong understanding of fundamentals of Thermofluids, Mechanical Design and Manufacturing (Processes and Systems)
2. Ability to apply mechanical engineering principles to address challenges in real life problems through creative interdisciplinary thinking
3. Ability to use different simulation and computational tools for a better understanding and designing of mechanical processes/systems
4. Capability to appreciate the use of some of the advanced concepts like AI & ML, Robotics, Industry 4.0, IoT in Mechanical Engineering applications
5. Awareness of grassroots problems of the society and ability to provide technological solutions of sustainable nature.
6. Entrepreneurial spirit to undertake disruptive innovations
7. Skills to communicate engineering concepts and ideas to peers in written or oral forms
8. Commitment towards professional ethics and have humanitarian engineering skills.

Learning Outcome
Graduates of the B.Tech. program in Mechanical Engineering will:

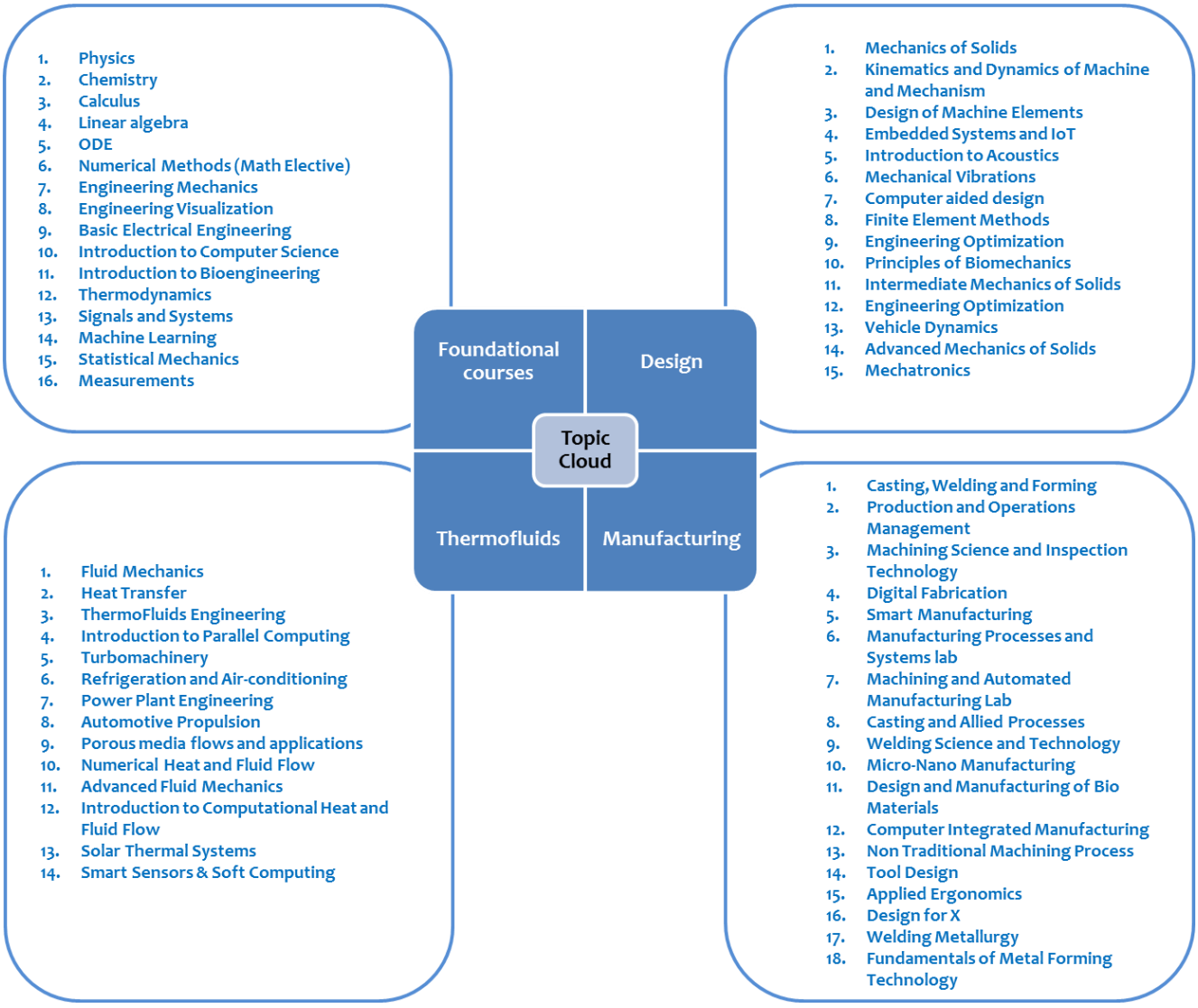
1. Gain a strong understanding of mathematics, science and engineering fundamentals of mechanical engineering
2. Be able to design and conduct experiments as well as to analyze and interpret data
3. Be introduced to concepts including engineering design / optimization / sensors fabrication / computational methods / simulation tools / thermal systems / refrigeration / heat transfer/ fluid flows/ nanomaterials/ AI/ IoT/ Smart Computing for various applications
4. Have the ability to design a mechanical system, component or process tailored to meet desired needs under socio-economic and environmental constraints
5. Be exposed to common problems that are prevalent in the domains of energy storage, systems and devices, clean energy, and nano-materials, futuristic technology, and advanced scientific computation methods, allowing them to innovate and develop technological solutions for the same
6. Receive effective, hands-on laboratory training as a part of laboratory courses and short-term research projects
7. Develop their communication skills by participating in classroom presentations, seminars and workshops on manuscript / patent writing / presentation skills
8. Be taught the value of team work and group discussion in problem solving, and time management to continue co-curricular activities without compromising for academics.

New skillsets targeted
Multi and interdisciplinary approaches

1. Design, develop and manufacturing of new or modified components for mechanical systems using computer-aided design/modelling software/additive manufacturing
2. Latest industrial pursuits, particularly in the areas of automation, robotics, and smart scientific computing, microfluidics etc.
3. Development of smart manufacturing capabilities for relevant industries
4. To play key roles in improving the range and performance of hybrid and electric automotive vehicles
5. Design of power-producing machines in the fields of alternative energies
6. Experimental validation of computational designs

7. Selection of materials based on engineering applications to ensure that it is safe, reliable and efficient
8. Advanced mechanical testing and characterization techniques
9. Familiarity with advanced and futuristic scientific computing techniques

Topic clouds and Mapping of Topic clouds with proposed courses



Topics and Mapping of Topic with Courses

Area	Topics	Category (Core/ Techniques Technology/Systems)	Course (PC/PE)
Design	Stress, Strain, Bending & Torsion	Core	Mechanics of Solid (PC)
	Hydraulic and Pneumatic Systems, Electro-Mechanical systems, Microprocessor and Microcontroller based Mechatronic systems, Design and Selection of Mechatronics Elements	Core and Techniques	Embedded systems and IoT (PC)
	Geometric & Functional Requirements, Sizing, Theory of Failures, Design and Selection of Machine Elements	Core and Techniques	Design of Machine Elements (PC)
	Mechanism Synthesis, Motion Analysis, Force Analysis, Gear Trains, Cams, Dynamics of Multi-Cylinder Engines	Core and Techniques	Kinematics & Dynamics of Machines (PC)
	Engineering Mechanics	Core	Engineering Mechanics
	Galerkin methods Finite element methods	Techniques	Introduction to Finite element methods(PE)
	Mechanical vibrations of one, two and multi degree of freedom systems, types of damping, vibration control and measurements, Introduction to continuous systems.	Core	Mechanical Vibrations (PE)

	Advanced analysis of strength of materials	Core	Advanced mechanics of solids (PE)
	Optimization techniques for engineering problems	Technique	Engineering Optimization (PE)
	Curves, Surfaces and Solid Modeling	Core, systems and Techniques	Computer aided Design (PE)
	Mechatronics, IoT	Systems and Technology	Mechatronics (PE)
	Biomechanical systems	Systems and Techniques	Principles of Biomechanics (PE)
	Intermediate Mechanics of Solids	Core	Intermediate Mechanics of Solids (PE)
	Control system	Systems and Techniques	Control Systems (PE)
	Experimental Robotics	Systems and Techniques	Experimental Robotics (PE)
	Links, mechanisms and dynamics in vehicles	Systems	Vehicle dynamics (PE)
	Theory of sound generation, sound propagation and sound reception.	Systems	Introduction to Acoustics (PE)
Manufacturing	Forming Technology	Core and Technology	Fundamentals of Metal Forming Technology (PE)
	Casting, Welding and Forming	Core and Techniques	Casting, Welding and Forming (PC)
	Production and Operations Management	Core and Techniques	Production and Operations Management (PC)
	Machining Science and Metrology	Core and Techniques	Machining Science and Inspection Technology (PC)
	Smart Manufacturing	Core and Techniques	Smart Manufacturing (PC)
	Digital fabrication	Core and Techniques	Digital Fabrication (PC)
	Manufacturing Lab	Core and Techniques	Manufacturing Process and Systems Lab (PC)
	Machining Lab	Core and Techniques	Machining and Automated Manufacturing Lab (PC)
	Casting and Allied Processes	Core and Technology	Casting and Allied Processes (PE)
	Welding Science and Technology	Core and Technology	Welding Science and Technology (PE)
	Micro-Nano Manufacturing	Core and Technology	Micro-Nano Manufacturing (PE)
	Design and Manufacturing of Bio Materials	Core and Technology	Design and Manufacturing of Bio Materials (PE)

	Computer Integrated Manufacturing	Core and Technology	Computer Integrated Manufacturing (PE)
	Non Traditional Machining Process	Core and Technology	Non Traditional Machining Process (PE)
	Tool Design	Core and Technique	Tool Design (PE)
	Applied Ergonomics	Core and Technology	Applied Ergonomics (PE)
	Design for X	Core and Technology	Design for X (PE)
	Welding metallurgy	Core and Technology	Welding Metallurgy (PE)
Thermofluids	Fluid Statics, Kinetics, Dynamics, Inviscid Theory, Viscous Flow, Turbulence and Compressible flow Fundamentals	Core and Techniques	Fluid Mechanics (PC)
	Conduction, Convection, Radiation, Boiling & Condensation, Heat Exchanger	Core and Techniques	Heat and Mass Transfer (PC)
	Thermodynamics	Core	Thermodynamics (PC)
	Heat engines and Power Plant Cycles, Turbomachines, Refrigeration and Air-conditioning	Systems and Technique	Thermofluids Engineering (PC)
	Parallel computing techniques	Systems and Technique	Introduction to parallel computing (PE)
	Turbines, pumps and compressors	Systems and Technique	Turbomachinery (PE)
	Combustion driven engines for automobiles	Systems and Technique	Automotive Propulsion(PE)
	Refrigeration cycles and air-conditioning systems	Systems and Technique	Refrigeration and Air-conditioning(PE)
	Cycles in power plant and energy conversion systems	Systems and Technique	Power Plant Engineering(PE)
	Fluid dynamics in porous media	Core and Technique	Porous media flows and applications(PE)
	Computational techniques for heat and fluid dlow	Core and Technique	Introduction to Computational Heat and Fluid Flow(PE)
	Advanced Fluid	Core	Advanced Fluid Mechanics

	Mechanics		(PE)
	Solar syatems	Technique and Technology	Solar Thermal Systems
	Smart Sensors	Technology	Smart Sensors & Soft Computing(PE)