

Mukesh Patel School of Technology Management and Engineering

B.Tech (Mechanical Engineering)

- Program Educational Objectives (PEOs)
- Program Outcomes (POs)
- Course Outcomes (COs)

Program Educational Objectives (PEOs):

- 1. Professional Skills
- 2. Career Growth
- 3. <u>Higher Studies</u>

Program Outcomes (POs):

PO-1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO-2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO-3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society, and environment as required. (WK5)

PO-4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO-5: Engineering Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO-6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture, and environment. (WK1, WK5, and WK7).

PO-7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity, and inclusion; adhere to national & international laws. (WK9)

PO-8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO-9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

PO-10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO-11: Life-Long Learning: Recognize the need for, and have the preparation and ability for independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change.

Courses and Course Outcomes (COs):

Chemistry

- **CO-1:** Explain the basic concepts of polymers, their types, and applications
- **CO-2:** Apply knowledge of lubrication properties and numerical problem-solving
- **CO-3:** Evaluate combustion processes and the characteristics of different types of fuels by solving related numerical problems
- **CO-4:** Assess the chemistry of water hardness, and softening methods, and solve related numerical problems
- **CO-5:** Investigate the properties and applications of engineering materials, composites, and nanomaterials

Technical Communication

- **CO-1:** Apply the fundamentals of written communication to create written documents that are coherent, error-free, and well organized.
- **CO-2:** Develop the ability to create effective and persuasive business correspondence, such as letters and emails, that follow etiquette and are able to achieve the desired outcomes.
- **CO-3**: Create basic reports such as memo, letter, and survey-based report, using their understanding of report writing.

Constitution of India

- **CO-1:** Recall the historical evolution of India's democratic values, emphasizing the foundational principles of justice, equality, and liberty as enshrined in the Preamble of the Constitution.
- **CO-2:** Understand the fundamental rights enshrined in the Constitution, their permissible restrictions, and how these rights are balanced with duties, to grasp their application within societal and professional frameworks.

• **CO-3:** Apply the knowledge of the structure of India's polity and the role of the Judiciary in maintaining the basic structure of the Constitution in real-world professional contexts

Materials engineering

- **CO-1:** Relate mechanical properties with the mechanical processing of materials
- **CO-2:** Analyze the root cause of failure in different types of material
- **CO-3:** Recommend heat treatment processes with the help of phase diagrams
- **CO-4:** Select appropriate materials for various applications depending on the structural requirements

Engineering Thermodynamics

- **CO-1:** Understand the fundamental concepts of engineering thermodynamics
- **CO-2:** Analyze various flow systems, laws of thermodynamics, concept of exergy and various power cycles
- **CO-3:** Understand the properties of pure substances using steam tables and charts

Applied Thermodynamics

CO-1: Explain the fundamental concepts of applied thermodynamics

CO-2: Analyze the components of steam power systems

CO-3: Investigate the concept of I.C. Engines, air compressors and refrigeration and air conditioning systems

Mechanical Measurements and Metrology

- **CO-1:** Describe the measurement terminologies and the concept of generalized measurement systems.
- **CO-2:** Select sensors, devices, and methods for measurement of specific parameters with required accuracy.
- **CO-3:** Analyze the impact of various factors on the measurement process.

Manufacturing Processes -II

- **CO-1:** Classify the metal cutting processes with tool geometry and forces of cut
- **CO-2:** Choose appropriate method of machining, to produce required geometrical features in components
- **CO-3:** Analyze various process parameters that affect machining processes

Additive Manufacturing

- **CO-1:** Compare the fundamental principles of various additive manufacturing technologies in terms of material requirements, manufacturing technologies and applications
- **CO-2:** Identify critical areas where AM can be applied to create value for the product
- **CO-3:** Apply the necessary skills in selecting the right AM process for a given application

Probability and Statistics

- **CO-1:** Understand the basic concepts of probability theory and statistics.
- **CO-2:** Solve problems involving random variables, probability distributions and testing of hypothesis, correlation, and regression
- **CO-3:** Identify suitable probability distribution and testing techniques to solve problems
- **CO-4:** Apply knowledge of random variables, probability distributions, measures of central tendency, correlation, and regression to solve real life problems
- **CO-5:** Analyse data samples using statistical methods

Heat Transfer

- **CO-1**: Describe the basic laws of heat transfer
- **CO-2:** Analyse realistic problems involving different modes of heat transfer
- **CO-3:** Apply basic principles of heat transfer to design heat transfer devices

Fluid Mechanics

- **CO-1:** Differentiate fluid properties and their static- dynamic nature
- **CO-2:** Analyze fundamental behavior of incompressible fluid
- **CO-3:** Evaluate the fundamental behaviour of laminar and turbulent flow and boundary layer theory to solve real life problems

Digital Manufacturing Laboratory

- **CO-1:** Describe FDM Technology.
- **CO-2:** Prepare given model for 3D printing.
- **CO-3:** Create products of high technological value using 3D printer

Industrial Applications of HVAC

- **CO-1:** Apply HVAC theory in the design and selection of HVACR plant equipment
- **CO-2:** Discuss and analyze the different air conditioning and industrial refrigeration systems
- **CO-3:** Explain different components and control systems in the HVAC and refrigeration industry

Computational Fluid Dynamics

- **CO-1:** Explain the need for modelling and simulation as well as the working of CFD software
- **CO-2:** Apply standard direct and iterative techniques to solve a system of linear algebraic equation
- **CO-3:** Analyze the heat transfer and fluid flow problems using techniques of CFD

Capstone Project

- **CO-1:** Select an appropriate problem statement after reviewing the literature and identifying the research gaps.
- **CO-2:** Formulate the different use cases/feasible design model.

- **CO-3:** Implement the prototype/proof of concept, test and validate the results.
- **CO-4:** Manage a team project.
- **CO-5:** Summarize the topic into a technical report.

Project

- **CO-1:** Select an appropriate problem statement after reviewing the literature and identifying the research gaps.
- **CO-2:** Formulate the different use cases/feasible design model.
- **CO-3:** Implement the prototype/proof of concept, test and validate the results.
- **CO-4:** Work efficiently in a team environment.
- **CO-5:** Summarize the topic into a technical report.

Manufacturing Processes-I

- **CO-1:** Recognize different metal casting processes, forming processes and joining processes along with defects associated with them
- **CO-2:** Apply the knowledge, techniques, skills and tools of the manufacturing processes to broadly defined engineering technology activities
- **CO-3:** Demonstrate the knowledge of construction of a lathe machine and its various operations

Kinematics and Dynamics of Machines

- **CO-1:** Understand the fundamentals of links, mechanisms, machines, brakes, clutches, and gyroscope
- **CO-2:** Analyse planar mechanism for displacement, velocity, and acceleration graphically and analytically
- **CO-3:** Construct various type of Cam profiles and analyze the standard motion of the follower
- **CO-4:** Compare different type of gears, gear-trains, and its applications

Finite Element Analysis

- **CO-1:** Derive the stiffness matrix for the beam and Constant-Strain Triangular element
- **CO-2:** Describe some of the approximations essential in finite element solutions
- **CO-3:** Solve a heat transfer problem by the finite element method

Engineering Graphics and Design

- **CO-1:** Interpret and communicate drawings effectively using different types of curves, lines, planes and solids.
- **CO-2:** Analyze the concepts of projection and section of right regular solids with their development.
- **CO-3:** Apply the techniques, skills, and modern tools to create projections of machine components with the help of software.

CAD/CAM/CIM

- **CO-1:** Create accurate and precise geometry of complex engineering systems and use the geometric models in different engineering applications
- **CO-2:** Apply the concepts of machining for the purpose of selection of machining parameters and cutting tools for CNC milling and turning
- **CO-3:** Understand concepts of different CAD/CAM/CIM systems and various data management systems

3D Printing

- **CO-1:** Compare the fundamental principles of various additive manufacturing technologies in terms of material requirements, manufacturing technologies and applications.
- **CO-2:** Identify critical areas where AM can be applied to create value for the product.
- **CO-3:** Apply the necessary skills in selecting the right AM process for a given application.

Design Thinking

- **CO-1:** Develop a human centred approach to problem solving
- **CO-2:** Apply design thinking principles to come up with innovative solutions to the problems, as new products, services, experiences or new Business models
- **CO-3:** Students will present case studies demonstrating how organizations have successfully leveraged this methodology for innovation and problem-solving.

Design of transmission systems

- **CO-1:** Articulate the design of belt drives and selection of belt, rope and chain drives
- **CO-2:** Analyze forces to design spur gears and helical gears
- **CO-3:** Design bevel and worm gears

Basic Electrical & Electronics Engineering

- **CO-1:** Explain the fundamental concepts of DC circuits, including Kirchhoff's laws and network theorems
- **CO-2:** Interpret the principles of AC circuit analysis, including resonance and three-phase systems
- **CO-3:** Illustrate the working principles of transformers and different types of electrical machines
- **CO-4:** Explain the basic operation of analog electronic components, including rectifiers, transistors, and operational amplifiers.
- **CO-5:** Make use of logic gates and Boolean expressions for digital circuits.

Critical Thinking

- **CO-1:** solve problems or take decisions by processing information in a clear, logical, reasoned, and reflective manner.
- **CO-2:** recognise, build, and appraise arguments
- **CO-3:** analyse contexts effectively
- **CO-4:** recognise bias and its impact on decision making