B.TECH. - MECHANICAL ENGINEERING PROGRAMME LEARNING OUTCOMES

PLO1-Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and IC design and technology concepts towards modelling and prototyping Integrated systems.

PLO2-Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PLO3-Design/development of solutions: Design methodology to offer hardware solutions to public health, safety and agriculture, consumer electronics along with cultural, societal, and environmental considerations.

PLO4-Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PLO5-Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PLO6-The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PLO7-Environment and sustainability: understand the impact of the professional engineering solutions in societal and environmental contexts, demonstrate the knowledge of, and need for, sustainable development.

PLO8-Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PLO9-Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

PLO10-Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehended write

effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PLO11-Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply the set one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PLO12-Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

COURSE LEARNING OUTCOMES (CLO)

SEMESTER III

ENGINEERING MATHEMATICS-III (COMMON TO ALL BRANCHES)	
Course Code:23AS301	Continuous Evaluation: …. Marks
Credits: 4	End Semester Examination:… Marks
L T P : 3 1 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Solve different types of partial differential equations.
- Find solutions of boundary value problems including heat and wave equations.
- Apply and analyze Fourier transforms with different applications.
- Evaluate the problems using z-transforms.
- Understand linear algebra and its application to Engineering.

Strength of Materials	
Course Code: 23ME301	
Credits: 3	
L T P : 3 0 0	
Prerequisite: Engineering Mechanics	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1 Understand the fundamental concepts of stress and strain and the relationship between both through the strain-stress equations in order to solve problems for simple three-dimensional elastic solids.

2 Calculate and represent the stress diagrams in bars and simple structures.

3 Understand and solve problems related to to pure and non-uniform bending of beams and other simple structures

4 Grasp the concept of design of thick and thin cylinder

5 Understand the concept of buckling and be able to solve the problems related to isolated bars

MANUFACTURING TECHNOLOGY	
Course Code: 23ME302	
Credits: 3	
L T P : 3 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1 Understand various ways of working of metals
2 Understand the concepts of Casting and Welding Technology
3 Understand the working of Machining with lathes and automats
4 Grasp the concept of Milling machine and Gear manufacturing process
5 Understand the various Machine tools used in manufacturing

ENGINEERING THERMODYNAMICS	
Course Code: 23ME303	
Credits: 3	
L T P : 3 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1 Understand the basic concepts of thermodynamic system, surrounding, closed and open system, extensive and intensive properties
2 Understand the concepts of laws of thermodynamics and its application in everyday life
3 Understand the Thermodynamic relations like Maxwell‘s equations –
Clapeyron equation and Dalton’s law of partial pressure
4 Grasp the concept of entropy, enthalpy, availability, irreversibility
5 Understand the application of Mollier diagram, throttling and concpt of isothermal expansion

Introduction to Mechatronics and Robotics	
Course Code: 23ME304	
Credits: 3	
L T P : 3 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1 Understand the basic concepts of control system
2 Understand the Types of Microprocessors, the pin diagram and architecture of 8085 microprocessor
3 Understand the concepts of PLC, ladder diagrams
4 Grasp the working of different sensors, transducers and actuators used in the mechatronics system
5 Understand the case studies on the real-life application of the mechatronics system

Strength of Materials Laboratory	
Course Code: 23ME351	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1 Describe the behaviour of materials upon normal external loads.
2 Predict the behaviour of the material under impact conditions.
3 Recognize the mechanical behaviour of materials.

Manufacturing Process Laboratory	
Course Code: 23ME352	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1 Understand the working of various types of lathe operations.
2 Produce flat surface and contour shapes on the given component.
3 Learn various methods of making gears.
4 Have the ability to make good quality products with good surface finish. 5 Learn to operate machines and metal cutting operations

Industrial Automation Level-I	
Course Code: 24SEC301	
Credits: 1	
L T P : 0 0 2	
Prerequisite: None	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to demonstrate:

1 The understanding of Industrial Automation
2 The principles of sensors and their outputs
3 The process of PLC programming
4 The understanding of concepts of HMI and MPS
5 The operation of Industrial Robotics

EFFECTIVE COMMUNICATION SKILLS	
Course Code: 23SS351	
Credits: 1	
L T P : 0 0 2	
Prerequisite: Nil	

Training Learning Outcomes (TLO): -

After the completion of the training, the student will have ability:

1. To communicate effectively and interact with people with confidence.
2. To demonstrate and differentiate between various forms of communication.
3. To apply effective communication skills confidently which a student need to get ahead in job and life.

SEMESTER - IV

FLUID MECHANICS	
Course Code:23ME401	
Credits: 3	
L T P : 3 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1 Student will know the concept of fluid and its properties, manometry, hydrostatic forces acting on different surfaces and problem-solving techniques.

2 exposed to the basic laws of fluids, flow patterns, viscous flow

3 Aware of the basic concepts of velocity profiles, dimensionless numbers and dimensional analysis.

4 Student will know the hydrodynamic forces acting on vanes and their performance evaluation.

5 Student will be in a position to evaluate the performance characteristics of hydraulic turbines. Also, knowledge on hydraulic systems.

COMPUTER AIDED DESIGN AND MANUFACTURING	
Course Code: 23ME402	
Credits: 3	
L T P : 3 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1 Explain lifecycle of a product and the role of computer-aided design (CAD) in product development.
2 Create the different wireframe primitives, surface primitives and solid primitives using parametric representations.
3 Apply geometric transformations on the created wireframe, surface and solid models.
4 Understand concepts of modeling in 2D and 3D.
5 Apply concepts of computer graphics.
6 Understand different CAD Packages and its features.
7 Apply the CNC machine tools and programming manufacturing processes

DESIGN OF MACHINE ELEMENT	
Course Code: 23ME403	
Credits: 3	
L T P : 3 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

Upon the completion of this course the students will be able to

1. Explain the influence of steady and variable stresses in machine component design.
2. Apply the concepts of design to shafts, keys and couplings.
3. Apply the concepts of design to temporary and permanent joints.
4. Apply the concepts of design to energy absorbing members, connecting rod and crank shaft.
5. Apply the concepts of design to bearings.

MATERIAL SCIENCE	
Course Code: 23ME404	
Credits: 3	
L T P : 3 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

At the end of the course students will be able to,

- Understand the basic concepts of metallurgy
- Understand the Types of crystal structures and their imperfections
- Study the failure mechanisms like fracture, fatigue, creep etc.
- To study the different hardening mechanisms like heat treatment, nitriding etc.
- Understand different alloys, constituents, properties and the applications

FLUID MECHANICS LABORATORY	
Course Code: 23ME451	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

After completion of the course:

1 Student will be able to compare performance of various machines at different operating points.

2 Student will be able to gain the knowledge of various flow meters and the concept of fluid mechanics.

3 The students will have creative thinking and a deeper understanding and intuitive feel for Fluid Mechanics, Fluid Dynamics, and Fluid Machinery.

4 Student will be able to compare performance of various machines at different operating points.

Industrial Automation Level-II	
Course Code: 24SEC401	
Credits: 1	
L T P : 0 0 2	
Prerequisite: None	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to demonstrate:

1 The understanding of advances of Industrial Automation
2 The principles of sensors and their outputs to control multiple actuators
3 The process of PLC programming
4 The understanding of concepts of HMI
5 The operation of Industrial Robotics and Industry 4.0

MANUFACTURING AND ASSEMBLY DRAWING Lab	
Course Code: 23ME453	
Credits: 2	
L T P : 1 0 2	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

After completion of this course, the students will learn:

1. The in-depth knowledge of Indian codes and standards for engineering drawing.
2. Ability to represent Fits and Tolerances in technical drawing.
3. Demonstrate the assembly drawing of joints, coupling and bearings.
4. Competence to prepare production drawing for simple components.
5. Demonstrate the assembly drawing of machine elements.

TEAMWORK & INTERPERSONAL SKILLS	
Course Code: 23SS451	
Credits: 3	
L T P : 3 0 0	
Prerequisite: NIL	

Training Learning Outcomes (TLO): -

After the completion of the training, the student will have ability:

- To be confident working in a team and leading it as well.
- To categorise the work and achieve expected performance within the time frame & will be able to adapt himself to work under various kinds of stress and re-energise himself to bounce back from such situations.
- To get benefitted from Emotional Quotient in building stronger professional relationships and achieveing career and personal goals.
- To face complex problems and effectively deal with it in the job due to Critical Thinking & Problem Solving Skills.

LIVE PROJECTS – I / INTERNSHIP	
Course Code: 23LP451	
Credits: 1	
L T P : 0 0 1	
Prerequisite: Nil	

INDUSTRIAL INTERNSHIP LEARNING OUTCOMES (IILOs):

The student should be able to:

1. Demonstrate the project assigned and its real life applications
2. Demonstrate the specific skills learned and in-depth understanding of production processes.
3. Demonstrate team work, designing, planning, and organizing of project implementation and work culture of Industry.
4. Demonstrate cleanliness and safety.

SEMESTER – V

Theory of Machines- I	
Course Code: 23ME501	
Credits: 3	
L T P: 3 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

1. The student is expected to be familiar with broader areas of basic mechanisms,
2. An understanding of, velocity and acceleration of simple mechanisms.
3. The student would be able to learn the fundamental concepts on Gear & gear train calculations.
4. An understanding of belt and friction.

IC ENGINES	
Course Code: 23ME502	
Credits : 3	
L T P : 3 0 0	
Prerequisite : NIL	

COURSE LEARNING OUTCOMES (CLOs)

On successful completion of the course, the student will be able to,

1. Engine components, auxiliary systems and combustion aspects of SI and CI Engines
2. The latest developments in the field of IC engines like lean burn engines, MPFI, Catalytic converters.
3. Given an engine design specification, predict performance and fuel economy trends.
4. Able to design SI & CI engine system.
5. Develop an ability to optimize future engine design for better fuel economy, performance and emissions.

HEAT AND MASS TRANSFER	
Course Code: 23ME503	
Credits: 3	
L T P: 3 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

1. Identify and compute the rate of thermal energy transfer, via conduction, convection and radiation, between systems or a system and its surroundings.
2. Select and apply appropriate analytical/numerical solution techniques and/or correlations to heat transfer problems.
3. Analyze and quantify the heat transfer processes in applications typically found in engineering practice, primarily Piping systems, heat exchangers and heating systems
4. Perform the kinds of calculations, which lead to a rational design, and/or an improved understanding of the performance of thermal exchange systems.

COMPUTER DESIGN SOFTWARE	
Course Code: 23ME551	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

At the end of the course students will be able to,

1 Drafting practice using computer.

2 Modeling of 2D and 3D parts.

3 Creating assembly drawing of components.

4 Prepare standard drawing layout for modeled parts or assemblies with BoM

DESIGN THINKING AND AUGMENTED VIRTUAL REALITY	
Course Code: 23CS0301	Continuous Evaluation: .....Marks
Prerequisite: NIL	End Semester Examination:……. Marks
L T P : 0 0 2	
Credits: 1	

TRAINING LEARNING OUTCOMES (TLOS)

After the completion of TRAINING the students will be able to:

1. Understand and critically apply the concepts and methods of business processes.
2. Understand and analyzing design thinking history and its various concepts.
3. Understand, analyzing and create models with users collaboration to apply design thinking concepts.
4. Understands the role and importance of graphics in VR, AR and MR.
5. Understand the technical and experiential design foundation required for the implementation of immersive environments in current and future virtual, augmented and mixed reality platforms.

PRESENTATION & SPEAKING SKILLS	
Course Code: 23SS551	
Credits : 3	
L T P : 0 0 2	
Prerequisite : NIL	

Training Learning Outcomes (TLO): -

After the completion of the training, the student will have ability:

1 TLO1. To be confident in presenting himself infront of audience.

2 TLO2. To become professional in his approach towards work culture.

3 TLO3. To enhance the level of communication skills while interacting with others.

SEMESTER – VI

THEORY OF MACHINES-II	
Course Code: 23ME601	
Credits: 3	
L T P: 3 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. The student is expected to be familiar with broader areas of basic mechanisms, velocity and acceleration of simple mechanisms.
2. An understanding of, Drawing the profile of cams and its analysis.
3. The student would be able to learn the fundamental concepts on Gear & gear train calculations.
4. An understanding of Balancing of machines.

NON-TRADITIONAL MACHINING TECHNIQUES	
Course Code:23ME602	
Credits: 3	
L T P : 3 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Understand the need of Non-Traditional Machining Processes and able to Classify various processes
2. Recognize the role of mechanical energy in non-traditional machining processes.
3. Apply the knowledge on machining electrically conductive material through electrical energy in non-traditional machining processes.
4. Understand the concept of machining the hard material using chemical energy and electrochemical energy.
5. Familiarity with various thermal energy based non-traditional

machining processes.

INDUSTRY 4.0	
Course Code: 23ME603	
Credits: 3	
L T P : 3 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

At the end of the course students will be able to,

1. The scope of Industry 4.0 and its applicability in Indian Industry.
2. The conceptual framework and road map of Industry 4.0
3. Requirement of Robotic technology and Augmented reality for Industry 4.0
4. The obstacles and framework conditions for Industry 4.0
5. Advantages of machine integration for Industry 4.0

REFRIGERATION AND AIR CONDITIONING	
Course Code: 23ME604	
Credits: 3	
L T P: 3 0 0	
Prerequisite: Nil	

Course Learning Outcomes (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Identify and know about the vapour compression and vapour absorption system operation, Cycle analysis and method for improving performance,
2. Understand Various components of refrigeration systems,
3. The student is expected to be familiar with the Design of air conditioning systems by cooling load calculations.
4. Application of refrigeration and air conditioning systems.

THEORY OF MACHINES LAB	
Course Code: 23ME651	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

At the end of the course students will be able to,

1. Understand and use various types of gears and gear trains.
2. Understand and verify the laws governing the dynamics of machines
3. Understand the case studies on the field of Vibration
4. Understand the CAM and their applications.

BIG DATA ANALYTICS, TOOLS AND TECHNIQUES	
Course Code: 21CS0302	Continuous Evaluation: .....Marks
Prerequisite: NIL	End Semester Examination:……. Marks
L T P : 0 0 2	
Credits: 1	

TRAINING LEARNING OUTCOMES (TLO)

After completion of TRAINING, students would be able to:

1. Understand the vision of Big Data from a global context.
2. To understand and apply Hadoop in Market perspective of Big Data.
3. To evaluate the application of Big Data in Industrial and Commercial Building Automation, evaluating Big Data performance using MapReduce and Real-World Design Constraints.
4. Applying and analyzing architecture and APIs with use of Devices, Gateways and Data Management in Big data.

LIVE PROJECTS – III & INDUSTRIAL VISIT	
Course Code: 23LP651	
Credits: 1	
L T P : 0 0 1	
Prerequisite: Nil	

INDUSTRIAL INTERNSHIP LEARNING OUTCOMES (IILOs):

The student should be able to:

1. Demonstrate the project assigned and its real life applications
2. Demonstrate the specific skills learned and in-depth understanding of production processes.
3. Demonstrate team work, designing, planning, and organizing of project implementation and work culture of Industry.
4. Demonstrate cleanliness and safety.

SEMESTER VII

Engineering Metrology And Instrumentation	
Course Code: 23ME701	
Credits : 3	
L T P : 3 0 0	
Prerequisite : NIL	

COURSE LEARNING OUTCOMES (CLOs)

Upon successful completion of the course the students will be able to

1. Analyze the principle of different metrology instruments
2. Reduce various components on machine tools and carryout dimensional measurement.
3. Demonstrate the terminology and its application of interference of light wave.
4. Perform the available different precision instruments in the field of measurement.
5. Quantify the measurement uncertainty along with Quality.

Additive Manufacturing	
Course Code: 23ME702	
Credits: 3	
L T P : 3 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

At the end of the course, student should be able

1. To understand about Additive Manufacturing Technology – Tooling – Applications.
2. To understand about Data Processing for Additive Manufacturing Technology: CAD model preparation
3. To understand about Principles of SLS process – Process, advantages and applications, Three Dimensional Printing

ENGINEERING METROLOGY AND INSTRUMENTATION LABORATORY	
Course Code: 23ME751	
Credits : 1	
L T P : 0 0 2	
Prerequisite : NIL	

COURSE LEARNING OUTCOMES (CLOs)

After completion of the course student will be able to:

1. Develop quality standards of engineering products in industries.
2. Demonstrate work in quality control departments of industries and to ensure quality of products.
3. Analyze the measurement of the surface roughness and perform alignment tests.
4. Develop the ability to apply the principles in instruments and measuring techniques.
5. Demonstrate work in designing the instrumentation for a particular purpose and special purpose devices.

DATA STRUCTURES USING C++	
Course Code: 23CS0401	Continuous Evaluation: .....Marks
Pre-Requisite : Basic Programming Knowledge	End Semester Examination:……. Marks
L T P : 0 0 2	
Credits: 1	

TRAINING LEARNING OUTCOMES (TLO)
After the completion of training the students will be able to:

1. Prepare object-oriented design for small/medium scale problems.
2. Demonstrate the differences between traditional imperative design and object-oriented design
3. To explain class structures as fundamental, modular building blocks, to understand the role of inheritance, polymorphism, dynamic binding and generic structures in building reusable code
4. For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.
5. For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.
6. For a given Search problem (Linear Search and Binary Search) student will able to implement it.
7. Design and identify how to select the appropriate data structure according to the problem.

INTERPERSONAL SKILLS: STRATEGIES	
Course Code: 23SS751	
Credits: 1	
L T P : 0 0 2	
Prerequisite: Nil	

Training Learning Outcomes (TLO): -

After the completion of the training, the student will have ability:

1. To develop knowledge, skills and understanding people in-group and individually.
2. To learn to apply communication strategies either in-group or one on one basis and will be confident to lead the discussion among them.
3. To work with people even with conflicts and reducing the differences among them by reaching to an equilibrium.

LIVE PROJECTS – IV & INTERNSHIP	
Course Code: 23LP751	
Credits: 1	
L T P : 0 0 1	
Prerequisite: Nil	

INDUSTRIAL INTERNSHIP LEARNING OUTCOMES (IILOs):

The student should be able to:

1. Demonstrate the project assigned and its real life applications
2. Demonstrate the specific skills learned and in-depth understanding of production processes.
3. Demonstrate team work, designing, planning, and organizing of project implementation and work culture of Industry.
4. Demonstrate cleanliness and safety.

MINOR PROJECT	
Course Code: 21ME752	
Credits: 4	
L T P : 0 0 4*	
Prerequisite: Nil	

1. **COURSE LEARNING OUTCOMES (CLOs)**

On successful completion of the minor project, the student will be able to,

1. Identify real world problems of mechanical engineering and related systems.
2. Interpret the working of mechanical engineering systems.
3. Apply the principles of mechanical engineering in real world systems.

4. Criticize and experiment to arrive at solutions for real world mechanical engineering problems.
5. Analyse and evaluate to obtain solution for problems in mechanical engineering systems.

SEMESTER VIII

MAJOR PROJECT	
Course Code: 21ME851	
Credits: 12	
L T P : 0 0 24	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLOs)

On successful completion of the course, the student will be able to,

1. Identify real world problems of mechanical engineering and related systems.
2. Interpret the working of mechanical engineering systems.
3. Apply the principles of mechanical engineering in real world systems.
4. Criticize and experiment to arrive at solutions for real world mechanical engineering problems.
5. Analyse and evaluate to obtain solution for problems in mechanical engineering systems.