

## **B.TECH. - MECHANICAL ENGINEERING PROGRAMME LEARNING OUTCOMES**

- PLO1.** An ability to apply knowledge & skill of mathematics, science and engineering.
- PLO2.** An ability to identify, analyze, design, develop, implement and integrate mechanical design system
- PLO3.** An ability to understand emerging technologies and related security issues in the computing paradigm.
- PLO4.** An ability to acquire and apply the skill in modern techniques, methodologies and tools to be innovative and creative.
- PLO5.** An ability to formulate, design & demonstrate strong logical, analytical and reasoning skills to adeptly solve problems
- PLO6.** An ability to apply algorithmic principles and programming prowess in the development of software systems.
- PLO7.** An awareness of social, health, ethical, legal, financial, and professional responsibilities.
- PLO8.** An ability to analyse the local and global impact of computing discipline on environmental issues and sustainable development
- PLO9.** Recognition of the need for self-motivation and ability to engage in lifelong learning and professional development
- PLO10.** An ability to effectively manage projects involving multidisciplinary and teams with ethnic diversity.
- PLO11.** An ability to communicate effectively, both in written and verbal forms.
- PLO12.** An ability to demonstrate leadership and entrepreneurship qualities.

## **Course Learning Outcome ( CLO)**

## SEMESTER – I /II

<b>ENGINEERING MATHEMATICS-I</b> (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
<b>Course Code:21AS101</b>	<b>L T P : 3 1 0</b>
<b>Credits: 4</b>	<b>Prerequisite: Nil</b>

### 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. Apply the knowledge of calculus, Gamma & Beta functions for analyzing engineering problems.
2. Solve first order differential equation analytically using standard method.
3. Demonstrate various physical models through higher order differential equation and solve such linear ordinary differential equation.
4. Obtain series solution of differential equation and explain application of Bessel's function
5. Understand differentiation and integration of vectors with knowledge of Green's, Gauss divergence and Stoke's theorems.

<b>ENGINEERING PHYSICS</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21AS102/202</b>	<b>L T P : 3 1 0</b>
<b>Credits: 4</b>	<b>Prerequisite: NIL</b>

### 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 Physics such as mechanics of solids, optics, mechanical and electromagnetic waves oscillations and their relevance in Engineering.
2. An understanding of Physics also helps engineers understand the working and limitations of existing devices and techniques, which eventually leads to new innovations and improvements.
3. The student would be able to learn the fundamental concepts on Quantum behavior of matter in its micro state.
4. The course also helps the students to be exposed to the phenomena of electromagnetism and also to have exposure on semiconductor devices such as solar .

## **ENGINEERING CHEMISTRY** (COMMON TO ALL BRANCHES)

<b>Course Code: 21AS103/203</b>	<b>L T P : 3 1 0</b>
<b>Credits: 4</b>	<b>Prerequisite: NIL</b>

### **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 to identify the quality of water and how to improve the quality of water.
2. Rationalize bulk properties and processes using thermodynamic considerations.
3. Get preliminary understanding on introductory idea about nano materials.
4. Analyze the quantitative aspects of fuel combustion, spectroscopy and the mechanism of corrosion.

## **BASIC ELECTRICAL ENGINEERING** (COMMON TO ALL BRANCHES)

<b>Course Code: 21EE101/201</b>	<b>L T P : 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: NIL</b>

### **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. Learn about transient analysis of RLC circuits with DC excitation.
2. Realize the requirement of transformers in transmission and distribution of electric power and other applications.
3. Develop an idea on Magnetic circuits, Electromagnetism
4. Learn about measuring instruments, single phase and polyphase AC circuits

## **BASIC ELECTRONICS ENGINEERING** (COMMON TO ALL BRANCHES)

<b>Course Code: 21EC101/201</b>	<b>L T P : 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: NIL</b>

### **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. To learn the fundamental concepts of semiconductor devices
2. An ability to apply the concept of diode in clipper and clamper circuits
3. Acquire the skills of constructing the different transistors configurations
4. To learn the basic concepts of integrated circuits
5. To Compile the different building blocks in digital electronics using logic gates and implement simple logic function using basic universal gates
6. To acquire the knowledge of microprocessors.

<b>ENGINEERING MECHANICS</b> (Common to all Branches)	
<b>Course Code: 21ME101/201</b>	<b>L T P : 3 1 0</b>
<b>Credits: 3</b>	<b>Prerequisite: NIL</b>

### **COURSE LEARNING OUTCOMES (CLO)**

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

After completion of the ~~course~~ students would be able to:

1. Understand the concepts of force and moments in equilibrium.
2. Apply principles of mechanics to real engineering problems.
3. Understand the basics of Centroids and MOI.
4. Grasp the elements of rigid body kinematics and kinetics.
5. Understand the mechanics of deformable bodies.

<b>FUNDAMENTALS OF COMPUTER &amp; C PROGRAMMING</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21CS101/201</b>	<b>L T P : 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: NIL</b>

### **COURSE LEARNING OUTCOMES (CLO)**

After completion of course, students would be able to:

1. Understand the fundamental concepts of computers, both hardware and software.
2. Learn and understand the major system software's that help in developing of an application.
3. Apply and analyse the basic programming constructs in context of C programming language.
4. Analyse and evaluate the derived datatypes (array) and the operations that can be performed on them, along with the concept of modularity through functions
5. Create and manipulate a database or data storage through files.
6. Develop a methodological way of problem solving.
7. Learn a programming approach to solve problems.

<b>COMMUNICATIVE ENGLISH</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21HS101/201</b>	<b>L T P : 2 0 0</b>
<b>Credits: 2</b>	<b>Prerequisite: NIL</b>

### **COURSE LEARNING OUTCOMES (CLO)**

1. The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:
2. Learners will be able to write effectively using correct grammatical structures.
3. Learners will be able to read and speak fluently in English.
4. Learners will know the nuances of effective presentations.
5. Learners will be able to engage in group discussions, debate, deliver speeches and such others.
6. Learners will be able to write project reports, research papers, prepare MoM and agendas,

and such other documents required to be created in any work place.

<b>INDIAN CONSTITUTION &amp; POLITY</b> (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
<b>Course Code: 21HS102/202</b>	<b>L T P : 2 0 0</b>
<b>Credits: 2</b>	<b>Prerequisite: NIL</b>

#### **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 explore basic concepts in the Constitution and understand their applicability & scope and the importance of the role of judiciary in ensuring checks and balances.
2. Differentiate different aspects of Indian Legal System and its related bodies
3. To appreciate the critical Interface between fundamental Rights and directive principles of state policy and apply the rationale to emerging issues and challenges.
4. Know about the enforcement remedies available under the Constitution of India
5. To apply Intellectual Property Law principles to real problems and analyse the social impact of Intellectual Property Law and Policy
6. To apply the very dynamics of IP Law to the individuals, MNC's and other possible stakeholders.

<b>ENGINEERING PHYSICS LAB</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21AS152/252</b>	<b>L T P : 0 0 2</b>
<b>Credits: 1</b>	<b>Prerequisite: NIL</b>

#### **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:

- Use the different measuring devices and meters to record the data with precision
- Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results
- Apply the mathematical concepts/equations to obtain quantitative results

<b>ENGINEERING CHEMISTRY LAB</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21AS153/253</b>	<b>L T P : 0 0 2</b>
<b>Credits: 1</b>	<b>Prerequisite: NIL</b>

#### **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 measurement techniques.
2. The synthesis, dynamics, chemical transformation and their applications

<b>BASIC ELECTRICAL ENGINEERING LAB</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21EE151/251</b>	<b>L T P : 0 0 2</b>
<b>Credits: 1</b>	<b>Prerequisite: Nil</b>

#### **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. Verify fundamental laws like Ohm's Law, KCL, KVL, etc.
2. Understand the calibration of energy meter.
3. Understand open circuit and short circuit test of single-phase transformer.
4. Analyse RLC series and parallel circuits

<b>BASIC ELECTRONICS ENGINEERING LAB</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21EC151/251</b>	<b>L T P : 0 0 2</b>
<b>Credits: 1</b>	<b>Prerequisite: NIL</b>

#### **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. Measure voltage, frequency and phase of any waveform using CRO.
2. Generate sine, square and triangular waveforms with required frequency and amplitude using function generator.
3. Analyse the characteristics of different electronic devices such as diodes, transistors and operational amplifiers
4. To develop skill to build and verify digital circuits

<b>BASIC MECHANICAL ENGINEERING LAB</b> (Common to all Branches)	
<b>Course Code: 21ME151/251</b>	<b>L T P : 0 0 2</b>
<b>Credits: 1</b>	<b>Prerequisite: NIL</b>

#### **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 working of thermal power plants.
2. The working of 2 and 4 stroke IC engines.
3. Different automobile parts, gears and gear trains.
4. The working of Refrigeration and Air Conditioning cycles.
5. The working principles of flow meters and U-tube manometers.

<b>C PROGRAMMING LAB</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21CS151/251</b>	<b>L T P : 0 0 2</b>
<b>Credits: 1</b>	<b>Prerequisite: NIL</b>

#### **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 Typical C Program Development Environment, compiling, debugging, Linking and executing.
2. Introduction to C Programming using Control Statements and Repetition Statement
3. Apply and practice logical formulations to solve some simple problems leading to specific applications.
4. Design effectively the required programming components that efficiently solve computing problems in real world.
5. Employ good programming practices such as incremental development, data integrity checking and adherence to style guidelines.

<b>COMMUNICATIVE ENGLISH LAB</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21HS151/251</b>	<b>L T P : 0 0 2</b>
<b>Credits: 1</b>	<b>Prerequisite: NIL</b>

#### **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. Learners will be able to write effectively using correct grammatical structures.
2. Learners will be able to read and speak fluently in English.
3. Learners will know the nuances of effective presentations.
4. Learners will be able to engage in group discussions, debate, deliver speeches and such others.
5. Learners will be able to write project reports, research papers, prepare MoM and agendas, and such other documents required to be created in any work place.

<b>NATIONAL SERVICE SCHEME</b> (COMMON TO ALL BRANCHES EXCEPT)	
<b>Course Code: 21SE151</b>	<b>L T P: 0 0 2</b>
<b>Credits: 1</b>	<b>Prerequisite: Nil</b>

**COURSE LEARNING OUTCOMES (CLO) :** Course aims at evoking social consciousness among students through various activities viz., working together, constructive and creative social work, to be skillful in executing democratic leadership, developing skill in



programme development to be able for self-employment, reducing gap between educated and uneducated, increasing awareness and desire to help sections of society.

<b>YOGA &amp; PHYSICAL EDUCATION Practices (COMMON TO ALL BRANCHES EXCEPT)</b>	
<b>Course Code: 21SE151</b>	<b>L T P: 0 0 2</b>
<b>Credits: 1</b>	<b>Prerequisite: Nil</b>

**COURSE LEARNING OUTCOMES (CLO):** After completion of the course, the learner will be able to,

1. Define the concepts of yoga.
2. Describe the historical development of yoga in India.
3. Demonstrate the different stages of the Surya Namaskar.
4. Numerate the different types of Asanas.
5. Analyse the preventive and curative effects of yoga.

<b>MECHANICAL WORKSHOP LAB (Common to all Branches)</b>	
<b>Course Code: 21ME152/252</b>	<b>L T P : 0 0 2</b>
<b>Credits: 1</b>	<b>Prerequisite: NIL</b>

**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. Use different manufacturing (Fitting, carpentry, sheet metal, welding, smithy working etc.) processes required to manufacture a product from the raw materials.
2. Use different measuring, marking, cutting tools used in the workshop.
3. Be aware of the safety precautions while working in the workshop.

<b>ENGINEERING GRAPHICS &amp; DESIGN LAB (Common to all Branches)</b>	
<b>Course Code: 21ME153/253</b>	<b>L T P : 0 0 2</b>
<b>Credits: 1</b>	<b>Prerequisite: NIL</b>

**COURSE LEARNING OUTCOMES (CLO)**

Once the course is completed, the students will be able to

1. Understand orthographic projections of points and lines in any position through AutoCAD.
2. Imagine and convert isometric view into orthographic projections and vice versa.
3. Should be able to understand the simple machine components and draw its projections

## SEMESTER – II

<b>ENGINEERING MATHEMATICS-II</b> (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
<b>Course Code: 21AS201</b>	<b>L T P : 3 1 0</b>
<b>Credits: 4</b>	<b>Prerequisite: Engineering Mathematics-I</b>

### 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. Develop the essential tool of matrices to compute inverse, eigenvalues and eigenvectors required for matrix diagonalization process.
2. Apply Laplace transforms to find the solution of differential equations.
3. Solve different problems with help of Fourier series.
4. Know, analytic functions and conformal mapping of complex variables.
5. Evaluate complex integration and residues.

## SEMESTER – III

<b>FRENCH LANGUAGE PHASE I</b>	
<b>Course Code: 21FLFR301</b>	<b>L T P : 2 0 0</b>
<b>Credits: 2</b>	<b>Prerequisite: Nil</b>

### COURSE LEARNING OUTCOMES (CLOs)

- After completion of this student will be able to read and write short, simple texts.
- After completion of this student will have Fluency in reading and writing.
- After completion of this student will be able understand a dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.
- student will able to know the culture of the countries where the French language is spoken.

<b>GERMAN LANGUAGE PHASE I</b>	
<b>Course Code: 21FLGR301</b>	<b>L T P: 2 0 0</b>
<b>Credits: 2</b>	<b>Prerequisite: Nil</b>

### COURSE LEARNING OUTCOMES (CLOs)

- After completion of this student will be able to read and write short, simple texts.
- After completion of this student will have Fluency in reading and writing.
- After completion of this student will be able understand a dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.
- student will able to know the culture of the countries where the German language is spoken.
- Developing pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own CV and developing a fundamental conversation with any German national.

**ENGINEERING MATHEMATICS-III**  
(COMMON TO ALL BRANCHES)

<b>Course Code: 21AS301</b>	<b>L T P : 3 1 0</b>
<b>Credits: 4</b>	<b>Prerequisite: Nil</b>

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

**Electrical & Electronics, Measurements and Instrumentation**

<b>Course Code: 21EE0209</b>	<b>L T P : 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: Nil</b>

**COURSE LEARNING OUTCOMES (CLO)**

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

1. Understand the working of analog meters for power and energy measurements.
2. Learn the operation of different measuring and display devices.
3. Comprehend the measurement of non- electrical quantities.
4. Understand the working of biomedical instruments and data acquisition system.

**MANUFACTURING TECHNOLOGY**

<b>Course Code: 21ME302</b>	<b>L T P : 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: NIL</b>

**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

<b>FLUID MECHANICS AND HYDRAULIC MACHINES</b>	
<b>Course Code:21ME303</b>	<b>L T P : 3 1 0</b>
<b>Credits: 4</b>	<b>Prerequisite: Nil</b>

**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.

<b>Electric Vehicle Technology</b>	
<b>Course Code:22ME305</b>	<b>L T P: 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: Nil</b>

**COURSE LEARNING OUTCOMES (CLO)**

After completion of course, students would be able to:

1. Student will know the concept of Electric Vehicles technology.
2. exposed to the basic Power train, energy source and auxiliary subsystems.
3. Aware of the basic concepts of Power Train: Configuration and control of dc and induction motor drives for EV
4. Student will know the Energy and energy management strategies, Regenerative braking-fundamentals
5. Student will be in a position to know Elementary of Control theory, Electronic Control unit

<b>Electrical Measurement and Control Laboratory</b>	
<b>Course Code: 21EE0259</b>	<b>L T P: 0 0 2</b>
<b>Credits: 1</b>	<b>Prerequisite: 21EE0206,21EE0209</b>

**COURSE LEARNING OUTCOMES (CLO)**

1. At the end of the course, the student will be able to
2. Learn the measurement of non-electrical variables and electrical quantities
3. Apply the fundamentals of measuring methods in computing basic R,L and C parameters.

4. Understand the characteristic behaviour of transducers and Programmable Logic Controller in industrial applications.
5. Design and develop simple control mechanisms for given LTI systems.

<b>MANUFACTURING PROCESS LABORATORY</b>	
<b>Course Code: 21ME351</b>	<b>L T P : 0 0 2</b>
<b>Credits: 1</b>	<b>Prerequisite: NIL</b>

#### **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:

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

<b>FLUID MECHANICS &amp; HYDRAULIC MACHINES LABORATORY</b>	
<b>Course Code: 21ME352</b>	<b>L T P : 0 0 2</b>
<b>Credits: 1</b>	<b>Prerequisite: NIL</b>

#### **COURSE LEARNING OUTCOMES (CLO)**

After completion of 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.

<b>ESSENTIALS OF BLOCKCHAIN &amp; IOT –LEVEL - I</b>	
<b>Course Code: 21CS0201</b>	<b>L T P : 0 0 2</b>
<b>Credits: 1</b>	<b>Pre-Requisite: NIL</b>

#### **TRAINING LEARNING OUTCOMES (TLOS)**

After the completion of training students will be able to:

1. Understand how bitcoin and other coins work in real world.
2. Analyse the properties of Block Chain models.
3. Understand the vision of IoT and communication protocols from a global context.

4. Design portable IoT using appropriate boards.

<b>LIVE PROJECTS – I &amp; INDUSTRIAL VISIT</b>	
<b>Course Code: 21LP351</b>	<b>L T P : 0 0 1</b>
<b>Credits: 1</b>	<b>Prerequisite: Nil</b>

**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.

<b>EFFECTIVE COMMUNICATION SKILLS</b>	
<b>Course Code: 21SS351</b>	<b>L T P : 0 0 2</b>
<b>Credits: 1</b>	<b>Prerequisite: Nil</b>

**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**

<b>FRENCH LANGUAGE PHASE II</b>	
<b>Course Code: 21FLFR401</b>	<b>L T P : 2 0 0</b>
<b>Credits: 2</b>	<b>Prerequisite: Nil</b>

**COURSE LEARNING OUTCOMES (CLOs)**

1. After completion of this student will be able to read and write short, simple texts.
2. After completion of this student will have Fluency in reading and writing.
3. After completion of this student will able to use language creatively and spontaneously.
4. After completion of this student will able to know the culture of the countries where the French language is spoken.

<b>GERMAN LANGUAGE PHASE II</b>	
<b>Course Code: 21FLGR401</b>	<b>L T P: 2 0 0</b>
<b>Credits: 2</b>	<b>Prerequisite: Nil</b>

#### **COURSE LEARNING OUTCOMES (CLOs)**

1. After completion of this student will be able to read and write short, simple texts.
2. After completion of this student will have Fluency in reading and writing.
3. After completion of this student will able to use language creatively and spontaneously.
4. Students will get awareness of cross-cultural and intercultural difference.

<b>NUMERICAL METHODS</b>	
<b>Course Code: 21AS401</b>	<b>L T P : 3 1 0</b>
<b>Credits: 4</b>	<b>Prerequisite:</b>

#### **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. Find solutions by various numerical methods to get approximation solutions of algebraic a transcendental, simultaneous linear equations.
2. Get interpolating values by different numerical methods.
3. Do differentiation and integrations of tabular data.
4. To find numerical solutions of ordinary and partial differential equations.
5. Understand curve fitting and find largest and smallest eigen values according to use in applications.

<b>MECHANICS OF SOLIDS</b>	
<b>Course Code: 21ME401</b>	<b>L T P : 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: Engineering Mechanics</b>

#### **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

<b>ELEMENTS OF MECHATRONICS</b>	
<b>Course Code: 21ME402</b>	<b>L T P : 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: NIL</b>

#### **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 Microprocessor, 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

<b>THERMODYNAMICS</b>	
<b>Course Code: 21ME403</b>	<b>L T P : 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: NIL</b>

#### **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 concept of isothermal expansion

<b>COMPUTER AIDED DESIGN AND MANUFACTURING</b>	
<b>Course Code: 21ME404</b>	<b>L T P : 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: Nil</b>

#### **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

<b>TEAMWORK &amp; INTERPERSONAL SKILLS</b>	
<b>Course Code: 21SS452</b>	<b>L T P : 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: NIL</b>

#### **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 achieving career and personal goals.
- To face complex problems and effectively deal with it in the job due to Critical Thinking & Problem Solving Skills.

<b>STRENGTH OF MATERIALS LABORATORY</b>	
<b>Course Code: 21ME451</b>	<b>L T P : 0 0 2</b>
<b>Credits: 1</b>	<b>Prerequisite: NIL</b>

#### **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.

<b>MANUFACTURING AND ASSEMBLY DRAWING</b>	
<b>Course Code: 21ME453</b>	<b>L T P : 1 0 2</b>
<b>Credits: 2</b>	<b>Prerequisite: Nil</b>

#### **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.

<b>ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING-LEVEL-II</b>	
<b>Course Code: 21CS0202</b>	<b>L T P : 0 0 2</b>
<b>Pre-Requisite : NIL</b>	<b>Credits: 1</b>

#### **TRAINING LEARNING OUTCOMES (TLOS): -**

1. Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem
2. Understands the basics and need of AI and Machine learning in global view.
3. Understands, apply and evaluate the supervised learning techniques.
4. Design and implement the different applications using the concepts of AI and ML

<b>LIVE PROJECTS – II &amp; INDUSTRIAL VISIT</b>	
<b>Course Code: 21LP451</b>	<b>L T P : 0 0 1</b>
<b>Credits: 1</b>	<b>Prerequisite: Nil</b>

#### **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**

<b>FUNDAMENTALS OF VIBRATION AND NOISE</b>	
<b>Course Code: 21ME501</b>	<b>L T P : 3 1 0</b>
<b>Credits : 4</b>	<b>Prerequisite : NIL</b>

#### **COURSE LEARNING OUTCOMES (CLOs)**

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

1. Construct the equations of motion for free-body diagrams
2. Compute the natural frequency for free and forced vibration of a single degree of freedom under damped or un-damped system
3. Apply vibration absorbers and isolators for minimizing vibration in systems with two

degree of freedom.

4. Identify and estimate the case studies on the field of Vibration.
5. Demonstrate sources of noises and the ways to control it.

<b>HEAT AND MASS TRANSFER</b>	
<b>Course Code: 21ME502</b>	<b>L T P: 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: NIL</b>

### **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 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.

<b>METALLURGY AND MATERIAL SCIENCE</b>	
<b>Course Code: 21ME503</b>	<b>L T P : 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: Nil</b>

### **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

<b>THEORY OF MACHINES</b>	
<b>Course Code: 21ME504</b>	<b>L T P: 3 1 0</b>
<b>Credits: 4</b>	<b>Prerequisite: NIL</b>

### **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.

<b>PRESENTATION &amp; SPEAKING SKILLS</b>	
<b>Course Code: 21SS553</b>	<b>L T P : 0 0 2</b>
<b>Credits : 3</b>	<b>Prerequisite : NIL</b>

**Training Learning Outcomes (TLO): -**

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

1. TLO1. To be confident in presenting himself in front 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.

<b>THEORY OF MACHINES LABORATORY</b>	
<b>Course Code: 21ME551</b>	<b>L T P : 0 0 2</b>
<b>Credits: 1</b>	<b>Prerequisite: NIL</b>

**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.

<b>HEAT POWER LABORATORY</b>	
<b>Course Code: 21ME552</b>	<b>L T P : 0 0 2</b>
<b>Credits: 1</b>	<b>Prerequisite: Basics of Engineering Thermodynamics</b>

**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 types of I.C. Engines and Cycles of operation.
2. Analyze the effect of various operating variables on engine performance
3. Identify fuel metering and fuel supply systems for different types of engines
4. Understand normal and abnormal combustion phenomena in SI and CI engines
5. Evaluate performance Analysis of IC Engine and Justify the suitability of IC Engine for different application

6. Understand the conventional fuels for IC engines and effects of emission formation of IC engines, its effects and the legislation standards.

<b>COMPUTER AIDED MANUFACTURING (CNC) LABORATORY-I</b>	
<b>Course Code: 21ME553</b>	<b>L T P : 0 0 2</b>
<b>Credits: 1</b>	<b>Prerequisite: NIL</b>

### **COURSE LEARNING OUTCOMES (CLO)**

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

- Display competency in manual CNC part programming for milling and turning machines
- Exhibit generation of part programs using CNC programming and simulation s/w for CNC Lathe, CNC Milling
- Demonstrate machining the parts on actual machines CNC Lathe and CNC Milling Machine.

<b>DESIGN THINKING AND AUGMENTED VIRTUAL REALITY-LEVEL- II &amp; III</b>	
<b>Course Code: 21CS0301</b>	<b>L T P : 0 0 2</b>
<b>Credits: 1</b>	<b>Prerequisite: NIL</b>

### **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.

<b>LIVE PROJECTS – III &amp; INDUSTRIAL VISIT</b>	
<b>Course Code: 21LP551</b>	<b>L T P : 0 0 1</b>
<b>Credits: 1</b>	<b>Prerequisite: Nil</b>

### **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 VI**

<b>INDUSTRIAL AUTOMATION AND APPLICATION</b>	
<b>Course Code: 21ME601</b>	<b>L T P : 3 1 0</b>
<b>Credits: 4</b>	<b>Prerequisite: Nil</b>

### **COURSE LEARNING OUTCOMES (CLO)**

After completion of this course, the students will be able to:

1. Demonstrate the technique and procedures associated with hydraulic power system.
2. Analyse the pneumatic controls and techniques.
3. Deliver knowledge of robot kinematics
4. To analyse robot dynamics.
5. Model basic grippers with sensors.

<b>MECHANICAL ENGINEERING DESIGN</b>	
<b>Course Code: 21ME602</b>	<b>L T P : 3 1 0</b>
<b>Credits: 4</b>	<b>Prerequisite: Nil</b>

### **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.

<b>INDUSTRY 4.0</b>	
<b>Course Code: 21ME603</b>	<b>L T P : 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: Nil</b>

### **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

<b>MANAGEMENT AND ORGANISATIONAL BEHAVIOUR</b>	
<b>Course Code: 21BSXXX</b>	<b>L T P : 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite:</b> Understanding of human behaviour

### **Course Learning Outcomes:**

On completion of the course, it is expected that students will be able to:

1. Understand the concept of management
2. Learn about different management skills requirements for the corporate world.
3. Demonstrate application of previous knowledge testing of Principles of Management in solving business problems.
4. Understand the human behaviour and its contribution at work place
5. Understand the competitiveness in businesses.

<b>PROFESSIONAL WRITING SKILLS</b>	
<b>Course Code: 21SS655</b>	<b>L T P : 0 0 2</b>
<b>Credits: 1</b>	<b>Prerequisite: Nil</b>

### **Training Learning Outcomes (TLO): -**

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

1. To understand the importance of professional writing required in workplace.
2. To explore different formats in resume, cover letters & other business related letters.
3. To develop knowledge, skills and understanding people in-group and individually.
4. To apply communication strategies either in-group or one on one basis and will be confident to lead the discussion among them.

<b>AUTOMATION LABORATORY</b>	
<b>Course Code: 21ME651</b>	<b>L T P : 0 0 2</b>
<b>Credits: 1</b>	<b>Prerequisite: NIL</b>

### **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. Able to choose the transducers for a particular mechatronic system
2. Able to understand how automation works in the day today life.
3. Know the underlying principles of mechatronic systems

<b>COMPUTER AIDED MANUFACTURING (CNC) LABORATORY-II</b>	
<b>Course Code: 21ME652</b>	<b>L T P : 0 0 2</b>
<b>Credits: 1</b>	<b>Prerequisite: NIL</b>

### **COURSE LEARNING OUTCOMES (CLO)**

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

- Apply the fundamental working principle of CNC machine tool.
- Program G & M Code programming and simulate the CNC program.
- Generate part programming data through CAM software.
- Integrate CNC and unconventional machine tools.
- Apply the principles of Additive Manufacturing process.

<b>BIG DATA ANALYTICS, TOOLS AND TECHNIQUES- LEVEL-III</b>	
<b>Course Code: 21CS0302</b>	<b>L T P : 0 0 2</b>
<b>Prerequisite: NIL</b>	<b>Credits: 1</b>

### **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.

<b>LIVE PROJECTS – IV &amp; INDUSTRIAL VISIT</b>	
<b>Course Code: 21LP651</b>	<b>L T P : 0 0 1</b>
<b>Credits: 1</b>	<b>Prerequisite: Nil</b>

### **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

METROLOGY AND QUALITY CONTROL	
Course Code: 21ME701	L T P : 3 1 0
Credits : 4	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.

DESIGN OF TRANSMISSION SYSTEMS	
Course Code: 21ME702	L T P: 3 1 0
Credits: 4	Prerequisite: Use of approved data book permitted

### 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 compute the Design the Flexible drives.
2. Select and apply appropriate analytical/numerical solution techniques to Design the gears.
3. Select and apply appropriate analytical/numerical solution techniques to Design the gear box.
4. Identify and compute the Design the bearing.

OPERATIONS RESEARCH	
Course Code: 21ME703	L T P : 3 0 0
Credits: 3	Prerequisite: Nil

### COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Formulate real-world problems as a linear programming model and describe the theoretical workings of the graphical and simplex method, demonstrate the solution process by hand and solver.
2. Understand variety of problems such as assignment, transportation, travelling salesman.
3. Understand the network model for the project
4. Understand different queuing situations and find the optimal solutions using models for

different situations

5. Understand the concept of inventory in the organisation.

INTERPERSONAL SKILLS: STRATEGIES	
Course Code: 21SS756	L T P : 0 0 2
Credits: 1	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.

DATA STRUCTURES USING C++	
Course Code:	L T P : 0 0 2
Credits: 1	Pre-Requisite : Basic Programming Knowledge

**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.

<b>METROLOGY AND QUALITY CONTROL LABORATORY</b>	
<b>Course Code: 21ME751</b>	<b>L T P : 0 0 2</b>
<b>Credits : 1</b>	<b>Prerequisite : NIL</b>

### **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.

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

### **MINOR PROJECT LEARNING OUTCOMES (MPLOs)**

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**

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

### **MAJOR PROJECT LEARNING OUTCOMES (MPLOs)**

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.

## OPEN ELECTIVES

<b>Sustainable Growth &amp; Development</b>	
<b>Course Code:21ESUG202</b>	<b>L T P : 2 0 2</b>
<b>Credits: 3</b>	<b>Prerequisite:</b> Basics understanding of environment and natural ecosystems

### COURSE LEARNING OUTCOMES

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

1. To develop an awareness about our environment and elicit collective response for its protection.
2. Able to understand the different types of environmental pollution problems and their sustainable solutions.
3. Able to work in the area of sustainability for research and education.
4. Having a broader perspective in thinking for sustainable practices by utilizing the engineering knowledge and principles gained from this course

## OPEN ELECTIVES IV

<b>WASTE MANAGEMENT</b>	
<b>Course Code:21ESUG203</b>	<b>L T P : 2 0 2</b>
<b>Credits: 3</b>	<b>Prerequisite:</b> Basics understanding of about waste

### COURSE LEARNING OUTCOMES

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

1. To develop an awareness about solid waste and management practices
2. Able to design feasible solutions for waste management
3. Students will have understanding of waste management practices, law and regulation related to solid waste management.

## PROFESSIONAL ELECTIVE COURSES-I

<b>INTERNAL COMBUSTION ENGINES</b>	
<b>Course Code: 21ME505</b>	<b>L T P : 3 0 0</b>
<b>Credits : 3</b>	<b>Prerequisite : NIL</b>

### 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.

<b>SUPPLY CHAIN MANAGEMENT</b>	
<b>Course Code:21ME507</b>	<b>L T P : 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: Nil</b>

### **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 Analyze Business Models, Business Strategies and, corresponding Competitive Advantage.
2. Formulate and implement Warehouse Best Practices and Strategies
3. Plan Warehouse and Logistics operations for optimum utilization of resources
4. Understand the various models and activities of SCM

<b>Electric Vehicle Machines and Drives</b>	
<b>Course Code:22ME511</b>	<b>L T P : 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: Electric Vehicle technology</b>

### **COURSE LEARNING OUTCOMES (CLO)**

1. After completion of course, students would be able to:
2. Motor Drive Technology, Energy Source Technology
3. Design Criteria of DC Motor Drives for EVs
4. Design Criteria of PM Brushless Motor Drives for EVs,
5. Design Criteria of SR Motor Drives for EVs

<b>Industrial Tribology</b>	
<b>Course Code:22ME513</b>	<b>L T P : 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: nil</b>

### **COURSE LEARNING OUTCOMES (CLO)**

After completion of course, students would be able to familiar with :

- The friction and wear in materials
- The lubricants and their properties.
- The preparation of bearing materials

## PROFESSIONAL ELECTIVE COURSES-II

GAS DYNAMICS AND TURBOMACHINERY	
Course Code: 21ME606	L T P : 3 0 0
Credits : 3	Prerequisite : NIL

### COURSE LEARNING OUTCOMES (CLOs)

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

1. Design C-D nozzles by applying the concepts of isentropic compressible flow through variable area duct.
2. Analyze normal shock and expansion waves in high speed flows.
3. Apply the concepts of Fanno flow and Rayleigh flow towards the design of combustion sections and jet pipes.
4. Apply the knowledge of shock-shock interaction, shock reflection and Prandtl-Meyer expansion fan-shock interaction.
5. Explain Turbomachines and related terms.

<b>NON-TRADITIONAL MACHINING TECHNIQUES</b>	
<b>Course Code:21ME608</b>	<b>L T P : 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: Nil</b>

#### **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 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.

<b>FINITE ELEMENT METHODS</b>	
<b>Course Code:21ME610</b>	<b>L T P : 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: Nil</b>

#### **COURSE LEARNING OUTCOMES (CLO)**

After completion of course, students would be able to:

1. Understand the concepts of Basics of Finite Element analysis
2. Understand different methods for solving FEM problems
3. Develop element characteristic equation and generation of global equation.
4. Able to apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, and dynamic problems and solve them displacements, stress and strains induced.

<b>Automotive control Systems</b>	
<b>Course Code:21ME612</b>	<b>L T P : 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: Nil</b>

#### **COURSE LEARNING OUTCOMES (CLO):** After completion of course, students would be able to:

1. Understand the concepts of Automotive Control-System Design Process
2. Understand different Coordinates and Notation for Vehicle Dynamics
3. Understand the concept of Hybrid Vehicle-Control Hierarchy, Control Concepts for Series Hybrids
4. Able to apply suitable Parametric Design Considerations, Cruise and Headway Control

## **PROFESSIONAL ELECTIVES – III**

<b>FLEXIBLE MANUFACTURING SYSTEMS</b>	
<b>Course Code: 21ME705</b>	<b>L T P : 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: NIL</b>

### **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 different types of production system.
2. Identify how automation can be used in production systems.
3. Recall basic elements of automation, and automation strategies.
4. Apply group technology, cellular manufacturing concepts.
5. Design of flexible manufacturing cells and systems.

<b>INDUSTRIAL ENGINEERING</b>	
<b>Course Code: 21ME707</b>	<b>L T P : 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: Nil</b>

### **COURSE LEARNING OUTCOMES (CLO)**

After completion of this course, the students will learn:

1. Demonstrate the technique and procedures of work measurement and work study.
2. Analyse the planning procedures and Human effectiveness.
3. The in-depth knowledge of work design ergonomics, production & productivity
4. The ability to do production planning and control.
5. Demonstrate the Japanese style of Management.

<b>REFRIGERATION AND AIR CONDITIONING SYSTEMS</b>	
<b>Course Code: 21ME709</b>	<b>L T P: 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: Nil</b>

### **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.



## **ALTERNATIVE SOURCES OF ENERGY AND HYBRID SYSTEM**

<b>Course Code:22ME711</b>	<b>L T P : 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: Nil</b>

**COURSE LEARNING OUTCOMES (CLO):** At the end of the course students will be able to,

1. To analyze the various renewable energy sources like wind, solar,
2. To analyze the various biomass, Ocean energy, Fuel cells and MHD systems.
3. Exposure on biomass gasification and combustion, Theory of flat plate collectors, photo voltaic, thermal applications and limitations of solar energy are also provided.

## **PROFESSIONAL ELECTIVES - IV**

### **TQM AND RELIABILITY ENGINEERING**

<b>Course Code: 21ME706</b>	<b>L T P: 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: Nil</b>

### **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. Meaning of TQM and Theories about TQM
2. Planning and manufacturing for quality its tools and techniques
3. Human involvement to improve quality and the development and transformation due to such involvement.
4. About failure models, component reliability & system reliability & maintainability concepts like MTTR, MDT etc.

### **COMPUTER INTEGRATED MANUFACTURING**

<b>Course Code: 21ME708</b>	<b>L T P: 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: Nil</b>

### **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. Describe scope of C.I.M. in manufacturing technology.
2. Describe scope of group technology in manufacturing industry.
3. Write program for manufacturing component.
4. Prepare CAPP (Computer Aided Process Planning) for fabrication process equipment.
5. Describe concept of reverse engineering.

<b>COMPOSITE MATERIALS: MANUFACTURING AND MECHANICS</b>	
<b>Course Code: 21ME710</b>	<b>L T P : 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: Nil</b>

### **COURSE LEARNING OUTCOMES (CLO)**

At the end of the course, student should be able

1. To understand the terms associated with composite materials
2. To differentiate between different types of composite materials
3. To manufacture composite materials by VARTM process
4. To understand testing standards of composite materials
5. To apply failure theories to composite materials.

<b>Additive Manufacturing Technology</b>	
<b>Course Code: 21ME712</b>	<b>L T P : 3 0 0</b>
<b>Credits: 3</b>	<b>Prerequisite: Nil</b>

### **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.