



**NARAYANA**  
**ENGINEERING COLLEGE**  
**GUDUR, Tirupati Dist., AP**

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## DEPARTMENT OF MECHANICAL ENGINEERING

### COURSE OUTCOMES

#### II YEAR-I SEM(NECR21)

##### Course Name: **ENGINEERING MECHANICS**

21ES1008	ENGINEERING MECHANICS
CO1	Compute the resultant of system of forces in plane and space acting on bodies. (BL-3)
CO2	Solve the mechanics problems associated with friction forces. (BL-3)
CO3	Determine the support-reactions and analyze the internal forces of the members of various Trusses and frames. (BL-4)
CO4	Calculate the location of centroid and Moment of Inertia of composite areas. (BL-4)
CO5	Solve problems related to kinematics and kinetics. (BL-3)

##### Course Name: **THERMODYNAMICS**

21ES1011	THERMODYNAMICS
CO1	Understand the concepts of system, control volume, thermodynamic properties, thermal equilibrium, work and heat. (BL-2)
CO2	Apply the laws of thermodynamics for different work stations. (BL-3)
CO3	Analyze the performance of steam power cycles. (BL-4)
CO4	Measure the properties of pure substances. (BL-3)
CO5	Analyze air standard cycles applied in prime movers. (BL-4)

**Course Name: FLUID MECHANICS AND HYDRAULIC MACHINES**

<b>21ME2001</b>	<b>FLUID MECHANICS AND HYDRAULIC MACHINES</b>
<b>CO1</b>	Apply the concepts of fluid statics, fluid kinematics and fluid dynamics in solving the problems of fluid flows (BL-3)
<b>CO2</b>	Become conversant with concepts of flow through pipes, pitot tube, venturi meter, orifice meter, flow nozzle and turbine meter and able to describe them.(BL-1)
<b>CO3</b>	Illustrate the concepts of fluid jets on stationary and moving flat, inclined and curved vanes and also hydro power stations (BL-2)
<b>CO4</b>	Make use of the various concepts of water turbines for calculating the efficiencies and unit and specific quantities (BL-3)
<b>CO5</b>	Demonstrate the knowledge of working principles of centrifugal pumps (BL-2)

**Course Name: MANUFACTURING PROCESSES**

<b>21ME2002</b>	<b>MANUFACTURING PROCESSES</b>
<b>CO1</b>	Introduce the basic concepts of casting, pattern preparation and gating system [BL-2]
<b>CO2</b>	Demonstrate different special casting processes and melting systems[BL-2]
<b>CO3</b>	Classify working of various welding processes,weld joint and their characteristics[BL-2]
<b>CO4</b>	Apply the principles of various gas welding and cutting processes[BL-3]
<b>CO5</b>	Outline the manufacturing methods of ceramics and powder metallurgy[BL-2]

**Course Name: CAD&M LAB**

<b>21ES1515</b>	<b>CAD&amp;M LAB</b>
<b>CO1</b>	Study basic of CAD software and study basic concept of product design (BL-1)
<b>CO2</b>	Use the software package for drafting and modelling and explain representation of curves for real time applications. (BL-2)
<b>CO3</b>	Construct 2D models of Engineering Components (BL-3)
<b>CO4</b>	construct 3D models of Engineering Components (BL-3)

**Course Name: FLUID MECHANICS AND HYDRAULIC MACHINES LAB**

<b>21ME2501</b>	<b>FLUID MECHANICS AND HYDRAULIC MACHINES LAB</b>
<b>CO1</b>	Acquaint with Calibration of discharge measuring devices such as Venturi meter and Orifice meter.(BL-3)
<b>CO2</b>	Familiarize with measuring minor loss (sudden contraction) and major loss (Frictional factor) of a given pipe to calculate hydraulic Resistance.(BL-3)
<b>CO3</b>	Conduct an experiment to prove Bernoulli's Theorem and to find hydraulic thrust on vanes.(BL-3)
<b>CO4</b>	Gain practical experience in handling various hydraulic machines like Pelton wheel (BL-3)

**Course Name: MANUFACTURING PROCESSES LAB**

<b>21ME2502</b>	<b>MANUFACTURING PROCESSES LAB</b>
<b>CO1</b>	understand the importance of safety in metal casting technology[BL-2]
<b>CO2</b>	Apply Hands on experience on welding machine to perform welding and cutting operations[BL-3]
<b>CO3</b>	Demonstrate Press Working operations on jobs[BL-2]
<b>CO4</b>	select the proper tools to work on a machine for the type of part required[BL-4]



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## DEPARTMENT OF MECHANICAL ENGINEERING

### COURSE OUTCOMES

#### II YEAR-II SEM(NECR21)

##### **Course Name: KINEMATICS OF MACHINERY**

<b>21ME2003</b>	<b>KINEMATICS OF MACHINERY</b>
<b>CO1</b>	Identify different types of mechanisms and inversions of different kinematic chains.(BL-3)
<b>CO2</b>	Identify and enumerate different mechanisms with basic understanding of motion and machine.(BL-3)
<b>CO3</b>	Drawing velocity and acceleration diagrams for different mechanisms. (BL-4)
<b>CO4</b>	Apply the knowledge of gears terminology to Calculate pitch, module, number of teeth ,path of Contact for meshing gears.(BL-3)
<b>CO5</b>	Drawing displacement diagrams and cam profile diagram for followers Executing different types of motions and various configurations of followers.(BL-5)

##### **Course Name: MECHANICS OF SOLIDS**

<b>21ME2004</b>	<b>MECHANICS OF SOLIDS</b>
<b>CO1</b>	Explain the fundamentals of Stress and Elastic Constants. (BL-2)
<b>CO2</b>	Illustrate shear force and bending moment diagrams. (BL-2)
<b>CO3</b>	Explain the methods for calculating the stress in the beams with different sections. (BL-2)
<b>CO4</b>	Find the shear strength of solid and hallow shafts. (BL-1)
<b>CO5</b>	Classify different stresses and strains for the thin and thick cylinders(BL-2)

**Course Name: METAL FORMING PROCESSES**

21ME2005	METAL FORMING PROCESSES
CO1	Understand the basic concept on one, two and three dimensional stress analysis, theory of plasticity, strain hardening, hot and cold working process [BL-2]
CO2	Define different rolling and forging processes and their defects [BL-1]
CO3	Familiarize the fundamentals of extrusion process and their industrial applications[BL-2]
CO4	Identify various sheet metal working processes [BL-3]
CO5	Explain the concept of plastic manufacturing process and Rapid manufacturing process,[BL-2]

**Course Name: THERMAL ENGINEERING**

21ME2006	THERMAL ENGINEERING
CO1	Understand the working principle of IC engine.(BL-2)
CO2	Explain about various working systems in IC engines.(BL-2)
CO3	Describe the combustion processes of engines and identify the combustion chamber – requirements.(BL-2)
CO4	Evaluate the performance of IC engine.(BL-4)
CO5	Summarize about the types and working principles of compressors.(BL-2)

**Course Name: COMPUTER AIDED MACHINE DRAWING**

21ME2503	COMPUTER AIDED MACHINE DRAWING
CO1	Define various standards, specifications, dimensioning methods followed while preparing Engineering drawings. (BL-1)
CO2	Understand and practice to represent symbols for Foundation bolts and keys in drawings.(BL-2)
CO3	Develop, assemble and sketch assembled views of mechanical systems. (BL-3)
CO4	Develop suitable drawing views to represent part drawings of different machine parts in CAD software. (BL-3)

**Course Name: THERMAL ENGINEERING LAB**

21ME2504	THERMAL ENGINEERING LAB
CO1	Conduct constant speed and variable speed tests on IC engines and interpret their performance.(BL-3)
CO2	Determine the valve timing diagram of SI engine& CI engine. (BL-3)
CO3	Estimate energy distribution by conducting heat balance test on IC engines(BL-5) Apply the concept of Morse test on SI engine.(multi cylinder)
CO4	Experiment on IC engine load variations with Air fuel ratio. (BL-3)

**Course Name: MECHANICS OF SOLIDS LAB**

<b>21ME2505</b>	<b>MECHANICS OF SOLIDS LAB</b>
<b>CO1</b>	Analyze the behavior of the solid bodies subjected to various types of loading.
<b>CO2</b>	Apply knowledge of materials and structural elements to the analysis of simple structures.
<b>CO3</b>	Undertake problem identification, formulation and solution using a range of analytical methods
<b>CO4</b>	Analyze and interpret laboratory data relating to behavior of structures and the materials they are made of, and undertake associated laboratory work individually and in teams.



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## DEPARTMENT OF MECHANICAL ENGINEERING

### COURSE OUTCOMES

#### III YEAR-I SEM(NECR21)

**Course Name: DESIGN OF MACHINE ELEMENTS**

21ME2007	DESIGN OF MACHINE ELEMENTS
CO1	To design machine elements subjected to fluctuating loads.(L5)
CO2	To design fasteners and welded joints subjected to different loading conditions.(L5)
CO3	To design Shafts, Keys and Coupling for industrial applications.(L5)
CO4	To achieve an expertise in design of Sliding contact bearing in industrial applications.(L5)
CO5	To understand and apply principles of gear design to spur gears and industrial spur gear boxes.(L2)

**Course Name: MACHINE TOOLS**

21ME2008	MACHINE TOOLS
CO1	Choose cutting processes and variables. (L3)
CO2	Explain the working principle of lathe machine (L2)
CO3	Identify methods to generate different surfaces types of surfaces. (L3)
CO4	Explain the work holding and tool holding devices. (L2)
CO5	Explain the construction details of Grinding machines. (L2)

**Course Name: THERMAL POWER SYSTEMS**

<b>21ME2009</b>	<b>THERMAL POWER SYSTEMS</b>
<b>CO1</b>	Understand steam formation, properties, and Rankine cycles for working of thermal power plants.
<b>CO2</b>	Describe the construction and working of low pressure and high pressure boilers, and concept of draught.
<b>CO3</b>	Explain function and importance of nozzle, and working of condensers in thermal power plants
<b>CO4</b>	Understand working of Impulse turbine and calibrate the performance parameters of the turbine.
<b>CO5</b>	Understand working of Reaction turbine and calibrate the performance parameters of the turbine.

**Course Name: DESIGN THINKING & PRODUCT INNOVATION LAB**

<b>21ME2507</b>	<b>DESIGN THINKING &amp; PRODUCT INNOVATION LAB</b>
<b>CO1</b>	Learn about designing engineering products and solving problems through the product development process. (BTL-1)
<b>CO2</b>	Understand categories of design, stages in the engineering design process, from defining and identifying needs to elaborate design (BTL-2)
<b>CO3</b>	Understand Considerations of ergonomics and aesthetics in the design process, implementing design for manufacturing principles(BTL-2)
<b>CO4</b>	Learn about the concepts of setting limits, fits, and tolerances transducers. (BTL-1)

**Course Name: MACHINE TOOLS LAB**

<b>21ME2508</b>	<b>MACHINE TOOLS LAB</b>
<b>CO1</b>	Choose cutting processes and variables. (L3)
<b>CO2</b>	Explain the working principle of lathe machine (L2)
<b>CO3</b>	Identify methods to generate different surfaces types of surfaces. (L3)
<b>CO4</b>	Explain the work holding and tool holding devices. (L2)



**Course Name: CAD & SIMULATION LAB**

<b>21ME2506</b>	<b>CAD &amp; SIMULATION LAB</b>
<b>CO1</b>	Understanding of common mechanical components (knuckle joints, crank hooks, Plummer blocks, pipe vices).
<b>CO2</b>	Conduct stress analysis of various components under different loading conditions (plane stress, plane strain, ax symmetric).
<b>CO3</b>	Analyze and optimize product performance under various conditions (stress, temperature, fluid flow, etc.) before physical prototyping.
<b>CO4</b>	Identifying and resolving issues in code and optimizing machining processes.
<b>CO5</b>	Understanding of common mechanical components (knuckle joints, crank hooks, Plummer blocks, pipe vices).



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### COURSE OUTCOMES

#### III YEAR-II SEM(NECR21)

##### **Course Name: COMPUTER INTEGRATED MANUFACTURING**

21ME2010	COMPUTER INTEGRATED MANUFACTURING
CO1	Describe the concepts CIM and Computerized elements of CIM system [BL-2].
CO2	Demonstrate Computer Aided Process Planning Logical steps in Computer Aided Process Planning and benefits of CAPP [BL-3]
CO3	Identify CNC programming, and its types manual part programming a mechanical component.[BL-2]
CO4	Describe Group Technology(GT), Part Families and Parts Classification its principles and applications [BL-2]
CO5	Illustrate the Classification of Robots- Robot Control systems [BL-3]

##### **Course Name: DYNAMICS OF MACHINERY**

21ME2011	DYNAMICS OF MACHINERY
CO1	Analyze stabilization of sea vehicles, aircrafts and automobile vehicles.
CO2	Understand the operations of governors in automobiles
CO3	Understand balancing of reciprocating and rotary masses
CO4	Analyze the vibration in machine comments
CO5	Analyze the vibration in machine comments and transmissibility

**Course Name: HEAT TRANSFER**

<b>21ME2012</b>	<b>HEAT TRANSFER</b>
<b>CO1</b>	Apply the concepts of different modes of heat transfer. (L3)
<b>CO2</b>	Apply knowledge of conduction heat transfer in the design of insulation of furnaces and pipes. (L3)
<b>CO3</b>	Analyse free and forced convection phenomena in external and internal flows. (L4)
<b>CO4</b>	Design of thermal shields using the concepts of black body and non-black body radiation. (L5)
<b>CO5</b>	Apply the basics of mass transfer for applications in diffusion of gases. (L3)

**Course Name: POWER PLANT ENGINEERING**

<b>21ME4007-12</b>	<b>POWER PLANT ENGINEERING</b>
<b>CO1</b>	List & understand the sources of energy, power plant economics and environmental aspects. (BL-1)
<b>CO2</b>	Explain the working of the components of different power plants. (BL-2)
<b>CO3</b>	Discuss the working principle, types, layout of diesel power plant & Gas turbines.(BL-2)
<b>CO4</b>	Explain the working principle, layout, auxiliary equipments of hydro electric power plant.(BL- 2)
<b>CO5</b>	Interpret the renewable energy sources, working principle and types of nuclear power plants, working principle and advantages and hazards.(BL-2)

**Course Name: INDUSTRIAL ENGINEERING**

<b>21ME4013-18</b>	<b>INDUSTRIAL ENGINEERING</b>
<b>CO1</b>	Explain the core ideas in management, administration, and organization.(BTL-1)
<b>CO2</b>	Evaluate the systematic approach of increasing the value of a product.(BTL-6)
<b>CO3</b>	Apply method study to enhance the layout and condition of the workspace. (BTL-3)
<b>CO4</b>	Evaluate the right amount of inventory on hand to satisfy consumer demand.(BTL-1)
<b>CO5</b>	Defined standards for the use of engineering production, purchasing and quality control etc. (BTL-1)

**Course Name: HEAT TRANSFER LAB**

<b>21ME2510</b>	<b>HEAT TRANSFER LAB</b>
<b>CO1</b>	Determination of coefficient of thermal conductivity. (L2)
<b>CO2</b>	Identify parameters for measurement for calculating heat transfer. (L1)
<b>CO3</b>	To calculate the average heat transfer co-efficient of vertical cylinder under natural Convection. (L3)
<b>CO4</b>	To calculate the effectiveness of a parallel and counter flow heat exchanger. (L4)

**Course Name: COMPUTER AIDED MANUFACTURING LAB**

<b>21ME2509</b>	<b>COMPUTER AIDED MANUFACTURING LAB</b>
<b>CO1</b>	Explain the concept of scale factors and their application
<b>CO2</b>	Analyze the properties of curves, including continuity, smoothness, and control point influence.
<b>CO3</b>	Defining parameters and utilizing them to control model dimensions.
<b>CO4</b>	Understand the syntax and structure of G-code and M-code commands.



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## DEPARTMENT OF MECHANICAL ENGINEERING

### COURSE OUTCOMES

#### IV YEAR-I SEM(NECR21)

##### **Course Name: DESIGN OF TRANSMISSION SYSTEM**

21ME2013	DESIGN OF TRANSMISSION SYSTEM
CO1	Design of belts
CO2	Design of gears like spur gears and helical gears
CO3	Design spur gears and helical gears
CO4	Design of gear boxes
CO5	Design clutches and brakes

##### **Course Name: METROLOGY AND MEASUREMENTS**

21ME2014	METROLOGY AND MEASUREMENTS
CO1	Learn about linear and angular measurements. (BTL-1)
CO2	Understand about limits, fits and tolerances. (BTL-2)
CO3	Understand the surface texture measurement. (BTL-2)
CO4	Learn about the concepts of transducers. (BTL-1)
CO5	Learn about concepts of mechanical measurement. (BTL-1)

##### **Course Name: AUTOMOBILE ENGINEERING**

21ME3004	AUTOMOBILE ENGINEERING
CO1	Demonstrate the knowledge on working of various components of an automobile.[BT-2]
CO2	Identify and analyze the various systems and sub systems suitable for an automobile.[BT-2]
CO3	Explain the probable solution in the design of steering systems..[BT-3]
CO4	Analyze the complex issues in suspension and braking system.[BT-4]
CO5	Apply the techniques to estimate pollution from the emissions of automobiles.[BT-3]

**Course Name: SOFTWARE TOOLS LAB**

<b>21ME2511</b>	<b>SOFTWARE TOOLS LAB</b>
<b>CO1</b>	Demonstrate the various applications of simulation and analysis tools.(BTL-2)
<b>CO2</b>	Discuss the need of software tools to analyse engineering problem(BTL-2)
<b>CO3</b>	Create the model, analyse and simulate experiments to meet real world systems (BTL-6)
<b>CO4</b>	Evaluate the performance of the various models using thermal, vibration and modal analysis (BTL-5)

**Course Name: METROLOGY & MEASUREMENTS LAB**

<b>21ME2512</b>	<b>METROLOGY &amp; MEASUREMENTS LAB</b>
<b>CO1</b>	To understand about fundamentals of measurement and measuring instruments
<b>CO2</b>	To learn about alignments on lathe, milling, drilling and instruments used in alignment tests
<b>CO3</b>	To study about various instruments used in metrology and its applications
<b>CO4</b>	To understand basic concepts in mechanical measurements and its applications