2.6.1 Programme Outcomes (POs) and Course Outcomes (COs) for all Programmes offered by the Institution are stated and displayed on website and attainment of POs and COs are evaluated.

PO.1.Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO.2.Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO.3.Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO.4.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.

PO.5.Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO.6.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.

PO.7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO.8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO.9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO.10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO.11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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PO.12. 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.

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NAAC "B++" Accredited Institute
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Mechanical Engineering I & II SEM Course Outcomes For the A.Y 2022-23

S.no	Year/Sem	Course Name	Course Outcomes
1	II-I	Mechanics of Solids	CO1:Analyze the behavior of the solid bodies subjected to various types of Loading
			CO2:Apply knowledge of materials and structural elements to the analysis of simple structures
			CO3:Undertake problem identification, formulation and solution using a range of analytical methods
			CO4:Analyze and interpret laboratory data relating to behavior of structures and the materials
			CO5:are made of, and undertake associated laboratory work individually and in teams. Expectation and capacity to undertake lifelong learning
2	II-I	Production Technology	CO1:Understand the idea for selecting materials for patterns
			CO2:Know Types and allowances of patterns used in casting and analyze the components
			CO3:moulds. Design core, core print and gating system in metal casting processes
			CO4:Understand the arc, gas, solid state and resistance welding processes
			CO5:Develop process-maps for metal forming processes using plasticity principles
3	II-I	ThermoDynamics	CO1 : Analyze the work and heat interactions associated with a prescribed process path
			CO2:Criticize a different operations on steady flow energy equation
			CO3:Define the fundamentals of the first and second laws of thermodynamics and explain their significance to a wide range of systems.
			CO4: Evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process from such calculations.

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4	II-I	Production Technology Lab	CO1: Understanding the properties of moulding sands and pattern making. Fabricate joints using gas welding and arc welding. Evaluate the quality of welded joints. Basic idea of press working tools and performs moulding studies on plastics
			CO2 :Design and manufacture simple patterns
			CO3 :Control sand properties in foundry
			CO4 :Operate arc welding, gas welding and resistance welding equipment
5	II-I	Machine Drawing and Practice lab	CO1: Preparation of engineering and working drawings with dimensions and bill of material during
			CO2:design and development. Developing assembly drawings using part drawings of machine components. Conventional representation of materials, common machine elements and parts .
			CO3:Types of Drawings – working drawings for machine parts.
			CO4:centers, curved and tapered features. Title boxes, their size, location and details - common abbreviations and their liberal usage
6	II-I	Material Science & Mechanics Of Solids Lab	CO1: The Primary focus of the Metallurgy and Material science program is to provide undergraduates with a fundamental knowledge based associated materials properties, and their selection and application. Upon graduation, students would have acquired and developed the necessary background and skills for successful careers in the materials-related industries. Furthermore, after completing the program, the student should be well prepared for management positions in industry or continued education toward a graduate degree

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7	II-II	Basic Electrical & Electronics Engineering	CO1:To analyze and solve electrical circuits using network laws and theorems.
			CO2:To understand and analyze basic Electric and Magnetic circuits
			CO3:To study the working principles of Electrical Machines
			CO4:To introduce components of Low Voltage Electrical Installations
			CO5:To identify and characterize diodes and various types of transistors
8	II-II	Kinematics Of Machinery	CO1:Understand the principles of kinematic pairs, chains and their classification, DOF, inversions, equivalent chains and planar mechanisms.
			CO2:Analyze the planar mechanisms for position, velocity and acceleration.
			CO3:Design cams and followers for specified motion profiles
			CO4:Evaluate gear tooth geometry and select appropriate gears for the required applications.
			CO5:Synthesize planar four bar and slider crank mechanisms for specified kinematic conditions.
9	II-II	Thermal Engineering -I	**CO1**:At the end of the course, the student should be able to evaluate the performance of IC engines and compressors under the given operating conditions. Apply the laws of Thermodynamics to evaluate the performance of Refrigeration and air-conditioning cycles. Understand the functionality of the major components of the IC Engines and effects of operating conditions on their performance
10	II-II	Fluid Mechanics &Hydraulic Machines	CO1: Able to identify type of fluid flow patterns and describe continuity equation
			CO2:To analyze a variety of practical fluid flow and measuring devices and utilize Fluid Mechanics
			CO3:Able to demonstrate boundary layer concepts
			CO4:principles in design. To select and analyze an appropriate turbine with reference to given situation in power plants

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11	II-II	Instrumentation & Control Systems	CO1:To identify various elements and their purpose in typical instruments, to identify various errors
			CO2:Analysis of errors so as to determine correction factors for each instrument
			CO3:To understand static and dynamic characteristics of instrument and should be able to determine
			CO4: loading response time. For given range of displacement should be able to specify transducer, it accurate and loading
12	II-II	Basic Electrical & Electronics Engineering Lab	CO1:To analyze and solve electrical circuits using network laws and theorems.
			CO2:To understand and analyze basic Electric and Magnetic circuits
			CO3:To study the working principles of Electrical Machines
			CO4:To introduce components of Low Voltage Electrical Installations
			CO5:To identify and characterize diodes and various types of transistors
13	II-II	Fluid Mechanics &Hydraulic Machines Lab	CO1: Able to explain the effect of fluid properties on a flow system
			CO2:Able to identify type of fluid flow patterns and describe continuity equation
			CO3:To analyze a variety of practical fluid flow and measuring devices and utilize fluid mechanics
			CO4:principles in design. To select and analyze an appropriate turbine with reference to given situation in power plants
			CO5:Able to demonstrate boundary layer concepts
14	II-II	Instrumentation & Control Systems Lab	CO1: At the end of the course, the student will be able to Characterize and calibrate measuring devices. Identify and analyze errors in measurement. Analyze measured data using regression analysis. Calibration of Pressure Gauges, temperature, LVDT, capacitive transducer, rotameter.

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15	III-I	Dynamics Of Machinery	CO1: the study of KOM & DOM are necessary to have an idea while designing the various machine members like shafts, bearings, gears, belts & chains and various I.C. Engine Components & Machine tool parts
			CO2: Analyze stabilization of sea vehicles, aircrafts and automobile vehicles
			CO3:Compute frictional losses, torque transmission of mechanical systsms.
			CO4 :Analyze dynamic force analysis of slider crank mechanism and design of flywheel
			CO5 : Understand balancing of reciprocating and rotary masses.
16	III-I	Design Of Machine members-I	CO1: The student acquires the knowledge about the principles of design, material selection
			CO2:component behavior subjected to loads, and criteria of failure.
			CO3:Design on the basis of strength and rigidity and analyze the stresses and strains induced in machine element
17	III-I	Metrology and Machine Tools	CO1:the student would be able to Identify techniques to minimize the errors in measurement
			CO2Identify methods and devices for measurement of length, angle, gear
			CO3;& thread parameters, surface roughness and geometric features of parts. Understand working of lathe, shaper, planer, drilling, milling and grinding machine
			CO4;Comprehend speed and feed mechanisms of machine tools.
			CO5:Estimate machining times for machining operations on machine tools
18	III-I	Business Economics &Financial Analysis	CO1:The students will understand the various Forms of Business and the impact of economic variables on the Business. The Demand, Supply, Production, Cost, Market Structure , Pricing aspects are learnt. The Students can study the firm's financial position by analysing the Financial Statements of a Company

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19	III-I	Thermal Engineering -II	CO1:Develop state – space diagrams based on the schematic diagrams of process flow of steam
			CO2: gas turbine plants Apply the laws of Thermodynamics to analyze thermodynamic cycles
			CO3:Differentiate between vapour power cycles and gas power cycles
			CO4:Infer from property charts and tables and to apply the data for the evaluation of performance
20	III-I	Operations Research	CO1 : An ability to apply the knowledge of mathematics, basic sciences and engineering concepts to solve the complex engineering problems
			CO2 : The ability to conduct experiments and to critically analyze and interpret the experimental data to reach at substantial outcomes
			CO3 :An understanding of professional and ethical responsibility.
			CO4 : An ability to communicate effectively with written, oral, and visual means.
			CO5 : An ability to recognize the need to engage in life-long learning
21	III-I	Kinematics & Dynamics Lab	CO1:Understand types of motion
			CO2;Analyze forces and torques of components in linkages
			CO3:Understand static and dynamic balance
			CO4:Understand forward and inverse kinematics of open-loop mechanisms
22	III-II	Design Of Machine Members-II	CO1: Estimation of life of rolling element bearings and their selection for given service conditions‘
			CO2:Acquaintance with design of the components as per the standard, recommended procedures
			CO3:which is essential in design and development of machinery in industry

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23	III-II	Heat Transfer	CO1:Understand and analyze heat transfer through extended surfaces
			CO2:Understand one dimensional transient conduction heat transfer
			CO3:Understand concepts of continuity, momentum and energy equations
			CO4:Interpret and analyze forced and free convective heat transfer
			CO5:Understand the principles of boiling, condensation and radiation heat transfer
24	III-II	CAD/CAM	CO1:: Understand geometric transformation techniques in CAD. Develop mathematical models to represent curves and surfaces. Model engineering components using solid modeling techniques. Develop programs for CNC to manufacture industrial components. To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.
			CO2:Creation of part drawings and 3D models using CAD techniques
			CO3 :Generation of part programs for industrial components using CAM techniques
25	III-II	Unconventional Machining Process	CO1:Understand the basic techniques of Unconventional Machining processes modeling
			CO2:Estimate the material removal rate and cutting force, in an industrially useful manner, for Unconventional Machining processes
			CO3: Explain the basic types of machines.
			CO4 :Discuss various non-conventional machines and their applications
26	III-II	Machine Tool Design	CO1:At the end of the course, the student will be able to, understand basic motions involved in a machine tool, design machine tool structures, design and analyze systems for specified speeds and feeds, select subsystems for achieving high accuracy in machining, understand control strategies for machine tool operations and apply appropriate quality tests for quality assurance

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27	III-II	Production Planning and Control	CO1:At the end of the course, the student will be able to understand production systems and their characteristics. Evaluate MRP and JIT systems against traditional inventory control systems. Understand basics of variability and its role in the performance of a production system. Analyze aggregate planning strategies. Apply forecasting and scheduling techniques to production systems. Understand theory of constraints for effective management of production systems
28	III-II	Finite Element Methods	CO1:At the end of the course, the student will be able to, Apply finite element method to solve problems in solid mechanics, fluid mechanics and heat transfer. Formulate and solve problems in one dimensional structures including trusses, beams and frames. Formulate FE characteristic equations for two dimensional elements and analyze plain stress, plain strain, axisymmetric and plate bending problems
			CO2 : Understand the concepts of Nodes and elements
			C03 :Understand use of FEA in Structural and thermal problem
			CO4 : Understand the application of FEA in heat transfer problem
29	III-II	Heat Transfer Lab	CO1: Perform steady state conduction experiments to estimate thermal conductivity of different
			CO2 : materials Perform transient heat conduction experiment
			CO3:Estimate heat transfer coefficients in forced convection, free convection, condensation
			CO4:correlate with theoretical values Obtain variation of temperature along the length of the pin fin under forced and free

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30	III-II	CAD/CAM Lab	CO1: To be able to understand and handle design problems in a systematic manner. To be able to apply CAD in real life applications. To be understand the basic principles of different types of analysis
			CO2 : Model complex shapes including freeform curves and surfaces
			CO3 : Explain the basic concepts of CNC programming and machining
			CO4 : Implement CNC programs for milling and turning machining operations
31	III-II	Refrigeration & Air Conditioning	
			CO1: At the end of the course, the student should be able to Differentiate between different types of refrigeration systems with respect to application as well as conventional and unconventional refrigeration systems. Thermodynamically analyse refrigeration and air conditioning systems and evaluate performance parameters. Apply the principles of Psychometrics to design the air conditioning loads for the industrial applications
			CO2 :Analyze the reversed Carnot cycle and vapour compression refrigeration cycle (VCR)
			CO3: Select the air-refrigeration systems for aircraft, and vapour absorption refrigeration system for rural and remote areas and select environmental friendly refrigerants considering the international standards.
32	IV-I	Additive Manufacturing	CO1: Describe various CAD issues for 3D printing and rapid prototyping and related operations
			CO2:STL model manipulation. Formulate and solve typical problems on reverse engineering for surface reconstruction
			CO3 :Explain the processes used in additive manufacturing for a range of materials and applications

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33	IV-I	Power Plant Engineering	CO1: Understand the concept of Rankine cycle.
			CO2:Understand working of boilers including water tube, fire tube and high pressure boilers and
			CO2:determine efficiencies. Analyze the flow of steam through nozzles
			CO3:Evaluate the performance of condensers and steam turbines
			CO4:Evaluate the performance of gas turbines
34	IV-I	Renewable Energy Sources	CO1:Understanding of renewable energy sources
			CO2:Knowledge of working principle of various energy systems
			CO3:Capability to carry out basic design of renewable energy systems
35	IV-I	Turbo Machinery	CO1:Ability to design and calculate different parameters for turbo machines
			CO2:Prerequisite to CFD and Industrial fluid power courses
			CO3:Ability to formulate design criteria
			CO4:Ability to understand thermodynamics and kinematics behind turbo machines
36	IV-II	Industrial Robotics	CO1: At the end of the course, the student will be able to understand the basic components of robots. Differentiate types of robots and robot grippers. Model forward and inverse kinematics of robot manipulators. Analyze forces in links and joints of a robot. Programme a robot to perform tasks in industrial applications. Design intelligent robots using sensors.
			CO2 : To learn about knowledge for the design of robotics.
			CO3: Will understand robot kinematics and robot programming.
			CO4: Will understand application of Robots
37	IV-II	Industrial Management	CO1:Able to design the organization structure
			CO2:Able to apply techniques for plant location, design plant layout and value analysis
			CO3 : To learn about force and torque sensing
			CO4 : To learn about application of robot

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38	IV-II	Production And Operations Management	CO1:Able to execute operations management functions
			CO2:Able to carry out value analysis
			CO3:Able to carry out aggregate planning and implement MRP Or JIT
			CO5:Able to schedule the jobs so as to complete them in minimum makespan time
			CO6:Able to carry out network analysis
39	IV-II	Total Quality Management	CO1 : Understand the fundamental principles of Total Quality Management;
			CO2 : . Choose appropriate statistical techniques for improving processes;
			of Total Quality Management

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