		automotive applications, considering factors such as safety, efficiency, and sustainability. CO-4: Develop proficiency in utilizing computer-aided design (CAD) software and other engineering tools to model, simulate, and analyze automotive systems, and use the obtained insights for improving design and performance. CO-5: Evaluate and employ advanced automotive technologies, such as hybrid and electric powertrains, autonomous driving systems, and connected vehicle technologies, while considering the environmental impact and societal implications of these innovations.
PEC MEL 303	**Composite Materials**	CO-1: Analyze the fundamental properties and behavior of composite materials, including their mechanical, thermal, and electrical characteristics. CO-2: Apply the principles of composite materials selection and design to solve engineering problems in various applications, such as aerospace, automotive, and structural engineering. CO-3: Demonstrate proficiency in manufacturing techniques and processes specific to composite materials, including lay-up, curing, molding, and post-processing methods. CO-4: Evaluate the performance and reliability of composite structures by conducting experimental testing and analysis, considering factors such as load-bearing capacity, fatigue resistance, and failure modes. CO-5: Develop an understanding of the environmental impact and sustainability considerations associated with composite materials, including their recycling, disposal, and life cycle assessment, and propose strategies for their responsible use in engineering applications.
PEC MEL 304	**Mechatronic Systems**	CO-1: Apply knowledge of mechanical engineering principles, electronic systems, and control theory to analyze and design mechatronic systems. CO-2: Integrate mechanical, electrical, and computer engineering concepts to develop efficient and innovative mechatronic solutions for real-world problems. CO-3: Design, model, and simulate mechatronic systems using appropriate software tools and techniques, considering factors such as system dynamics, feedback control, and system reliability.

		CO-4: Demonstrate proficiency in the selection, integration, and implementation of sensors, actuators, and controllers in mechatronic systems to achieve desired system behavior. CO-5: Collaborate effectively in multidisciplinary teams to design, build, and test mechatronic prototypes, and communicate the design process and outcomes through technical reports and presentations.
PEC MEL 305	**Microprocessors in Automation**	CO-1: Analyze the architecture and operation of microprocessors used in automation systems to understand their role in controlling mechanical processes. CO-2: Design and develop assembly language programs to interface microprocessors with peripheral devices, demonstrating an understanding of input/output operations and data transfer techniques. CO-3: Apply knowledge of microprocessor-based systems to design and troubleshoot automation circuits, integrating sensors, actuators, and control logic to achieve desired mechanical functionalities. CO-4: Evaluate the performance of microprocessor-based automation systems by conducting experiments and analyzing data, considering factors such as response time, accuracy, and stability. CO-5: Incorporate microprocessors into automation projects by integrating software and hardware components, demonstrating the ability to design and implement control strategies for mechanical systems.
PCC-ME 304	**Heat Transfer Lab**	CO-1: Apply fundamental principles and concepts of heat transfer to analyze and solve practical engineering problems related to heat transfer phenomena. CO-2: Design and conduct experiments to measure and analyze heat transfer characteristics in various systems, including conduction, convection, and radiation. CO-3: Use appropriate instrumentation and techniques to measure and record relevant parameters such as temperature, heat flux, and thermal conductivity in heat transfer experiments. CO-4: Analyze and interpret experimental data obtained from heat transfer experiments using statistical analysis and apply theoretical knowledge to validate experimental results.

		CO-5: Communicate effectively, both orally and in written form, the results of heat transfer experiments, including the analysis, interpretation, and conclusions drawn from the data, while adhering to professional and ethical standards.
HSMC301 (OEL II)	**Humanities I (Effective Technical Communication)**	CO-1: Demonstrate effective written communication skills by producing technical documents with clear and concise language, proper grammar, and appropriate formatting. CO-2: Apply critical thinking and analytical skills to analyze and interpret technical information, research findings, and scholarly articles in the field of mechanical engineering. CO-3: Develop effective oral communication skills by delivering well-structured and organized technical presentations using appropriate visual aids and communication techniques. CO-4: Utilize effective communication strategies to collaborate and work effectively in multidisciplinary teams, demonstrating the ability to listen actively, provide constructive feedback, and resolve conflicts. CO-5: Apply ethical and professional standards in technical communication, demonstrating an understanding of intellectual property rights, plagiarism, and the importance of accurate referencing and citation in academic and professional writing.
PROJ- ME 301	**Minor Project/ Seminar/Summer Internship**	CO-1: Analyze and evaluate real-world engineering problems related to the field of mechanical engineering, and propose appropriate solutions by integrating theoretical knowledge gained during the B.Tech program. CO-2: Apply engineering principles, tools, and techniques to design, develop, and implement innovative solutions for practical problems encountered during the minor project, seminar, or summer internship in the field of mechanical engineering. CO-3: Demonstrate effective communication and presentation skills to convey technical concepts and findings related to the minor project, seminar, or summer internship, both orally and in written form, to a diverse audience including technical and non-technical stakeholders.

PCC- ME 306	**Automation in Manufacturing**	CO-1: Apply principles of automation in manufacturing to design and optimize automated systems for various manufacturing processes. CO-2: Analyze the advantages and limitations of different automation technologies in manufacturing and make informed decisions for their implementation in industrial settings. CO-3: Develop proficiency in programming and configuring industrial robots, CNC machines, and other automated equipment used in manufacturing processes. CO-4: Evaluate and select appropriate sensors, actuators, and control systems for automation in manufacturing, considering factors such as reliability, precision, and cost-effectiveness. CO-5: Collaborate effectively in multidisciplinary teams to design, implement, and troubleshoot automated manufacturing systems, considering factors such as safety, productivity, and quality.
PCC- ME 307	**Automation in Manufacturing Lab**	CO-1: Apply programming concepts to design and develop automated manufacturing systems. CO-2: Analyze and evaluate the performance of various automation components and systems used in manufacturing processes. CO-3: Demonstrate proficiency in operating and troubleshooting industrial robots and robotic systems. CO-4: Implement computer-aided design (CAD) and computer-aided manufacturing (CAM) tools to optimize manufacturing processes. CO-5: Design and integrate automated control systems for manufacturing processes to improve productivity, quality, and safety.
PEC MEL 306	**Energy Conservation and Management**	CO-1: Apply the principles of energy conservation and management to analyze and evaluate energy systems and processes. CO-2: Identify and implement energy-efficient strategies and technologies in various mechanical systems and industries. CO-3: Develop and design effective energy management plans and policies to optimize energy consumption and reduce energy waste. CO-4: Demonstrate proficiency in energy auditing techniques, including data collection, analysis, and reporting, to identify areas for energy conservation

		and improvement. CO-5: Evaluate the economic and environmental impacts of energy conservation measures and propose sustainable solutions to enhance energy efficiency in mechanical engineering applications.
PEC MEL 307	**Refrigeration and Air Conditioning**	CO-1: Analyze the principles and working mechanisms of refrigeration and air conditioning systems. CO-2: Evaluate the thermodynamic processes and cycles involved in refrigeration and air conditioning systems. CO-3: Design and select appropriate components for efficient refrigeration and air conditioning systems. CO-4: Apply troubleshooting techniques to identify and rectify faults in refrigeration and air conditioning systems. CO-5: Evaluate the environmental impact of refrigeration and air conditioning systems and propose sustainable solutions to minimize their negative effects.
PEC MEL 308	**Process Planning and Cost Estimation**	CO-1: Analyze manufacturing processes and select appropriate process planning techniques for a given mechanical engineering project. CO-2: Apply cost estimation methods to accurately determine the manufacturing costs of a mechanical engineering project. CO-3: Develop efficient process plans that optimize resource utilization, minimize production time, and ensure high-quality output. CO-4: Evaluate and compare different manufacturing processes and materials to make informed decisions regarding process selection and cost optimization. CO-5: Demonstrate effective communication skills in presenting process plans and cost estimations to stakeholders, considering technical aspects, feasibility, and economic viability.
PEC MEL 309	**Principles of Management**	CO-1: Apply key principles of management to analyze and solve complex problems in mechanical engineering organizations. CO-2: Evaluate the importance of effective leadership, communication, and teamwork skills in managing engineering projects and teams. CO-3: Demonstrate an understanding of the ethical

		and legal considerations in management decision-making processes within the mechanical engineering industry. CO-4: Assess the impact of globalization and technological advancements on management practices in the context of the mechanical engineering sector. CO-5: Design and implement strategies for optimizing resources, enhancing productivity, and ensuring sustainable practices in mechanical engineering organizations.
PEC MEL 310	**Design of Transmission Systems**	CO-1: Analyze and evaluate the mechanical components and principles involved in the design of transmission systems, including gears, shafts, bearings, and clutches. CO-2: Apply engineering calculations and modeling techniques to design and select appropriate transmission system components based on specified performance requirements and constraints. CO-3: Design and optimize the layout of transmission systems, considering factors such as power transmission efficiency, reliability, noise, and vibration. CO-4: Incorporate knowledge of materials science and manufacturing processes to select suitable materials and manufacturing methods for transmission system components, ensuring their strength, durability, and cost-effectiveness. CO-5: Evaluate the performance and reliability of designed transmission systems through testing, analysis, and simulation, and propose improvements or modifications as necessary to meet desired functional requirements.
OEC 301	**Soft Skills and Interpersonal Communication**	CO-1: Apply effective verbal and non-verbal communication techniques to express ideas and information clearly in professional and personal contexts. CO-2: Demonstrate active listening skills to comprehend and interpret information accurately, and respond appropriately in various interpersonal communication situations. CO-3: Employ critical thinking and problem-solving skills to resolve conflicts, negotiate effectively, and collaborate with team members to achieve common goals.

		CO-4: Apply emotional intelligence to manage personal and professional relationships, understand diverse perspectives, and adapt communication styles accordingly. CO-5: Demonstrate proficiency in written communication, including the ability to write concise and coherent reports, emails, and other professional documents, using appropriate language and formatting.
OEC 302	**ICT for Development**	CO-1: Analyze the role of information and communication technologies (ICT) in the context of development, particularly in the field of mechanical engineering. CO-2: Evaluate the impact of ICT solutions on various aspects of development, such as social, economic, and environmental, and their relevance to mechanical engineering practices. CO-3: Apply ICT tools and techniques to address development challenges in the field of mechanical engineering, with an emphasis on sustainability, efficiency, and innovation. CO-4: Design and implement ICT-based solutions to improve productivity, quality, and safety in mechanical engineering processes, taking into account the specific needs and constraints of development contexts. CO-5: Critically assess the ethical, legal, and societal implications of ICT deployment in development projects, and propose strategies to ensure responsible and inclusive use of technology in the field of mechanical engineering.
OEC 303	**Human Resource Development and Organizational Behavior**	CO-1: Identify and analyze the key concepts and theories of human resource development and organizational behavior in the context of mechanical engineering. CO-2: Apply effective communication and interpersonal skills to facilitate positive workplace relationships and foster a collaborative work environment in a mechanical engineering organization. CO-3: Evaluate the impact of organizational culture, diversity, and ethical considerations on human resource development strategies in the mechanical engineering industry.

		CO-4: Design and implement employee training and development programs that align with the strategic goals of a mechanical engineering organization and enhance individual and team performance. CO-5: Assess the role of leadership, motivation, and team dynamics in driving organizational effectiveness and employee engagement in the context of the mechanical engineering field.
MC-II	**Essence of Indian Knowledge Tradition**	CO-1: Analyze and critically evaluate the key concepts and principles of Indian knowledge tradition, including its philosophical, scientific, and technological aspects, within the context of mechanical engineering. CO-2: Apply the principles and techniques derived from Indian knowledge tradition to solve complex engineering problems related to mechanical systems, demonstrating an understanding of the cultural and historical significance of these solutions. CO-3: Demonstrate an ability to integrate the principles of Indian knowledge tradition into the design and development of mechanical systems, taking into account the holistic and sustainable approach inherent in the traditional practices. CO-4: Develop a deep appreciation for the ethical, social, and environmental implications of Indian knowledge tradition in the field of mechanical engineering, and apply this understanding to make informed decisions in professional practice. CO-5: Communicate effectively, both orally and in writing, about the significance and relevance of Indian knowledge tradition in the context of mechanical engineering, and engage in constructive discussions on its potential applications and future developments.
PROJ-ME 302	**Project-II(Major Project)**	CO-1: Apply engineering principles and problem-solving skills to develop innovative solutions in the field of mechanical engineering for the Major Project. CO-2: Design and create a comprehensive project plan, including defining project objectives, identifying project scope, and establishing project timelines and milestones. CO-3: Demonstrate proficiency in utilizing advanced tools, techniques, and software relevant to the Major Project, and apply them effectively for modeling, simulation, and analysis purposes.

		CO-4: Execute the project plan efficiently by effectively managing resources, coordinating tasks, and ensuring adherence to project schedules, quality standards, and safety regulations. CO-5: Communicate project progress, findings, and recommendations effectively through written reports, oral presentations, and visual aids, demonstrating professional and ethical conduct.
PEC MEL 401	**Gas Dynamics and Jet Propulsion**	CO-1: Analyze and interpret the fundamental principles of gas dynamics and their application in jet propulsion systems. CO-2: Apply the concepts of compressible flow and thermodynamics to analyze and design various types of jet engines and propulsion systems. CO-3: Evaluate the performance parameters of jet engines, such as thrust, specific fuel consumption, and efficiency, and propose improvements for enhanced performance. CO-4: Design and analyze various types of nozzles, diffusers, and intake systems used in jet propulsion, considering factors like flow behavior, pressure recovery, and choking. CO-5: Demonstrate proficiency in the selection, operation, and maintenance of different types of jet engines, including turbojet, turbofan, and ramjet engines, while adhering to safety and environmental regulations.
PEC MEL 401	**Total Quality Management**	CO-1: Apply the principles and techniques of Total Quality Management (TQM) to analyze and improve the quality of mechanical engineering processes and products. CO-2: Evaluate the effectiveness of quality management systems and tools in enhancing the overall performance of mechanical engineering projects. CO-3: Design and implement quality control procedures, including statistical process control, to monitor and maintain the quality standards of mechanical engineering processes. CO-4: Demonstrate the ability to lead and participate in cross-functional teams for implementing TQM practices in mechanical engineering organizations, fostering a culture of continuous improvement. CO-5: Critically analyze case studies and real-world

		examples of successful TQM implementations in the mechanical engineering industry, identifying best practices and lessons learned for future application.
PEC MEL 401	**Power Plant Engineering**	CO-1: Apply the principles of thermodynamics and heat transfer to analyze and design various components of power plants, such as boilers, turbines, and condensers. CO-2: Demonstrate a comprehensive understanding of different types of power generation systems, including thermal power plants, gas turbine power plants, and combined cycle power plants, and their working principles. CO-3: Evaluate and select appropriate materials for power plant components based on their mechanical properties, corrosion resistance, and high-temperature characteristics, taking into account operational and safety considerations. CO-4: Analyze and optimize the performance of power plants by considering factors such as efficiency, heat rate, power output, and environmental impact, using appropriate computational tools and simulation techniques. CO-5: Develop an understanding of the operational and maintenance requirements of power plants, including safety protocols, equipment inspection, troubleshooting techniques, and regulatory compliance, in order to ensure efficient and reliable operation of the plant.
PEC MEL 401	**Computer Aided Design**	CO-1: Apply computer-aided design (CAD) software proficiently to create accurate and detailed 2D and 3D mechanical engineering drawings. CO-2: Analyze and interpret engineering design specifications, and effectively utilize CAD tools to generate models and designs that meet the given requirements. CO-3: Demonstrate proficiency in applying advanced CAD techniques, such as parametric modeling, assembly modeling, and surface modeling, to develop complex mechanical designs. CO-4: Evaluate and optimize mechanical designs using CAD tools, considering factors such as material selection, stress analysis, and manufacturability, to ensure functionality and efficiency. CO-5: Collaborate effectively in multidisciplinary

		teams, utilizing CAD software for design communication and documentation, and presenting design concepts and solutions to stakeholders.
PEC MEL 401	**Finite Element Analysis**	CO-1: Apply the principles of finite element analysis to analyze and solve mechanical engineering problems. CO-2: Develop and implement finite element models for structural and thermal analysis. CO-3: Evaluate the performance and behavior of mechanical components and systems using finite element analysis techniques. CO-4: Demonstrate proficiency in interpreting and analyzing the results obtained from finite element analysis simulations. CO-5: Design and optimize mechanical systems based on the insights gained from finite element analysis.
OEC 401	**Cyber Law and Ethics**	CO-1: Identify and analyze key legal frameworks and regulations related to cybersecurity, privacy, and intellectual property rights in the context of the digital landscape. CO-2: Evaluate ethical dilemmas and make informed decisions regarding the use, access, and dissemination of digital information, taking into consideration societal norms, values, and ethical principles. CO-3: Apply legal concepts and principles to assess and mitigate legal risks associated with cybercrime, including hacking, data breaches, identity theft, and online fraud.. CO-4: Develop strategies to protect intellectual property rights, including copyright, patents, and trademarks, in the digital domain, and understand the legal implications of using open-source software. CO-5: Demonstrate an understanding of the legal and ethical considerations in emerging technologies such as artificial intelligence, blockchain, and internet of things (IoT), and their impact on privacy, security, and individual rights.
OEC 402	**Introduction to Philosophical Thoughts**	CO-1: Analyze and evaluate key philosophical concepts and theories from different philosophical traditions. CO-2: Apply critical thinking skills to examine and interpret complex philosophical texts and arguments. CO-3: Demonstrate an understanding of the

		relationship between philosophical thoughts and ethical decision-making in engineering contexts. CO-4: Formulate well-reasoned arguments and articulate philosophical perspectives in oral and written forms. CO-5: Recognize and appreciate the relevance of philosophical thoughts in addressing contemporary societal and global issues.
OEC 403	**Comparative Study of Literature**	CO-1: Analyze and compare the major themes, styles, and literary techniques employed in various works of literature from different time periods and cultures. CO-2: Evaluate the cultural, historical, and social contexts that shape the production and reception of literary texts, enabling students to identify the interplay between literature and society. CO-3: Apply critical thinking skills to interpret and evaluate literary works, demonstrating the ability to discern the underlying messages, symbolism, and artistic choices made by authors. CO-4: Develop effective written and oral communication skills through the articulation of well-supported arguments and interpretations of literary texts, employing appropriate evidence and references. CO-5: Synthesize knowledge gained from comparative literary studies to understand and appreciate the diversity of human experiences across cultures, fostering a broader worldview and cultural sensitivity.
OEC 404	**Indian Music System**	CO-1: Demonstrate knowledge and understanding of the basic principles and concepts of the Indian Music System, including the classification of ragas, talas, and the melodic and rhythmic structures. CO-2: Analyze and interpret different ragas and talas in Indian classical music, and evaluate their aesthetic qualities, historical significance, and cultural context. CO-3: Apply the principles of Indian music composition and improvisation techniques to create original musical compositions within the framework of ragas and talas, showcasing creativity and technical proficiency. CO-4: Critically evaluate and compare various musical performances in the Indian Music System, identifying the nuances, ornamentation, and expressions employed by the performers, and

		demonstrating an appreciation for the diverse styles and genres. CO-5: Demonstrate effective communication skills by explaining and presenting concepts related to the Indian Music System, including the theoretical aspects, practical techniques, and historical developments, both orally and in written form, to diverse audiences.
OEC 405	**History of Science & Engineering**	CO-1: Analyze the historical development of scientific and engineering principles and their impact on technological advancements in the field of mechanical engineering. CO-2: Evaluate the contributions of key scientists, inventors, and engineers throughout history to the development of mechanical engineering concepts, theories, and technologies. CO-3: Apply historical perspectives to critically examine the ethical, social, and environmental implications of scientific and engineering discoveries, innovations, and practices in the context of mechanical engineering. CO-4: Demonstrate a comprehensive understanding of the major milestones in the history of mechanical engineering, including significant technological breakthroughs, paradigm shifts, and advancements in industrial applications. CO-5: Synthesize historical knowledge with current trends and emerging technologies in the field of mechanical engineering to envision and propose innovative solutions to contemporary engineering challenges, while considering the lessons learned from the past.
OEC 406	**Introduction to Art and Aesthetics**	CO-1: Analyze and evaluate various art forms and their aesthetic components within the context of cultural, historical, and social perspectives. CO-2: Apply principles of art and aesthetics to enhance creativity and innovation in mechanical engineering design processes. CO-3: Critically examine the impact of art and aesthetics on human perception, emotions, and well-being, and its relevance to mechanical engineering applications. CO-4: Develop the ability to communicate effectively about art and aesthetics in both oral and written forms,

		employing appropriate terminology and concepts. CO-5: Demonstrate an understanding of ethical considerations in the field of art and aesthetics, and apply ethical principles to address complex aesthetic dilemmas in mechanical engineering practice.
MC-III	**Constitution of India**	CO-1: Analyze the fundamental principles and features of the Constitution of India, including its historical context, structure, and key provisions. CO-2: Explain the fundamental rights and duties of Indian citizens as enshrined in the Constitution and evaluate their significance in promoting democratic values and social justice. CO-3: Examine the structure and functioning of the Indian government, including the executive, legislative, and judicial branches, and understand the principles of separation of powers and checks and balances. CO-4: Evaluate the constitutional provisions related to the protection and promotion of social justice, including provisions for reservation, affirmative action, and safeguards for marginalized communities, and assess their impact on inclusive development. CO-5: Apply the constitutional provisions related to fundamental freedoms, such as freedom of speech, expression, and religion, and analyze their role in promoting individual liberties and maintaining social harmony in a diverse society.
PROJ ME 401	**Short Term Training (21-45 Days)/ Project-III**	CO-1: Analyze and apply theoretical concepts and practical knowledge acquired in the field of mechanical engineering to solve real-world problems encountered during the short-term training or project. CO-2: Demonstrate proficiency in utilizing machine tools and techniques specific to the mechanical engineering domain during the execution of the short-term training or project. CO-3: Design and develop innovative solutions by integrating engineering principles and concepts within the scope of the assigned project or training, considering factors such as feasibility, efficiency, and sustainability.
PROJ-ME 402	**Industrial Internship/Project-IV**	CO-1: Apply theoretical knowledge and engineering principles to solve real-world problems encountered during the industrial internship/project in the field of

		mechanical engineering. CO-2: Analyze and evaluate manufacturing processes, equipment, and systems encountered during the industrial internship/project, identifying areas for improvement and optimization. CO-3: Acquire practical skills and hands-on experience with industrial tools, equipment, and software relevant to the mechanical engineering field, enhancing technical proficiency and professional competence.

MEWAR UNIVERSITY

Department of Mechanical Engineering

Program Outcomes (POs) of M.Tech. Manufacturing Systems Engineering:

1. **Engineering Knowledge (PO1):** Apply advanced knowledge of manufacturing systems engineering principles, mathematics, science, and specialized expertise to solve complex problems in the field.
2. **Problem Analysis (PO2):** Identify, formulate, and analyze intricate manufacturing problems, integrating principles from engineering, mathematics, and manufacturing sciences to arrive at well-supported conclusions.
3. **Design and Development of Solutions (PO3):** Design innovative solutions for complex manufacturing challenges, integrating system components or processes that align with industry standards, safety regulations, and socio-environmental considerations.
4. **Investigations of Complex Problems (PO4):** Employ advanced research methods, including experimental design, data analysis, and synthesis, to provide valid conclusions and recommendations for complex manufacturing issues.
5. **Modern Tool Usage (PO5):** Utilize advanced techniques, resources, modern engineering tools, and IT tools to conduct sophisticated analyses and simulations within the manufacturing domain.
6. **Engineer and Society (PO6):** Evaluate ethical, societal, legal, and cultural implications of manufacturing solutions, employing contextual understanding to fulfill professional responsibilities effectively.
7. **Environment and Sustainability (PO7):** Recognize the impact of manufacturing solutions on the environment and society, and apply principles of sustainability to engineering practices.
8. **Ethics (PO8):** Demonstrate adherence to ethical principles and professional norms in manufacturing systems engineering, maintaining integrity in decision-making and actions.
9. **Individual and Team Work (PO9):** Collaborate effectively in multidisciplinary teams, assuming roles as leaders or members, and adapting to diverse environments.

10. **Communication (PO10):** Communicate proficiently about intricate manufacturing concepts to both engineering peers and broader audiences, using diverse mediums for effective information dissemination.
11. **Project Management and Finance (PO11):** Apply engineering and management principles to lead projects, manage resources, and contribute to strategic decision-making in manufacturing settings.
12. **Life-long Learning (PO12):** Recognize the need for continuous learning and professional development in the dynamic field of manufacturing systems engineering.

MEWAR UNIVERSITY

Department of Mechanical Engineering

Program Specific Outcomes (PSOs) of M.Tech. Manufacturing Systems Engineering:

1. **PSO-1:** Design and optimize manufacturing processes and systems by integrating advanced manufacturing technologies and methodologies, enhancing productivity and quality.
2. **PSO-2:** Apply principles of automation, robotics, and digital manufacturing to develop efficient and adaptive manufacturing systems that align with industry 4.0 standards.
3. **PSO-3:** Analyze and optimize supply chain and logistics operations within manufacturing environments, employing advanced techniques to enhance efficiency and sustainability.

M TECH IN MANUFACTURING SYSTEM ENGINEERING

Course Code	Course Title	Course Outcomes
MSE -411	Computer Integrated Manufacturing Systems	CO-1: Analyze and evaluate the principles and concepts of Computer Integrated Manufacturing (CIM) systems in order to comprehend their role in modern manufacturing processes. CO-2: Apply knowledge of CAD/CAM (Computer-Aided Design/Computer-Aided Manufacturing) technologies to design, simulate, and optimize manufacturing processes within a computer-integrated environment. CO-3: Develop the ability to select and integrate appropriate hardware and software components to implement a computer-integrated manufacturing system, considering factors such as cost, efficiency, and compatibility. CO-4: Employ advanced techniques and methodologies for the planning, scheduling, and control of manufacturing operations within a computer-integrated framework, with an emphasis on optimizing productivity and minimizing production costs. CO-5: Demonstrate proficiency in troubleshooting, maintaining, and optimizing computer-integrated manufacturing systems, utilizing diagnostic tools and techniques to identify and resolve issues that may arise during system operation.
MSE -412	Production Planning and Control	CO-1: Evaluate and apply various production planning and control techniques to optimize manufacturing operations and achieve efficient resource utilization in a manufacturing system. CO-2: Analyze and design production planning systems, including material requirement planning (MRP), capacity planning, and scheduling, to ensure timely production and delivery of goods while minimizing costs and meeting customer demands. CO-3: Develop strategies for inventory management, including inventory control models and techniques, to minimize inventory carrying costs, reduce stockouts, and

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		improve overall supply chain performance. CO-4: Apply principles of lean manufacturing and just-in-time (JIT) production to eliminate waste, reduce lead times, and improve production efficiency in a manufacturing environment. CO-5: Utilize appropriate software tools and techniques for production planning and control, such as enterprise resource planning (ERP) systems and simulation software, to model, analyze, and optimize manufacturing processes and make informed decisions for process improvement.
MSE -413	**Advanced Manufacturing Processes**	CO-1: Apply advanced manufacturing techniques and processes to optimize production systems. CO-2: Analyze and evaluate the performance of advanced manufacturing processes in terms of productivity, quality, and cost-effectiveness. CO-3: Design and implement efficient manufacturing strategies using advanced techniques such as automation, robotics, and computer-integrated manufacturing. CO-4: Evaluate and select appropriate materials and technologies for advanced manufacturing processes based on their characteristics and suitability for specific applications. CO-5: Develop innovative solutions to overcome challenges and improve the efficiency and sustainability of advanced manufacturing processes in a global context.
MSE -414	**Industrial Robotics**	CO-1: Analyze and evaluate the principles and concepts of industrial robotics in the context of manufacturing system engineering. CO-2: Design and develop robotic systems for industrial applications, considering factors such as task requirements, workspace limitations, safety measures, and productivity enhancement. CO-3: Apply knowledge of sensors, actuators, and control systems to program and operate industrial robots effectively, ensuring accurate and precise movement, task execution, and error handling. CO-4: Evaluate the performance and efficiency of industrial

		robotic systems by conducting experiments, analyzing data, and implementing improvements to optimize productivity and quality in manufacturing processes. CO-5: Demonstrate effective communication and collaboration skills to work as a team member or leader in industrial robotics projects, considering ethical, economic, and environmental aspects of robotic applications in the manufacturing industry.
MSE -513	**Industrial Inspection and Non Destructive Testing**	CO-1: Apply principles and techniques of industrial inspection and non-destructive testing to identify and evaluate defects, discontinuities, and other anomalies in manufacturing processes and components. CO-2: Analyze and interpret inspection and testing data, including visual inspection results, radiographic images, ultrasonic scans, and magnetic particle testing, to assess the quality and integrity of materials and products. CO-3: Demonstrate proficiency in utilizing advanced non-destructive testing methods, such as eddy current testing, liquid penetrant testing, and thermography, for the detection and characterization of flaws and irregularities in industrial components. CO-4: Develop and implement effective inspection and testing procedures, considering factors such as material properties, test equipment, safety protocols, and regulatory requirements, to ensure compliance with industry standards and specifications. CO-5: Design and evaluate inspection plans and quality control systems, incorporating statistical analysis techniques and reliability assessment methods, to enhance the reliability and efficiency of industrial inspection processes and contribute to continuous improvement initiatives in manufacturing systems.
MSE -421	**Product Design and Development**	CO-1: Evaluate and analyze product design requirements and develop innovative solutions to meet the specified objectives and customer needs within the context of manufacturing system engineering. CO-2: Apply advanced techniques and tools for concept generation, selection, and embodiment design to develop robust and feasible product designs that consider factors such as manufacturability, cost-effectiveness, and

		sustainability. CO-3: Demonstrate proficiency in utilizing computer-aided design (CAD) software and other relevant tools to create virtual models, perform simulations, and evaluate the performance and functionality of product designs. CO-4: Plan and execute systematic product development processes, including prototyping, testing, and validation, to ensure the realization of high-quality and reliable products that meet the desired specifications and standards. CO-5: Apply effective project management principles and practices to coordinate cross-functional teams, communicate design requirements, and successfully navigate the product development lifecycle, considering factors such as time, cost, resources, and risk mitigation.
MSE -422	**Mechatronics**	CO-1: Demonstrate proficiency in analyzing and designing mechatronic systems by integrating knowledge from mechanical engineering, electrical engineering, and computer science. CO-2: Apply principles of control systems and automation to design, develop, and optimize advanced mechatronic systems for industrial applications. CO-3: Evaluate the performance of mechatronic systems through the application of mathematical modeling, simulation, and experimental techniques. CO-4: Develop a comprehensive understanding of sensor and actuator technologies, their selection criteria, and their integration into mechatronic systems. CO-5: Apply principles of artificial intelligence and machine learning to enhance the intelligence and autonomy of mechatronic systems for improved decision-making and functionality.
MSE -423	**Maintenance and Reliability Engineering**	CO-1: Analyze and evaluate the principles and concepts of maintenance and reliability engineering to enhance the performance and longevity of manufacturing systems. CO-2: Apply advanced techniques and methodologies for predicting and preventing equipment failures, ensuring optimal reliability and availability in manufacturing systems.

		CO-3: Design and implement effective maintenance strategies, including preventive, corrective, and predictive maintenance, to minimize downtime and maximize the overall equipment effectiveness (OEE) of manufacturing systems. CO-4: Develop skills to analyze and optimize maintenance processes, such as spare parts management, maintenance scheduling, and resource allocation, to improve the efficiency and cost-effectiveness of maintenance operations in manufacturing systems. CO-5: Demonstrate proficiency in utilizing modern tools and technologies, such as condition monitoring systems, reliability-centered maintenance (RCM) software, and failure analysis techniques, to facilitate data-driven decision-making and continuous improvement in maintenance and reliability engineering within manufacturing systems.
MSE -424	**Materials Management**	CO-1: Evaluate different materials management strategies and their impact on manufacturing system efficiency and overall cost reduction. CO-2: Analyze and apply principles of inventory management to optimize stock levels, minimize carrying costs, and ensure uninterrupted production flow. CO-3: Design effective procurement and sourcing strategies to ensure timely and cost-effective acquisition of materials, while maintaining quality standards. CO-4: Apply concepts of supply chain management to streamline material flows, coordinate with suppliers, and enhance overall supply chain performance. CO-5: Develop and implement effective material handling and storage systems, considering factors such as space utilization, material handling equipment, and safety regulations.
MSE -431	**Total Quality Management**	CO-1: Analyze the principles and concepts of Total Quality Management (TQM) to evaluate and improve the overall performance of manufacturing systems. CO-2: Apply statistical process control techniques to monitor and control the quality of manufacturing processes and identify areas for improvement.

		CO-3: Design and implement effective quality management systems, including quality assurance and quality control measures, to enhance the efficiency and effectiveness of manufacturing operations. CO-4: Evaluate and select appropriate tools and methodologies for quality improvement, such as Six Sigma, Lean Manufacturing, and Kaizen, to optimize manufacturing processes and achieve higher levels of customer satisfaction. CO-5: Demonstrate the ability to lead and manage teams effectively in implementing TQM principles and practices, fostering a culture of continuous improvement in a manufacturing environment.
MSE -432	**Design of Experiments & Research Methodology**	CO-1: Apply principles of experimental design and research methodology to design and conduct effective experiments in the field of manufacturing system engineering. CO-2: Analyze and interpret experimental data using appropriate statistical techniques to draw meaningful conclusions and make informed decisions in the context of manufacturing system engineering. CO-3: Evaluate and select appropriate research methodologies, tools, and techniques for conducting scientific investigations and problem-solving in manufacturing system engineering. CO-4: Design and develop research proposals, including defining research objectives, formulating research questions, and identifying suitable data collection methods, in the domain of manufacturing system engineering. CO-5: Demonstrate effective communication skills by presenting research findings and experimental results through written reports, oral presentations, and visual representations in a clear and concise manner, following ethical and professional standards.
MSE -433	**Seminar**	CO-1: Demonstrate advanced knowledge and understanding of the principles and concepts of manufacturing systems engineering. CO-2: Apply critical thinking and problem-solving skills to analyze complex manufacturing system issues and propose

		effective solutions. CO-3: Evaluate and select appropriate manufacturing technologies, processes, and methodologies to optimize productivity and enhance quality in manufacturing systems. CO-4: Develop proficiency in using advanced tools, techniques, and software applications for modeling, simulation, and optimization of manufacturing systems. CO-5: Communicate effectively, both orally and in writing, with technical and non-technical audiences on manufacturing system engineering topics, demonstrating professionalism and clarity of thought.
MSE -434	**Minor Project**	CO-1: Apply advanced principles of manufacturing system engineering to analyze and solve real-world problems in the field. CO-2: Design and implement innovative manufacturing system solutions by integrating relevant technologies, processes, and tools. CO-3: Demonstrate proficiency in utilizing software applications and simulation tools to optimize manufacturing processes and improve productivity. CO-4: Communicate effectively through written reports and oral presentations to convey complex manufacturing system engineering concepts and project outcomes. CO-5: Collaborate in multidisciplinary teams to plan, execute, and evaluate minor projects in manufacturing system engineering, considering economic, environmental, and ethical aspects.
MSE -441	**Dissertation**	CO-1: Demonstrate an in-depth understanding of advanced manufacturing principles and concepts, and apply them to analyze and solve complex problems in manufacturing system engineering. CO-2: Critically evaluate and select appropriate manufacturing technologies, processes, and systems to optimize production efficiency, quality, and cost-effectiveness. CO-3: Design and implement innovative strategies for the integration of advanced automation and robotics in

		manufacturing systems to enhance productivity and competitiveness. CO-4: Apply advanced mathematical modeling and simulation techniques to analyze and optimize manufacturing processes, including production planning, scheduling, inventory management, and supply chain optimization. CO-5: Conduct comprehensive research, develop a well-structured dissertation, and effectively communicate research findings and recommendations to a professional audience in the field of manufacturing system engineering.

MEWAR UNIVERSITY

Department of Mechanical Engineering

Program Outcomes (POs) of M.Tech. Thermal Engineering:

1. **Engineering Knowledge (PO1):** Apply advanced knowledge of thermal engineering principles, mathematics, science, and specialized expertise to solve complex problems in the field of heat transfer and energy conversion.
2. **Problem Analysis (PO2):** Identify, formulate, and analyze intricate thermal engineering problems, utilizing advanced principles from engineering, mathematics, and heat and mass transfer to reach well-founded conclusions.
3. **Design and Development of Solutions (PO3):** Design innovative solutions for complex thermal challenges, including heat exchangers, energy systems, and thermal management, while considering safety, environmental impact, and societal needs.
4. **Investigations of Complex Problems (PO4):** Employ advanced research methods, experimental techniques, and computational tools to investigate and provide valid insights into complex thermal phenomena and energy conversion processes.
5. **Modern Tool Usage (PO5):** Utilize advanced simulation software, computational methods, and experimental setups to analyze and predict thermal behavior in various engineering applications.
6. **Engineer and Society (PO6):** Evaluate ethical, societal, environmental, and economic dimensions of thermal engineering solutions, considering contextual factors and fulfilling professional responsibilities.
7. **Environment and Sustainability (PO7):** Recognize the impact of thermal engineering solutions on the environment, and demonstrate a commitment to sustainable practices in energy utilization and conservation.
8. **Ethics (PO8):** Demonstrate adherence to ethical principles and professional norms in thermal engineering practices, ensuring integrity and accountability in decision-making.
9. **Individual and Team Work (PO9):** Collaborate effectively in multidisciplinary teams, adapting to various roles, and contributing constructively in the development and implementation of thermal systems.
10. **Communication (PO10):** Communicate proficiently about complex thermal engineering concepts to technical and non-technical audiences, using diverse communication channels effectively.

11. **Project Management and Finance (PO11):** Apply engineering and management principles to lead and contribute to projects involving thermal systems design, energy management, and optimization.
12. **Life-long Learning (PO12):** Recognize the need for continuous learning and professional development in the dynamic field of thermal engineering, staying updated with evolving technologies and practices.

MEWAR UNIVERSITY

Department of Mechanical Engineering

Program Specific Outcomes (PSOs) of M.Tech. Thermal Engineering:

1. **PSO-1:** Develop advanced heat transfer solutions and thermal management strategies for industrial applications, focusing on efficiency enhancement and thermal optimization.
2. **PSO-2:** Design, analyze, and optimize energy conversion systems, such as power plants and renewable energy systems, incorporating advanced thermodynamics principles and technologies.
3. **PSO-3:** Apply computational fluid dynamics (CFD) and numerical methods to simulate and analyze complex thermal and fluid flow phenomena in various engineering scenarios.

M TECH IN THERMAL ENGINEERING

Course Code	Course Title	Course Outcomes
TE-411	Applied Mathematics	CO-1: Apply mathematical techniques to model and analyze thermal engineering systems, including heat transfer, fluid mechanics, and thermodynamics, to solve complex engineering problems. CO-2: Utilize advanced numerical methods, such as finite element analysis, . computational fluid dynamics, and optimization techniques, to simulate and predict the behavior of thermal engineering systems. CO-3: Develop mathematical models to optimize energy utilization and efficiency in thermal engineering processes, taking into account various constraints and operational parameters. CO-4: Apply mathematical tools and statistical methods to analyze experimental data, interpret results, and draw conclusions in the context of thermal engineering research and development. CO-5: Use mathematical modeling and analysis to design and evaluate thermal control systems, such as HVAC (heating, ventilation, and air conditioning) systems, heat exchangers, and power generation systems, with an emphasis on energy conservation and environmental sustainability.
TE -412	Computational Methods in Fluid flow and Heat transfer	CO-1: Analyze and apply numerical methods to solve complex fluid flow and heat transfer problems encountered in thermal engineering. CO-2: Develop computational models and algorithms to simulate fluid flow and heat transfer phenomena, considering different boundary conditions and physical properties. CO-3: Evaluate and interpret the results obtained from computational simulations and identify the limitations and accuracy of the computational methods used. CO-4: Design and optimize thermal systems using computational tools, taking into account factors such as efficiency, heat transfer rates, and fluid flow

		characteristics. CO-5: Apply computational methods to investigate and solve practical problems related to fluid flow and heat transfer in various engineering applications, including thermal power plants, heat exchangers, and HVAC systems.
TE -413	**Analysis of Thermal Power Cycles**	CO-1: Analyze the fundamental principles and thermodynamic concepts underlying various thermal power cycles. CO-2: Apply advanced techniques to evaluate the performance parameters of thermal power cycles, such as thermal efficiency, work output, and heat transfer rates. CO-3: Demonstrate the ability to identify and analyze the factors affecting the efficiency of thermal power cycles, including irreversibilities, pressure drops, and heat losses. CO-4: Design and optimize thermal power cycles by considering various parameters, such as working fluid selection, component sizing, and cycle configurations. CO-5: Evaluate the environmental impact of thermal power cycles and propose strategies for mitigating emissions and improving overall sustainability in the context of thermal power plant operations.
TE -414	**Solar Energy**	CO-1: Analyze and evaluate the principles and theories underlying solar energy conversion, including photovoltaic and solar thermal technologies, within the context of M.Tech Thermal Engineering program at Mewar University. CO-2: Apply advanced mathematical and computational methods to model and simulate solar energy systems, enabling the prediction of their performance and optimization of their design. CO-3: Design and integrate solar energy systems into various applications, such as power generation, heating, cooling, and water desalination, while considering the technical, economic, and environmental aspects. CO-4: Assess the potential and feasibility of solar energy projects by conducting site surveys, resource assessments, and techno-economic analyses, considering factors like

		solar radiation, land availability, and regulatory requirements. CO-5: Develop and implement innovative strategies to enhance the efficiency, reliability, and sustainability of solar energy systems, including the integration of energy storage, intelligent controls, and grid integration techniques.
TE -511-	**Materials Management**	CO-1: Evaluate different materials management strategies and their impact on manufacturing system efficiency and overall cost reduction. CO-2: Analyze and apply principles of inventory management to optimize stock levels, minimize carrying costs, and ensure uninterrupted production flow. CO-3: Design effective procurement and sourcing strategies to ensure timely and cost-effective acquisition of materials, while maintaining quality standards. CO-4: Apply concepts of supply chain management to streamline material flows, coordinate with suppliers, and enhance overall supply chain performance. CO-5: Develop and implement effective material handling and storage systems, considering factors such as space utilization, material handling equipment, and safety regulations.
TE -421	**Advanced Fluid Mechanics**	CO-1: Apply the principles of advanced fluid mechanics to analyze and solve complex fluid flow problems encountered in thermal engineering systems. CO-2: Evaluate the performance and characteristics of various types of fluid machinery and devices, such as pumps, turbines, and compressors, using advanced fluid mechanics principles. CO-3: Design and optimize fluid flow systems by applying advanced fluid mechanics concepts, including boundary layer theory, flow separation, and fluid dynamics in pipes and channels. CO-4: Analyze and predict the behavior of fluids under different flow conditions, including steady and unsteady flows, laminar and turbulent flows, and compressible and incompressible flows, using advanced mathematical

		models and numerical methods. CO-5: Apply computational fluid dynamics (CFD) techniques and software tools to simulate and analyze complex fluid flow phenomena in thermal engineering applications, and interpret and communicate the results effectively.
TE -422	**I C Engine Theory and Performance**	CO-1: Analyze the fundamental principles and concepts of internal combustion engines, including thermodynamics, combustion processes, and engine cycles. CO-2: Evaluate the performance characteristics of internal combustion engines, including power output, fuel consumption, and emissions, using appropriate measurement and analysis techniques. CO-3: Design and optimize engine systems by applying advanced knowledge of combustion, fuel injection, air intake, and exhaust systems to improve engine performance, efficiency, and emissions. CO-4: Apply computational tools and simulation techniques to model and analyze the behavior of internal combustion engines, predicting their performance under different operating conditions and optimizing engine design parameters. CO-5: Develop critical thinking and problem-solving skills to identify and resolve challenges related to internal combustion engines, such as engine knocking, emissions control, and fuel efficiency improvement, while considering environmental and regulatory aspects.
TE -423	**Turbo machines**	CO-1: Analyze the fundamental principles and operational characteristics of turbo machines used in thermal engineering, including turbines and compressors. CO-2: Apply advanced techniques and methods to assess the performance and efficiency of turbo machines, considering factors such as thermodynamics, fluid dynamics, and system integration. CO-3: Design and optimize turbo machine components, such as blades, vanes, and impellers, while considering factors like material selection, manufacturing processes, and performance requirements.

		CO-4: Develop the ability to troubleshoot and diagnose operational issues in turbo machines, identifying potential causes and proposing effective solutions to improve performance and reliability. CO-5: Demonstrate proficiency in the application of computational tools and simulation software to model, analyze, and predict the behavior of turbo machines, allowing for the evaluation of different design options and performance enhancements.
TE -424	**Non Conventional Energy Systems**	CO-1: Evaluate the principles and applications of non-conventional energy systems in the field of thermal engineering. CO-2: Analyze and design renewable energy conversion systems, such as solar thermal, geothermal, and wind power systems, to meet specific energy requirements. CO-3: Apply advanced computational tools and techniques to model and simulate the performance of non-conventional energy systems, considering various operating conditions and constraints. CO-4: Develop innovative solutions for improving the efficiency, reliability, and sustainability of non-conventional energy systems, while considering economic and environmental factors. CO-5: Critically assess the social, economic, and environmental impacts of non-conventional energy systems, and propose strategies for their integration into the existing energy infrastructure for a sustainable future.
TE -523	**Thermal and Nuclear Power Plants**	CO-1: Analyze the fundamental principles and working mechanisms of thermal and nuclear power plants in the context of Mewar University's M.Tech Thermal Engineering Program. CO-2: Evaluate the performance and efficiency of thermal and nuclear power plants, considering factors such as heat transfer, thermodynamics, and fluid mechanics. CO-3: Design and optimize components and systems used in thermal and nuclear power plants, incorporating knowledge of materials, energy conversion processes, and safety considerations.

		CO-4: Apply advanced computational tools and simulation techniques to model and analyze the behavior of thermal and nuclear power plants, enabling accurate prediction of their performance and behavior. CO-5: Develop sustainable and innovative solutions for improving the efficiency, reliability, and environmental impact of thermal and nuclear power plants, considering emerging technologies and regulatory requirements in the field.
TE -431	**Air Conditioning Systems**	CO-1: Analyze and evaluate the principles and fundamental concepts of air conditioning systems in terms of thermodynamics, heat transfer, and fluid mechanics. CO-2: Design and select appropriate components for air conditioning systems, considering factors such as load calculations, psychrometry, duct design, and equipment selection. CO-3: Apply advanced techniques and tools to model, simulate, and optimize air conditioning systems for improved performance, energy efficiency, and sustainability. CO-4: Demonstrate proficiency in installing, commissioning, and maintaining air conditioning systems, ensuring compliance with industry standards, safety regulations, and environmental considerations. CO-5: Evaluate and troubleshoot air conditioning systems, identify potential issues, and implement effective solutions to enhance system performance, indoor air quality, and occupant comfort.
TE -432	**Design of Thermal Systems**	CO-1: Apply advanced principles of thermodynamics and heat transfer to design and analyze thermal systems, demonstrating proficiency in the use of relevant mathematical and computational tools. CO-2: Evaluate and select appropriate components and materials for the efficient functioning of thermal systems, taking into account factors such as durability, cost-effectiveness, environmental impact, and safety. CO-3: Design and optimize thermal systems by considering various parameters, constraints, and performance criteria, while incorporating innovative and sustainable solutions to

		enhance energy efficiency and reduce environmental impact. CO-4: Develop skills in modeling, simulation, and experimentation to assess the performance of thermal systems, interpret and analyze experimental data, and validate theoretical predictions with practical results. CO-5: Communicate effectively and professionally through written reports, oral presentations, and visual aids, showcasing the ability to articulate and justify design choices, system performance, and recommendations for improvement in thermal systems.
TE -433	**Seminar**	CO-1: Apply advanced principles of thermal engineering to analyze and design efficient energy systems and components. CO-2: Evaluate the performance of various heat transfer mechanisms and apply appropriate techniques to enhance thermal energy transfer in practical engineering applications. CO-3: Analyze and model complex thermodynamic systems to optimize their efficiency and sustainability, taking into consideration the economic, environmental, and social aspects. CO-4: Develop proficiency in utilizing advanced computational tools and software to simulate and analyze thermal processes, enabling effective problem-solving and design optimization. CO-5: Demonstrate effective communication and teamwork skills to collaborate with multidisciplinary teams, present technical information, and engage in professional discussions within the field of thermal engineering.
TE -434	**Minor Project**	CO-1: Analyze and apply fundamental principles of thermal engineering to identify and solve complex engineering problems encountered in the minor project. CO-2: Design, simulate, and optimize thermal systems using advanced computational tools, taking into consideration various factors, such as heat transfer, fluid mechanics, thermodynamics, and energy efficiency.

		CO-3: Demonstrate proficiency in conducting experimental investigations related to thermal engineering, including data collection, analysis, interpretation, and drawing conclusions to validate theoretical concepts. CO-4: Develop innovative solutions and propose feasible design modifications to enhance the performance, reliability, and sustainability of thermal systems, considering economic and environmental factors. CO-5: Effectively communicate technical information related to the minor project, both in written and oral forms, employing appropriate engineering terminology and using relevant graphical representation techniques to convey ideas and results clearly to diverse stakeholders.
TE -441	**Dissertation**	CO-1: Evaluate and analyze advanced principles and concepts in thermal engineering, demonstrating a comprehensive understanding of heat transfer, thermodynamics, and fluid mechanics. CO-2: Design and develop innovative solutions to complex thermal engineering problems, incorporating knowledge of energy systems, power generation, and renewable energy technologies. CO-3: Apply advanced computational tools and simulation techniques to model and optimize thermal systems, demonstrating proficiency in software packages commonly used in the field. CO-4: Conduct independent research in thermal engineering, including data collection, analysis, and interpretation, to address real-world challenges and contribute to the existing body of knowledge in the field. CO-5: Communicate effectively through written reports, technical presentations, and documentation of research findings, adhering to professional and ethical standards, while demonstrating the ability to work collaboratively in multidisciplinary teams.

MEWAR UNIVERSITY

Department of Mechanical Engineering

Program Outcomes (POs) of M.Tech. Production Engineering:

1. **Engineering Knowledge (PO1):** Apply advanced knowledge of production engineering principles, mathematics, science, and specialized expertise to address complex challenges in manufacturing and production processes.
2. **Problem Analysis (PO2):** Identify, formulate, and analyze intricate production engineering problems, integrating advanced concepts from engineering, mathematics, and manufacturing sciences to arrive at well-supported conclusions.
3. **Design and Development of Solutions (PO3):** Devise innovative solutions for complex production challenges, encompassing product design, manufacturing processes, quality assurance, and optimization, while considering safety, regulations, and environmental aspects.
4. **Investigations of Complex Problems (PO4):** Employ advanced research methodologies, experimental techniques, and data analysis to investigate and provide valid insights into complex production-related issues.
5. **Modern Tool Usage (PO5):** Utilize advanced simulation software, computer-aided design (CAD), and manufacturing tools to analyze, optimize, and model production systems and processes.
6. **Engineer and Society (PO6):** Evaluate ethical, societal, and cultural implications of production engineering solutions, applying contextual understanding to fulfill professional and societal responsibilities.
7. **Environment and Sustainability (PO7):** Recognize the impact of production solutions on the environment and society, integrating principles of sustainability into manufacturing practices.
8. **Ethics (PO8):** Demonstrate adherence to ethical principles and professional norms in production engineering practices, ensuring integrity and social responsibility in decision-making.
9. **Individual and Team Work (PO9):** Collaborate effectively in multidisciplinary teams, adapting to various roles, and contributing constructively in the design, development, and management of production systems.

10. **Communication (PO10):** Communicate proficiently about complex production engineering concepts to technical and non-technical audiences, using various communication methods and platforms.
11. **Project Management and Finance (PO11):** Apply engineering and management principles to lead projects related to production engineering, resource management, and process optimization.
12. **Life-long Learning (PO12):** Recognize the need for continuous learning and professional development in the ever-evolving field of production engineering, adapting to emerging technologies and practices.

MEWAR UNIVERSITY

Department of Mechanical Engineering

Program Specific Outcomes (PSOs) of M.Tech. Production Engineering:

1. **PSO-1:** Design and optimize manufacturing processes and systems by integrating advanced manufacturing technologies and methodologies, enhancing productivity, quality, and efficiency.
2. **PSO-2:** Develop expertise in automation, robotics, and digital manufacturing to design adaptive and efficient production systems in alignment with Industry 4.0 standards.
3. **PSO-3:** Analyze and improve supply chain and logistics operations within manufacturing environments, employing advanced techniques to enhance efficiency and sustainability.

M TECH IN PRODUCTION ENGINEERING

Course Code	Course Title	Course Outcomes
PE-411	Theory Of Metal Cutting	CO-1: Analyze the principles of metal cutting to comprehend the underlying mechanisms and phenomena involved in the process. CO-2: Evaluate the different types of cutting tools, their materials, geometries, and coatings, and select appropriate tools for specific machining applications. CO-3: Apply mathematical models and equations to calculate cutting forces, power requirements, and material removal rates for various metal cutting operations. CO-4: Design optimal cutting parameters and machining strategies based on material properties, tool characteristics, and desired machining outcomes. CO-5: Critically analyze and troubleshoot metal cutting processes to identify and rectify common issues such as tool wear, surface finish problems, and dimensional inaccuracies.
PE -412	Quatitative Techniques in Decision Making	CO-1: Apply statistical methods and tools to analyze and interpret data in order to support decision-making processes in production engineering. CO-2: Utilize quantitative techniques such as optimization, simulation, and mathematical modeling to solve complex problems and make informed decisions in production engineering scenarios. CO-3: Develop proficiency in using statistical software packages and programming languages to implement quantitative techniques and analyze data effectively in the context of production engineering. CO-4: Evaluate the reliability and validity of data, identify sources of variation, and apply appropriate statistical techniques to ensure accuracy in decision-making processes within the field of production engineering. CO-5: Demonstrate effective communication and

		presentation skills in conveying quantitative analysis results and recommendations to diverse stakeholders in the production engineering domain, facilitating informed decision-making.
PE -413	**Theory of Metal Forming**	CO-1: Analyze and evaluate the fundamental principles and theories of metal forming processes to predict material behavior and understand the influence of process parameters on the final product. CO-2: Apply mathematical models and computational techniques to simulate metal forming processes, predict deformation behavior, and optimize process parameters to achieve desired product characteristics. CO-3: Design and select appropriate forming tools, dies, and equipment for different metal forming operations, considering factors such as material properties, product specifications, and process requirements. CO-4: Evaluate and compare various metal forming techniques, such as forging, rolling, extrusion, and sheet metal forming, in terms of their advantages, limitations, and applicability to different manufacturing scenarios. CO-5: Investigate and analyze the effects of process variables, such as temperature, strain rate, lubrication, and material properties, on the microstructure and mechanical properties of formed components, and propose strategies for improving product quality and performance through process optimization.
PE -414	**Industrial Robotics**	CO-1: Analyze and evaluate the principles and concepts of industrial robotics in the context of manufacturing system engineering. CO-2: Design and develop robotic systems for industrial applications, considering factors such as task requirements, workspace limitations, safety measures, and productivity enhancement. CO-3: Apply knowledge of sensors, actuators, and control systems to program and operate industrial robots effectively, ensuring accurate and precise movement, task execution, and error handling. CO-4: Evaluate the performance and efficiency of industrial robotic systems by conducting experiments, analyzing data,

		and implementing improvements to optimize productivity and quality in manufacturing processes. CO-5: Demonstrate effective communication and collaboration skills to work as a team member or leader in industrial robotics projects, considering ethical, economic, and environmental aspects of robotic applications in the manufacturing industry.
PE-512	**Materials Management**	CO-1: Evaluate different materials management strategies and their impact on manufacturing system efficiency and overall cost reduction. CO-2: Analyze and apply principles of inventory management to optimize stock levels, minimize carrying costs, and ensure uninterrupted production flow. CO-3: Design effective procurement and sourcing strategies to ensure timely and cost-effective acquisition of materials, while maintaining quality standards. CO-4: Apply concepts of supply chain management to streamline material flows, coordinate with suppliers, and enhance overall supply chain performance. CO-5: Develop and implement effective material handling and storage systems, considering factors such as space utilization, material handling equipment, and safety regulations.
PE -421	**Advanced Joining Processes**	CO-1: Apply advanced joining techniques to join different materials and components for the production of high-quality products. CO-2: Analyze and evaluate the suitability of various joining processes based on material properties, design requirements, and manufacturing constraints. CO-3: Demonstrate proficiency in selecting and implementing appropriate welding, brazing, soldering, and adhesive bonding techniques for specific applications in the production industry.. CO-4: Design and optimize joint configurations and welding parameters to ensure structural integrity, mechanical strength, and durability of the joined components.

		CO-5: Investigate and troubleshoot welding defects and implement corrective measures to improve the quality and reliability of the joined assemblies in industrial settings.
PE -422	**Product Data Management**	CO-1: Apply principles of product data management (PDM) to effectively organize and manage product-related information in the context of production engineering. CO-2: Design and implement robust data structures and databases for storing, retrieving, and updating product data using industry-standard PDM tools and techniques. CO-3: Analyze and evaluate the impact of PDM on product lifecycle management, including product development, manufacturing processes, quality control, and supply chain management. CO-4: Develop strategies for ensuring data integrity, security, and confidentiality in PDM systems, considering legal and ethical implications related to intellectual property rights and data protection. CO-5: Collaborate effectively with cross-functional teams and stakeholders to facilitate seamless data exchange and integration between different systems, fostering efficient communication and decision-making in a production engineering environment.
PE -423	**Finite Element Method**	CO-1: Apply the principles and concepts of finite element method to analyze and solve engineering problems in the field of production engineering. CO-2: Develop proficiency in using finite element analysis software and tools to model and simulate various manufacturing processes, components, and systems. CO-3: Evaluate the performance and behavior of structures, materials, and manufacturing processes through the application of finite element analysis techniques. CO-4: Design and optimize engineering components and systems using finite element analysis, considering factors such as stress distribution, deformation, and failure modes. CO-5: Demonstrate the ability to critically analyze and interpret finite element analysis results, and effectively communicate findings and recommendations to technical and non-technical stakeholders.

PE -424	**Tool Design**	CO-1: Analyze and evaluate the principles of tool design to develop efficient and cost-effective solutions for manufacturing processes in the field of production engineering. CO-2: Apply advanced knowledge of materials, machining processes, and design principles to develop innovative tooling solutions that enhance productivity, quality, and safety in manufacturing operations. CO-3: Design and optimize various types of tools and fixtures, considering factors such as tolerances, fits, clearances, and ergonomic considerations, to ensure precise and reliable performance in production environments. CO-4: Utilize computer-aided design (CAD) and computer-aided manufacturing (CAM) software tools to create and simulate tool designs, enabling the visualization and validation of tool performance before fabrication and implementation. CO-5: Incorporate principles of reliability engineering and maintainability into the tool design process, ensuring the longevity, maintainability, and ease of repair of the developed tools, thereby minimizing downtime and enhancing overall productivity.
PE -521	**Smart Materials And Structure**	CO-1: Analyze the fundamental principles and characteristics of smart materials and structures used in production engineering applications. CO-2: Evaluate the design and manufacturing processes involved in developing smart materials and structures for industrial applications. CO-3: Apply advanced techniques and tools to investigate the mechanical, electrical, and thermal properties of smart materials and structures. CO-4: Design innovative solutions that incorporate smart materials and structures to enhance the performance and functionality of production systems. CO-5: Evaluate the economic and environmental impacts of implementing smart materials and structures in production engineering, and propose sustainable strategies for their utilization.

PE -425	**Computer Integrated Manufacturing & Automation**	CO-1: Apply principles of computer-integrated manufacturing (CIM) to optimize production processes and improve overall productivity in manufacturing industries. CO-2: Analyze and design automated systems for manufacturing operations, incorporating robotics, sensors, and advanced control techniques to enhance efficiency and accuracy. CO-3: Evaluate and integrate computer-aided design (CAD), computer-aided manufacturing (CAM), and computer-aided engineering (CAE) tools to facilitate seamless product development and production. CO-4: Implement and manage data-driven decision-making processes using real-time monitoring, data analysis, and visualization techniques to optimize production performance and quality control. CO-5: Demonstrate proficiency in the use of industrial automation systems and technologies, such as programmable logic controllers (PLCs), human-machine interfaces (HMIs), and supervisory control and data acquisition (SCADA) systems, to automate manufacturing processes and ensure smooth operations.
PE -431	**Computer Integrated Manufacturing Systems**	CO-1: Demonstrate proficiency in utilizing computer-aided design (CAD) and computer-aided manufacturing (CAM) software to develop and optimize manufacturing processes in a computer-integrated manufacturing (CIM) environment. CO-2: Apply advanced techniques and strategies for the integration of various manufacturing systems, such as robotics, programmable logic controllers (PLCs), and computer numerical control (CNC) machines, to enhance productivity and efficiency in a CIM setting. CO-3: Analyze and evaluate the performance of computer-integrated manufacturing systems, including their components, subsystems, and interfaces, and propose appropriate improvements for enhanced productivity and quality. CO-4: Design and implement automated material handling systems and logistics processes within a computer-integrated manufacturing framework, considering factors such as inventory management, supply chain integration, and lean manufacturing principles.

		CO-5: Apply principles of quality control and assurance to monitor and control manufacturing processes within a computer-integrated environment, ensuring compliance with industry standards and specifications, and implementing corrective measures to minimize defects and optimize product quality.
PE -432	**Production Planning and Control**	CO-1: Analyze and evaluate various production planning and control techniques and their application in different manufacturing environments. CO-2: Design effective production schedules and develop strategies for optimizing resource allocation in order to enhance productivity and minimize production costs. CO-3: Apply principles of capacity planning, material requirement planning, and inventory management to effectively manage production processes and ensure timely delivery of products. CO-4: Utilize advanced software tools and techniques for production planning and control, including computer-aided manufacturing (CAM) systems and enterprise resource planning (ERP) software. CO-5: Assess the performance of production systems, identify bottlenecks, and propose improvements to enhance overall efficiency and quality in production operations.
PE -433	**Seminar**	CO-1: Identify and analyze advanced production engineering concepts and techniques: Upon completion of the seminar, students will be able to identify and critically analyze advanced concepts and techniques in the field of production engineering, demonstrating a deep understanding of their applications and implications. CO-2: Evaluate emerging trends and technologies in production engineering: Students will be able to evaluate and assess the latest trends and technologies in production engineering, including Industry 4.0, smart manufacturing, automation, and advanced materials, and understand their potential impact on the industry. CO-3: Apply problem-solving skills to optimize production processes: Through the seminar, students will develop problem-solving skills and be able to apply them to optimize production processes, considering factors such as

		efficiency, productivity, quality, cost-effectiveness, and sustainability. CO-4: Design and develop innovative production systems: Upon completion of the seminar, students will possess the ability to design and develop innovative production systems, incorporating principles of lean manufacturing, agile methodologies, and advanced planning and scheduling techniques. CO-5: Communicate and collaborate effectively in interdisciplinary production engineering teams: Students will enhance their communication and collaboration skills by actively participating in interdisciplinary production engineering teams, effectively conveying their ideas, and working together towards achieving common goals..
PE -434	**Minor Project**	CO-1: Identify and analyze the problem statement for the minor project in the field of production engineering, demonstrating a comprehensive understanding of the project requirements and objectives. CO-2: Apply advanced production engineering principles and techniques to develop innovative solutions for the identified problem, integrating theoretical knowledge with practical applications. CO-3: Design and implement an effective project plan, including data collection, experimentation, analysis, and interpretation, using appropriate tools and methodologies in the field of production engineering. CO-4: Evaluate and critically assess the outcomes of the minor project, considering factors such as feasibility, efficiency, effectiveness, and sustainability, while addressing the identified problem statement. CO-5: Communicate the research findings, project outcomes, and recommendations effectively through comprehensive project reports, presentations, and technical discussions, adhering to professional standards in production engineering.
PE -441	**Dissertation**	CO-1: Evaluate and analyze advanced manufacturing processes and technologies in the field of production engineering to identify opportunities for improvement and optimization.

		CO-2: Design and develop innovative strategies for production planning and control, considering factors such as resource allocation, scheduling, and quality management, to enhance productivity and efficiency in manufacturing operations. CO-3: Apply statistical and optimization techniques to analyze and interpret data related to production systems, enabling informed decision-making and process improvement. CO-4: Develop and implement sustainable manufacturing practices, including waste reduction, energy efficiency, and environmentally conscious production methods, to promote a greener and more sustainable approach to production engineering. CO-5: Demonstrate effective communication and teamwork skills, as well as professional ethics, in effectively presenting research findings, collaborating with interdisciplinary teams, and addressing ethical challenges in the field of production engineering.

MEWAR UNIVERSITY

Department of Mechanical Engineering

Program Outcomes (POs) of B.Tech. Mechanical Engineering:

1. **Engineering Knowledge (PO1):** Apply a deep understanding of mathematics, science, engineering fundamentals, and specialized knowledge to solve complex engineering challenges.
2. **Problem Analysis (PO2):** Identify, formulate, and analyze intricate engineering problems using foundational principles of mathematics, natural sciences, and engineering sciences, while drawing conclusions supported by research.
3. **Design and Development of Solutions (PO3):** Devise solutions for complex engineering problems and design components or processes that meet specific requirements, considering safety, public health, culture, society, and the environment.
4. **Investigations of Complex Problems (PO4):** Employ research-based knowledge and methods, including experimental design, data analysis, and information synthesis, to draw valid conclusions from complex issues.
5. **Modern Tool Usage (PO5):** Utilize appropriate techniques, resources, modern engineering tools, and IT tools to engage in complex engineering tasks, understanding their limitations.
6. **Engineer and Society (PO6):** Evaluate societal, health, safety, legal, and cultural factors, applying contextual knowledge to address relevant responsibilities in professional engineering practice.
7. **Environment and Sustainability (PO7):** Grasp the impact of engineering solutions on society and the environment, demonstrating an awareness of and commitment to sustainable development.
8. **Ethics (PO8):** Apply ethical principles and uphold professional ethics, responsibilities, and norms in engineering practice.
9. **Individual and Team Work (PO9):** Collaborate effectively in diverse teams, whether as a leader or a member, in multidisciplinary settings.
10. **Communication (PO10):** Communicate proficiently about complex engineering activities with the engineering community and the wider society. This includes creating clear reports, design documents, presentations, and instructions.

11. **Project Management and Finance (PO11):** Apply engineering and management principles to lead or participate in teams, manage projects, and navigate multidisciplinary environments.
12. **Life-long Learning (PO12):** Recognize the need for continuous self-directed learning and adaptability in the face of technological advancements.

MEWAR UNIVERSITY

Department of Mechanical Engineering

Program Specific Outcomes (PSOs) of B.Tech. Mechanical Engineering:

1. **PSO-1:** Innovate and implement novel ideas for product design and development, utilizing modern computer-aided tools while adhering to best manufacturing practices.
2. **PSO-2:** Apply engineering knowledge, design, and analysis tools to solve problems in the domains of thermal and fluid mechanics.
3. **PSO-3:** Develop composite materials, manufacturing processes, and products safely, efficiently, and cost-effectively.

MEWAR UNIVERSITY
DEPARTMENT OF MECHANICAL ENGINEERING
COURSE OUTCOMES

B. TECH. IN MECHANICAL ENGINEERING

Course Code	Course Title	Course Outcomes
BSC-107	Mathematics-III	CO-1: Apply advanced mathematical techniques to solve engineering problems in the field of mechanical engineering. CO-2: Analyze and interpret mathematical models to understand and predict mechanical systems and processes. CO-3: Demonstrate proficiency in mathematical tools and methods used in engineering analysis and design. CO-4: Apply mathematical principles and techniques to optimize mechanical systems and processes. CO-5: Communicate mathematical concepts and solutions effectively in both written and oral forms, using appropriate mathematical language and notation.
BSC-108	Biology for Engineers	CO-1: Analyze and interpret the fundamental principles and concepts of biology to comprehend the biological systems relevant to engineering applications. CO-2: Apply knowledge of biological processes and systems to solve engineering problems in fields such as biotechnology, bioinformatics, biomedical engineering, and environmental engineering. CO-3: Demonstrate an understanding of the relationship between biology and engineering disciplines, and effectively communicate and collaborate with professionals from both fields to develop innovative solutions. CO-4: Evaluate the ethical and societal implications of engineering practices related to biology, and demonstrate a responsible and sustainable approach towards the use of biological resources in engineering applications. CO-5: Design and conduct experiments, analyze data, and apply statistical methods to investigate and solve engineering problems related to biological systems, demonstrating proficiency in laboratory techniques and instrumentation commonly used in biological research and engineering practices.

PCC-ME201	**Thermodynamics**	CO-1: Understand fundamental thermodynamics concepts, including systems, control volumes, and thermodynamic equilibrium, for analyzing energy interactions in various engineering systems. CO-2: Apply the Zeroth and First Laws of Thermodynamics to analyze steady and unsteady flow processes. CO-3: Utilize the Second Law of Thermodynamics and its applications in energy conversion processes, heat engines, and refrigeration cycles. CO-4: Apply thermodynamic relations to solve engineering problems related to availability, irreversibility, and other thermodynamic processes. CO-5: Analyze properties of steam and the Rankine cycle, as well as air-water vapor mixtures and psychrometric processes.
PCC-ME202	**Strength of Materials**	CO-1: Apply the principles of strength of materials to analyze and determine the stress, strain, and deformation behavior of engineering structures and components. CO-2: Utilize appropriate mathematical models and calculations to predict the strength and stability of structural elements under different loading conditions. CO-3: Design and select materials based on their mechanical properties to ensure the safe and efficient operation of mechanical systems and structures. CO-4: Evaluate and interpret experimental data obtained from various testing methods to assess the mechanical behavior and performance of materials and structures. CO-5: Apply theoretical concepts and engineering principles to solve real-world engineering problems related to the strength and structural integrity of mechanical components and systems.
PCC-ME203	**Materials Engineering**	CO-1: Apply principles of materials science and engineering to analyze and design mechanical components and systems. CO-2: Evaluate the mechanical properties of different materials and select appropriate materials for specific engineering applications. CO-3: Demonstrate proficiency in various manufacturing processes and techniques used for shaping and forming different materials. CO-4: Design and conduct experiments to investigate

		the behavior of materials under different loading conditions and analyze the results to make informed engineering decisions. CO-5: Develop an understanding of the relationship between materials structure, properties, and performance. and apply this knowledge to solve engineering problems related to materials selection, processing, and performance.
PCC-ME204	**Fluid Mechanics & Fluid Machines**	CO-1: Apply fundamental principles of fluid mechanics to analyze and solve engineering problems related to fluid flow and fluid properties. CO-2: Demonstrate an understanding of the behavior of fluids and their applications in different engineering systems, including pipes, pumps, and turbines. CO-3: Evaluate and predict fluid forces acting on immersed bodies and apply this knowledge to design and analyze fluid machinery and systems. CO-4: Analyze and design different types of fluid machines, such as pumps, compressors, and hydraulic turbines, considering factors like efficiency, power output, and performance characteristics. CO-5: Apply computational tools and software to simulate and model fluid flow phenomena, enabling the analysis and design of fluid systems and machines.
PCC-ME205	**Strength of Materials Lab**	CO-1: Apply principles of mechanics to analyze and evaluate the behavior of materials under different loading conditions in the Strength of Materials Lab. CO-2: Conduct experiments using various testing methods to determine the mechanical properties of materials, such as stress, strain, modulus of elasticity, and yield strength. CO-3: Demonstrate proficiency in using laboratory equipment and techniques to measure and analyze forces, stresses, and deformations in structural components and materials. CO-4: Analyze experimental data obtained from material testing and interpret the results to draw conclusions about the mechanical behavior and performance of materials. CO-5: Develop effective communication skills through the preparation of laboratory reports, presenting experimental findings, and discussing the significance of the results in the context of engineering applications.

PCC-ME206	**Fluid Mechanics & Fluid Machines Lab**	CO-1: Apply principles of fluid mechanics to conduct experiments and analyze the behavior of fluids in various flow conditions. CO-2: Utilize fluid mechanics principles to measure properties such as pressure, velocity, and flow rate using appropriate laboratory equipment and techniques. CO-3: Demonstrate proficiency in the operation and performance evaluation of fluid machines such as pumps, turbines, and compressors through experimental investigations. CO-4: Analyze and interpret experimental data related to fluid mechanics phenomena, including fluid statics, flow through pipes, and fluid forces on submerged bodies. CO-5: Develop technical reports that effectively communicate experimental procedures, observations, and conclusions related to fluid mechanics and fluid machines experiments.
HSMC-201	**Organizational Behavior**	CO-1: Analyze the impact of organizational behavior theories and concepts on individual and group behavior within an engineering organization. CO-2: Evaluate the role of leadership and its effect on employee motivation, job satisfaction, and organizational performance in the context of mechanical engineering organizations. CO-3: Apply knowledge of organizational behavior to effectively manage conflicts, diversity, and ethical dilemmas within an engineering organization. CO-4: Demonstrate an understanding of the factors influencing individual and group decision-making processes in engineering organizations and propose strategies to enhance decision-making effectiveness. CO-5: Design and implement strategies to promote effective communication, teamwork, and collaboration within a diverse engineering workforce, considering the principles of organizational behavior.
PCC- ME 207	**Applied Thermodynamics**	CO-1: Analyze and evaluate thermodynamic principles and concepts to solve real-world engineering problems related to energy conversion and heat transfer. CO-2: Apply the laws of thermodynamics to analyze and design thermodynamic systems, including power cycles, refrigeration cycles, and heat exchangers.

		CO-3: Design and optimize thermal systems by considering factors such as energy efficiency, sustainability, and environmental impact. CO-4: Demonstrate proficiency in using thermodynamic software tools to simulate and analyze thermodynamic processes, including performance evaluation and optimization. CO-5: Communicate effectively and professionally, both orally and in written form, to convey thermodynamic concepts, analysis, and design solutions to technical and non-technical audiences.
PCC- ME 208	**Instrumentation & Control**	CO-1: Apply principles of instrumentation and control to design and analyze systems in the field of mechanical engineering. CO-2: Utilize various instruments and sensors to measure, monitor, and control physical parameters in mechanical systems. CO-3: Analyze and interpret data obtained from instrumentation and control systems, and make informed decisions based on the results. CO-4: Design and implement control algorithms and strategies to optimize the performance of mechanical systems, considering factors such as stability, accuracy, and response time. CO-5: Demonstrate knowledge of safety regulations and standards related to instrumentation and control systems, and apply appropriate measures to ensure the safe operation of mechanical systems.
PCC- ME 209	**Solid Mechanics**	CO-1: Apply the principles of solid mechanics to analyze and solve engineering problems related to the behavior of materials under various loading conditions. CO-2: Design and select appropriate materials and structural elements for specific mechanical applications, considering factors such as strength, stiffness, and durability. CO-3: Develop the ability to model and analyze the response of mechanical components and structures to different types of loads, including static, dynamic, and thermal loads. CO-4: Apply mathematical and computational tools to predict and assess the performance of mechanical systems and structures, including stress analysis, strain measurements, and deformation analysis.

		CO-5: Demonstrate an understanding of the concepts and theories related to the mechanical behavior of materials, including elasticity, plasticity, and fracture mechanics, and their applications in engineering design and failure analysis.
PCC- ME 210	**Manufacturing Processes**	CO-1: Analyze and evaluate different manufacturing processes used in mechanical engineering, including casting, forming, machining, joining, and additive manufacturing, to determine their suitability for specific applications. CO-2: Apply fundamental principles and concepts of manufacturing processes to select appropriate materials, tools, and techniques for the production of mechanical components, taking into consideration factors such as cost, quality, and efficiency. CO-3: Design and optimize manufacturing processes by integrating knowledge of material properties, process parameters, and equipment capabilities, to achieve desired product specifications and meet industry standards. CO-4: Demonstrate proficiency in operating and controlling various manufacturing equipment and tools, such as lathes, milling machines, welding machines, and CNC machines, ensuring safe and efficient production processes. CO-5: Identify and troubleshoot common issues and challenges encountered during manufacturing processes, and implement effective solutions to enhance productivity, reduce defects, and improve overall process performance.
PCC- ME 211	**Kinematics & Theory of Machines**	CO-1: Analyze and interpret kinematic principles to solve problems related to motion and displacement of mechanisms, including rigid bodies and linkages. CO-2: Apply the principles of velocity and acceleration analysis to evaluate the motion characteristics of mechanisms, such as gears, cams, and flywheels. CO-3: Design and analyze mechanisms using graphical and analytical techniques, considering factors like gear trains, belt and chain drives, and their influence on motion transmission. CO-4: Apply the concepts of dynamic analysis to study the behavior of machines under various loads and forces, including balancing of rotating and

		reciprocating masses. CO-5: Evaluate the performance and limitations of different types of gears, bearings, and power transmission systems, and propose suitable modifications for optimizing machine efficiency and reliability.
PCC- ME 212	**Instrumentation & Control Lab**	CO-1: Apply theoretical knowledge of instrumentation and control systems to analyze, design, and troubleshoot various mechanical engineering applications. CO-2: Demonstrate proficiency in using different instruments and equipment to measure, control, and analyze physical parameters in mechanical systems. CO-3: Develop skills to design and implement control strategies for different mechanical processes and systems, considering safety, efficiency, and reliability. CO-4: Acquire the ability to calibrate, maintain, and repair instrumentation and control systems used in mechanical engineering, ensuring accurate and precise measurements. CO-5: Apply knowledge of data acquisition, signal processing, and control algorithms to develop and optimize automated control systems for mechanical engineering applications.
PCC- ME 213	**Manufacturing Processes Lab**	CO-1: Demonstrate proficiency in operating various manufacturing machines and tools commonly used in the industry, such as lathes, milling machines, and drilling machines. CO-2: Apply knowledge of manufacturing processes to effectively plan and execute the production of components using different techniques, such as casting, welding, machining, and forming. CO-3: Analyze and interpret engineering drawings and specifications to accurately set up and adjust machines for manufacturing operations. CO-4: Employ appropriate safety measures and practices while working with manufacturing equipment and processes, minimizing the risk of accidents and ensuring a safe working environment. CO-5: Collaborate effectively in a team-based manufacturing environment, demonstrating strong communication and interpersonal skills, and contributing to the successful completion of assigned projects and tasks.

PCC- ME 214	**Kinematics & Theory of Machines Lab**	CO-1: Apply principles of kinematics to analyze the motion of various mechanical systems in the Kinematics & Theory of Machines Lab. CO-2: Design and conduct experiments to investigate the performance of different mechanisms and machines using appropriate instruments and equipment. CO-3: Interpret experimental data and analyze the results to draw conclusions about the behavior and characteristics of various mechanical systems. CO-4: Develop skills in the usage of computer-aided software to simulate and model the motion of machines and mechanisms. CO-5: Demonstrate the ability to work effectively in teams, communicate technical information, and present experimental findings in a clear and concise manner.
H-102	**Universal Human Values 2: Understanding Harmony**	CO-1: Develop an awareness and appreciation of diverse cultural, religious, and social values, and their significance in promoting harmony in society. CO-2: Demonstrate an understanding of the principles and practices that foster harmonious relationships in personal and professional settings. CO-3: Analyze ethical dilemmas and conflicts that arise in the context of human values and employ appropriate strategies to resolve them while upholding harmony and respect for all individuals involved. CO-4: Apply the principles of empathy and compassion to promote inclusivity and unity in diverse teams and collaborative environments. CO-5: Evaluate the impact of universal human values on sustainable development and the well-being of individuals, societies, and the global community, and propose strategies to integrate these values into engineering practices for a harmonious and equitable future.
PCC- ME 301	**Heat Transfer**	CO-1: Apply the principles of conduction, convection, and radiation to analyze and solve heat transfer problems in various engineering systems. CO-2: Design and evaluate heat exchangers, including their sizing and performance analysis, using appropriate heat transfer calculations and concepts. CO-3: Analyze and predict the heat transfer characteristics and performance of different types of heat exchangers, such as shell-and-tube, plate, and finned tube heat exchangers.

		CO-4: Apply the laws of thermodynamics to analyze and optimize heat transfer processes, including heat conduction through solids, heat convection in fluids, and radiative heat transfer. CO-5: Evaluate the effectiveness and efficiency of different heat transfer mechanisms and technologies, and propose suitable heat transfer solutions for various industrial applications, taking into account practical constraints and considerations.
PCC- ME 302	**Manufacturing Technology**	CO-1: Analyze and apply fundamental principles of manufacturing technology to solve real-world engineering problems. CO-2: Demonstrate proficiency in utilizing various manufacturing processes, such as casting, machining, forming, and welding, to fabricate components and products. CO-3: Evaluate and select appropriate materials and manufacturing techniques based on design requirements, considering factors such as cost, efficiency, and sustainability. CO-4: Design and optimize manufacturing systems, including production lines and quality control processes, to enhance productivity and ensure product quality. CO-5: Apply knowledge of manufacturing technology to innovate and develop new manufacturing processes, products, or systems that meet industry standards and requirements.
PCC- ME 303	**Design of Machine Elements**	CO-1: Apply principles of engineering mechanics to analyze and design machine elements, including static and dynamic loading conditions. CO-2: Demonstrate the ability to select appropriate materials and manufacturing processes for designing machine elements based on their specific functions, constraints, and environmental considerations. CO-3: Design machine elements such as gears, bearings, shafts, and springs, considering factors such as strength, reliability, and fatigue life, to meet desired performance requirements and standards. CO-4: Utilize computational tools and software packages to model, simulate, and optimize the performance of machine elements, taking into account factors such as stress, deflection, and power transmission efficiency.

		CO-5: Evaluate and analyze the failure modes of machine elements, including fatigue, wear, and fracture, and propose design modifications or improvements to enhance the reliability and durability of mechanical systems.
PEC MEL 301	**Internal Combustion Engines**	CO-1: Demonstrate a comprehensive understanding of the working principles and fundamental concepts of internal combustion engines, including the various cycles and processes involved in the combustion of fuels. CO-2: Apply mathematical analysis and engineering principles to calculate the performance parameters of internal combustion engines, such as power, torque, fuel consumption, and efficiency, using appropriate equations and computational methods. CO-3: Identify and analyze the key components of internal combustion engines, including the fuel delivery system, ignition system, cooling system, lubrication system, and emission control devices, and assess their roles in the overall functioning of the engine. CO-4: Design and optimize internal combustion engine systems by considering factors such as combustion chamber design, intake and exhaust system design, compression ratio, and fuel selection, with a focus on enhancing performance, efficiency, and emission control. CO-5: Apply experimental and analytical techniques to evaluate the performance and emissions of internal combustion engines, conduct laboratory tests, and interpret the results to assess engine performance characteristics, identify potential issues, and propose appropriate solutions.
PEC MEL 302	**Automobile Engineering**	CO-1: Analyze and evaluate the fundamental principles of automobile engineering to comprehend the design, operation, and performance of various automotive systems. CO-2: Apply theoretical knowledge of thermodynamics, fluid mechanics, and heat transfer to analyze and optimize the performance of internal combustion engines and other automotive powertrain systems. CO-3: Demonstrate the ability to design and select appropriate materials, components, and systems for