



DEPARTMENT OF MECHATRONICS ENGINEERING
COURSE OUTCOMES (REGULATION 2021)

SEMESTER III

Course Code / Course Name: MA3351 / Transforms and Partial Differential Equations

CO No.	Course Outcomes (COs)
C201.1	Explain the basic concepts of Partial Differential Equations (PDE) for solving standard partial differential equations.
C201.2	Apply Fourier series analysis to solve boundary value problems and engineering applications.
C201.3	Demonstrate the use of Fourier series techniques in solving heat flow problems across various situations.
C201.4	Analyse and utilize Fourier transform techniques in a wide range of practical applications.
C201.5	Develop mathematical tools, including Z-transform techniques, for solving partial differential equations modelling physical processes and discrete-time systems.

Course Code / Course Name: ME3351 / Engineering Mechanics

CO No.	Course Outcomes (COs)
C202.1	Illustrate the vector and scalar representation of forces and moments
C202.2	Analyse the rigid body in equilibrium
C202.3	Evaluate the properties of distributed forces
C202.4	Determine the friction and the effects by the laws of friction.
C202.5	Calculate dynamic forces exerted in rigid body

Course Code / Course Name: MF3391 / Mechanics of Materials

CO No.	Course Outcomes (COs)
C203.1	Apply the principle concepts behind stress, strain and deformation of solids for various engineering applications.
C203.2	Analyse the transverse loading on beams and stresses in beam for various engineering applications.
C203.3	Analyse the torsion principles on shafts and springs for various engineering applications.
C203.4	Analyse the deflection of beams for various engineering applications.
C203.5	Understanding the concept of theories of failure

Course Code / Course Name: MR3351 / Fluid Mechanics and Thermal Systems

CO No.	Course Outcomes (COs)
C204.1	Exploring Fluid Properties and Fluid Statics: Fundamental Concepts.
C204.2	Analysing Problems in Fluid Kinematics and Dynamics.
C204.3	Evaluating Energy Losses in Pipe Flow and the Steady Flow Equation.
C204.4	Understanding the Core Principles of the First Law of Thermodynamics.
C204.5	Understanding the Fundamental Concepts of the Second Law of Thermodynamics.

Course Code / Course Name: MR3391 / Digital Electronics and Microprocessor

CO No.	Course Outcomes (COs)
C205.1	Explain digital fundamentals, Boolean algebra, and their applications in digital systems.
C205.2	Design various combinational digital circuits using logic gates.
C205.3	Analyse and apply design procedures for both synchronous and asynchronous sequential circuits.
C205.4	Describe the various types of semiconductor memories and their related technologies.
C205.5	Construct electronic circuits used in the design and implementation of logic gates.

Course Code / Course Name: MR3392 / Electrical Drives and Actuators

CO No.	Course Outcomes (COs)
C206.1	Recognize the principles and working of relays, drives and motors.
C206.2	Explain the working and characteristics of various drives and motors.
C206.3	Apply the solid state switching circuits to operate various types of Motors
C206.4	Interpret the performance of Motors and Drives.
C206.5	Suggest the Motors and Drivers for given applications.

Course Code / Course Name: MR3361 / Electrical Drives and Actuators Laboratory

CO No.	Course Outcomes (COs)
C207.1	Practice the fundamental operation of AC motors, DC motors, stepper motors, servo motors, and synchronous motors using power electronic drives.
C207.2	Demonstrate the control techniques for AC motors, DC motors, stepper motors, servo motors, and synchronous motors with power electronic drives.
C207.3	Analyse the performance characteristics of AC motors, DC motors, stepper motors, servo motors, and synchronous motors when controlled by power electronic drives.
C207.4	Understand the working principles and control strategies for different motors, including AC, DC, stepper, servo, and synchronous motors, using power electronic drives.
C207.5	Evaluate the operational efficiency and behaviour of AC, DC, stepper, servo, and synchronous motors under the influence of power electronic drive systems.

Course Code / Course Name: MR3311 / Design and Modelling Laboratory

CO No.	Course Outcomes (COs)
C208.1	Understand the basics of design and modelling software.
C208.2	Apply CAD tools and techniques to create 2D models effectively.
C208.3	Apply CAD tools and techniques to create 3D models effectively.
C208.4	Create accurate assembly drawings both manually and using standard CAD software.
C208.5	Assemble mechanical parts using CAD software and conduct motion simulations on 3D models.

Course Code / Course Name: GE3361 / Professional Development

CO No.	Course Outcomes (COs)
C209.1	Demonstrate the ability to create well-structured and professional documents using MS Word for technical and academic purposes.
C209.2	Utilize MS Excel to perform data operations, analyse trends, and visualize data effectively using tables, charts, and graphs.
C209.3	Record and retrieve data using MS Excel to support data-driven decision-making and information sharing.
C209.4	Create interactive and visually appealing academic presentations using MS PowerPoint, incorporating tables, graphs, media objects, and interlinked elements.
C209.5	Analyse and interpret visual data representations and utilize them for effective communication and decision-making.

SEMESTER IV

Course Code / Course Name: ME3493 / Manufacturing Technology

CO No.	Course Outcomes (COs)
C210.1	Apply the mechanism of metal removal process and to identify the factors involved in improving machinability.
C210.2	Describe the constructional and operational features of centre lathe and other special purpose lathes.
C210.3	Describe the constructional and operational features of reciprocating machine tools
C210.4	Apply the constructional features and working principles of CNC machine tools.
C210.5	Demonstrate the Program CNC machine tools through planning, writing codes and setting up CNC machine tools to manufacture a given component.

Course Code / Course Name: MR3451 / Kinematics and Dynamics of Machinery

CO No.	Course Outcomes (COs)
C211.1	Recognize the basic terminologies of kinematics and dynamics of machines
C211.2	Interpret the various concepts of kinematics and dynamics including forces and frictions
C211.3	Show the motions parameters on the various mechanisms, gears and gear trains.
C211.4	Apply the mechanism, gears and gear train for the design of new machines.
C211.5	Analyse the working of various mechanism, gears and gear train.

Course Code / Course Name: MR3491 / Sensors and Instrumentation

CO No.	Course Outcomes (COs)
C212.1	Identify various calibration techniques and signal types used in sensors
C212.2	Explain the working principles and characteristics of force, magnetic, heading, pressure, temperature, smart sensors, and transducers.
C212.3	Apply sensors and transducers across a range of practical applications.
C212.4	Select suitable sensors for specific application requirements.
C212.5	Acquire and analyse signals from diverse sensors using data acquisition systems.

Course Code / Course Name: MR3492 / Embedded Systems and Programming

CO No.	Course Outcomes (COs)
C213.1	Explain the architecture and fundamental units of microcontrollers and their role in mechatronic systems.
C213.2	Demonstrate knowledge of microcontroller programming methodologies and apply communication protocols for effective data exchange.
C213.3	Design interface circuits and program I/O devices, sensors, and actuators for practical applications.
C213.4	Analyse the ARM processor architecture and its role in addressing computational and interfacing needs in mechatronic systems.
C213.5	Apply knowledge of real-time embedded operating systems for the design and development of advanced embedded systems.

Course Code / Course Name: MR3452 / Control Systems Engineering

CO No.	Course Outcomes (COs)
C214.1	Describe the components and their representations in control systems.
C214.2	Analyse the time response, frequency response, and stability of control systems using appropriate methods.
C214.3	Apply various methods for system frequency analysis to evaluate system behaviour and performance.
C214.4	Understand and interpret the concepts and techniques involved in stability analysis.
C214.5	Utilize state variable methods for the analysis and design of control systems.

Course Code / Course Name: GE3451 / Environmental Sciences and Sustainability

CO No.	Course Outcomes (COs)
C215.1	Understand the functions of environment, ecosystems and biodiversity and their conservation.
C215.2	Identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.
C215.3	Understand renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
C215.4	Recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.
C215.5	Demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization

Course Code / Course Name: MR3461 / Sensors and Instrumentation Laboratory

CO No.	Course Outcomes (COs)
C216.1	Demonstrate the working principles of strain gauges, pressure sensors, and piezoelectric sensors to measure load, torque, and force.
C216.2	Analyse the characteristics of displacement, temperature, and light sensors for accurate measurements.
C216.3	Measure distance, angular velocity, vibration, and direction using ultrasonic sensors, gyroscopes, accelerometers, and magnetometers.
C216.4	Evaluate speed, position, and force measurements using encoders and multi-axis force sensors.
C216.5	Perform data acquisition, visualization, and signal analysis for measurement interpretation.

Course Code / Course Name: ME3382 / Manufacturing Technology Laboratory

CO No.	Course Outcomes (COs)
C217.1	Apply safety precautions in a mechanical workshop environment to ensure a safe working practice.
C217.2	Apply the Gas Metal Arc Welding (GMAW) process to effectively join two metals.
C217.3	Perform machining processes, including rolling, drawing, turning, shaping, drilling, and milling, to create workpieces of specified shapes and sizes.
C217.4	Operate gear-making machines to manufacture gears and evaluate defects in cast and machined components.
C217.5	Identify the defects in both cast and machined mechanical components to ensure quality and precision in manufacturing.

SEMESTER V

Course Code / Course Name: MR3591/Fluid Power Systems and Industrial Automation

CO No.	Course Outcomes (COs)
C301.1	Identify standard symbols and explain the functions of basic fluid power generation and actuation elements.
C301.2	Understand the roles of fluid regulation and control elements, their applications in fluid power circuits, and assemble various types of pneumatic circuits.
C301.3	Design procedures to create fluid power circuits and ability to construct various types of electro-hydraulic circuits.
C301.4	Understand and explain the fundamentals of PLCs and their applications in automation.
C301.5	Understand the concepts of Data Communication and SCADA Systems in modern mechatronic and automation applications.

Course Code / Course Name: CRA334 / Agricultural Robotics and Automation

CO No.	Course Outcomes (COs)
C302.1	Recognize the areas in agricultural process where robotics can be applied.
C302.2	Apply global positioning and information systems to enhance farming operations
C302.3	Analyse traction performance and conduct testing procedures for farming machinery.
C302.4	Implement effective weed management practices using appropriate machinery.
C302.5	Evaluate and select farming machinery based on technical, economic, and environmental criteria.

Course Code / Course Name: CME339 / Additive Manufacturing/ Professional Elective II

CO No.	Course Outcomes (COs)
C303.1	Explain the development of Additive Manufacturing (AM) and identify its business opportunities and applications.
C303.2	Utilize various software tools, processes, and techniques to create physical objects that meet product development or prototyping requirements using AM.
C303.3	Demonstrate knowledge of vat polymerization and direct energy deposition processes in AM.
C303.4	Analyse powder bed fusion and material extrusion processes for their capabilities and applications.
C303.5	Apply knowledge of binder jetting, material jetting, and sheet lamination processes in real-world applications.

Course Code / Course Name: CME380 / Automobile Engineering/ Professional Elective III

CO No.	Course Outcomes (COs)
C304.1	Explain the construction and working principles of various parts of an automobile.
C304.2	Demonstrate the assembly and dismantling of engine parts and transmission systems.
C304.3	Analyse the functionality and design of different transmission systems in automobiles.
C304.4	Evaluate the operation and performance of steering, brakes, and suspension systems.
C304.5	Explore the use of alternative energy sources in automotive applications.

Course Code / Course Name: CME396 / Process Planning and cost Estimation

CO No.	Course Outcomes (COs)
C305.1	Apply process planning concepts to make cost estimations for various products.
C305.2	Demonstrate the ability to perform various process planning activities.
C305.3	Explain the importance of costing and estimation in manufacturing.
C305.4	Calculate production costs through accurate estimation techniques.
C305.5	Perform machining time calculations for different manufacturing processes.

Course Code / Course Name: MX3084 & Disaster Risk Reduction and Management

CO No.	Course Outcomes (COs)
C306.1	Explain the concepts of disaster, vulnerability, and disaster risk reduction.
C306.2	Analyze hazards, vulnerabilities, and disaster risk assessments to identify prevention and risk reduction strategies.
C306.3	Apply disaster response skills by utilizing relevant tools and technologies effectively.
C306.4	Understand the institutional processes for disaster response within the country.
C306.5	Develop foundational skills to respond sensitively to potential disasters in their immediate surroundings.

Course Code / Course Name: MR3561 / Industrial Automation Laboratory

CO No.	Course Outcomes (COs)
C307.1	Evaluate the performance of speed control circuits, single and double-acting cylinders, and directional control valves.
C307.2	Design electro-pneumatic circuits with sequencing operations for automation systems.
C307.3	Develop ladder logic programs for implementing logic gates, timers, counters, and control applications.
C307.4	Apply PLC programming techniques, configure IO interfacing, and establish communication between PLC stations.
C307.5	Demonstrate PLC-based sequencing operations for pick-and-place mechanisms, object sorting, and conveyor control systems.

Course Code / Course Name: MR3917 / Kinematics and Dynamics of Machinery

Laboratory

CO No.	Course Outcomes (COs)
C308.1	Demonstrate the principles of kinematics and dynamics of machinery to analyse motion and force in mechanical systems.
C308.2	Evaluate the Moment of Inertia of mechanical systems to understand their rotational motion and dynamic behaviour under varying conditions.
C308.3	Use appropriate measuring devices for dynamic testing to evaluate the performance and behaviour of mechanical systems.
C308.4	Calculate the natural frequency of vibrations and critical speed of shafts to assess the stability and safety of mechanical components.
C308.5	Determine the transmissibility ratio in vibrating systems to analyse and minimize the effects of vibrations in machinery.

SEMESTER VI

Course Code / Course Name: MR3601 / Design of Mechatronics System

CO No.	Course Outcomes (COs)
C309.1	Design and simulate mechatronics systems with a focus on ergonomics and safety.
C309.2	Apply theoretical and practical knowledge of interfacing, real-time data acquisition, and control.
C309.3	Develop motion converters, pneumatic and hydraulic controllers, and temperature control systems.
C309.4	Utilize real-time interfacing software to create effective man-machine interfaces.
C309.5	Evaluate various applications of Mechatronics systems in real-world scenarios.

Course Code / Course Name: MR3691 / Robotics

CO No.	Course Outcomes (COs)
C310.1	Explain the basics of robots and their classifications.
C310.2	Analyse robot kinematics in various planar mechanisms.
C310.3	Apply concepts of robot dynamics to evaluate robot performance.
C310.4	Demonstrate trajectory planning and programming for robotic systems.
C310.5	Evaluate various applications of robots in industrial and non-industrial settings

Course Code / Course Name: OCS352 / IoT Concepts and Applications

CO No.	Course Outcomes (COs)
C311.1	Understand the fundamental concept of the Internet of Things (IoT), including its components and their roles in creating interconnected systems.
C311.2	Explore various communication models and protocols employed in IoT ecosystems to enable seamless data exchange and connectivity between devices.
C311.3	Design portable IoT systems by utilizing platforms like Arduino, Raspberry Pi, and other open-source tools, focusing on practical applications and functionality.
C311.4	Implement data analytics techniques and integrate cloud computing services in IoT systems to enhance data processing, storage, and remote access.
C311.5	Analyze real-time IoT applications across different industries and domains, understanding their impact and practical use cases.

Course Code / Course Name: CMR334 / Automotive Mechatronics

CO No.	Course Outcomes (COs)
C312.1	Understand the fundamentals of electronics, emission controls, and their significance in automobiles.
C312.2	Explain the operation of ignition and fuel injection systems in automobiles.
C312.3	Analyse the role of various sensors and actuators in enhancing fuel economy and controlling emissions.
C312.4	Describe the functions of mechatronic control units in managing fuel, ignition, diagnostic tools and exhaust systems.
C312.5	Examine different types of chassis and mechatronic safety systems in automobiles.

Course Code / Course Name: AU3791 / Electric and Hybrid Vehicles

CO No.	Course Outcomes (COs)
C313.1	Explain the operation and architecture of electric and hybrid vehicles.
C313.2	Identify and compare various energy source options such as batteries and fuel cells.
C313.3	Select the most suitable electric motor for specific applications in hybrid and electric vehicles.
C313.4	Analyse the role of power electronics in the performance of hybrid and electric vehicles.
C313.5	Evaluate the energy and design requirements necessary for developing efficient hybrid and electric vehicles.

Course Code / Course Name: CME341 / Design for X

CO No.	Course Outcomes (COs)
C313.1	Apply economic process selection and general design principles to ensure manufacturability in engineering product design, including casting design considerations.
C313.2	Analyse design considerations for forming processes in the creation of extruded, stamped, and forged products.

C313.3	Evaluate design considerations related to machining processes for turned, drilled, milled, planed, shaped, slotted, and ground products.
C313.4	Demonstrate understanding of design considerations for welding processes in the development of welded products.
C313.5	Examine design consideration principles in additive manufacturing processes for optimized product development.

Course Code / Course Name: CMR332 / Advanced Manufacturing Systems

CO No.	Course Outcomes (COs)
C314.1	Apply lean tools to achieve optimal quality levels in manufacturing processes.
C314.2	Demonstrate decision-making skills for effective new product development.
C314.3	Implement strategies to conserve energy and natural resources while minimizing environmental and societal impact.
C314.4	Utilize advanced information processing techniques for improving manufacturing efficiency.
C314.5	Evaluate various smart manufacturing techniques and their applications in industry.

Course Code / Course Name: CMR333 / Computer Aided Inspection and Testing

CO No.	Course Outcomes (COs)
C315.1	Identify measurement standards, explain the instruments used, and analyse various errors in measurements.
C315.2	Demonstrate the use of basic and advanced instruments for accurate measurements.
C315.3	Apply opto-electronic devices for precision measurements in practical applications.
C315.4	Describe different measurement techniques using laser metrology.
C315.5	Explain computer-aided inspection methods and evaluate recent advancements in metrology.

Course Code / Course Name: MX3089 / Industrial Safety

CO No.	Course Outcomes (COs)
C316.1	Define basic safety terminologies and explain their significance in the workplace.
C316.2	Identify important statutory regulations and standards related to workplace safety.
C316.3	Demonstrate the ability to conduct and participate in various safety activities in an industrial setting.
C316.4	Analyse workplace exposures and assess potential hazards.
C316.5	Evaluate risks and apply risk assessment techniques to identify hazards and their consequences.

Course Code / Course Name: MR3611 / Mechatronics System Design Laboratory

CO No.	Course Outcomes (COs)
C317.1	Identify the essential components for designing and integrating mechatronic systems.
C317.2	Apply standard simulation techniques for developing algorithms and controllers.
C317.3	Analyse system interactions and verify functionality to optimize real-time design and control.
C317.4	Demonstrate simulation and modelling processes for various types of robotic systems.
C317.5	Evaluate the performance of integrated systems using simulation tools for fine-tuning and real-time application.

Course Code / Course Name: MR3612 / Design and Fabrication Project

CO No.	Course Outcomes (COs)
C318.1	Apply fabrication techniques to mechanical components, enabling hands-on experience in creating functional parts.
C318.2	Design and construct components for a complete working model.
C318.3	Demonstrate the ability to apply design concepts in the fabrication process.
C318.4	Analyse the working functionality of the fabricated components in the model.
C318.5	Evaluate the performance of the working model created through student-designed components.

SEMESTER VII**Course Code / Course Name:** MR3701 / Machine Vision Systems

CO No.	Course Outcomes (COs)
C401.1	Explain the various types of sensors, lightings, hardware and concept of machine vision
C401.2	Acquire the image by the appropriate use of sensors, lightings and hardware
C401.3	Apply basic image processing techniques to improve image quality and analysis.
C401.4	Utilize feature extraction and vision techniques for effective image analysis.
C401.5	Analyse various applications of machine vision in real-world scenarios.

Course Code / Course Name: GE3791 / Human Values and Ethics

CO No.	Course Outcomes (COs)
C402.1	Explain the values and ethics enshrined in the Constitution of India to create awareness.
C402.2	Demonstrate an understanding of democratic values and their role in modern society.
C402.3	Promote respect and inclusivity among individuals regardless of their religion or affiliations.
C402.4	Develop a scientific temper and enhance critical thinking abilities in students.
C402.5	Instil a sense of responsibility and understanding the duties of a responsible citizen.

Course Code / Course Name: GE3752 / Total Quality Management

CO No.	Course Outcomes (COs)
C403.1	Explain the need for quality, its evolution, basic concepts, and the contributions of quality gurus, along with the TQM framework, barriers, and benefits.
C403.2	Apply the principles of Total Quality Management (TQM) in practical scenarios.
C403.3	Define the fundamentals of Six Sigma and utilize traditional and new quality tools, benchmarking, and FMEA.
C403.4	Analyse Taguchi's Quality Loss Function, performance measures, and apply techniques such as QFD, TPM, COQ, and BPR.
C403.5	Illustrate and implement Quality Management Systems (QMS) and Environmental Management Systems (EMS) within organizational settings.

Course Code / Course Name: OCS351 & Artificial Intelligence and Machine Learning Fundamentals

CO No.	Course Outcomes (COs)
C404.1	Explain the importance, principles, and search methods of Artificial Intelligence (AI).
C404.2	Demonstrate knowledge of predicate logic and programming using Prolog.
C404.3	Apply the fundamentals of machine learning to solve real-world problems.
C404.4	Analyse supervised learning algorithms and their practical applications.
C404.5	Evaluate unsupervised learning algorithms and their role in pattern recognition.

Course Code / Course Name: OPT351 & Basics of Plastics Processing

CO No.	Course Outcomes (COs)
C405.1	Explain the fundamentals of plastic processing, including the relationship between material structural properties and processing parameters.
C405.2	Demonstrate practical knowledge of polymer selection and its processing methods.
C405.3	Identify and compare major plastic material processing techniques such as extrusion, injection molding, compression and transfer molding, blow molding, thermoforming, and casting.
C405.4	Analyse suitable additives for plastics compounding and their role in product performance.
C405.5	Propose effective troubleshooting mechanisms for defects in plastic products manufactured using various processing techniques.

Course Code / Course Name: OCH353 & Energy Technology

CO No.	Course Outcomes (COs)
C406.1	Describe the fundamentals and main characteristics of renewable energy sources and compare them with fossil fuels.
C406.2	Demonstrate professional expertise in various fields of energy engineering.
C406.3	Compare different renewable energy technologies and select the most suitable option based on local conditions.

C406.4	Explain the technological foundations and methods for harnessing renewable energy sources.
C406.5	Identify and evaluate current developments and emerging trends in renewable energy technologies to develop a comprehensive technical understanding of advanced energy challenges.

Course Code / Course Name: MR3711 / Robotics and Machine Vision Laboratory

CO No.	Course Outcomes (COs)
C407.1	Identify different types of robotics and demonstrate their components and working principles.
C407.2	Develop programs to perform basic robotic operations, showcasing programming skills and control logic.
C407.3	Gain practical exposure to machine vision elements, lighting techniques, processing software, and algorithms.
C407.4	Analyse the role of machine vision in robotic systems and its integration into operations.
C407.5	Evaluate the performance of robotic systems and their components in practical applications.

SEMESTER VIII

Course Code / Course Name: MR3811 / Project Work/ Internship

CO No.	Course Outcomes (COs)
C408.1	Formulate real-world problems and define project goals effectively, establishing clear objectives to guide the project.
C408.2	Identify the various tasks involved in a project to establish standard procedures, ensuring efficient task organization for execution.
C408.3	Apply new tools, algorithms, and techniques relevant to the project, enhancing the quality and efficiency of the work.
C408.4	Evaluate product validation procedures and analyze cost-effectiveness in project outcomes, ensuring quality and feasibility.
C408.5	Understand the guidelines for preparing reports and conducting oral demonstrations, ensuring clear communication of results.