

MECHANICAL ENGINEERING (21 SCHEME)	
Course Code	21EVN15/25 - Engineering Visualisation
CO1	Understand and visualize the objects with definite shape and dimensions
CO2	Analyze the shape and size of objects through different views
CO3	Develop the lateral surfaces of the object
CO4	Create a 3D view using CAD software
CO5	Identify the interdisciplinary engineering components or systems through its graphical representation.
Course Code	21ME15/25-ELEMENTS OF MECHANICAL ENGINEERING
CO1	Understand basic concepts of mechanical engineering in the fields of energy and its utilization, materials technology, manufacturing techniques, and transmission
CO2	Understand the application of energy sources in Power generation and utilization, Engineering materials, manufacturing, and machining techniques leading to the latest
CO3	Apply the skills in developing simple mechanical elements and processes
Course Code	21IDT19/29 - INNOVATION and DESIGN THINKING
CO1	Appreciate various design process procedure
CO2	Generate and develop design ideas through different technique
CO3	Identify the significance of reverse Engineering to Understand products
CO4	Draw technical drawing for design ideas
Course Code	21MAT 31 TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES
CO1	To solve ordinary differential equations using Laplace transform.
CO2	Demonstrate the Fourier series To study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
CO3	To use Fourier transforms To analyze problems involving continuous-time signals and To apply Z-Transform techniques To solve difference equations
CO4	To solve mathematical models represented by initial or boundary value problems involving partial differential equations

CO5	Determine the extremals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.
Course Code	21ME32 - METAL CASTING FORMING & JOINING PROCESS (IPCC)
CO1	Select appropriate primary manufacturing process and related parameters for obtaining initial shape and size of components.
CO2	Design and develop adequate Tooling linked with casting, welding and forming operations.
CO3	Appreciate the effect of process parameters on quality of manufactured components
CO4	Demonstrate various skills in preparation of molding sand for conducting tensile, shear and compression tests using Universal sand testing machine.
CO5	Demonstrate skills in preparation of forging models involving upsetting, drawing and bending operations.
CO6	Demonstrate skills in preparation of Welding models.
Course Code	21ME33 - MATERIAL SCIENCE AND ENGINEERING (IPCC)
CO1	Understand the atomic arrangement in crystalline materials and describe the periodic arrangement of atoms in terms of
CO2	Understand the importance of phase diagrams and the phase transformations.
CO3	Know various heat treatment methods for controlling the microstructure..
CO4	Correlate between material properties with component design and identify various kinds of defects.
CO5	Apply the method of materials selection, material data and knowledge sources for computer-aided selection of materials.
Course Code	21ME34 - THERMODYNAMICS
CO1	Describe the fundamental concepts and principles of engineering thermodynamics.
CO2	Apply the governing laws of thermodynamics for different engineering applications.
CO3	Analyse the various thermodynamic processes, cycles and results.
CO4	Interpret and relate the impact of thermal engineering practices To real life problems.
Course Code	21MEL35 - MACHINE DRAWING AND GD & T
CO1	Interpret the Machining and surface finish symbols on the component drawings.
CO2	Apply limits and Tolerances To assemblies and choose appropriate fits for given assemblies.
CO3	Illustrate various machine components through drawings
CO4	Create assembly drawings as per the conventions.

Course Code	21ME381 - INTRODUCTION To PYTHON
CO1	Demonstrate proficiency in handling of loops and creation of functions.
CO2	Identify the methods To create and manipulate lists, tuples and dictionaries.
CO3	Discover the commonly used operations involving regular expressions and file system.
CO4	Examine working of PDF and word file formats
Course Code	21ME382 - INTRODUCTION To VIRTUAL REALITY
CO1	Describe how VR systems work and list the applications of VR.
CO2	Understand the design and implementation of the hardware that enables VR systems To be built.
CO3	Understand the system of human vision and its implication on perception and rendering.
CO4	Explain the concepts of motion and tracking in VR systems.
CO5	Describe the importance of interaction and audio in VR systems.
Course Code	21ME383 - DIGITAL SOCIETY
CO1	Identify the ways in which digital media shape identity
CO2	Utilize new opportunities for meaningful data collection from and using sophisticated forms of artificial intelligence
CO3	Identify knowledge and truth amongst the abundance of information
Course Code	21MATME41 - COMPLEX ANALYSIS, PROBABILITY AND LINEAR PROGRAMMING
CO1	Use the concepts of an analytic function and complex potentials To solve the problems arising in fluid flow.
CO2	Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image
CO3	Apply discrete and continuous probability distributions in analyzing the probability models arising in the engineering
CO4	Analyze and solve linear programming models of real-life situations and solve LPP by the simplex method
CO5	Learn techniques To solve Transportation and Assignment problems.
Course Code	21ME42 - MACHINING SCIENCE AND JIGS & FIXTURES (IPCC)
CO1	Demonstrate the Conventional CNC machines and advanced manufacturing process operations
CO2	Determine Tool life, cutting force, and economy of the machining process.
CO3	Analyze the influence of various parameters on machine Tools' performance.
CO4	Select the appropriate machine Tools and process, the Jigs, and fixtures for various applications.
Course Code	21ME43 - FLUID MECHANICS (IPCC)
CO1	Understand the basic principles of fluid mechanics and fluid kinematics

CO2	Acquire the basic knowledge of fluid dynamics and flow measuring instruments
CO3	Understand the nature of flow and flow over bodies and the dimensionless analysis
CO4	Acquire the compressible flow fundamental and basics of CFD packages and the need for CFD analysis.
CO5	Conduct basic experiments of fluid mechanics and understand the experimental uncertainties.
Course Code	21ME44 - MECHANICS OF MATERIALS
CO1	Understand simple, compound, thermal stresses and strains their relations and strain energy.
CO2	Analyse structural members for stresses, strains and deformations.
CO3	Analyse the structural members subjected To bending and shear loads.
CO4	Analyse shafts subjected To twisting loads.
CO5	Analyse the short columns for stability.
Course Code	21MEL46 - MECHANICAL MEASUREMENTS AND METROLOGY LABORATORY
CO1	Understand Calibration of pressure gauge, thermocouple, LVDT, load cell, micrometer.
CO2	Apply concepts of Measurement of angle
CO3	Demonstrate measurements using Optical Projector/Tool maker microscope, Optical flats.
CO4	Analyse Screw thread parameters using 2-Wire or 3-Wire method, gear Tooth profile using gear Tooth Vernier/Gear
CO5	Understand the concepts of measurement of surface roughness.
CO6	Demonstrate the use of Coordinate Measuring Machine (CMM) / Laser Scanner
Course Code	21MT481 - SPREAD SHEETS FOR ENGINEERS
CO1	To create different plots and charts
CO2	To compute different functions, conditional functions and make regression analysis
CO3	To carryout iterative solutions for roots, multiple roots, optimization and non-linear regression analysis
CO4	To carryout matrix operations
CO5	To Understand VBA and UDF
CO6	To understand VBA subroutines and Macros
CO7	To carryout numerical integration and solving differential equations using different methods
Course Code	21ME482 - INTRODUCTION To AI AND ML
CO1	Understand the basic principles and goals of AI tasks.
CO2	Outline the role of AI in different real-time applications.
CO3	Construct a problem with the suitable AI task.
CO4	Demonstrate the importance of biology in AI.

CO5	Survey the future development of AI.
Course Code	21ME483 - Introduction To Augmented Reality
CO1	Describe how AR systems work and list the applications of AR.
CO2	Understand and analyse the hardware requirement of AR.
CO3	Use computer vision concepts for AR and describe AR techniques
CO4	Analyse and understand the working of various state of the art AR devices
CO5	Acquire knowledge of mixed reality
Course Code	21ME51 - THEORY OF MACHINES
CO1	Knowledge of mechanisms and their motion and the inversions of mechanisms
CO2	Analyse the velocity, acceleration of links and joints of mechanisms..
CO3	Analyse the mechanisms for static and dynamic equilibrium.
CO4	Carry out the balancing of rotating and reciprocating masses
CO5	Analyse different types of governors used in real life situation.
CO6	Analyze the free and forced vibration phenomenon.
Course Code	21ME52 - THERMO-FLUIDS ENGINEERING (IPCC)
CO1	Apply the concepts of testing of I. C. Engines and evaluate their performance, and evaluate the performance of
CO2	Apply and analyse the concepts related To Refrigeration and Air conditioning, and get conversant with Psychrometric
CO3	Explain the construction, classification and working principle of the Turbo machines and apply of Euler's turbine equation To evaluate the energy transfer and other related parameters. Compare and evaluate the performance of positive displacement pumps.
CO4	Classify, Explain and analyse the various types of hydraulic turbines and centrifugal pumps.
CO5	Classify, Explain and analyse various types of steam turbines and centrifugal compressor.
Course Code	21ME53 - FINITE ELEMENT ANALYSIS
CO1	Identify the application and characteristics of FEA elements such as bars, beams, plane and isoparametric elements.
CO2	Develop element characteristic equation and generation of global equation.
CO3	Formulate and solve Axi-symmetric and heat transfer problems.
CO4	Apply suitable boundary conditions To a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axi-symmetric and dynamic problems.

Course Code	21ME54 - MODERN MOBILITY & AUTOMOTIVE MECHANICS
CO1	Understand the working of different systems employed in automobile
CO2	Analyse the limitation of present day automobiles
CO3	Evaluate the energy sources suitability
CO4	Apply the knowledge for selection of automobiles based on their suitability
Course Code	21MEL55 - DESIGN LAB
CO1	Compute the natural frequency of the free and forced vibration of single degree freedom systems, critical speed of shafts.
CO2	Carry out balancing of rotating masses and gyroscope phenomenon.
CO3	Analyse the governor characteristics.
CO4	Determine stresses in disk, beams and plates using photo elastic bench.
CO5	Determination of Pressure distribution in Journal bearing
CO6	Analyse the stress and strains using strain gauges in compression and bending test
CO7	To realize different mechanisms and cam motions
Course Code	21ME581 - BASICS OF MATLAB
CO1	Able To implement loops, branching, control instruction and functions in MATLAB programming environment.
CO2	Able To program curve fitting, numerical differentiation and integration, solution of linear equations in MATLAB and
CO3	Able To understand implementation of ODE using ode 45 and execute Solutions of nonlinear equations and DFT in
CO4	Able To simulate MATLAB Simulink examples
Course Code	21ME582- DIGITAL MARKETING
CO1	To identify the importance of the digital marketing for marketing success,
CO2	To manage customer relationships across all digital channels and build better customer relationships
CO3	To create a digital marketing plan, starting from the SWOT analysis and defining a target group, then identifying digital channels, their advantages and limitations,
CO4	To perceive ways of the integration taking into consideration the available budget.

Course Code	21ME583 - VFX: VISUAL EFFECTS
CO1	Gain good understanding about compositing process.
CO2	Identify major applications of compositing process used in industry.
CO3	Develop a visual effects pipeline.
CO4	Demonstrate an in-depth knowledge of grading and VFX principles, practice and system capabilities.
CO5	Create cusTomized Tools through software or scripting To allow for more creative application of visual effects
Course Code	21ME61 - PRODUCTION AND OPERATIONS MANAGEMENT
CO1	Apply the necessary Tools for decision making in operations management.
CO2	Examinevariousapproachesforforecastingthesalesdemandforanorganization.
CO3	ListvariouscapacityandlocationplansTodeterminethesuitablecapacityrequiredformetingtheforecastdemandofanorganizati
CO4	Analyse the aggregate plan and master production schedule for an organization, given its periodic demand.
CO5	Apply MRP, purchasing and SCM techniques inTo practice.
Course Code	21ME62 - HEAT TRANSFER (IPCC)
CO1	Solve steady state heat transfer problems in conduction.
CO2	Solve transient heat transfer problems
CO3	solve convection heat transfer problems using correlations
CO4	Solve radiation heat transfer problems
CO5	Explain the mechanisms of boiling and condensation. And Determine performance parameters of heat exchangers.
Course Code	21ME63 - MACHINE DESIGN
CO1	Apply codes and standards in the design of machine elements and select an element based on the Manufacturer's
CO2	Analyse the performance and failure modes of mechanical components subjected To combined loading and fatigue
CO3	Demonstrate the application of engineering design Tools To the design of machine components like shafts, springs,
CO4	Design different types of gears and simple gear boxes for relevant applications.
CO5	Apply design concepts of hydrodynamic bearings for different applications and select Anti friction bearings for different applications using the manufacturers, catalogue.
Course Code	21ME641 - SUPPLY CHAIN MANAGEMENT & INTRODUCTION To SAP
CO1	Understand the framework and scope of supply chain management.

CO2	Build and manage a competitive supply chain using strategies, models, techniques and information technology.
CO3	Plan the demand, inventory and supply and optimize supply chain network.
CO4	Understand the emerging trends and impact of IT on Supply chain.
CO5	Understand the basics of SAP material management system
Course Code	21ME642 - MECHATRONICS SYSTEM DESIGN
CO1	Discuss about Mechatronics design process and select the sensor and Actuator for a Mechatronics application
CO2	Explain Modeling and Simulation of mechanical Elements, electrical Elements and fluid systemthe sensors in mechatronics systems and Fault detection techniques in Mechatronics.
CO3	Understand the elements of Data Acquisition and Control System, Convert the data in real time interfacing
CO4	Model the dynamic response of first order and second order systems.
Course Code	21ME643 - AUTONOMOUS VEHICLES
CO1	Describe the evolution of Automotive Electronics and the operation of ECUs.
CO2	Compare the different type of sensing mechanisms involved in Autonomous Vehicles.
CO3	Discuss about the use of computer vision and learning algorithms in vehicles.
CO4	Summarize the aspects of connectivity fundamentals existing in a driverless car.
CO5	Identify the different levels of automation involved in an Autonomous Vehicle.
CO6	Outline the various controllers employed in vehicle actuation
Course Code	21ME644 - INTERNET OF THINGS (IOT)
CO1	Explain IoT architecture, interpret the design principles that govern connected devices, summarize the roles of various
CO2	Explain the basics of microcontrollers, outline the architecture of Arduino, develop simple applications using Arduino
CO3	outline the architecture of Raspberry Pi, develop simple applications using Raspberry Pi, select a platform for a particular
CO4	interpret different protocols and compare them, select which protocol can be used for a specific application, Utilize the
CO4	select IoT APIs for an application, design and develop a solution for a given application using APIs, test for errors in the
Course Code	21ME651 - PROJECT MANAGEMENT
CO1	Understand the selection, prioritization and initiation of individual projects and strategic role of project management.
CO2	Understand the work breakdown structure by integrating it with organization.
CO3	Understand the scheduling and uncertainty in projects.
CO4	Understand risk management planning using project quality Tools.

CO5	Understand the activities like purchasing, acquisitions, contracting, partnering and collaborations related To performing
CO6	Determine project progress and results through balanced scorecard approach
CO7	Draw the network diagram To calculate the duration of the project and reduce it using crashing.
Course Code	21ME652 - RENEWABLE ENERGY POWER PLANTS (OPEN ELECTIVE)
CO1	Describe the various forms of non-conventional energy resources.
CO2	Apply the fundamental knowledge of mechanical engineering To design various renewable energy systems
CO3	Analyze the implications of renewable energy forms for selecting an appropriate system for a specific application
CO4	Discuss on the environmental aspects and impact of non-conventional energy resources, in comparison with various conventional energy systems, their prospects and limitations.
Course Code	21ME653 - MECHATRONICS
CO1	Illustrate various components of Mechatronics systems.
CO2	Assess various control systems used in auTomation.
CO3	Design and conduct experiments To evaluate the performance of a mechatronics system or component with respect To specifications, as well as To analyse and interpret data.
CO4	Apply the principles of Mechatronics design To product design.
CO5	Function effectively as members of multidisciplinary teams.
Course Code	21ME654 - MODERN MOBILITY
CO1	Understand the working of different systems employed in auTomobile
CO2	Analyse the limitation of present day auTomobiles
CO3	Evaluate the energy sources suitability
CO4	Apply the knowledge for selection of auTomobiles based on their suitability
Course Code	21MEL66 - CNC PROGRAMMING AND 3-D PRINTING LAB
CO1	Students will have knowledge of G-code and M-code for machining operations.
CO2	Students will able To perform CNC programming for turning, drilling, milling and threading operation.
CO3	Students will able To visualize the 3D models using CAD software's
CO4	Students will able To use 3D printing technology
CO5	Students are able To understand robotic programming and FMS

Course Code	21ME71 - AUTOMATION AND ROBOTICS (PCC)
CO1	Translate and simulate a real time activity using modern Tools and discuss the Benefits of auTomation.
CO2	Identify suitable auTomation hardware for the given application.
CO3	Recommend appropriate modelling and simulation Tool for the given manufacturing Application.
CO4	Explain the basic principles of Robotic technology, configurations, control and Programming of Robots.
CO5	Explain the basic principles of programming and apply it for typical Pick & place, Loading & unloading and palletizing applications
Course Code	21ME72 -CONTROL ENGINEERING
CO1	Identify the type of control and control actions and develop the mathematical model of the physical systems.
CO2	Estimate the response and error in response of first and second order systems subjected standard input signals.
CO3	Represent the complex physical system using block diagram and signal flow graph and obtain transfer function.
CO4	Analyse a linear feedback control system for stability using Hurwitz criterion, Routh's criterion and root Locus technique in complex domain.
CO5	Analyse the stability of linear feedback control systems in frequency domain using polar plots, Nyquist and Bode plots.
Course Code	21ME731 - ADDITIVE MANUFACTURING
CO1	Demonstrate the knowledge of the broad range of AM processes, devices, capabilities and materials that are available.
CO2	Demonstrate the knowledge of the broad range of AM processes, devices, capabilities and materials that are available.
CO3	Understand the various software Tools, processes and techniques that enable advanced/additive manufacturing.
CO4	Apply the concepts of additive manufacturing To design and create components that satisfy product development/proTototyping requirements, using advanced/additive manufacturing devices and processes.
CO5	Understand characterization techniques in additive manufacturing.
CO6	Understand the latest trends and business opportunities in additive manufacturing.
Course Code	21ME732 - ToTAL QUALITY MANAGEMENT

CO1	Explain the various approaches of TQM
CO2	Infer the customer perception of quality
CO3	Analyse customer needs and perceptions To design feedback systems.
CO4	Apply statistical Tools for continuous improvement of systems
CO5	Apply the Tools and technique for effective implementation of TQM.
Course Code	21ME733 - REFRIGERATION AND AIR-CONDITIONING
CO1	Illustrate the principles, nomenclature and applications of refrigeration systems.
CO2	Explain vapour compression refrigeration system and identify methods for performance improvement
CO3	Study the working principles of air, vapour absorption, thermoelectric and steam-jet and thermoacoustic refrigeration systems.
CO4	Estimate the performance of air-conditioning systems using the principles of psychrometry.
CO5	Compute and Interpret cooling and heating loads in an air-conditioning system.
CO6	Identify suitable refrigerant for various refrigerating systems.
Course Code	21ME734 - MEMS AND MICROSYSTEM TECHNOLOGY
CO1	Explain MEMS Technology, Present, Future, and Challenges.
CO2	Explain micro-sensors, micro-actuators, their types, and applications.
CO3	Explain fabrication processes for producing micro-sensors and actuators.
CO4	Apply Reliability and Failure Analysis Testing.
CO5	Understand the operation of microdevices, microsystems, and their applications. Design the microdevices and microsystems using the MEMS fabrication process.
Course Code	21ME735 - DESIGN FOR MANUFACTURING & ASSEMBLY
CO1	have knowledge on design principles for manufacturability
CO2	have knowledge Influencing factors on Design.
CO3	have knowledge on Machining consideration while design.
CO4	have knowledge on casting consideration while design.
CO5	have knowledge on environment consideration while design.
CO6	have ability To understand contemporary issues and their impact on design for manufacturing and assembly.
Course Code	21ME741 - ADVANCED VIBRATIONS AND CONDITION MONITORING
CO1	Identify & classify the vibration systems

CO2	Analyse the vibration parameters through different theoretical methods
CO3	Apply the knowledge of vibration measurement instruments and control system
CO4	Understand the sound generation and propagation arising through vibration
Course Code	21ME742 - Theory and Design of IC Engines
CO1	Understand various types of I.C. Engines, Cycles of operation and Identify fuel metering, fuel supply systems for different types of engines.
CO2	Understand combustion phenomena in SI and CI engines and Analyze the effect of various operating variables on engine performance.
CO3	Evaluate performance Analysis of IC Engine and Justify the suitability for different applications.
CO4	Understand the conventional and non-conventional fuels and effects of emission formation of IC engines, its effects, and the legislation standards
Course Code	21ME743-ADVANCED TURBOMACHINES
CO1	Explain the various thermodynamic processes involved in turbomachines with the application of 1st and 2nd law of Thermodynamics and also apply of the concept of law of conservation of energy for the flow through nozzle and diffuser.
CO2	Demonstrate the concept of two-dimensional cascading and evaluating the cascade performance in compressor and turbines.
CO3	Explain the thermodynamics of axial flow turbines and analyse its performance and characteristics.
CO4	Explain the thermodynamics of axial flow compressor and fans and analyse its performance and characteristics.
CO5	Explain and apply the various vortex flow concepts for designing the blades and describe the process of control and maintenance aspects of turbomachines.
Course Code	21ME744-PRODUCT DESIGN & ERGONOMICS
CO1	To learn the concept of product design and the ergonomics.
CO2	Design the various controls and displays by knowing the anthropometric data's.
CO3	To learn the psychology of visuals effects.
CO4	Learning the different colour combinations for optimal design of engineering equipments.
CO5	Realize the importance of environmental factors and aesthetics in industrial design.

Course Code	21ME751-NON-TRADITIONAL MACHINING
CO1	Understand the compare traditional and non-traditional machining process and recognize the need for Non- traditional machining process.
CO2	Understand the constructional features, performance parameters, process characteristics, applications, advantages and limitations of USM, AJM and WJM.
CO3	Identify the need of Chemical and electro-chemical machining process along with the constructional features, process parameters, process characteristics, applications, advantages and limitations.
CO4	Understand the constructional feature of the equipment, process parameters, process characteristics, applications, advantages and limitations EDM & PAM.
CO5	Understand the LBM equipment, LBM parameters, and characteristics. EBM equipment and mechanism of metal removal, applications, advantages and limitations LBM & EBM.
Course Code	21ME752-HYDRAULICS AND PNEUMATICS
CO1	Have knowledge of hydraulic and pneumatic system and its components.
CO2	Understand the working principle of various hydraulic and pneumatic components.
CO3	Apply working principles of Hydraulic and Pneumatic Systems for various applications.
CO4	Determine cause for hydraulic and pneumatic system break down and performance of hydraulic pumps, moTors.
Course Code	21ME753-OPERATIONS RESEARCH
CO1	Understand the meaning, definitions, scope, need, phases and techniques of operations research.
CO2	Formulate as L.P.P and derive optimal solutions To linear programming problems by graphical method, Simplex method, Big-M method and Dual Simplex method.
CO3	Formulate as Transportation and Assignment problems and derive optimum solutions for transportation, Assignment and travelling salesman problems.
CO4	Solve problems on game theory for pure and mixed strategy under competitive environment.
CO5	Solve waiting line problems for M/M/1 and M/M/K queuing models.
CO6	Construct network diagrams and determine critical path, floats for deterministic and PERT networks including crashing of Networks