MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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MECHANICAL ENGINEERING DEPARTMENT

Flexible Scheme: Course Outcomes (COs) The course outcomes of the courses of 2017 admitted batch from 1st year to 4th year of the undergraduate course of mechanical Engineering Program are given below:

Course	Course Outcomes	
100105: Engineering Graphics	CO1	**Visualize** the geometric details of engineering objects
	CO2	**Translate** the geometric information of engineering objects into engineering drawings
	CO3	**Draw** orthographic projections and sections
	CO4	**Develop** knowledge to read, understand and explain drawing
	CO5	**Improve** their skills so that they can apply these skills in developing new products
	CO6	**Prepare** simple layout of factory, machine and buildings
100106: Manufacturing Practices	CO1	**Discuss** the hand tools, machine tools and power tools
	CO2	**Utilize** appropriate tools required for specific operation.
	CO3	**Apply** safety measures required to be taken while using the tools in floor shops, Machine ships and carpentry shop
	CO4	**Use** the techniques, skills, and modern engineering tools necessary for manufacturing and production engineering
	CO5	**Conduct** experiments in the field of Production engineering
	CO6	**Design** a system, components, or process to meet desired needs, ethical, health and safety, manufacturability and sustainability
100204: Basic Mechanical Engineering	CO1	**Define** the essential concepts of thermal, design and production used in Mechanical Engineering
	CO2	**Summarize** fundamental techniques and process used in power generating machines
	CO3	**Solve** the various problems based on basic concepts of Mechanical Engineering
	CO4	**Analyze** the various gas, steam and air cycles
	CO5	**Evaluate** the problems of Steam Generator, Thermodynamics, Steam and I.C. engines
	CO6	**Generate** the skills to demonstrate steam Generator and reciprocating machine in depth
120301: Material Science	CO1	**State** the principles of diffusion theory and various types of defects in materials
	CO2	**Discuss** mechanical properties of materials
	CO3	**Compare** the different processes to alter the material properties
	CO4	**Determine** the effect of different phases, impurities on the behavior of materials
	CO5	**Analyze** crystal structure and composition of different materials
	CO6	**Create** the different engineering materials and alloys

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120302: Mechanics of Materials-I	CO1	**Identify** various structural elements and its application
	CO2	**Illustrate** different types of stress and strain on various types of structural elements like beam, shaft column etc
	CO3	**Calculate** principal stresses, maximum shearing stress, and the different stresses acting on a structural member.
	CO4	**Analyse** stresses and deflection for beam, shaft, long columns, thin cylinder etc
	CO5	**Select** appropriate materials in design considering engineering properties, sustainability, cost and weight
	CO6	**Design** simple bars, beams, and circular shafts to meet desired needs in terms of strength and deformation
120302(P): Mechanics of Materials-I lab	CO1	**Evaluate** the values of yield stress, breaking stress and ultimate stress of the given specimen under tension test
	CO2	**Conduct** the torsion test to determine the modulus of rigidity of given specimen
	CO3	**Perform** compression tests on spring and wood
	CO4	**Justify** the Rockwell hardness test over with Brinell hardness and measure the hardness of the given specimen
	CO5	**Determine** elastic constants using flexural and torsion tests
	CO6	**Examine** the stiffness of the open coil and closed coil spring and grade them
120303: Theory of Machines-I	CO1	**Identify** basic mechanisms in real life applications
	CO2	**Discuss** about mechanics of various machines
	CO3	**Apply** fundamental principles of statics and dynamics to machinery.
	CO4	**Analyse** various types of motions and mechanisms of machinery
	CO5	**Compare** various components suitable for different applications. e.g. different types of governor, clutch, brakes, flywheel etc
	CO6	**Create** the mechanism or components to justify the demands of work
120303(P): Theory of Machines-I lab	CO1	**Design** and **analyze** mechanism required for the specified type of motion
	CO2	**Draw** inversions and determine velocity and acceleration of different mechanisms
	CO3	**Construct** different types of cam profile for a given data.
	CO4	**Analyze** various motion transmission elements like gears, gear trains, cams, belt drive and rope drive.
	CO5	**Compare** the various components related to machines and mechanism
	CO6	**Determine** the degrees-of-freedom (mobility) of a mechanism

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120304: Fluid Mechanics and Hydraulic Machines	CO1	**Define** the fundamental properties of fluids
	CO2	**Relate** the concepts of mechanics with various laws of fluid mechanics.
	CO3	**Identify** the laws of fluid mechanics applicable for the body in various fluids under different conditions
	CO4	**Analyse** various forces and their effects, related to fluids mechanics
	CO5	**Measure** and compare losses in different fluid flow conditions
	CO6	**Compare** different turbo machines depending on their behaviour and their merits and demerits
120304(P): Fluid Mechanics and Hydraulic Machines lab	CO1	**Experiment** with flow measurement devices like venturimeter and orifice meter
	CO2	**Estimate** the friction and measure the frictional losses in fluid flow.
	CO3	**Predict** the coefficient of discharge for flow through pipes
	CO4	**Evaluate** pressure drop in pipe flow using Hagen-Poiseuille's equation for laminar flow in a pipe
	CO5	**Calculate** the Critical Reynolds's Number through Pipe Set Apparatus
	CO6	**Compare** the overall efficiency of various types of turbines
120305: Software Lab	CO1	**Describe** AutoCAD and CATIA toolbars
	CO2	**Summarize** 2D and 3D commands
	CO3	**Solve** real time problems using AutoCAD and CATIA software
	CO4	**Analyse** various mechanical engineering problems
	CO5	**Evaluate** technical drawings of machine assemblies as a design engineer
	CO6	**Generate** 2D and 3D solid models with new features in machine elements
120401: Theory of Machines-II	CO1	**Identify** the motion and the dynamical forces acting on mechanical systems composed of linkages, gears and cams
	CO2	**Classify** various components of machines like gear, gear train cam etc
	CO3	**Solve** numerical problems of various components of machines like gear, gear train cam etc
	CO4	**Analyze** the forces and motion of complex systems of linkages, gears and cams
	CO5	**Evaluate** the applications of components e.g. gear, gear train, balancing, cam etc. and select appropriate machine elements for the required applications
	CO6	**Design** the mechanism or components to justify the demands of work such as linkage, cam, gear, gear train mechanism etc

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120401(P): Theory of Machines-II lab	CO1	**Identify** the kinematic chain and mobility, and perform the kinematic analysis of a given mechanism
	CO2	**Analyze** various motion transmission elements like gears, gear trains, cams, belt drive and rope drive
	CO3	**Determine** the degrees-of-freedom (mobility) of a mechanism
	CO4	**Apply** the fundamental principles of statics and dynamics to machinery
	CO5	**Evaluate** the dynamic forces for various machines
	CO6	**Analyze** the fundamentals of machines for desired kinematic or dynamic performance.
120402: Design of Machine Elements	CO1	**Describe** the basic design process and function of Permanent and temporary joints used in Machine Design
	CO2	**Summarize** the design techniques, skills and tools used in design
	CO3	**Solve** the various design engineering problems by formulate and proper assumptions for practice
	CO4	**Analyze** the stress and strain on mechanical components; and understand, identify and quantify failure modes for mechanical parts
	CO5	**Evaluate** the cases of Temporary and permanent joints problems successfully
	CO6	**Create** design techniques for a mechanical component under variety of environmental and service conditions
120402(P): Design of Machine Elements lab	CO1	**Design** and analysis the different part of an I.C Engine like Piston, cylinder, connecting rod , crank shafts , flywheel
	CO2	**Compare** the materials used in designing the automobile engine parts
	CO3	**Use** the software like AUTO CAD , CATIA , PRO/E, SOLID WORKS
	CO4	**Select** the spring for a proper application also can select the proper material of spring
	CO5	**Design** the different types of gear like spur gear, helical gear , worm gear , bevel gear and also able to know their practical applications.
	CO6	**Create** a gear box for modern Automotive vehicles and can use this for the benefits of society.
120403: Manufacturing Processes	CO1	**Describe** the different types of manufacturing processes and their applications
	CO2	**Identify** suitable manufacturing process to achieve the required product shape with the aim of avoid defects, material and time wastage
	CO3	**Illustrate** the advantage and limitations of various manufacturing processes with regard to shape formation and surface quality.
	CO4	**Analyse** the manufacturing processes for given problem and able to select an appropriate process according to a specific requirement.
	CO5	**Evaluate** the procedures and techniques involved for the manufacturing of components for its optimization.

	CO6	**Propose** a simplified manufacturing processes with the aim of reduction of cost and manpower.
120404: Engineering Thermodynamics	CO1	**Define** energy interactions between system and surroundings
	CO2	**Correlate** the law of thermodynamics to real life applications
	CO3	**Apply** the laws of thermodynamics to analyze boilers, heat pumps, refrigerators, heat engines, compressors and nozzles
	CO4	**Investigate** the effectiveness of energy conversion device in mechanical power generation
	CO5	**Analyze** air standard cycles applied in prime movers
	CO6	**Describe** benefits of improvements to thermodynamic systems
120405: Production Lab	CO1	**Define** the different conventional method of material removal and function of different parts
	CO2	**Apply** the theory of metal cutting in experiments
	CO3	**Perform** step, taper turning, knurling and threading
	CO4	**Produce** stepped surface using shaper and keyway using milling machine
	CO5	**Demonstrate** knowledge of different machine tools used in machine shop
	CO6	**Evaluate** the chip thickness ratio, shear angle and material removal rate
120501: Industrial Engineering	CO1	**Analyze** and measure productivity
	CO2	**Acquire** the knowledge and understanding regarding Production planning and controlled required for industry to analyze the engineering problems
	CO3	**Utilize** the operation research techniques as a problem solving techniques
	CO4	**Gives** practice through various Management and Operation Tools for Improving Quality and Quantity
	CO5	**Solve** various kinds of problems or issue faced by service and manufacturing industries like economic consideration, optimum utilization of resources, productivity.
	CO6	**Get** the solutions for materials requirement planning
120502: Metal Cutting and Machine Tools	CO1	**Apply** cutting mechanics to metal machining based on cutting force and power consumption
	CO2	**Operate** lathe, milling machines, drill press, grinding machines, etc
	CO3	**Select** cutting tool materials and tool geometries for different metals
	CO4	**Choose** appropriate machining processes and conditions for different metals
	CO5	**Optimize** parameters for material removal in unconventional machining processes

	CO6	**Identify** the process parameters, their effect and applications of different processes
120503: Heat and Mass Transfer	CO1	**State** principles of heat and mass transfer to basic engineering systems
	CO2	**Develop** basic concepts of heat transfer, differentiate between heat transfer and thermodynamics, modes of heat transfer (rates) i.e. Conduction, Radiation and convection.
	CO3	**Analyze** and **solve** heat transfer problem of conduction, convection and radiation
	CO4	**Apply** physics of heat transfer in the processes like Condensation and 'Boiling' and in applications like 'Fins' and 'Heat-Exchangers'. Analyze and design heat exchangers
	CO5	**Formulate** and **solve** one dimensional conduction with and without heat generation, convection and radiation heat transfer problems
	CO6	**Create** solution techniques which include both closed form and numerical methods of heat conduction and Convection
120504: Thermal Engineering	CO1	**Selection** of various types of fuels based on required applications
	CO2	**Outlining** the basics of Refrigeration and Air conditioning
	CO3	**Solve** analytical problems of thermal engineering
	CO4	**Compare** different turbo machines depending on their behaviour and their merits and demerits
	CO5	**Select** proper fluid machines for appropriate operation
	CO6	**Design** of various types of combustion chambers for Internal Combustion Engines
120505: Machine Design	CO1	**Describe** the design procedure used in automotive industry to design the engine parts
	CO2	**Classify** the different types of spring, bearing and Gears
	CO3	**Choose** the right strategy for designing the machine components based on material and methods
	CO4	**Apply** the design procedure for solving and drafting the different design of machine elements
	CO5	**Compare** the various curves and design procedure used
	CO6	**Selection** of machine elements under various loading and environmental conditions
120601: Advanced Production Technology	CO1	**Illustrate** the concepts/components of computer integrated manufacturing and integrate them in a coordinated fashion
	CO2	**Demonstrate** the machining operations, programming languages and its control system used for solving practical problems of automation based
	CO3	**Compare** the components of computer integrated manufacturing and integrate them in a coordinated manner

	CO4	**Decide** between the various trade-offs when selecting AM processes, devices and materials to suit particular engineering requirements
	CO5	**Designing** Flexible manufacturing cell after carrying out Group technology study, Automated Material Handling Systems, Automated Inspection Systems and finally creating FMS
	CO6	**Knowledge** in the broad spectrum of Production Engineering
120611: Vibration and Noise Engineering	CO1	**Understand** basics of vibration and noise
	CO2	**Define** the physical systems in to spring-mass-damper systems
	CO3	**Use** different methods and principles applicable to dynamic systems
	CO4	**Determine** responses of vibrating systems
	CO5	**Analyse** the behaviours of physical systems
	CO6	**Design** the mechanical systems by considering vibration and noise.
120612: Statistical Quality Control	CO1	**Draw** the histogram, bar charts
	CO2	**State** various techniques including various variable and attribute control charts
	CO3	**Relate** mathematical standard plots for defect analysis
	CO4	**Justify** the life cycle of component on the basis of Reliability and Quality
	CO5	**Compare** various statistical quality control tools
	CO6	**Solve** quality-related problems using these SQC tools and methods
120613: Work Study and Ergonomics	CO1	**Identify** potential and current OH&S hazards in the workplace relating to ergonomics issue
	CO2	**Describe** relation between human motion and industry
	CO3	**Calculate** the production capacity of man power of an organization
	CO4	**Analyze** the level of risk in a job causing stress, fatigue and musculoskeletal disorders and design appropriate work systems
	CO5	**Devise** appropriate wage and incentive plan for the employees of an organization
	CO6	**Design** physical and psychosocial work system and work places
120614: Turbo Machinery	CO1	**Understand** the working principles of rotating machines
	CO2	**Describe** the velocity triangles, thermodynamic plots and losses in turbo-machinery
	CO3	**Demonstrate** the knowledge of working, stages, performance characteristics, governing and selection of turbo machinery
	CO4	**Analyze** energy transfer through graphical and analytical methods in turbo machines
	CO5	**Design** different type of rotating machines
	CO6	**Evaluate** the performance characteristics of different kinds of turbo machines

900101 (OC-1): Robotics	CO1	**Understand** importance of robotics and its impact on human safety, quality of life, economy, environment, etc.; basics of open-ended type of Robotic manipulators
	CO2	**Discuss** Kinematics and dynamics of open-ended robotic mechanisms; Fixing frames
	CO3	**Ability to formulate**, derive, analyse, design and synthesize kinematics and dynamics of open-ended robotic mechanisms
	CO4	**Apply** detailed concepts relating to various actuators, sensors, and their integration with drives and signal conditioning for robotics
	CO5	**Impart** knowledge on the basic concepts of measurement, static and dynamic characteristics of measurement systems. control theory and applying them to design and development of robots
900102 (OC-1): Product Design	CO1	**Analyze** the demands and needs of customers to conceptualize product
	CO2	**Describe** the different steps involved in the product design
	CO3	**Analyze** the shortcoming in the product development
	CO4	**Identify** the opportunities to develop the product
	CO5	**Utilize** the recourses available in efficient manner for maximum productivity
	CO6	**Forecast** the impact of product on the surrounding environment
120711: Refrigeration and Air-conditioning	CO1	**Understand** vapour compression refrigeration system
	CO2	**Describe** the working principles of air, vapour absorption, thermoelectric and steam-jet refrigeration systems
	CO3	**Obtain** cooling capacity and coefficient of performance by conducting test on vapor compression refrigeration systems
	CO4	**Analyze** the basic air conditioning processes on psychometric charts, calculate cooling load for its applications in comfort and industrial air conditioning
	CO5	**Develop** thermal comfort conditions with respect to temperature and humidity
	CO6	**Estimate** cooling and heating loads in an air-conditioning system
120712: Basic of Finite Element Analysis	CO1	**Understand** the basics of finite element formulation
	CO2	**Define** discrete and continuous models
	CO3	**Use** variational Formulation of Boundary Value Problems
	CO4	**Apply** finite element formulations to solve one dimensional Problem
	CO5	**Analyse** finite element formulations to solve 2D scalar Problems and vector problems
	CO6	**Design** finite element method to solve problems on Isoparametric element and dynamic Problem

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120713: Metrology, Measurement and Control	CO1	**State** the basic of standards of measurement, limits, fits & tolerances
	CO2	**Compare** quality in engineering products
	CO3	**Apply** the principle of measurement in QC & QA aspects and calibration of measuring instruments
	CO4	**Analysis** the accuracy in the measurement
	CO5	**Evaluate** the product quality in manner of dimensional accuracy.
	CO6	**Design** limit gauges
120714: Total Quality Management	CO1	**Discuss** about quality measures, Quality control techniques
	CO2	**Describe** various theories of Total quality management.
	CO3	**Determine** the cost of poor quality and process effectiveness and efficiency to track performance quality
	CO4	**Apply** appropriate techniques in identifying customer needs, as well as the quality impact that will be used as inputs in TQM methodologies
	CO5	**Evaluate** the performance excellence of an organization, and determine the set of performance indicators
	CO6	**Enhance** management processes, such as benchmarking and business process reengineering
900203: INDUSTRIAL AUTOMATION	CO1	**Identify** potential areas for automation and justify need for automation
	CO2	**Select** suitable major control components required to automate a process or an activity
	CO3	**Translate** and simulate a real time activity using modern tools and discuss the benefits of automation
	CO4	**Decide** suitable automation hardware for the given application
	CO5	**Design** appropriate modelling and simulation tool for the given manufacturing application
900204: SOLAR ENERGY	CO1	**Define** the basic terms used in solar systems and various sun-earth angles
	CO2	**Establish** the energy balance and develop the thermal model of different solar systems
	CO3	**Investigate** the effectiveness of utilizing the solar energy by different solar systems
	CO4	**Analyze** the life cycle cost and other economic aspects of solar syste
	CO5	**Describe** the application of solar systems and find out the areas of improvement

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900214: ENGINEERING MATERIALS FOR INDUSTRIAL APPLICATIONS	CO1	**State** the properties of engineering materials
	CO2	**Understand** the material composition and their effects
	CO3	**Classify** different engineering material.
	CO4	**Discuss** the production and fabrication techniques of Engineering Materials
	CO5	**Select** different types of materials as per requirement.
900215: Maintenance Engineering	CO1	**Describe** the fundamental concepts of maintenance engineering noise and vibration, measurement techniques of Condition Monitoring
	CO2	**Show** skills of fault diagnosis
	CO3	**Demonstrate** the need of instrumentation and signal processing for condition monitoring
	CO4	**Examine** the condition of machine parts through Failure analysis of plant machineries
	CO5	**Apply** correct usage of a method or procedure of maintenance