

**Department of Mechanical Engineering**  
**Course Outcome (CO)**

<b>First Year -2019 Course</b>			
<b>Course Code</b>	<b>Course Name</b>	<b>Course Outcomes</b>	
<b>Semester I</b>			
<b>102003</b>	<b>Systems in Mechanical Engineering</b>	C102003.1	Describe and compare the conversion of energy from renewable and non-renewable energy sources
		C102003.2	Explain basic laws of thermodynamics, heat transfer and their applications
		C102003.3	List down the types of road vehicles and their specifications
		C102003.4	Illustrate various basic parts and transmission system of a road vehicle
		C102003.5	Discuss several manufacturing processes and identify the suitable process
		C102003.6	Explain various types of mechanism and its application
<b>Semester II</b>			
<b>102012</b>	<b>Engineering Graphics</b>	C102012.1	Draw the fundamental engineering objects using basic rules and able to construct the simple geometries
		C102012.2	Construct the various engineering curves using the drawing instruments
		C102012.3	Apply the concept of orthographic projection of an object to draw several 2D views and its sectional views for visualizing the physical state of the object
		C102012.4	Apply the visualization skill to draw a simple isometric projection from given orthographic views precisely using drawing equipment
		C102012.5	Draw the development of lateral surfaces for cut section of geometrical solids
		C102012.6	Draw fully-dimensioned 2D, 3D drawings using computer aided drafting tools

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<b>Second Year -2019 Course</b>			
<b>Course Code</b>	<b>Course Name</b>	<b>Course Outcomes</b>	
<b>Semester I</b>			
<b>202041</b>	<b>Solid Mechanics</b>	C203.1	Determine various strength properties of Material
		C203.2	Apply the concept of stress and strain and understand various stress and strain
		C203.3	Identify various types of stress and terms associated in elastic constants.
		C203.4	Apply transverse force on beam and understand SFD, BMD, bending and shear stresses.
		C203.5	Estimate torsional stresses and Determine critical load on column.
		C203.6	Construct geometrical Mohr's circle to predict the Principal stresses and predict behaviour of material under complex load.
<b>202042</b>	<b>Solid Modeling and Drafting</b>	C202.1	Explain the concepts of 3D Modeling in Solid Modeling.
		C202.2	Understand the mathematical representation of Curves and Surfaces.
		C202.3	Explain the concept of solid representation.
		C202.4	Understand and solve problems on geometric transformation techniques in Solid Modeling.
		C202.5	Model engineering components using commercial solid modeling software package
<b>202043</b>	<b>Engineering Thermodynamics</b>	C203.1	Understand the basics of thermodynamics, laws of thermodynamics and SFEE, and apply them to different types of thermodynamic systems.
		C203.2	Understand various ideal gas laws and their applications to various processes and also to understand second law of thermodynamics and its consequences.
		C203.3	Understand the concept of entropy, principle of increase of entropy, concept of availability and availability of flow and non-flow processes.
		C203.4	Determine and Demonstrate the properties of the steam and apply them to vapour power cycles and vapour refrigeration cycles.
		C203.5	Understand and Demonstrate various fuels, combustion processes and flue gas analysis
		C203.6	Understand construction, working and types of steam generators and demonstrate their performance.
<b>202044</b>	<b>Engineering</b>	C204.1	Compare crystal structures and Assess different lattice

	<b>Materials and Metallurgy</b>		parameters.
		C204.2	Correlate crystal structures and imperfections in crystals with mechanical behavior of materials.
		C204.3	Differentiate and Determine mechanical properties using destructive and non-destructive testing of materials.
		C204.4	Identify & Estimate different parameters of the system viz., phases, variables, component, grains, grain boundary, and degree of freedom, etc.
		C204.5	Analyse effect of alloying element & heat treatment on properties of ferrous & nonferrous alloy.
		C204.6	Select appropriate materials for various applications
<b>203156</b>	<b>Electrical and Electronics Engineering</b>	C256.1	Apply programming concepts to Understand role of Microprocessor and Microcontroller in embedded systems
		C256.2	Develop interfacing of different types of sensors and other hardware devices with Atmega328 based Arduino Board
		C256.3	Understand the operation of DC motor, its speed control methods and braking
		C256.4	Distinguish between types of three phase induction motor and its characteristic features
		C256.5	Explain about emerging technology of Electric Vehicle (EV) and its modular subsystems
		C256.6	Choose energy storage devices and electrical drives for EVs
<b>202045</b>	<b>Geometric Dimensioning and Tolerancing Lab</b>	C205.1	Select appropriate IS and ASME standards for drawing.
		C205.2	Read & Analyses variety of industrial drawings.
		C205.3	Apply geometric and dimensional tolerance, surface finish symbols in drawing.
		C205.4	Evaluate dimensional tolerance based on type of fit, etc.
		C205.5	Select an appropriate manufacturing process using DFM, DFA, etc.
<b>Semester II</b>			
<b>207002</b>	<b>Engineering Mathematics - III</b>	C207.1	Solve higher order linear differential equations and its applications to model and analyze mass spring systems.
		C207.2	Apply Integral transform techniques such as Laplace transform and Fourier transform to solve differential equations involved in vibration theory, heat transfer and related mechanical engineering applications.
		C207.3	Apply Statistical methods like correlation, regression in analyzing and interpreting experimental data applicable to reliability engineering and probability theory in testing and quality control.
		C207.4	Perform Vector differentiation & integration, analyze the vector fields and APPLY to fluid flow problems.

		C207.5	Solve Partial differential equations such as wave equation, one and two dimensional heat flow equations.
<b>202047</b>	<b>Kinematics of Machinery</b>	C208.1	Apply kinematic analysis to simple mechanisms
		C208.2	Analyze velocity and acceleration in mechanisms by vector and graphical method
		C208.3	Synthesize a four bar mechanism with analytical and graphical methods
		208.4	Apply fundamentals of gear theory as a prerequisite for gear design
		208.5	Construct cam profile for given follower motion
<b>202048</b>	<b>Applied Thermodynamics</b>	C208.1	To Learn fundamentals and determine COP of refrigeration system and analyze Psychrometric processes.
		C208.2	To Understand and discuss basics of engine terminology, air standard, fuel air and actual cycles.
		C208.3	To explains and identify factors affecting the combustion performance of SI and CI engines.
		C208.4	To Test and determine performance parameters of IC Engines and emission control.
		C208.5	To understand and explain working of various IC Engine systems and use of alternative fuels.
		C208.6	To study and calculate performance of single and multi-stage reciprocating compressors and DISCUSS rotary positive displacement compressors.
<b>202049</b>	<b>Fluid Mechanics</b>	C209.1	Understand basic properties of fluids.
		C209.2	Learn fluid statics and dynamics
		C209.3	Study basics of flow visualization
		C209.4	Understand Bernoulli's theorem and its applications
		C209.5	Understand losses in flow, drag and lift forces
		C209.6	Learn to establish relation between flow parameters
<b>202050</b>	<b>Manufacturing Processes</b>	C210.1	Select appropriate moulding, core making and melting practice and estimate pouring time, solidification rate and Design riser size and location for sand casting process
		C210.2	Understand mechanism of metal forming techniques and Calculate load required for flat rolling
		C210.3	Demonstrate press working operations and Apply the basic principles to Design dies and tools for forming and shearing operations
		C210.4	Classify and Explain different welding processes and Evaluate welding characteristics
		C210.5	Differentiate thermoplastics and thermosetting and Explain polymer processing techniques
		C210.6	Understand the principle of manufacturing of fibre-reinforce composites and metal matrix composites
<b>202051</b>	<b>Machine Shop</b>	C211.1	Perform welding using TIG/ MIG/ Resistance/Gas welding technique
		C211.2	Make Fibre-reinforced Composites by hand lay-up process or spray lay-up techniques

		C211.3	Perform cylindrical/surface grinding operation and Calculate its machining time
		C211.4	Determine number of indexing movements required and acquire skills to Produce a spur gear on a horizontal milling machine
		C211.5	Prepare industry visit report
		C211.6	Understand procedure of plastic processing
<b>202052</b>	<b>Project Based Learning - II</b>	C212.1	Understand the fundamentals of mechanical engineering, various disciplines and apply them in practical way.
		C212.2	Identify the real-world problems (possibly of interdisciplinary nature) through a rigorous literature survey.
		C212.3	Analyze the solution through critical thinking and solving real life problems by exploring and proposing sustainable solutions.
		C213.4	Contribute to society through proposed solutions by strictly following professional ethics and safety measures.
		C213.5	Develop the ability of leadership, team work and create the interdisciplinary lifelong learning environments.
<b>202053</b>	<b>Audit Course - IV</b>	C213.1	Explore the relationship between ethics and business and the subsequent theories of justice and economics across different cultural traditions.
		C213.2	Explain the relationship between ethics, morals and values in the workplace.
		C213.3	Formulate ethical philosophy to explain how it contributes to current practice.
		C213.4	Critically apply understanding of ethics of real-world contexts and gather and analyze information by way of undertaking a research project on a topic relevant to business ethics.
	<b>Environment Studies</b>	CO1	Gain in-depth knowledge on natural processes that sustain life and govern economy.
		CO2	Predict the consequences of human actions on the web of life, global economy and quality of human life.
		CO3	Develop critical thinking for shaping strategies (scientific, social, economic and legal) for environmental protection and conservation of biodiversity, social equity and sustainable development.
		CO4	Acquire values and attitudes towards understanding complex environmental-economicsocial challenges, and participating actively in solving current environmental problems and preventing the future ones.
		CO5	Adopt sustainability as a practice in life, society and industry.

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Third Year -2019 Course			
Course Code	Course Name	Course Outcomes	
<b>Semester I</b>			
<b>302041</b>	<b>Numerical &amp; Statistical Methods</b>	C302041.1	SOLVE system of equations using direct and iterative numerical methods
		C302041.2	ESTIMATE solutions for differential equations using numerical techniques
		C302041.3	DEVELOP solution for engineering applications with numerical integration
		C302041.4	DESIGN and CREATE a model using a curve fitting and regression analysis
		C302041.5	APPLY statistical Technique for quantitative data analysis
		C302041.6	DEMONSTRATE the data, using the concepts of probability and linear algebra
<b>302042</b>	<b>Heat &amp; Mass Transfer</b>	C302042.1	ANALYZE & APPLY the modes of heat transfer equations for one dimensional thermal system
		C302042.2	DESIGN a thermal system considering fins, thermal insulation and & Transient heat conduction
		C302042.3	EVALUATE the heat transfer rate in natural and forced convection & validate with experimentation results
		C302042.4	INTERPRET heat transfer by radiation between objects with simple geometries, for black and grey surfaces
		C302042.5	ABILITY to analyze the rate of mass transfer using Fick's Law of Diffusion and understands mass diffusion in different coordinate systems
		C302042.6	ANALYZE various performance parameters for existing heat exchanger and DEVELOP methodologies for designing a heat exchanger under prescribed conditions and for a particular application, with references TEMA standards
<b>302043</b>	<b>Design of Machine Elements</b>	C302043.1	DESIGN AND ANALYZE the cotter and knuckle Joints, levers and components subjected to eccentric loading.
		C302043.2	DESIGN shafts, keys and couplings under static loading conditions.
		C302043.3	ANALYZE different stresses in power screws and APPLY those in the procedure to design screw jack
		C302043.4	EVALUATE dimensions of machine components under fluctuating loads.

		C302043.5	EVALUATE & INTERPRET the stress developed on the different type of welded and threaded joints.
		C302043.6	APPLY the design and development procedure for different types of springs.

<b>302044</b>	<b>Mechatronics</b>	C302044.1	DEFINE key elements of mechatronics, principle of sensor and its characteristics.
		C302044.2	UTILIZE concept of signal processing and MAKE use of interfacing systems such as ADC, DAC, Digital I/O.
		C302044.3	DETERMINE the transfer function by using block diagram reduction technique
		C302044.4	EVALUATE Poles and Zero, frequency domain parameter for mathematical modeling for mechanical system.
		C302044.5	APPLY the concept of different controller modes to an industrial application.
		C302044.6	DEVELOP the ladder programming for industrial application.
<b>302045</b>	<b>Elective-I (Advanced Forming &amp; Joining Processes)</b>	C302045A.1	ANALYSE the effect of friction in metal forming deep drawing and IDENTIFICATION of surface defects and their remedies in deep drawing operations
		C302045A.2	ASSESS the parameters for special forming operation and SELECT appropriate special forming operation for particular applications
		C302045A.3	ANALYSE the effect of HAZ on microstructure and mechanical properties of materials
		C302045A.4	CLASSIFY various solid state welding process and SELECT suitable welding processes for particular applications
		C302045A.5	CLASSIFY various advanced welding process and SELECT suitable welding processes for particular applications
		C302045A.6	INTERPRET the principles of sustainable manufacturing and its role in manufacturing industry
<b>302045</b>	<b>Elective- I (Machining Science &amp; Technology)</b>	C302045B.1	DEFINE metal cutting principles and mechanics of metal cutting and tool life
		C302045B.2	DESCRIBE features of gear and thread manufacturing processes
		C302045B.3	SELECT appropriate grinding wheel and demonstrate the various surface finishing processes
		C302045B.4	SELECT appropriate jigs/fixtures and to draw the process plan for a given component
		C302045B.5	SELECT & EVALUATE various parameters of process planning
		C302045B.6	GENERATE CNC program for Turning / Milling processes and generate tool path using CAM software
<b>302046</b>	<b>Digital Manufacturing Laboratory</b>	C302046.1	DEVELOP a component using conventional machines, CNC machines and Additive Manufacturing Techniques
		C302046.2	ANALYZE cutting tool parameters for machining



			given job
		C302046.3	DEMONSTRATE simulation of manufacturing process using Digital Manufacturing Tools
		C302046.4	SELECT and DESIGN jigs and Fixtures for a given component.
		C302046.5	DEMONESTRATE different parameters for CNC retrofitting and reconditioning

<b>302047</b>	<b>Skill Development</b>	C302047.1	APPLY& DEMONSTRATE procedure of assembly & disassembly of various machines.
		C302047.2	DESIGN & DEVELOP a working/model of machine parts or any new product.
		C302047.3	EVALUATE fault with diagnosis on the machines, machine tools and home appliances.
		C302047.4	IDENTIFY & DEMONSTRATE the various activities performed in an industry such as maintenance, design of components, material selection

**Semester-II**

<b>302049</b>	<b>Artificial Intelligence &amp; Machine Learnings</b>	C302049.1	. DEMONSTRATE fundamentals of artificial intelligence and machine learning.
		C302049.2	APPLY feature extraction and selection techniques.
		C302049.3	APPLY machine learning algorithms for classification and regression problems.
		C302049.4	DEVISE AND DEVELOP a machine learning model using various steps.
		C302049.5	EXPLAIN concepts of reinforced and deep learning.
		C302049.6	SIMULATE machine learning model in mechanical engineering problems.
<b>302050</b>	<b>Computer Aided Engineering</b>	C302050.1	DEFINE the use of CAE tools and DESCRIBE the significance of shape functions in finite element formulations.
		C302050.2	APPLY the various meshing techniques for better evaluation of approximate results.
		C302050.3	APPLY material properties and boundary condition to SOLVE 1-D and 2-D element stiffness matrices to obtain nodal or elemental solution.
		C302050.4	ANALYZE and APPLY various numerical methods for different types of analysis.
		C302050.5	EVALUATE and SOLVE non-linear and dynamic analysis problems by analyzing the results obtained from analytical and computational method.
		C302050.6	GENERATE the results in the form of contour plot by the USE of CAE tools.
<b>302051</b>	<b>Design of</b>	C302051.1	APPLY the principle of Spur & Helical gear design for industrial application and PREPARE a manufacturing



	<b>Transmission Systems</b>		drawing with the concepts of GD&T.
		C302051.2	EXPLAIN and DESIGN Bevel & Worm gear considering design parameters as per design standards.
		C302051.3	SELECT & DESIGN Rolling and Sliding Contact Bearings from manufacturer's catalogue for a typical application considering suitable design parameters.
		C302051.4	DEFINE and DESIGN various types of Clutches, Brakes, used in automobile.
		C302051.5	APPLY various concept to DESIGN Machine Tool Gear box, for different applications
		C302051.6	ELABORATE various modes of operation, degree of hybridization and allied terms associated with hybrid electric vehicles.
<b>302052</b>	<b>Elective II (Composite Materials)</b>	C302052A.1	DEFINE & COMPARE composites with traditional materials
		C302052A.2	IDENTIFY & ESTIMATE different parameters of the Polymer Matrix Composite
		C302052A.3	CATEGORISE and APPLY Metal Matrix Process from possessions landscape
		C302052A.4	DETERMINE volume/weight fraction and strength of Composites
		C302052A.5	SELECT appropriate testing and inspection method for composite materials
		C302052A.6	SELECT composites materials for various applications
<b>302053</b>	<b>Measurement Laboratory</b>	C302053.1	EVALUATE causes of errors in Vernier calipers, micrometers by performing experiments in standard metrological conditions, noting deviations at actual and by plotting cause and effect diagram, to reduce uncertainty in measurement.
		C302053.2	ANALYZE strain measurement parameters by taking modulus of elasticity in consideration to acknowledge its usage in failure detection and force variations
		C302053.3	EXAMINE surface Textures, surface finish using equipment's like Talysurf and analyze surface finish requirements of metrological equipment's like gauges, jaws of vernier calipers, micrometers, magnifying glasses of height gauge and more, to optimize surface finish accuracy requirements and cost of measurement.
		C302053.4	MEASURE the dimensional accuracy using Comparator and limit gauges and appraise their usage in actual measurement or comparison with standards set to reduce measurement lead time.
		C302053.5	PERFORM Testing of Flow rate, speed and temperature measurements and their effect on performance in machines and mechanisms like hydraulic or pneumatic trainers, lathe machine etc. to increase repeatability and reproducibility.

		C302053.6	COMPILE the information of opportunities of entrepreneurs/business in various sectors of metrology like calibrations, testing, coordinate and laser metrology etc in an industry visit report.
<b>302054</b>	<b>Fluid Power &amp; Control Laboratory</b>	C302054.1	DEFINE working principle of components used in hydraulic and pneumatic systems
		C302054.2	IDENTIFY & EXPLAIN various applications of hydraulic and pneumatic systems
		C302054.3	SELECT an appropriate component required for hydraulic and pneumatic systems using manufactures' catalogs
		C302054.4	SIMULATE & ANALYSE various hydraulic and pneumatic systems for industrial/mobile applications
		C302054.5	DESIGN a hydraulic and pneumatic system for the industrial applications
		C302054.6	DESIGN & DEMONSTRATE various IoT, PLC based controlling system using hydraulics and pneumatics
<b>302055</b>	<b>Internship/Mini project</b>	C302055.1	DEMONSTRATE professional competence through industry internship
		C302055.2	APPLY knowledge gained through internships to complete academic activities in a professional manner
		C302055.3	CHOOSE appropriate technology and tools to solve given problem
		C302055.4	DEMONSTRATE abilities of a responsible professional and use ethical practices in day to day life
		C302055.5	DEVELOP network and social circle, and DEVELOPING relationships with industry people
		C302055.6	ANALYZE various career opportunities and DECIDE career goals