DEPARTMENT OF MECHANICAL ENGINEERING

REGULATION -2017

Vision and Mission of The Department:

Vision

To develop highly skilled Mechanical Engineers dedicated to serving society

Mission

M1: To Foster a dynamic learning environment that prepares competent student-research scholars in Mechanical Engineering.

M2: To Build state-of-the-art laboratories to meet technological advancements and transformations.

M3: To Uphold moral and ethical principles among faculty and students.

Program Educational Objectives (PEOs)

This Course is conducted to achieve the following Programme Educational Objectives (PEOs):

PEO 1. **Academic Excellence** Excel as successful engineers or entrepreneurs.

PEO2: Leadership Quality Become effective leaders, demonstrating professionalism and a commitment to lifelong learning.

PEO3: Research skill and Ethics: Handle real-time projects while upholding ethical values.

Program Outcomes (POs)

PO1 **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations..

PO6 **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

PO9 **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10 **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11 **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‘s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs):

PSO1: Apply fundamental and advanced concepts in mechanical engineering across multiple domains, such as materials, design, manufacturing, and thermal engineering, to effectively design, develop, and implement complex products and systems.

PSO2: Identify, select, and effectively utilize ICT tools commonly employed Mechanical Engineering such as Computer-Aided Design (CAD) software, simulation software, and data analysis tools to create and apply innovative solutions for the betterment of society.

Course Outcomes (Cos) of All Courses.

Anna University Chennai – R2017

S.NO	COURSE CODE.	SUBJECT CODE	COURSE TITLE
1	C101	HS8151	Communicative English
2	C102	MA8151	Engineering Mathematics - I
3	C103	PH8151	Engineering Physics
4	C104	CY8151	Engineering Chemistry
5	C105	GE8151	Problem Solving and Python Programming
6	C106	GE8152	Engineering Graphics
7	C107	GE8161	Problem Solving and Python Programming Laboratory
8	C108	BS8161	Physics and Chemistry Laboratory
9	C111	HS8251	Technical English
10	C112	MA8251	Engineering Mathematics - II
11	C113	PH8251	Materials Science
12	C114	BE8253	Basic Electrical, Electronics and Instrumentation Engineering
13	C115	GE8291	Environmental Science and Engineering
14	C116	GE8292	Engineering Mechanics
15	C117	GE8261	Engineering Practices Laboratory
16	C118	BE8261	Basic Electrical, Electronics and Instrumentation Engineering Laboratory
17	C201	MA8353	Transforms and Partial Differential Equations
18	C202	ME8391	Engineering Thermodynamics
19	C203	CE8394	Fluid Mechanics and Machinery
20	C204	ME8351	Manufacturing Technology - I
21	C205	EE8353	Electrical Drives and Controls
22	C206	ME8361	Manufacturing Technology Laboratory – I
23	C207	ME8381	Computer Aided Machine Drawing
24	C208	EE8361	Electrical Engineering Laboratory
25	C209	HS8381	Interpersonal Skills / Listening & Speaking
26	C211	MA8452	Statistics and Numerical Methods
27	C212	ME8492	Kinematics of Machinery
28	C213	ME8451	Manufacturing Technology – II
29	C214	ME8491	Engineering Metallurgy
30	C215	CE8395	Strength of Materials for Mechanical Engineers
31	C216	ME8493	Thermal Engineering- I
32	C217	ME8462	Manufacturing Technology Laboratory–II
33	C218	CE8381	Strength of Materials and Fluid Mechanics and Machinery Laboratory
34	C219	HS8461	Advanced Reading and Writing
35	C301	ME8595	Thermal Engineering- II
36	C302	ME8593	Design of Machine Elements
37	C303	ME8501	Metrology and Measurements
38	C304	ME8594	Dynamics of Machines
39	C305	ORO551	Renewable Energy Sources

40	C306	ME8511	Kinematics and Dynamics Laboratory
41	C307	ME8512	Thermal Engineering Laboratory
42	C308	ME8513	Metrology and Measurements Laboratory
43	C311	ME8651	Design of Transmission Systems
44	C312	ME8691	Computer Aided Design and Manufacturing
45	C313	ME8693	Heat and Mass Transfer
46	C314	ME8692	Finite Element Analysis
47	C315	ME8694	Hydraulics and Pneumatics
48	C316	ME8091	Automobile Engineering
49	C317	ME8681	C.A.D. / C.A.M. Laboratory
50	C318	ME8682	Design and Fabrication Project
51	C319	HS8581	Professional Communication
52	C401	ME8792	Power Plant Engineering
53	C402	ME8793	Process planning and cost estimation
54	C403	ME8791	Mechatronics
55	C404	OIE751	Robotics
56	C405	ME8073	Unconventional Machining Processes
57	C406	ME8097	Non Destructive Testing and Evaluation
58	C407	ME8711	Simulation and Analysis Laboratory
59	C408	ME8781	Mechatronics Laboratory
60	C409	ME 8712	Technical Seminar
61	C411	MG8591	Principles of Management
62	C412	IE8693	Production Planning and Control
63	C413	ME8811	Project

SEMESTER-I

HS8151 (C101) COMMUNICATIVE ENGLISH

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C101.1	Develop the ability to share information about family and friends. (K2)
C101.2	Develop your ability to understand and communicate ideas effectively through free writing. (K2)
C101.3	Utilize basic grammar techniques to enhance language development. (K2)
C101.4	Foster an environment for reading and develop good language skills. (K2)
C101.5	Develop flair for any kind of writing with rich vocabulary and proper syntax. (K2)
C101.6	Proficiency in writing technical articles and presenting papers on any topic of any genre. (K2)

MA8151 (C102) ENGINEERING MATHEMATICS – I

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C102.1	Diagonalize symmetric matrices and similar matrices using Eigen values and Eigen vectors.(K2)
C102.2	Explain gradients, potential functions, and directional derivatives of functions of several variables. (K2)
C102.3	Compute line, surface and volume integral using Gauss divergence, Green's and stoke's theorem. (K2)
C102.4	Discuss analytic functions in heat and fluid flow. (K2)
C102.5	Extend the concept of contour integrals in evaluating Real integrals. (K2)
C102.6	Discuss Laplace Transform methods to solve initial value problems for constant coefficient linear ODEs. (K2)

PH8151 (C103) ENGINEERING PHYSICS

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C103.1	Discuss the Young's modulus and Rigidity modulus of elasticity of materials and its determination through experimental methods. (K2)
C103.2	Describe the characteristics of laser light and their application in semiconductor laser. (K2)
C103.3	Discuss the principle behind the propagation of light through an optical fibre and its application in sensors. (K2)
C103.4	Summarize the different modes of heat transfer. (K2)
C103.5	Relate the quantum concepts in electron microscopes. (K2)
C103.6	Describe the unit cell characteristics and the growth of crystals. (K2)

CY8151 (C104) ENGINEERING CHEMISTRY

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C104.1	Summarize the water related problems in boilers and their treatment techniques. (K2)
C104.2	Discuss the applications of adsorption in the field of water and air pollution abatement. (K2)
C104.3	Discuss the types of catalysis and the mechanism of enzyme catalysis(K2)
C104.4	Associate phase rule in the alloying and the behaviour of one component and two component systems using phase diagram. (K2)
C104.5	Explain various types of fuels, their manufacturing processes and calculation of calorific theoretically. (K2)
C104.6	Summarize the principles and generation of energy in batteries ,nuclear reactors, solar cells, wind mills and fuel cells. (K2)

GE8151 (C105) PROBLEM SOLVING AND PYTHON PROGRAMMING

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C105.1	Discuss the logical solutions through Flowcharts, Algorithms and Pseudo code. (K2)
C105.2	Explain the syntax for python programming constructs. (K2)
C105.3	Compute the flow of the program to obtain the programmatic solution. (K3)
C105.4	Examine the programs with sub problems using ‘Python’ language. (K2)
C105.5	Compute the compound data using Python lists, tuples, and dictionaries. (K2)
C105.6	Apply python programs to read and write data from/to files. (K3)

GE8152 (C106) ENGINEERING GRAPHICS

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C106.1	Discuss about conics and orthographic views of engineering components. (K2)
C106.2	Draw the projection of points, lines and planes. (K1)
C106.3	Classify solids and projection of solids at different positions. (K3)
C106.4	Show sectioned view of solids and development of surface. (K3)
C106.5	Draw isometric projection and perspective views of an object/solid. (K1)
C106.6	Apply the concept of drawing in practical applications. (K3)

GE8161-(C107) PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C107.1	Write, test, and debug simple Python programs. (K1)
C107.2	Apply the concept of conditionals and loops in Python programs. (K3)
C107.3	Develop the Python programs step-wise by defining functions and calling them. (K4)
C107.4	Develop the programs in basic C constructs(K3)
C107.5	Read and write data from/to files in Python. (K1)
C107.6	Apply the concept of Pygame. (K3)

BS8161 (C108) PHYSICS AND CHEMISTRY LABORATORY

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C108.1	Assess optical fibre parameters using laser properties. (K2)
C108.2	Measure the velocity of ultrasonic waves in a given liquid medium. (K2)
C108.3	Compute the wavelength of mercury spectrum using properties of light(K2)
C108.4	Compute the thermal conductivity of a bad conductor using Lee's method. (K2)
C108.5	Determine the modulus of a material using Hooke's law. (K2)
C108.6	Estimate water quality parameters such as dissolved oxygen content, chloride content of the water samples. (K2)

SEMESTER: II

HS8251 (C111) TECHNICAL ENGLISH

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C111.1	Breakdown the ideas in to its elementary constituents, analyze and act after a meaning full thought process. (K2)
C111.2	Analyze the phrase and passage and explicitly pass on the ideas meaning fully. (K3)
C111.3	Manage to interpret the given phrase or the graphical rendering and review the contents well individually or as a group. (K3)
C111.4	Concentrate on the communication aspect of complicated ideas and respond positively. (K2)
C111.5	Debate the issues and find the rudiments of the problem individually and as a group. (K2)
C111.6	Respond intelligently and seek clarification and understand completely. (K2)

MA8251 (C112) ENGINEERING MATHEMATICS – I I

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C112.1	Compute Eigen values and Eigen vectors of a matrix, diagonalize symmetric matrices and similar matrices. (K2)
C112.2	Explain gradients, potential functions, and directional derivatives of functions of several variables. (K2)
C112.3	Compute line, surface and volume integral using Gauss divergence, Green's and stoke's theorem. (K2)
C112.4	Discuss analytic functions in heat and fluid flow. (K2)
C112.5	Extend the concept of contour integrals in evaluating Real integrals. (K2)
C112.6	Discuss Laplace Transform methods to solve initial value problems for constant coefficient linear ODEs. (K2)

PH8251 (C113) MATERIALS SCIENCE

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C113.1	Discuss on various phase diagrams and applications. (K2)
C113.2	Discuss the Iron Carbon phase diagram and the applications of ferrous alloys. (K2)
C113.3	Describe the mechanical properties of materials and their measurements. (K2)
C113.4	Summarize the properties of magnetic materials. (K2)
C113.5	Describe the properties of dielectrics and superconducting materials. (K2)
C113.6	Summarize the properties and applications of ceramics ,composites and nanomaterials. (K2)

BE8253 (C114) BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C114.1	Understand electric circuits and working principles of electrical machines. (K3)
C114.2	Understand the concepts of various electronic devices. (K3)
C114.3	Choose appropriate instruments for electrical measurement for a specific application. (K2)
C114.4	Explain the basic concepts of digital electronics. (K2)
C114.5	Explain the operating principles of measuring instruments. (K2)
C114.6	Analyze the AC Electrical Circuits. (K2)

GE8291 (C115) ENVIRONMENTAL SCIENCE AND ENGINEERING

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C115.1	Summarize the values, threats, conservation of biodiversity and ecosystems. (K2)
C115.2	Discuss the sources, effects, control measures of different types of pollution, and solid waste management. (K2)
C115.3	Associate the effects of exploitation of Natural resources on environment. (K2)
C115.4	Summarize the water conservation methods and various environmental acts for environmental sustainability. (K2)
C115.5	Explain the effect of Human population and role of IT in environment and human health. (K2)
C115.6	Discuss scientific, technological, economic and social solutions to environmental problems. (K2)

GE8292 (C116) ENGINEERING MECHANICS

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C116.1	Compute the resultant force for planar and spatial system of forces. (K2)
C116.2	Estimate the force, moment for planar and spatial system of forces. (K2)
C116.3	Compute the centroid, second moment of area, center of gravity, product moment of inertia and mass moment of inertia. (K2)
C116.4	Compute the motion parameters like displacement, velocity, acceleration using dynamics. (K2)
C116.5	Compute the reaction force by applying principles of friction and the motion parameters of rigid body. (K2)
C116.6	Apply the concepts of mechanics and work in force analysis. (K3)

GE8261 (C117) ENGINEERING PRACTICES LABORATORY

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C117.1	Identify Tools and Techniques used for Sheet Metal Fabrication. (K1)
C117.2	Use welding equipment to join the structures. (K3)
C117.3	Demonstrate Plumbing requirements of domestic buildings. (K3)
C117.4	Apply the skills of basic electrical engineering for house wiring practice.(K3)
C117.5	Measure various electrical quantities. (K3)
C117.6	Explain the working of electronic components and its utilization. (K2)

BE8261 (C118) BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING LABORATORY

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C118.1	Illustrate the performance, Characteristics and Load test on DC Shunt motor and DC Generator. (K2)
C118.2	Analyze the measurement of three phase power and explain the performance of induction motor & Transformer. (K2)
C118.3	Demonstrate the various electric circuits laws and theorems. (K2)
C118.4	Explain the various characteristics of different transducers. (K2)
C118.5	Apply the simple circuits based on diodes and transistors. (K2)
C118.6	Explain the study of CRO and measurement of AC Signals. (K2)

SEMESTER: III

MA8353 (C201) TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C201.1	Solve Linear Partial differential equations of first and second order. (K3)
C201.2	Identify the concepts of Fourier series expansion for even and odd functions. (K3)
C201.3	Apply the concepts of Fourier series in solving boundary value problems. (K3)
C201.4	Analyze Fourier Sine and Cosine transforms to identify the Fourier transform. (K4)
C201.5	Make use of the concepts of the Z-Transform when dealing with discrete-time systems. (K3)
C201.6	Apply transforms techniques in modeling physical processes like Heat Conduction, Communications systems and Electromagnetic Theory. (K3)

ME8391 (C202) ENGINEERING THERMODYNAMICS

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C202.1	Apply the first law of thermodynamics for simple open and closed systems under steady and unsteady conditions. (K2)
C202.2	Apply the concept of enthalpy and entropy in thermal systems. (K3)
C202.3	Identify the properties of pure substance and explain the working of steam cycles. (K3)
C202.4	Illustrate the properties of ideal and real gases. (K2)
C202.5	Solve problems in psychrometric processes and gas mixtures. (K3)
C202.6	Apply thermodynamic laws for real time applications. (K3)

CE8394 (C203) FLUID MECHANICS AND MACHINERY

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C203.1	Solve the fluid properties and flow characteristics. (K3)
C203.2	Build the flow of fluid in circular conduits. (K3)
C203.3	Explain the importance of dimensional and model analysis. (K2)
C203.4	Classify the centrifugal and reciprocating pumps using velocity triangles. (K2)
C203.5	Summarize the performance of impulse and reaction turbines. (K2)
C203.6	Develop the flow characteristics and performance of hydraulic machines for real time applications. (K3)

ME8351 (C204) MANUFACTURING TECHNOLOGY – I

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C204.1	Interpret the various casting methods for product making with their merits and demerits. (K2)
C204.2	Compare the various materials joining process and associated defects with possible cause and cure. (K2)
C204.3	Classify various metal forming process with its application. (K2)
C204.4	Construct the various process involved in sheet metal forming with its applications and salient features. (K3)
C204.5	Classify various processes in making of plastic components for engineering / domestic applications. (K2)
C204.6	Explain the process involved in blow moulding. (K2)

EE8353 (C205) ELECTRICAL DRIVES AND CONTROLS

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C205.1	Compare the various electrical drive and its power rating for different loading conditions. (K2)
C205.2	Contrast the characteristics of DC and AC Machines. (K2)
C205.3	Apply the different braking mechanism of Electrical drives. (K3)
C205.4	Explain the starting method of DC and AC Machines. (K2)
C205.5	Illustrate the conventional and solid-state speed control of DC drives. (K2)
C205.6	Explain the conventional and solid-state speed control of AC drives. (K2)

ME8361 (206) MANUFACTURING TECHNOLOGY LABORATORY – I

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C206.1	Demonstrate the working of lathe machine. (K2)
C206.2	Interpret the various operations performed in Lathe machines. (K2)
C206.3	Identify tool life, tool wear and forces in metal cutting. (K3)
C206.4	Choose suitable manufacturing techniques to manufacture different products. (K3)
C206.5	Construct to join the metals using arc welding. (K3)
C206.6	Make use of different moulding tools, patterns and prepare sand moulds. (K3)

ME8381 (C207) COMPUTER AIDED MACHINE DRAWING

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C207.1	Discuss the various CAD standards. (K2)
C207.2	Explain the basic principles of geometric dimensioning & tolerance. (K2)
C207.3	Show the Detailed drawing. (K2)
C207.4	Classify the bearings and valves. (K2)
C207.5	Explain the various feature used in 3D modeling. (K2)
C207.6	Build the various components in 3D modeling. (K3)

EE8361 (C208) ELECTRICAL ENGINEERING LABORATORY

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C208.1	Explain the performance of dc shunt and series motor. (K2)
C208.2	Classify the speed control methods for dc shunt motor. (K2)
C208.3	Demonstrate the load test of DC shunt and series generator. (K2)
C208.4	Identify the load test of transformer. (K3)
C208.5	Examine the performance of induction motor and alternator. (K4)
C208.6	Develop the working of synchronous motor to draw V and inverted V curves. (K3)

HS8381 (C209) INTERPERSONAL SKILLS/LISTENING & SPEAKING

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C209.1	Listen and respond appropriately. (K3)
C209.2	Participate in group discussions. (K1)
C209.3	Make effective presentations. (K3)
C209.4	Participate confidently and appropriately in conversations both formal and informal. (K1)
C209.5	Respond intelligently and seek clarification and understand completely. (K3)
C209.6	Concentrate on the communication aspect of complicated ideas and respond positively. (K2)

SEMESTER: IV

MA8452 (C211) STATISTICS AND NUMERICAL METHODS

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C211.1	Apply the concept of testing of hypothesis for small and large samples in real life problems. (K3)
C211.2	Apply the basic concepts of classifications of design of experiments in the field of agriculture. (K3)
C211.3	Explain the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems. (K2)
C211.4	Develop the knowledge of various techniques and methods for solving first and second order ordinary differential equations. (K3)
C211.5	Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications. (K3)
C211.6	Compare ordinary and partial differential equations using numerical methods(K2)

ME8492 (C212) KINEMATICS OF MACHINERY

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C212.1	Explain the principles of kinematic pairs of planar mechanisms. (K2)
C212.2	Construct velocity and acceleration polygons and instantaneous centers. (K2)
C212.3	Utilize various motion principles to draw cam profiles. (K2)
C212.4	Interpret the terminology with the various gears (spur, helical, worm etc.). (K2)
C212.5	Compare the effect of various friction involved in power transmission. (K2)
C212.6	Explain the concepts of kinematics in predicting motion mechanism for given application. **.** (K2)

ME8451 (C213) MANUFACTURING TECHNOLOGY – II

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C213.1	Explain the mechanism of material removal processes. **.** (K2)
C213.2	Demonstrate the constructional and operational features of centre lathe and other special purpose lathes. **.** (K2)
C213.3	Demonstrate the constructional and operational features of shaper, planner, milling, and drilling, sawing and broaching machines. (K2)
C213.4	Explain the types of grinding and other super finishing processes apart from gear manufacturing processes. (K2)
C213.5	Summarize numerical control of machine tools and write a part program. (K2)
C213.6	Apply suitable machine tool in machining of desired product. (K3)

ME8491 (C214) ENGINEERING METALLURGY

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C214.1	Explain alloys and phase diagram, Iron-Iron carbon diagram and steel classification. (K2)
C214.2	Explain isothermal transformation, continuous cooling diagrams and different heat treatment processes. (K2)
C214.3	Classify the effect of alloying elements on ferrous and non-ferrous metals. (K2)
C214.4	Summarize the properties and applications of non-metallic materials. (K2)
C214.5	Explain the testing of mechanical properties. (K2)
C214.6	Apply the knowledge of material science on material selection for specific requirements. (K3)

CE8395 (C215) STRENGTH OF MATERIALS FOR MECHANICAL ENGINEERS

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C215.1	Recall the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes. (K1)
C215.2	Explain the load transferring mechanism in beams and stress distribution due to shearing force and bending moment. (K2)
C215.3	Apply basic equation of simple torsion in designing of shafts and helical spring. (K3)
C215.4	Solve the slope and deflection in beams using different methods. (K3)
C215.5	Analyze and design thin and thick shells for the applied internal and external pressures. (K4)
C215.6	Compare the deformation in members subjected to axial, flexural and torsional loads. (K2)

ME8493 (C216) THERMAL ENGINEERING – I

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C216.1	Apply thermodynamic concepts to different air standard cycles and solve problems. (K3)
C216.2	Solve problems in single stage and multistage air compressors. (K3)
C216.3	Explain the functioning and features of IC engines, components and auxiliaries. (K2)
C216.4	Solve performance parameters of IC Engines. (K3)
C216.5	Explain the flow in Gas turbines and solve problems. (K2)
C216.6	Explain the working of air compressor along with factors influencing its performance. (K2)

ME8462 (C217) MANUFACTURING TECHNOLOGY LABORATORY – II

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C217.1	Experiment with specific milling machine to cut contour and gear teeth on the given work piece. (K3)
C217.2	Identify different machine tools to manufacturing gears. (K3)
C217.3	Interpret different machine tools for finishing operations. (K2)
C217.4	Make use of manufacture tools using cutter grinder. (K3)
C217.5	Develop CNC part programming. (K3)
C217.6	Apply suitable machining sequence to plan the process in producing a component. (K3)

CE8381 (C218) STRENGTH OF MATERIALS AND FLUID MECHANICS AND MACHINERY LABORATORY

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C218.1	Examine the tensile and shear properties of materials using UTM. (K4)
C218.2	Experiment with different hardness testing machine to find hardness of the materials. (K3)
C218.3	Find the stiffness of the spring using compression test. (K1)
C218.4	Identify the use of measurement equipment for flow measurement. (K3)
C218.5	Interpret the performance test on different fluid machinery. (K2)
C218.6	Apply specific testing methods for material characterization. (K3)

HS8461 (C219) ADVANCED READING AND WRITING

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C219.1	Develop different types of essays. (K2)
C219.2	Write winning job applications. (K1)
C219.3	Read and evaluate texts critically. (K5)
C219.4	Devise critical thinking in various professional contexts. (K3)
C219.5	Debate the issues and find the rudiments of the problem individually and as a group. (K2)
C219.6	Respond intelligently and seek clarification and understand completely. (K2)

SEMESTER: V

ME8595 (C301) THERMAL ENGINEERING- II

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C301.1	Solve problems in Steam Nozzle.(K3)
C301.2	Explain the functioning and features of different types of Boilers and auxiliaries and calculate performance parameters.(K2)
C301.3	Explain the flow in steam turbines, draw velocity diagrams for steam turbines and solve problems. (K2)
C301.4	Summarize the concept of Cogeneration, Working features of Heat pumps and Heat exchangers. (K2)
C301.5	Solve problems using refrigerant table / charts and psychrometric charts. (K2)
C301.6	Explain heat power engineering principles to IC Engine and R & AC applications. (K2)

ME8593 (C302) DESIGN OF MACHINE ELEMENTS

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C302.1	Solve the various stresses acting on various machine elements. (K3)
C302.2	Compute the dimensions, SF and BM of shafts and couplings based on various load conditions. (K2)
C302.3	Determine the size of welding required for parallel and double fillets. (K3)
C302.4	Design the energy absorbing members like springs connecting rod and crank shaft. (K3)
C302.5	Choose the appropriate bearing, from the standard catalog for varied applications. (K3)
C302.6	Identify the various dimensionless numbers for hydrodynamic bearing from PSG design data book. (K3)

ME8501 (C303) METROLOGY AND MEASUREMENTS

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C303.1	Explain the fundamentals of Measuring system & Errors in Measurement. (K2)
C303.2	Interpret the use of Linear and Angular Measurement instruments. (K2)
C303.3	Explain the working of Laser Interferometer and Coordinate Measuring Machine (CMM). (K2)
C303.4	Identify the methods available for measuring various forms. (K3)
C303.5	Select suitable measuring instruments to measure power, flow and temperature. (K3)
C303.6	Utilize different measurement technologies to quantify varying parameters for real time applications. (K3)

ME8594 (C304) DYNAMICS OF MACHINES

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C304.1	Define static and dynamic forces of mechanisms. (K1)
C304.2	Identify the balancing masses and their locations of reciprocating and rotating masses. (K3)
C304.3	Classify the frequency of free vibration. (K2)
C304.4	Solve the frequency of forced vibration and damping coefficient. (K3)
C304.5	Choose the speed and lift of the governor. (K3)
C304.6	Identify the gyroscopic effect on automobiles, ships and airplanes. (K3)

ORO551 (C305) RENEWABLE ENERGY SOURCES

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C305.1	Recall the physics of solar radiation. (K1)
C305.2	Classify the solar energy collectors and methodologies of storing solar energy. (K2)
C305.3	Apply the knowledge in solar energy in a useful way. (K3)
C305.4	Identify the knowledge in wind energy and biomass with its economic aspects. (K3)
C305.5	Apply knowledge in capturing and applying other forms of energy. (K3)
C305.6	Summarize the sources like wind, biogas and geothermal energies. (K2)

ME8511 (C306) KINEMATICS AND DYNAMICS LABORATORY

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C306.1	Explain the gear parameters of various types of gear trains. (K2)
C306.2	Find the Mass moment of inertia of Fly wheel and Axle system. (K1)
C306.3	Solve the gyroscopic effect and couple. (K3)
C306.4	Explain torsional natural frequency of single and Double Rotor systems. (K2)
C306.5	Demonstrate the kinematic working models of various mechanisms and cam profile. (K2)
C306.6	Identify the critical speed of shafts. (K3)

ME8512 (C307) THERMAL ENGINEERING LABORATORY

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C307.1	Find the conduction rate in one dimensional for the given plate and circular surfaces. (K1)
C307.2	Compute heat transfer coefficient for different types of convection. (K2)
C307.3	Utilize thermal analysis of different heat exchanger to compare the actual and theoretical heat transfer rate. (K3)
C307.4	Compute temperature distribution using heat transfer correlations for various apparatus. (K2)
C307.5	Apply thermodynamics principles to find various parameters of air conditioning and refrigeration system. (K3)
C307.6	Demonstrate the fundamentals of heat transfer and predict the response of thermal system (K2)

ME8513 (C308) METROLOGY AND MEASUREMENTS LABORATORY

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to explain:
C308.1	Demonstrate the correct methods for measurement and calibration of various measuring devices. (K2)
C308.2	Explain the effective methods of measuring straightness, flatness, gear profile, screw threads. (K2)
C308.3	Compute the internal bore diameter measurement by bore gauge and telescope gauge. (K2)
C308.4	Compare the force and torque using suitable measuring devices. (K2)
C308.5	Compute the temperature measurement using thermocouple. (K2)
C308.6	Apply the different measurement tools and perform measurements in quality Inspection. (K2)

SEMESTER: VI

ME8651 (C311) DESIGN OF TRANSMISSION SYSTEMS

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C311.1	Compute the design parameters of flexible transmission elements like belts, chains and wire ropes for given condition. (K3)
C311.2	Compute the spur and helical gear terminology considering strength and wear. (K3)
C311.3	Compute the required parameters in designing worm, bevel and double helical gear power transmission. (K3)
C311.4	Calculate the speed ratio and gear box parameters for the given application. (K3)
C311.5	Select the parameters require to design cam, clutches and brakes for varied applications. (K3)
C311.6	Select the parameters to design power transmission elements using standard catalogue. (K3)

ME8691 (C312) COMPUTER AIDED DESIGN AND MANUFACTURING

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C312.1	Explain the basic concept of product design and 2D / 3D CAD manipulations. (K2)
C312.2	Discuss the representation of curves, surface and solid modeling techniques for various real time applications. (K2)
C312.3	Summarize the visual realism techniques. (K2)
C312.4	Discuss the various CAD standards. (K2)
C312.5	Apply NC & CNC programming concepts to develop part programme for Lathe & Milling Machines. (K3)
C312.6	Summarize the different types of techniques used in Cellular Manufacturing and FMS. (K3)

ME8693 (C313) HEAT AND MASS TRANSFER

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C313.1	Utilize heat conduction equations to different surface configurations under steady state and transient conditions and solve problems. (K3)
C313.2	Apply free and forced convective heat transfer correlations to internal and external flows through/over various surface configurations and solve problems. (K3)
C313.3	Explain the phenomena of boiling and condensation, apply LMTD and NTU methods of thermal analysis to different types of heat exchanger configurations and solve problems. (K2)
C313.4	Interpret basic laws for Radiation and apply these principles to radiative heat transfer between different types of surfaces to solve problems. (K2)
C313.5	Make the use of mass transfer and its correlations. (K3)
C313.6	Apply the conduction and convection principles in product application by real time study. (K3)

ME8692 (C314) FINITE ELEMENT ANALYSIS

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C314.1	Summarize the basics of finite element formulation. (K2)
C314.2	Compute structural and thermal problems utilizing 1D problem formulation. (K3)
C314.3	Use 2D scalar formulation for solving thermal and torsion problems. (K3)
C314.4	Use 2D vector formulation for solving plane stress, plane strain and axisymmetric problems. (K3)
C314.5	Apply finite element method to solve problems on iso parametric element and dynamic Problems. (K3)
C314.6	Compute the real time primitive structural and thermal problems using finite element techniques. (K3)

ME8694 (C315) HYDRAULICS AND PNEUMATICS

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C315.1	Explain the Fluid power and operation of different types of pumps. (K2)
C315.2	Summarize the features and functions of Hydraulic motors, actuators and Flow control valves. (K2)
C315.3	Explain the different types of Hydraulic circuits and systems. (K2)
C315.4	Explain the working of different pneumatic circuits and systems. (K2)
C315.5	Summarize the various trouble shooting methods . (K2)
C315.6	Discuss the applications of hydraulic and pneumatic systems. (K2)

ME8091 (C316) AUTOMOBILE ENGINEERING

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C316.1	Identify the vehicle structure, engine components and accessories. (K3)
C316.2	Compare various engine auxiliary and emission control systems. (K2)
C316.3	Explain the working principle of various transmission and control systems. (K2)
C316.4	Interpret the functions of steering, brakes and suspension systems. (K2)
C316.5	Explain the various energy sources available for vehicles based on trend, economic and pollution free condition. (K2)
C316.6	Classify the working of various components in automobile engineering. (K2)

ME8681 (C317) CAD / CAM LABORATORY

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C317.1	Utilize standard software tools to create part, assemblies and check for clearances. (K3)
C317.2	Modify 2D drafting to 3D using modeling software. (K3)
C317.3	Summarize the modern control in manufacturing systems (FANUC, SIEMENS) (K2)
C317.4	Utilize the concepts of G and M codes and manual part programming for modern manufacturing technology. (K3)
C317.5	Utilize CAPP in machining and turning centre. (K3)
C317.6	Apply modern tools in design, manufacture and planning. (K3)

ME8682 (C318) DESIGN AND FABRICATION PROJECT

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C318.1	Make use of design principles and develop concept for the project. (K3)
C318.2	Estimate the time frame and cost for the project execution and completion.(K3)
C318.3	Analyze the project progress with remedial measures individual in a team. (K4)
C318.4	Examine the environmental impact of the project. (K3)
C318.5	Demonstrate the project functionality along with report and presentation. (K2)
C318.6	Apply the Engineering knowledge in design and economically manufacturing of components to support the society need. (K3)

HS8581 (C319) PROFESSIONAL COMMUNICATION

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C319.1	Develop adequate Soft Skills required for the workplace. (K2)
C319.2	Show an effective presentation. (K2)
C319.3	Build confidence in Group Discussions. . (K2)
C319.4	Develop personality development skills and utilize all types of interviews in effective manner. (K2)
C319.5	Compare the difference between groups and teams. (K2)
C319.6	Make use of networking professionally, respecting social protocols. (K3)

SEMESTER: VII

ME8792 (C401) POWER PLANT ENGINEERING

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C401.1	Explain the layout of thermal power plant and working principle of various types of boilers. (K2)
C401.2	Explain the working of diesel and gas turbine power plant along with optimization technique. (K2)
C401.3	List the various types of nuclear reactors used in nuclear power plant. (K1)
C401.4	Summarize the principles and working of various renewable energy power plants. (K2)
C401.5	Define the energy, economic and environmental issues of power plants. (K1)
C401.6	Identify the different types of power plant, its function and issues related to them. (K3)

ME8793 (C402) PROCESS PLANNING AND COST ESTIMATION

Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C402.1	Select the activity, equipment and tools for an effective process planning. (K1)
C402.2	Demonstrate the process planning activity chart for process parameters calculation. (K2)
C402.3	Apply the concept of cost estimation to the industries. (K2)
C402.4	Summarize the job order cost for different type of shop floor. (K2)
C402.5	Calculate the machining time for drilling and boring operations. (K3)
C402.6	Determine the machining time for milling, shaping, planning and grinding. (K3)

ME8791 (C403) MECHATRONICS

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C403.1	Explain the functions of sensors and transducers. (K2)
C403.2	Identify the features of microprocessor and microcontroller. (K3)
C403.3	Select various programmable peripheral interfaces for specific applications. (K3)
C403.4	Summarize the functionality of Programmable Logic Controller. (K2)
C403.5	Relate the concept of mechatronics and actuator systems for real time applications. (K1)
C403.6	Explain the influence of mechatronics systems in industrial automation. (K2)

OIE751 (C404) ROBOTICS

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C404.1	Explain the concepts of industrial robots, classification, specifications and coordinate systems. (K2)
C404.2	Illustrate the different types of robot drive systems as well as robot end effectors. (K2)
C404.3	Apply the different sensors and image processing techniques in robotics to improve the ability of robots. (K3)
C404.4	Develop robotic programs for different tasks and familiarize with the kinematics motions of Robot.(K3)
C404.5	Examine the implementation of robots in various industrial sectors and interpolate the economic analysis of robots. (K4)
C404.6	Summarize the need and application of robots in different sectors. (K2)

ME8073 (C405) UNCONVENTIONAL MACHINING PROCESSES

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C405.1	Explain the types, needs and application of unconventional machining process and Mechanical Energy based processes. (K2)
C405.2	Classify the thermal and electrical energy-based machining processes. (K2)
C405.3	Explain chemical and electrochemical energy-based machining processes for specific application. (K2)
C405.4	Explain various nano abrasives based unconventional machining processes. (K2)
C405.5	Explain various recent trends based unconventional machining processes. (K2)
C405.6	Relate the significance of various process parameters on MRR. (K1)

ME8097 (C406) NON DESTRUCTIVE TESTING AND EVALUATION

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C406.1	Define the fundamental concepts of NDT. (K1)
C406.2	Interpret the different methods of NDE. (K2)
C406.3	Explain the concept of Thermography and Eddy current testing. (K2)
C406.4	Explain the concept of Ultrasonic Testing and Acoustic Emission. (K2)
C406.5	Explain the concept of Radiography. (K2)
C406.6	Apply the significance of various processes. (K3)

ME8711 (C407) SIMULATION AND ANALYSIS LABORATORY

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C407.1	Apply the fundamentals concepts of finite element method in problem characterization. (K3)
C407.2	Find the force and stress using link elements in Trusses. (K1)
C407.3	Explain the effect of various load acting on 1D beam in real time problem. (K2)
C407.4	Find the thermal stress in cylindrical shells. (K1)
C407.5	Identify the natural frequency and mode shape of 2D components and beams. (K3)
C407.6	Analyze the stresses and strains induced in plates, brackets and beams and heat transfer problems. (K4)

ME8781 (C408) MECHATRONICS LABORATORY

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C408.1	Summarize assembly language programming of 8085 for arithmetic operation. (K2)
C408.2	Develop programmable peripheral interface for stepper motor and traffic light. (K3)
C408.3	Demonstrate the speed control of DC motor by microcontroller. (K2)
C408.4	Identify Hydraulic, Pneumatic and electro pneumatic circuits using software tool. (K3)
C408.5	Examine various fluid power circuits. (K4)
C408.6	Make use of PLC programs for controlling multiple cylinders using timers. (K3)

ME8712 (C409) TECHNICAL SEMINAR

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C409.1	Summarize the various thermodynamics laws to engineering application. (K2)
C409.2	Identify various power cycles and it's applications. (K3)
C409.3	Recall various mechanisms for design of mechanical system. (K1)
C409.4	Name the properties and strength of engineering material. (K1)
C409.5	Find out various manufacturing process suitable for making products. (K1)
C409.6	Explain the fluid properties and flow characteristics. (K2)

SEMESTER: VIII

MG8591 (C411) PRINCIPLES OF MANAGEMENT

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C411.1	Summarize the evolution of management thoughts and various challenges of managerial activities in a global business environment. (K2)
C411.2	Explain the types of Planning and Decision making at various levels management in the Organizations. (K2)
C411.3	Classify various Organization structure. (K2)
C411.4	List out the steps in Staffing process and stages in Career development. (K1)
C411.5	Explain the process of controlling (budgetary and non-budgetary). (K2)
C411.6	Interpret various Controlling techniques to maintain standards in Organizations. (K2)

IE8693 (412) PRODUCTION PLANNING AND CONTROL

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C412.1	Illustrate production planning and control act work study. (K2)
C412.2	Explain work study, production study and time study. (K2)
C412.3	Compare product planning and process planning. (K2)
C412.4	Explain the various production scheduling techniques. (K2)
C412.5	Apply the recent trends in PPC. (K3)
C412.6	Identify the various elements of just in time systems, MRP II and ERP. (K3)

ME8811 (C413) PROJECT WORK

COURSE OUTCOMES:	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
C413.1	Identify the objective, scope and the concept of the work. (K3)
C413.2	Apply suitable methods and materials to carry out experiments by conserving eco-system. (K3)
C413.3	Develop a prototype/experimental set-up necessary to complete the project. (K3)
C413.4	Discuss the results obtained to derive conclusions. (K2)
C413.5	Utilize the work by preparing a report as per the University format. (K3)
C413.6	Make the use of experimental information to publish in journals/conference. (K3)