

DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE



(AUTONOMOUS)
(Approved by AICTE & Affiliated to Anna University, Chennai)
Accredited with 'A' Grade by NAAC, Accredited by TCS
Accredited by NBA with BME, ECE & EEE
PERAMBALUR - 621 212. Tamil Nadu.
website : www.dsengg.ac.in



DEPARTMENT OF MECHANICAL ENGINEERING

REGULATION -2020

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.

Autonomous Regulation – R2020

S.NO	COURSE CODE.	SUBJECT CODE	COURSE TITLE
1	C101	U20HS101	Communicative English
2	C102	U20MA101	Engineering Mathematics
3	C103	U20PH101	Engineering Physics - I
4	C104	U20CY101	Engineering Chemistry
5	C105	U20GE101	C Programming
6	C106	U20GE102	Engineering Graphics
7	C107	U20BS101	Physics and Chemistry Laboratory
8	C108	U20GE103	C Programming Laboratory
9	C111	U20HS201	Functional English
10	C112	U20MA201	Advanced Calculus and Ordinary Differential Equations
11	C113	U20PH201	Engineering Physics - II
12	C114	U20GE201	Python Programming
13	C115	U20ES201	Basic Electrical and Electronics Engineering
14	C116	U20GE202	Engineering Mechanics
15	C117	U20GE203	Engineering Practices Laboratory
16	C118	U20ES202	Basic Electrical and Electronics Engineering Laboratory
17	C119	U20GE204	Python Programming Laboratory
18	C201	U20MA301	Transform Techniques and Partial Differential Equations
19	C202	U20ME301	Manufacturing Technology - I
20	C203	U20ME302	Engineering Thermodynamics
21	C204	U20ES301	Fluid Mechanics and Machinery
22	C205	U20ME303	Engineering Materials and Metallurgy
23	C206	U20ME304	Manufacturing Technology Laboratory - I
24	C207	U20ES302	Fluid Mechanics and Machinery Laboratory
25	C208	U20ME305	Computer Aided Machine Drawing Laboratory
26	C211	U20MA401	Numerical Methods
27	C212	U20ME401	Thermal Engineering
28	C213	U20ME402	Strength of Materials
29	C214	U20ME403	Manufacturing Technology - II
30	C215	U20ME404	Kinematics of Machinery
31	C216	U20ME405	Strength of Materials Laboratory
32	C217	U20ME406	Thermal Engineering Laboratory
33	C218	U20ME407	Manufacturing Technology Laboratory - II
34	C301	U20ME501	Design of Machine Elements
35	C302	U20ME502	Dynamics of Machines

36	C303	U20ME503	Heat and Mass Transfer
37	C304	U20ME504	Automobile Engineering
38	C305	U20ME505	Metrology and Measurements
39	C306	U20OME52	Renewable Energy Sources
40	C307	U20ME506	Dynamics Laboratory
41	C308	U20ME507	Heat Transfer Laboratory
42	C309	U20ME508	Metrology and Measurements Laboratory
43	C311	U20BS601	Operation Research
44	C312	U20ME601	Design of Transmission Systems
45	C313	U20ME602	Computer Aided Design
46	C314	U20ME603	Gas Dynamics and Jet Propulsion
47	C315	U20OAE72	High Temperature Materials
48	C316	U20ME661	Unconventional Machining Processes
49	C317	U20ME604	Design and Fabrication Project
50	C318	U20ME605	CAD/CAM Lab
51	C319	U20HS601	Professional Communication
52	C401	U20ME701	Finite Element Analysis
53	C402	U20HS701	Total Quality Management
54	C403	U20ME702	Mechatronics
55	C404	U20ME741	Power Plant Engineering
56	C405	U20ME751	Robotics
57	C406	U20ME703	Simulation and Analysis Laboratory
58	C407	U20ME704	Mechatronics Laboratory
59	C411	U20ES801	Engineering Economics
60	C412	U20ME821	Production Planning and Control
61	C413	U20ME801	Project Work

SEMESTER-I

U20HS101 (C101) COMMUNICATIVE ENGLISH

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
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)

U20MA101 (C102) ENGINEERING MATHEMATICS

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C102.1	Analyze the nature of quadratic forms.(K4)
C102.2	Explore the intervals of concavity and convexity.(K2)
C102.3	Understand limits and continuity in multivariable functions. .(K2)
C102.4	Gain proficiency in definite integrals and their properties. .(K2)
C102.5	Explore applications of multiple integrals in calculating areas and volumes. .(K2)
C102.6	Understand the concept of triple integrals and their applications in finding volume. .(K2)

U20PH101 (C103) ENGINEERING PHYSICS - I

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C103.1	Calculate inter-planar spacing, number of atoms per unit cell, atomic radius, coordination number, and packing factor for different crystal structures. (K2)
C103.2	Comprehend the concepts of elasticity, plasticity, and Hooke's law. (K2)
C103.3	Learn about the properties and production methods of ultrasonic waves. (K2)
C103.4	Understand the principles of black body radiation, Planck's hypothesis, and radiation laws. (K2)
C103.5	Understand the properties of lasers, population inversion, and pumping methods. (K2)
C103.6	Learn about different types of lasers, their uses, and holography. (K2)

U20CY101 (C104) ENGINEERING CHEMISTRY

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C104.1	Understand types (addition, condensation, copolymerization), mechanisms, functionality, and degree of polymerization. (K2)
C104.2	Learn about types, isotherms, and applications in pollution control. (K2)
C104.3	Acquire knowledge of thermodynamic terminology, including the second law and entropy changes. (K3)
C104.4	Understand laws, quantum efficiency, and processes like fluorescence and phosphorescence. (K2)
C104.5	Gain insights into the phase rule's components and its application in one-component and two-component systems. (K2)
C104.6	Learn about alloying, its significance, and effects on ferrous and non-ferrous alloys, including examples like Nichrome and Stainless steel. (K2)

U20GE101 (C105) C PROGRAMMING

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C105.1	Apply decision-making and looping statements effectively in C programs.(K3)
C105.2	Develop proficiency in string operations such as length, comparison, concatenation, and copying. .(K3)
C105.3	Develop the ability to define and use functions, including recursion, and understand the concept of function prototypes. .(K3)
C105.4	Understand unions and their applications, including their usage with pointers. .(K2)
C105.5	Acquire skills in file processing, including sequential and random access file handling. .(K2)
C105.6	Develop the ability to perform file operations such as finding averages and transaction processing using both sequential and random access files. .(K3)

U20GE102 (C106) ENGINEERING GRAPHICS

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
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)

U20BS101 (C107) PHYSICS AND CHEMISTRY LABORATORY

COURSE OUTCOMES:

Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C107.1	Assess optical fibre parameters using laser properties. (K2)
C107.2	Measure the velocity of ultrasonic waves in a given liquid medium. (K2)
C107.3	Compute the wavelength of mercury spectrum using properties of light(K2)
C107.4	Compute the thermal conductivity of a bad conductor using Lee's method. (K2)
C107.5	Determine the modulus of a material using Hooke's law. (K2)
C107.6	Estimate water quality parameters such as dissolved oxygen content, chloride content of the water samples. (K2)

U20GE103 (C108) C PROGRAMMING LABORATORY

COURSE OUTCOMES:

Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C108.1	Implement basic input/output operations using appropriate statements. .(K3)
C108.2	Develop a program to determine leap years based on specified conditions. .(K3)
C108.3	Utilize appropriate functions and control flow to perform specified operations. .(K2)
C108.4	Apply mathematical operations and conditional statements to validate Armstrong numbers. .(K3)
C108.5	Create functions to convert decimal numbers into binary, octal, and hexadecimal formats. .(K2)
C108.6	Design a program to sort a list of numbers using pass by reference. .(K3)

SEMESTER: II

U20HS201 (C111) FUNCTIONAL ENGLISH

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
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)

U20MA201 (C112) ADVANCED CALCULUS AND ORDINARY DIFFERENTIAL EQUATIONS

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C112.1	Solve linear differential equations, including second-order equations with constant coefficients. .(K3)
C112.2	Utilize inverse Laplace transforms and convolution theorem to solve differential equations. .(K2)
C112.3	Apply line integrals, surface integrals, and volume integrals in various coordinate systems. .(K3)
C112.4	Describe analytic functions and their properties, including necessary conditions for analyticity. .(K2)
C112.5	Understand Taylor's and Laurent's series expansions and their applications. .(K2)
C112.6	Apply Cauchy's integral theorem and formula to evaluate complex integrals. .(K3)

U20PH201 (C113) ENGINEERING PHYSICS - II

COURSE OUTCOMES:

Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C113.1	Derive expressions for electrical conductivity, thermal conductivity, and the Wiedemann-Franz law. .(K2)
C113.2	Describe the properties and types of semiconductors. .(K2)
C113.3	Calculate energy stored in capacitors and understand dielectric loss and breakdown mechanisms. .(K2)
C113.4	Analyze ferromagnetic domains, hysteresis, and the properties of soft and hard magnetic materials. .(K3)
C113.5	Define nanostructures and understand quantum confinement effects. .(K2)
C113.6	Describe various methods of preparing nanomaterials and their properties. .(K2)

U20GE201 (C114) PYTHON PROGRAMMING

COURSE OUTCOMES:

Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C114.1	Apply simple strategies for algorithm development, such as iteration and recursion, to solve basic problems. .(K3)
C114.2	Create modular programs using functions, understanding function definition, usage, parameters, and arguments. .(K2)
C114.3	Design fruitful functions with proper parameter passing, return values, and understanding scope.(K3).
C114.4	Understand the properties and operations of lists, tuples, and dictionaries in Python. .(K2)
C114.5	Utilize file handling techniques to read from and write to text files and handle exceptions during file operations. .(K2)
C114.6	Develop programs that utilize command-line arguments and handle errors and exceptions effectively. .(K3)

U20ES201 (C115) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C115.1	Understand electric circuits and working principles of electrical machines. (K3)
C115.2	Understand the concepts of various electronic devices. (K3)
C115.3	Choose appropriate instruments for electrical measurement for a specific application. (K2)
C115.4	Explain the basic concepts of digital electronics. (K2)
C115.5	Explain the operating principles of measuring instruments. (K2)
C115.6	Analyze the AC Electrical Circuits. (K2)

U20GE202 (C116) ENGINEERING MECHANICS

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
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)

U20GE203 (C117) ENGINEERING PRACTICES LABORATORY

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
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)

U20ES202 (C118) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
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)

U20GE204 (C119) PYTHON PROGRAMMING LABORATORY

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C119.1	Understand the concept of greatest common divisor (GCD) and implement an algorithm to compute it efficiently. .(K2)
C119.2	Demonstrate the ability to find the maximum value in a list of numbers, illustrating skills in list manipulation and algorithm design. .(K2)
C119.3	Create a program to generate the first n prime numbers, demonstrating proficiency in number theory and algorithm design. .(K3)
C119.4	Implement matrix multiplication algorithms, showcasing skills in matrix operations and algorithm design. .(K2)
C119.5	Design a program to find the most frequent words in a text file, demonstrating proficiency in string manipulation and algorithmic analysis. .(K3)
C119.6	Develop a simulation of a bouncing ball using Pygame, demonstrating proficiency in physics simulations and game development. .(K3)

SEMESTER: III

U20MA301 (C201) TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
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)

U20ME301 (C202) MANUFACTURING TECHNOLOGY – I

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C202.1	Interpret the various casting methods for product making with their merits and demerits. (K2)
C202.2	Compare the various materials joining process and associated defects with possible cause and cure. (K2)
C202.3	Classify various metal forming process with its application. (K2)
C202.4	Construct the various process involved in sheet metal forming with its applications and salient features. (K3)
C202.5	Classify various processes in making of plastic components for engineering / domestic applications. (K2)
C202.6	Explain the process involved in blow moulding. (K2)

U20ME302 (C203) ENGINEERING THERMODYNAMICS

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C203.1	Apply the first law of thermodynamics for simple open and closed systems under steady and unsteady conditions. (K2)
C203.2	Apply the concept of enthalpy and entropy in thermal systems. (K3)
C203.3	Identify the properties of pure substance and explain the working of steam cycles. (K3)
C203.4	Illustrate the properties of ideal and real gases. (K2)
C203.5	Solve problems in psychrometric processes and gas mixtures. (K3)
C203.6	Apply thermodynamic laws for real time applications. (K3)

U20ES301 (C204) FLUID MECHANICS AND MACHINERY

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C204.1	Solve the fluid properties and flow characteristics. (K3)
C204.2	Build the flow of fluid in circular conduits. (K3)
C204.3	Explain the importance of dimensional and model analysis. (K2)
C204.4	Classify the centrifugal and reciprocating pumps using velocity triangles. (K2)
C204.5	Summarize the performance of impulse and reaction turbines. (K2)
C204.6	Develop the flow characteristics and performance of hydraulic machines for real time applications. (K3)

U20ME303 (C205) ENGINEERING MATERIALS AND METALLURGY

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C205.1	Understand the constitution of alloys, including solid solutions, substitutional, and interstitial alloys. .(K2)
C205.2	Define various heat treatment processes, including full annealing, normalizing, hardening, tempering, and their effects on steel properties. .(K2)
C205.3	Analyze the effects of alloying additions on the properties of steel, including α and β stabilizers, and their impact on stainless and tool steels. .(K3)
C205.4	Classify polymers based on their structure and properties, distinguishing between commodity and engineering polymers. .(K2)
C205.5	Differentiate between various types of fractures and understand the factors influencing fracture behavior. .(K2)
C205.6	Perform mechanical tests, including tension, compression, and shear tests, to evaluate material properties. .(K2)

U20ME304 (206) MANUFACTURING TECHNOLOGY LABORATORY – I

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
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)

U20ES302 (C207) FLUID MECHANICS AND MACHINERY LABORATORY

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C207.1	Understand the principles of fluid flow measurement using an orifice meter. .(K2)
C207.2	Calculate the rate of flow using a rotameter and understand its operating principles. .(K3)
C207.3	Conduct experiments to determine the characteristic curves of gear pumps and understand their performance. .(K2)
C207.4	Perform experiments to determine the characteristic curves of Kaplan turbines and evaluate their performance. .(K2)
C207.5	Conduct experiments to determine the characteristic curves of Francis turbines and interpret the results. .(K2)
C207.6	Determine the friction factor for given pipes and understand its significance in fluid flow analysis. .(K2)

20ME305 (C208) COMPUTER AIDED MACHINE DRAWING LABORATORY

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C208.1	Discuss the various CAD standards. (K2)
C208.2	Explain the basic principles of geometric dimensioning & tolerance. (K2)
C208.3	Show the Detailed drawing. (K2)
C208.4	Classify the bearings and valves. (K2)
C208.5	Explain the various feature used in 3D modeling. (K2)
C208.6	Build the various components in 3D modeling. (K3)

SEMESTER: IV

U20MA401 (C211) NUMERICAL METHODS

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C211.1	Apply methods of criteria for convergence to ensure the convergence of numerical algorithms. .(K3)
C211.2	Interpolate data points using cubic splines and Lagrangian polynomials. .(K2)
C211.3	Perform numerical differentiation using interpolation formulas. .(K2)
C211.4	Utilize multistep methods such as Milne's and Adam's predictor-corrector methods for solving ordinary differential equations. .(K2)
C211.5	Interpret the physical significance of solutions obtained from numerical methods for boundary value problems. .(K3)
C211.6	Analyze the accuracy and stability of finite difference methods in solving boundary value problems. .(K3)

U20ME401 (C212) THERMAL ENGINEERING

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C212.1	Calculate the mean effective pressure and air standard efficiency of gas power cycles. .(K2)
C212.2	Describe the classification of internal combustion engines and explain the function of their components. .(K2)
C212.3	Analyze the flow of steam through nozzles and the principles of impulse and reaction turbines. .(K3)
C212.4	Classify various types of air compressors and explain their working principles. .(K2)
C212.5	Discuss the processes, types, and working principles of air conditioning systems and concepts like RSHP, GSHP, and ESHP. .(K2)
C212.6	Explain the properties of refrigerants and the vapor compression refrigeration cycle. .(K2)

U20ME402 (C213) STRENGTH OF MATERIALS

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C213.1	Recall the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes. (K1)
C213.2	Explain the load transferring mechanism in beams and stress distribution due to shearing force and bending moment. (K2)
C213.3	Apply basic equation of simple torsion in designing of shafts and helical spring. (K3)
C213.4	Solve the slope and deflection in beams using different methods. (K3)
C213.5	Analyze and design thin and thick shells for the applied internal and external pressures. (K4)
C213.6	Compare the deformation in members subjected to axial, flexural and torsional loads. (K2)

U20ME403 (C214) MANUFACTURING TECHNOLOGY – II

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C214.1	Explain the mechanism of material removal processes. . (K2)
C214.2	Demonstrate the constructional and operational features of centre lathe and other special purpose lathes. . (K2)
C214.3	Demonstrate the constructional and operational features of shaper, planner, milling, and drilling, sawing and broaching machines. (K2)
C214.4	Explain the types of grinding and other super finishing processes apart from gear manufacturing processes. (K2)
C214.5	Summarize numerical control of machine tools and write a part program. (K2)
C214.6	Apply suitable machine tool in machining of desired product. (K3)

U20ME404 (C215) KINEMATICS OF MACHINERY

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C215.1	Explain the principles of kinematic pairs of planar mechanisms. (K2)
C215.2	Construct velocity and acceleration polygons and instantaneous centers. (K2)
C215.3	Utilize various motion principles to draw cam profiles. (K2)
C215.4	Interpret the terminology with the various gears (spur, helical, worm etc.). (K2)
C215.5	Compare the effect of various friction involved in power transmission. (K2)
C215.6	Explain the concepts of kinematics in predicting motion mechanism for given application. . (K2)

U20ME405 (C216) STRENGTH OF MATERIALS LABORATORY

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C216.1	Interpret the results of tension tests on mild steel rods to analyze their mechanical properties under tensile loading. .(K2)
C216.2	Analyze hardness test results using Brinell and Rockwell hardness numbers to determine material hardness properties. .(K4)
C216.3	Evaluate the results of torsion tests on mild steel rods to assess their torsional strength and behavior. .(K2)
C216.4	Interpret deflection test results on beams to understand their behavior under bending loads. .(K2)
C216.5	Analyze the effects of hardening on the hardness and impact resistance of steels to understand the improvement in mechanical properties. .(K4)
C216.6	Conduct microscopic examinations of hardened and hardened and tempered samples to analyze their microstructure and correlate with mechanical properties. .(K4)

U20ME406 (C217) THERMAL ENGINEERING LABORATORY

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C217.1	Interpret valve timing and port timing diagrams to understand the operation of internal combustion engines. .(K2)
C217.2	Conduct performance tests on 4-stroke diesel engines to assess their operational characteristics. .(K2)
C217.3	Perform retardation tests on diesel engines to assess their braking performance. .(K2)
C217.4	Determine the flash point and fire point of various fuels and lubricants to ensure safety in engine operation. .(K3)
C217.5	Study steam generators and turbines to understand their working principles and components. .(K2)
C217.6	Perform performance and energy balance tests on a steam turbine to assess its efficiency and power output. .(K2)

U20ME407 (C218) MANUFACTURING TECHNOLOGY LABORATORY – II

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C218.1	Experiment with specific milling machine to cut contour and gear teeth on the given work piece. (K3)
C218.2	Identify different machine tools to manufacturing gears. (K3)
C218.3	Interpret different machine tools for finishing operations. (K2)
C218.4	Make use of manufacture tools using cutter grinder. (K3)
C218.5	Develop CNC part programming. (K3)
C218.6	Apply suitable machining sequence to plan the process in producing a component. (K3)

SEMESTER: V

U20ME501 (C301) DESIGN OF MACHINE ELEMENTS

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C301.1	Solve the various stresses acting on various machine elements. (K3)
C301.2	Compute the dimensions, SF and BM of shafts and couplings based on various load conditions. (K2)
C301.3	Determine the size of welding required for parallel and double fillets. (K3)
C301.4	Design the energy absorbing members like springs connecting rod and crank shaft. (K3)
C301.5	Choose the appropriate bearing, from the standard catalog for varied applications. (K3)
C301.6	Identify the various dimensionless numbers for hydrodynamic bearing from PSG design data book. (K3)

U20ME502 (C302) DYNAMICS OF MACHINES

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C302.1	Define static and dynamic forces of mechanisms. (K1)
C302.2	Identify the balancing masses and their locations of reciprocating and rotating masses. (K3)
C302.3	Classify the frequency of free vibration. (K2)
C302.4	Solve the frequency of forced vibration and damping coefficient. (K3)
C302.5	Choose the speed and lift of the governor. (K3)
C302.6	Identify the gyroscopic effect on automobiles, ships and airplanes. (K3)

U20ME503 (C303) HEAT AND MASS TRANSFER

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C303.1	Utilize heat conduction equations to different surface configurations under steady state and transient conditions and solve problems. (K3)
C303.2	Apply free and forced convective heat transfer correlations to internal and external flows through/over various surface configurations and solve problems. (K3)
C303.3	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)
C303.4	Interpret basic laws for Radiation and apply these principles to radiative heat transfer between different types of surfaces to solve problems. (K2)
C303.5	Make the use of mass transfer and its correlations. (K3)
C303.6	Apply the conduction and convection principles in product application by real time study. (K3)

U20ME504 (C304) AUTOMOBILE ENGINEERING

COURSE OUTCOMES:

Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C304.1	Identify the vehicle structure, engine components and accessories. (K3)
C304.2	Compare various engine auxiliary and emission control systems. (K2)
C304.3	Explain the working principle of various transmission and control systems. (K2)
C304.4	Interpret the functions of steering, brakes and suspension systems. (K2)
C304.5	Explain the various energy sources available for vehicles based on trend, economic and pollution free condition. (K2)
C304.6	Classify the working of various components in automobile engineering. (K2)

U20ME505 (C305) METROLOGY AND MEASUREMENTS

COURSE OUTCOMES:

Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C305.1	Explain the fundamentals of Measuring system & Errors in Measurement. (K2)
C305.2	Interpret the use of Linear and Angular Measurement instruments. (K2)
C305.3	Explain the working of Laser Interferometer and Coordinate Measuring Machine (CMM). (K2)
C305.4	Identify the methods available for measuring various forms. (K3)
C305.5	Select suitable measuring instruments to measure power, flow and temperature. (K3)
C305.6	Utilize different measurement technologies to quantify varying parameters for real time applications. (K3)

U20OME52 (C306) RENEWABLE ENERGY SOURCES

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C306.1	Recall the physics of solar radiation. (K1)
C306.2	Classify the solar energy collectors and methodologies of storing solar energy. (K2)
C306.3	Apply the knowledge in solar energy in a useful way. (K3)
C306.4	Identify the knowledge in wind energy and biomass with its economic aspects. (K3)
C306.5	Apply knowledge in capturing and applying other forms of energy. (K3)
C306.6	Summarize the sources like wind, biogas and geothermal energies. (K2)

U20ME506 (C307) DYNAMICS LABORATORY

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C307.1	Understanding gear parameters such as pitch diameter, module, pressure angle, etc. .(K2)
C307.2	Determining range sensitivity, effort, etc., for various types of governors including Watts, Porter, Proell, and Hartnell Governors. .(K2)
C307.3	Analyzing Single degree of freedom Spring Mass System to determine natural frequency, verify Laws of springs, and determine damping coefficient. .(K4)
C307.4	Analyzing undamped and damped vibrations of Equivalent Spring mass systems. .(K4)
C307.5	Determination of transmissibility ratio using a vibrating table. .(K2)
C307.6	Studying transverse vibration of Free-Free beams with and without concentrated masses. .(K2)

U20ME507 (C308) HEAT TRANSFER LABORATORY

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C308.1	Conduct experiments to measure thermal conductivity using different apparatus. .(K2)
C308.2	Perform experiments to determine the thermal conductivity of composite materials and insulating powders. .(K2)
C308.3	Measure the Stefan-Boltzmann constant and determine the emissivity of a grey surface. .(K2)
C308.4	Determine the Coefficient of Performance (COP) of a refrigeration system.(K3)
C308.5	Perform performance tests on reciprocating air compressors and refrigeration systems. .(K3)
C308.6	Evaluate the performance of a fluidized bed cooling tower. .(K3)

U20ME508 (C309) METROLOGY AND MEASUREMENTS LABORATORY

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to explain:</i>
C309.1	Demonstrate the correct methods for measurement and calibration of various measuring devices. (K2)
C309.2	Explain the effective methods of measuring straightness, flatness, gear profile, screw threads. (K2)
C309.3	Compute the internal bore diameter measurement by bore gauge and telescope gauge. (K2)
C309.4	Compare the force and torque using suitable measuring devices. (K2)
C309.5	Compute the temperature measurement using thermocouple. (K2)
C309.6	Apply the different measurement tools and perform measurements in quality Inspection. (K2)

SEMESTER: VI

U20BS601 (C311) OPERATION RESEARCH

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C311.1	Formulate the dual problem and perform duality analysis. .(K2)
C311.2	Solve the Traveling Salesman Problem using appropriate algorithms. .(K3)
C311.3	Calculate economic order quantity and quantity discount models. .(K2)
C311.4	Explain queueing models and their characteristics. .(K2)
C311.5	Utilize dynamic programming to solve complex decision problems. .(K3)
C311.6	Apply models based on service life and economic life in decision-making. .(K3)

U20ME601 (C312) DESIGN OF TRANSMISSION SYSTEMS

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C312.1	Compute the design parameters of flexible transmission elements like belts, chains and wire ropes for given condition. (K3)
C312.2	Compute the spur and helical gear terminology considering strength and wear. (K3)
C312.3	Compute the required parameters in designing worm, bevel and double helical gear power transmission. (K3)
C312.4	Calculate the speed ratio and gear box parameters for the given application. (K3)
C312.5	Select the parameters require to design cam, clutches and brakes for varied applications. (K3)
C312.6	Select the parameters to design power transmission elements using standard catalogue. (K3)

U20ME602 (C313) COMPUTER AIDED DESIGN

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C313.1	Describe the architecture of Computer-Aided Design (CAD) systems and their components. .(K2)
C313.2	Analyze the properties and applications of Bezier and B-spline surfaces. .(K4)
C313.3	Implement algorithms for hidden-line, hidden-surface, and hidden-solid removal. .(K2)
C313.4	Perform tolerance analysis and mass property calculations for assemblies. .(K2)
C313.5	Explain the importance of standards for computer graphics. .(K2)
C313.6	Explain communication standards for CAD systems. .(K2)

U20ME603 (C314) GAS DYNAMICS AND JET PROPULSION

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C314.1	Describe the influence of Mach number on compressibility and its implications for engineering applications. .(K2)
C314.2	Explain the fundamentals of flows through constant area ducts with heat transfer (Rayleigh flow) and friction (Fanno flow). .(K2)
C314.3	Derive the governing equations for normal and oblique shocks and explain their physical significance. .(K2)
C314.4	Analyze the operating principles and cycle analysis of various jet engines including ram jet, turbojet, turbofan, and turboprop engines. .(K4)
C314.5	Discuss the characteristics of different propellants and their feeding systems in rocket engines. .(K4)
C314.6	Analyze the performance of rocket engines and evaluate their applications in space flights. .(K4)

U20OAE72 (C315) HIGH TEMPERATURE MATERIALS

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C315.1	Analyze the imperfections in crystals and their effects on material properties in physical metallurgy.(K4)
C315.2	Explain the factors influencing the functional life of components at elevated temperatures and the concept of creep curve. .(K2)
C315.3	Differentiate between various types of fractures and understand their transition from brittle to ductile behavior at different temperatures. .(K2)
C315.4	Examine the defect structure and methods for controlling oxidation by alloy additions. .(K3)
C315.5	Describe the composition and properties of iron-base, nickel-base, and cobalt-base super alloys. .(K2)
C315.6	Explain the characteristics and applications of high-temperature ceramics and intermetallics. .(K2)

U20ME661 (C316) UNCONVENTIONAL MACHINING PROCESSES

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C316.1	Explain the types, needs and application of unconventional machining process and Mechanical Energy based processes. (K2)
C316.2	Classify the electrical energy-based machining processes. (K2)
C316.3	Explain chemical and electrochemical energy-based machining processes for specific application. (K2)
C316.4	Relate the significance of various process parameters on MRR. (K1)
C316.5	Analyze the principles of Plasma Arc Machining (PAM) and its applications in precision machining. .(K2)
C316.6	Analyze the principles of Laser Beam Machining (LBM) and its applications in modern manufacturing. .(K2)

U20ME604 (C317) DESIGN AND FABRICATION PROJECT

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C317.1	Make use of design principles and develop concept for the project. (K3)
C317.2	Estimate the time frame and cost for the project execution and completion.(K3)
C317.3	Analyze the project progress with remedial measures individual in a team. (K4)
C317.4	Examine the environmental impact of the project. (K3)
C317.5	Demonstrate the project functionality along with report and presentation. (K2)
C317.6	Apply the Engineering knowledge in design and economically manufacturing of components to support the society need. (K3)

U20ME605 (C318) CAD / CAM LABORATORY

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C318.1	Utilize standard software tools to create part, assemblies and check for clearances. (K3)
C318.2	Modify 2D drafting to 3D using modeling software. (K3)
C318.3	Summarize the modern control in manufacturing systems (FANUC, SIEMENS) (K2)
C318.4	Utilize the concepts of G and M codes and manual part programming for modern manufacturing technology. (K3)
C318.5	Utilize CAPP in machining and turning centre. (K3)
C318.6	Apply modern tools in design, manufacture and planning. (K3)

U20HS601 (C319) PROFESSIONAL COMMUNICATION

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
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

U20ME701 (C401) FINITE ELEMENT ANALYSIS

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C401.1	Summarize the basics of finite element formulation. (K2)
C401.2	Compute structural and thermal problems utilizing 1D problem formulation. (K3)
C401.3	Use 2D scalar formulation for solving thermal and torsion problems. (K3)
C401.4	Use 2D vector formulation for solving plane stress, plane strain and axisymmetric problems. (K3)
C401.5	Apply finite element method to solve problems on iso parametric element and dynamic Problems. (K3)
C401.6	Compute the real time primitive structural and thermal problems using finite element techniques. (K3)

U20HS701 (C402) TOTAL QUALITY MANAGEMENT

Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C402.1	Understand the dimensions of product and service quality and the basic concepts of Total Quality Management (TQM).(K2)
C402.2	Explain continuous process improvement tools such as PDCA cycle and Kaizen to improve quality. (K2)
C402.3	Recall the seven traditional tools of quality and understand their applications. (K2)
C402.4	Apply Quality Function Deployment (QFD) and Taguchi quality loss function in product design and improvement. (K2)
C402.5	Recall the need for ISO 9000 and understand its elements and documentation requirements. (K2)
C402.6	Apply quality auditing techniques to assess compliance with ISO standards. (K2)

U20ME702 (C403) MECHATRONICS

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
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)

U20ME741 (C404) POWER PLANT ENGINEERING

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C404.1	Explain the layout of thermal power plant and working principle of various types of boilers. (K2)
C404.2	Explain the working of diesel and gas turbine power plant along with optimization technique. (K2)
C404.3	List the various types of nuclear reactors used in nuclear power plant. (K1)
C404.4	Summarize the principles and working of various renewable energy power plants. (K2)
C404.5	Define the energy, economic and environmental issues of power plants. (K1)
C404.6	Identify the different types of power plant, its function and issues related to them. (K3)

U20ME751 (C405) ROBOTICS

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C405.1	Explain the concepts of industrial robots, classification, specifications and coordinate systems. (K2)
C405.2	Illustrate the different types of robot drive systems as well as robot end effectors. (K2)
C405.3	Apply the different sensors and image processing techniques in robotics to improve the ability of robots. (K3)
C405.4	Develop robotic programs for different tasks and familiarize with the kinematics motions of Robot.(K3)
C405.5	Examine the implementation of robots in various industrial sectors and interpolate the economic analysis of robots. (K4)
C405.6	Summarize the need and application of robots in different sectors. (K2)

U20ME703 (C406) SIMULATION AND ANALYSIS LABORATORY

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C406.1	Apply the fundamentals concepts of finite element method in problem characterization. (K3)
C406.2	Find the force and stress using link elements in Trusses. (K1)
C406.3	Explain the effect of various load acting on 1D beam in real time problem. (K2)
C406.4	Find the thermal stress in cylindrical shells. (K1)
C406.5	Identify the natural frequency and mode shape of 2D components and beams. (K3)
C406.6	Analyze the stresses and strains induced in plates, brackets and beams and heat transfer problems. (K4)

U20ME704 (C407) MECHATRONICS LABORATORY

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C407.1	Summarize assembly language programming of 8085 for arithmetic operation. (K2)
C407.2	Develop programmable peripheral interface for stepper motor and traffic light. (K3)
C407.3	Demonstrate the speed control of DC motor by microcontroller. (K2)
C407.4	Identify Hydraulic, Pneumatic and electro pneumatic circuits using software tool. (K3)
C407.5	Examine various fluid power circuits. (K4)
C407.6	Make use of PLC programs for controlling multiple cylinders using timers. (K3)

SEMESTER: VIII

U20ES801 (C411) ENGINEERING ECONOMICS

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
C411.1	Apply the concept of opportunity cost to decision-making processes in engineering economics.(K3)
C411.2	Explain the aims and functions of value engineering.(K2)
C411.3	Understand the concepts of present worth, future worth, and annual equivalent methods.(K2)
C411.4	Recall the types of maintenance and replacement problems.(K1)
C411.5	Understand the concept of inflation-adjusted decisions in depreciation.(K2)
C411.6	Apply various depreciation methods to evaluate public alternatives.(K2)

U20ME821 (412) PRODUCTION PLANNING AND CONTROL

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
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)

U20ME801 (C413) PROJECT WORK

COURSE OUTCOMES:	
Course Code	Course Outcomes
	<i>Upon completion of the course, the students will be able to:</i>
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)