I YEAR & -I SEMESTER			
COURSE CODE	**COURSE NAME**	**CO**	**CO STATEMENT**
C101	Linear Algebra and Ordinary Differential Equations	C101.1	1. Apply the matrix algebra techniques to engineering applications. (L3)
		C101.2	2. Apply the concepts of eigen values and eigen vectors to free vibration of a two mass systems. (L3)
		C101.3	3. Apply mean value theorems to real world problems.(L3)
		C101.4	4. Solve the first order ordinary differential equations related to various engineering fields. (L3)
		C101.5	5. Solve the higher order differential equations and analyze physical situations. (L3)
C102	Engineering Physics	C102.1	1. Apply the principles of acoustics and Ultrasonics for noise reduction (L3)
		C102.2	2. Develop the relationship between elastic constants(L3)
		C102.3	3. Identify the principles of lasers and mechanics (L2)
		C102.4	4. Explain the various types of crystal systems and nano materials(L2)
		C102.5	5. Demonstrate the working principles of heat engine and refrigerator using laws of thermodynamics(L3)
C103	Basic Electrical & Electronics Engineering	C103.1	1. Analyze the behavior of an electrical circuit. (L4)
		C103.2	2. Measure the performance quantities such as losses, efficiency of DC machines and transformers. (L3)
		C103.3	3. Measure the performance quantities such as losses, efficiency of transformer and induction motor. (L3)
		C103.4	4. Understand the importance and applications of p-n junction diode. (L2)
		C103.5	5. Evaluate the configurations and applications of Op-Amps. (L5)

		C104.1	1. Understand the value of Human Conduct for career development through life skills: Ethics & Values and use root words and Prepositions without errors. Gain reading skills for comprehension, specific information, gist, and pleasure through extensive reading
		C104.2	2. Observe the significance of imagery in poetry to use it in real-time contexts and learn to use and misuse of Articles, Prefixes, Suffixes, and Punctuations. Gain reading skills for comprehension, specific information, gist, and pleasure through extensive reading
C104	English	C104.3	3. Acquire conversation skills through drama and enhance the correct use of Nouns, Pronouns, Verbs and Concord to write paragraphs effectively. Gain reading skills for comprehension, specific information, gist, and pleasure through extensive reading
		C104.4	4. Develop reading for inspiration, interpretation & innovation and learn to use modifiers, synonyms and antonyms to write essays effectively. Gain reading skills for comprehension, specific information, gist, and pleasure through extensive reading
		C104.5	5. Learn meaningful use of language by avoiding meaningless cliches, bureaucratic euphemisms and academic jargon in order to acquire the skill of summarising. Gain reading skills for comprehension, specific information, gist, and pleasure through extensive reading
		C105.1	1. Apply the basics of engineering drawing to construct the polygons and curves. (L3)
		C105.2	2. Draw the orthographic projections of points and lines. (L3)
C105	Engineering Graphics	C105.3	3. Draw the projections of planes in various conditions. (L3)
		C105.4	4. Draw the projections of regular solids inclined to one of the planes. (L3)
		C105.5	5. Imagine the isometric views of orthographic views and vice versa. (L6)
C106	Engineering Physics Lab	C106.1	1. Apply the working principles of laboratory experiments in optics, mechanics, electromagnetic and electronics and perform the experiments using required apparatus. (L3)
		C106.2	2. Compute the required parameter by suitable formula using experimental values (observed values) in mechanics, optics, electromagnetic and electronic experiments. (L3)

		C106.3	3. Analyze the experimental results through graphical interpretation. (L4)
		C106.4	4. Recognize the required precautions to carry out the experiment and handling the apparatus in the laboratory. (L2)
		C106.5	5. Demonstrate the working principles, procedures and applications. (L3)
C107	Communicative English Lab -I	C107.1	1. enhance pronunciation with befitting tone for clarity in a speech to communicate language effectively.
		C107.2	2. Participate in short conversations in routine contexts on topics of interest and ask questions and make requests politely.
		C107.3	3. Listen for specific information, gist, note-taking, note-making and comprehension and develop convincing and negotiating skills through debates
		C107.4	4. acquire effective strategies for good writing and demonstrate the same in summarizing and reporting .
		C107.5	5. Gain knowledge of grammatical structures and vocabulary for day-to-day successful conversations
C108	Basic Electrical and Electronics Engineering Lab	C108.1	1. Prove laws and theorems (L5)
		C108.2	2. Determine the characteristics of DC Machines (L5)
		C108.3	3. Analyze the V-I characteristics of diode (L4)
		C108.4	4. Design MOSFET, Inverting and Non-Inverting Amplifier (L6)
		C108.5	5. Experiment with PSPICE (L3)
C109	Constitution of India	C109.1	Impart knowledge on historical background of the constitution making and its importance for building a democratic India.(L2)
		C109.2	Analyze the functioning of three wings of the government ie., executive, legislative and judiciary.(L2)
		C109.3	Explain the value of the fundamental rights and duties for becoming good citizen of India.(L2)

		C109.4	Analyze the decentralization of power between central, state and local self government.(L4)
		C109.5	Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.(L3)
I YEAR & II SEMESTER			
C110	Transform Techniques and Partial Differential Equations	C110.1	1. Apply the Laplace transform for solving differential equations and integral equations. (L3)
		C110.2	2. Apply partial differentiation to find maxima and minima of functions of several variables. (L3)
		C110.3	3. Find the Fourier series expansions of various functions and apply integral expressions for the forwards and inverse Fourier transform. (L3)
		C110.4	4. Solve partial differential equations of first and higher order using analytical methods. (L2)
		C110.5	5. Develop Z transform techniques to solve discrete time systems. (L3)
C111	Engineering Chemistry	C111.1	1. Analyze the suitable method for industrial water treatment. (L-4)
		C111.2	2. Design the metallic materials to prevent the corrosion. (L-6)
		C111.3	3. Illustrate the properties and applications of polymers, understand the mechanism of setting and hardening of cement. (L-2)
		C111.4	4. Assess the quality of fuels and identify the suitable one. (L-5)
		C111.5	5. Demonstrate the preparation, properties and applications of nano materials and importance of green chemistry. (L-2)
C112	Engineering Mechanics	C112.1	1. Find the resultant for any no of forces in mechanical system with (or) without application of concept of friction(L4)
		C112.2	2. Analyze the simple Structures& estimation of the work done by the forces (L4)
		C112.3	3. Determine the centroid /centre of gravity/moment of inertia for composite sections (L3)
		C112.4	4. Analyze the motion of the bodies with (or) without the application of force (L4)
		C112.5	5. Determine the displacement, velocity &acceleration relations in dynamic systems (L3)
C113	Problem Solving and Programming using C	C113.1	1. Develop algorithms and flowcharts and also Understand the compilation, debugging, execution and writing of basic C programs
		C113.2	2. Develop C Programs using control and iterative statements
		C113.3	3. Develop C programs using Arrays and functions
		C113.4	4. Apply the knowledge of strings and pointers in programming
		C113.5	5. Comprehend file handling and user defined data types
C114	Engineering Workshop & IT Workshop Lab	C114.1	1. Apply wood working skills in real world applications. (L3)
		C114.2	2. Build different parts with fitting in engineering applications. (L3)
		C114.3	3. Apply forging operations for different black smith applications. (L3)

		C114.4	4. Apply different types of basic electric circuit connections. (L3)
		C114.5	5. Understand the basic components, peripherals and basic operations of a computer. (L3)
C115	Computer Aided Engg Drawing	C115.1	1. Draw the projections of solids and sections of solids in different types of projecting methods. (L3)
		C115.2	2. Draw the development of surfaces is required in designing and manufacturing of the objects. (L3)
		C115.3	3. Know the various commands in AutoCAD to draw the geometric entities.(L2)
		C115.4	4. Construct 3D objects using CAD software package. (L3)
		C115.5	5. Apply the principles of engineering drawing in machine drawing. (L3)
C116	Engineering Chemistry Lab	C116.1	1. Analyze the quality of ground water sample. (L-4)
		C116.2	2. Explain the functioning of the instruments such as pH, Viscometer, Cleve lands and Potentiometric meters. (L-2)
		C116.3	3. Prepare polymers and nano materials. (L-4)
		C116.4	4. Estimate the metal content in different ores (Fe & Cu). (L-3)
		C116.5	5. Identify the safety precautions to carry out the experiments in the laboratory using chemicals. (L-3)
C117	Problem Solving and programming using C Lab	C117.1	1. Document and present the algorithms, flowcharts and programs in form of user-manual and also apply and practice logical ability to solve the problems.
		C117.2	2. Understand C programming development environment, compiling, debugging, and Linking And executing a program using the development environment
		C117.3	3. analyzing the complexity of problems modularize the problems into small modules and then convert them into programs
		C117.4	4. Understand and apply the in-built functions and customized functions for solving the problems.
		C117.5	5. Understand and apply the pointers, memory allocation techniques and use of files for dealing with variety of problems.
C118	Communicative English Lab -II	C118.1	1. Enabling students to use Computer assisted Language Laboratory (CALL) to enhance their pronunciation through stress, intonation and rhythm for routine and spontaneous interaction
		C118.2	2. Attainment of communicative competence for the fulfilment of academic, professional and social purposes.
		C118.3	3. Attainment of language Proficiency through Contextualized, Task Based Activities to realize employment potential at the end of the course.
		C118.4	4. Acquired listening, speaking, reading and writing skills necessary for the survival in the

		C118.5	5. Development of fluency and accuracy for effective and professional communication in real-time situations by using appropriate verbiage and contextual knowledge.
C119	Environmental Science	C119.1	1. Understand about the environment and natural resources.
		C119.2	2. Illustrate about the ecosystem and knows the importance of conservation of biodiversity.
		C119.3	3. Understands about various attributes of different types of pollution and their impacts on the environment and control methods along with waste management practices.
		C119.4	4. Relate the current environmental impacts with the societal problems.
		C119.5	5. Identify the current population growth with their impacts and apply the knowledge how to manage environment issues.
II YEAR & I SEMESTER			
C201	Numerical Methods and Multi variable Calculus	C201.1	1. Solve non-linear equations using various numerical methods.(L2)
		C201.2	2. Construct interpolation polynomials for a given data using Lagrange's and Newton's interpolation formulae.(L2)
		C201.3	3. Apply numerical methods to find derivatives, integrations and solutions of ordinary differential equations(L3)
		C201.4	4. Evaluate the surface area of solids using multiple integrals and apply the properties of Beta, Gamma functions to evaluate the integrals. (L3)
		C201.5	5. Estimate the work done against a field, circulation and flux using vector integral theorems. (L3)
C202	Mechanics of Solids	C202.1	1. Apply the concepts of stress and strain to machine numbers. (L3)
		C202.2	2. Determine, shear forces, and bending moments in beams. (L4)
		C202.3	3. Demonstrate the shear stress and bending stress distribution in different cross section of beams. (L3)
		C202.4	4. Estimate the stress in machine members such as shafts and springs.(L4)
		C202.5	5. Analyse columns for buckling loads and estimate the stresses in thin cylinders due to internal pressure.(L4)
C203	Material Science & Metallurgy	C203.1	1. Explain the principles of binary phases. (L2)
		C203.2	2. Apply heat treatment to different applications. (L3)
		C203.3	3. Select steel and cast irons for a given application. (L3)
		C203.4	4. Utilize nonferrous metals and alloys in engineering. (L3)
		C203.5	5. Choose composites for various applications. (L3)
C204	Fluid Mechanics & Hydraulic Machines	C204.1	1 Define fluid properties and their behaviour in static and dynamic states.(L1)
		C204.2	2 Analyse the type of fluid flow patterns and use Continuity equitation to one dimensional fluid flow situations.(L4)

		C204.3	3 Analyse the impact of jet on the vanes.(L2)
		C204.4	4 Analyse the various components of turbines and study their characteristics curves and power output from turbines. Introduce the concepts of boundary layer(L4)
		C204.5	5 Evaluate performance of hydraulic machines (L3)
C205	Thermodynamics	C205.1	1. Identify concepts of heat, work, energy and governing rules for conversion of one form to other.(L1)
		C205.2	2. Explain relationships between properties of matter and basic laws of thermodynamics. (L2)
		C205.3	3. Explain the concept of available energy for maximum work conversion(L1)
		C205.4	4. Analyse the steam properties to understand working of steam power plants.(L4)
		C205.5	5. To enable the students to Provide fundamental concepts of thermodynamics cycles used in steam power plants, IC engines and gas turbines(L2)
C206	Machine Drawing	C206.1	1. Identify conventional representation of machine components. (L3)
		C206.2	2. Draw the sectional views of various machine parts (L3)
		C206.3	3. Construct the engine parts like Fuel pump, Petrol Engine connecting rod, piston assembly. (L3)
		C206.4	4. Draw the machine parts like Screws jacks, Machine Vices Plummer block, Tailstock.(L3)
		C206.5	5. Draw the Valves like spring loaded safety valve, feed check valve and air cock. (L3)
C207	Metallurgy & Mechanics of Solids Lab	C207.1	1. Identify various microstructures of steels, cast iron. (L3)
		C207.2	2. Evaluate hardness of treated and untreated steels. (L4)
		C207.3	3. Understand the study the stress-strain relations of different materials.(L1)
		C207.4	4. Evaluate the hardness of different materials. (L3)
		C207.5	5. evaluate the Modulus of rigidity of different materials. (L3)
C208	Fluid Mechanics & Hydraulic Machines Lab	C208.1	1. Apply laws of conservation in verification of principles of fluid flow(L3)
		C208.2	2. Perform measuring of pressure, discharge and velocity of fluid flow(L3)
		C208.3	3. Evaluate major and minor losses in a pipe flow(L3).
		C208.4	4. Analyze the performance characteristics curves of different turbines and pumps(L4)
		C208.5	5. Analyze experimental results using formulas of work done, discharge power, efficiency, data tables, and graphs(L4).
C209	Essence of Indian Traditional Knowledge	C209.1	1. Knowledge about the concept of traditional knowledge and analyze social context(L2)
		C209.2	2. Apply significance of traditional knowledge protection (L3)
		C209.3	3. Analyze various enactments related to the protection of plant varieties. (L4)
		C209.4	4. Evaluate desired concepts of Intellectual property to protect the traditional knowledge(L4)
		C209.5	5. Compare the traditional knowledge in various sectors (L4)

			II YEAR & II SEMESTER
C210	Complex Variables, Probability& Statistics	C210.1	1. Examine the analyticity of complex functions. (L3)
		C210.2	2. Evaluate complex integration using Cauchy's theorems and Cauchy's residue theorem. (L3)
		C210.3	3. Compute probabilities, theoretical frequencies using discrete and continuous probability distributions for real data. (L3)
		C210.4	4. Apply the concept of hypothesis test to large samples. (L3)
		C210.5	5. Apply statistical inferential methods to small samples. (L3)
C211	Kinematics of Machinery	C211.1	1. Demonstrate the four bar, single slider and double slider mechanisms. (L3)
		C211.2	2. Demonstrate the lower pair mechanisms (L3)
		C211.3	3. Analyse the four bar, single slider and double slider mechanisms kinematically, cam profile by considering different types of velocities. (L5)
		C211.4	4. Design gears for power transmission (L5)
		C211.5	5. Analyze various power transmission systems such as belts, ropes ,chain drives and gear trains. (L5)
C212	Applied Thermodynamics	C212.1	1. Familiarize the developments in IC engines & understand combustion process in SI and CI engines.(L2)
		C212.2	2. Understand different types of compressors.(L2)
		C212.3	3. Familiarize concepts of thermodynamics cycles used in steam power plants and gas turbines(L2)
		C212.4	4. Impart knowledge on the working of nozzles, turbines, refrigeration and air conditioning.(L3)
		C212.5	5. Understand the Principles of Psychrometry, Air Conditioning and basic cycles of various refrigerating systems, their performance evaluation along with details of system components and refrigerant properties.(L3)
C213	Production Technology	C213.1	1. Explain different metal casting processes and gating systems. (L2)
		C213.2	2. Evaluate the forces and power requirements in rolling process. (L5)
		C213.3	3. Apply the principles of various forging operations. (L3)
		C213.4	4. Classify working of various welding processes and outline the manufacturing methods of plastics, ceramics. (L2)
		C213.5	5. Demonstrate the application of plastics and power metallurgy. (L2)
C214	Instrumentation & Control Systems	C214.1	1. Explain the principles of measurements. (L2)
		C214.2	2. Measure the temperature and pressure of various instruments. (L4)
		C214.3	3. Measure the flow, speed of various instruments (L4)
		C214.4	4. Calibrate the strain using strain gauge.
		C214.5	5. Explain the elements of control systems. (L2)

		C215.1	1. Apply the design procedure to engineering problems, including the consideration of technical and manufacturing constraints.(L4)
C215	Design of Machine Members	C215.2	2. Select suitable materials and significance of tolerances and fits in critical design applications. (L5)
		C215.3	3. Design the elements for strength, stiffness and fatigue. (L4)
		C215.4	4. Identify the loads, the machine members subjected and calculate static and dynamic stresses to ensure safe design.(L1)
		C215.5	5. Identify various types of stresses induced in couplings and ensure a safe design. (L1)
C216	Production Technology Lab	C216.1	1. Exercise for Strength and Permeability for sand.(L4)
		C216.2	2. Design the Gating and pouring time and solidification time calculations.(L4).
		C216.3	3. Fabricate different types of components using various welding techniques (L6).
		C216.4	4. Perform Blanking and Piercing operation with Simple, Compound and Combination dies.(L6)
		C216.5	5. Perform the Plasma arc cutting, Wire cut EDM and exercise Additive manufacturing with reverse engineering. (L6)
C217	Instrumentation & Control Systems Lab	C217.1	1. Measurement of various linear, angular dimensions of the products and flatness of the surface by using precision measuring instruments.
		C217.2	2. Learn how to check various parameters of the threads and gears.
		C217.3	3. Selection of the appropriate measuring instruments
		C217.4	4. Knowledge of the requirement of calibration and errors in measurement and perform accurate measurements
		C217.5	5. Alignment various machines used in manufacturing
C218	English Communication skills-II	C218.1	Aims to help learners develop their English language skills, particularly those planning to appear for Competitive Exams that test their English Language abilities.
		C218.2	Presents a wider scope for gaining the power of expression through rich Vocabulary to get placed well.
		C218.3	Imparts critical reading strategies for comprehension of complex texts
		C218.4	Provides training and opportunities to develop fluency in English through participation in formal group discussions and Self Introductions.
		C218.5	Demonstrates good writing skills for effective Paragraph Writing, Essay Writing and formal correspondence through Emails.
III YEAR& I SEMESTER			
C301	Dynamics of Machinery	C301.1	1. Analyse the stabilization of sea vehicles, aircrafts and automobile vehicles. (L4)
		C301.2	2. Compute frictional losses, torque transmission of mechanical systems. (L3)
		C301.3	3. Enumerate dynamic force analysis of slider crank mechanism and design of flywheel, demonstrate various concepts on design of various types of governors along with other

			topics such as sensitiveness and hunting.(L6)
		C301.4	4. Demonstrate the methods of balancing of rotating masses and balancing of reciprocating masses as well. (L2)
		C301.5	5. Find out the methods to calculate the natural frequencies of different systems. (L2)
C302	Design of Power Transmission Elements	C302.1	1. Select of suitable bearing depending upon the application and can calculate life of the bearing. (L5)
		C302.2	2. Design Curved beams having different cross sections.(L4)
		C302.3	3. Design different I.C Engine parts like cylinder and piston (L4)
		C302.4	4. Design of various of power screws (L4)
		C302.5	5. Design of different types of gears. (L4)
C303	Metal Cutting & Machine Tools	C303.1	1. Choose cutting processes and variables. (L3)
		C303.2	2. Relate tool wear and tool life. (L1)
		C303.3	3. Demonstrate the various process like boring, reaming etc. (L2)
		C303.4	4. Identify methods to generate different types of surfaces. (L3)
		C303.5	5. Explain work-holding requirements. (L2)
C304	Managerial Economics and Industrial Management	C304.1	Equipped with the knowledge of fundamentals of economics, estimating the Demand for a product, Capable of analyzing Elasticity & Forecasting methods(L2)
		C304.2	Apply production concepts, assess the costs and Determine Break Even Point (BEP) of an enterprise for managerial decision making(L4)
		C304.3	Identify the influence and price determination of various markets structures and knowledge of the forms of business organization and Business cycles(L4)
		C304.4	Analyze and interpret the process & principles of accounting & apply financial statements for appropriate decisions to run the business profitably(L4)
		C304.5	Analyze how to invest adequate amount of capital in order to get maximum return from selected business activity..(L4)
C305	IC Engines &Turbo Machinery	C305.1	Understand normal and abnormal combustion phenomena in SI and CI engines(L1)
		C305.2	Identify fuel metering and fuel supply systems for different types of engines (L3)
		C305.3	Analyze the effect of various operating variables on engine performance (L3)
		C305.4	Understand the operation of turbomachines (L1)
		C305.5	Gain idea on performance characteristics, governing and selection of turbomachinery

C306	Power Plant Engineering	C306.1	Outline sources of energy, power plant economics, and environmental aspects. (L2)
		C306.2	Explain power plant economics and environmental considerations. (L2)
		C306.3	Illustrate the working mechanism of diesel and gas turbine power plants. (L2)
		C306.4	Summarize types of renewable energy sources and their working principle. (L2)
		C306.5	Demonstrate the working principle of nuclear power plants. (L4)
C307	Industrial Hydraulic & Pneumatics	C307.1	1. understand the general fundamental concepts associated with Hydraulic and Pneumatic equipment as found in industry today. (L2)
		C307.2	2. design of hydraulic cylinder, motors and selection of actuators.(L4)
		C307.3	3. discuss difference between control and regulation elements.(L4)
		C307.4	4. identification of application in pneumatic system.(L3)
		C307.5	5. identify the practical applications in automation. (L300
C308	Mechanical Behaviour of Materials	C308.1	1. Apply materials based on their structure and failure modes (L3).
		C308.2	2. Discuss grain size strengthening and solid solution strengthening(L1)
		C308.3	3. Characterize materials using different machines (L1).
		C308.4	4. Summarize the various strengthening mechanisms with suitable examples (L2)
		C308.5	5. Identify the creep in different materials and its influence in selection of materials (L1)
C309	Composite Materials	C309.1	1. Identify the practical applications of composites. (L3)
		C309.2	2. Identify the polymer matrix composites. (L3)
		C309.3	3. Outline the various types of metal matrix composite. (L2)
		C309.4	4. Summarize the various types of ceramic matrix materials.(L2)
		C309.5	5. Examine the Properties and applications of bio- degradable composites. (L3)
C310	Advanced Manufacturing Processes	C310.1	1. Discuss the modern manufacturing process with respect to productivity economic(L6)
		C310.2	2. Explain the trends in development of manufacturing process selection of suitable process for metal cutting and non-traditional manufacturing(L2)
		C310.3	3. Understand electrical discharge machining processes and applications(L2)
		C310.4	4. Explain chemical and electrical machining processes and limitations(L2)
		C310.5	5. Explain principle different welding processes(L2)
C311	Casting and Welding Techniques	C311.1	1. Select the type of casting alloy (L2)
		C311.2	2. Describe about furnaces and moulds (L2)
		C311.3	3. Explain about solidification of casted parts. (L2)

		C311.4	4. Describe about welding process and its types. (L2)
		C311.5	5. Explain about soldering, brazing and metallurgical aspects in welding. (L20
C312	Statistical Quality Control	C312.1	1. In-depth knowledge of theoretical and practical aspects of SQC.(L3)
		C312.2	2. Understanding of the link between SQC and business analysis / business planning. Skills acquisition (L2,L4)
		C312.3	3. Understand the statistical underpinnings of quality monitoring.(L2)
		C312.4	4. Analysing the statistical and economical design issues associated with the monitoring tools.(L4)
		C312.5	5. Demonstrate the ability to design and implement these tools
C313	Thermal Engineering Lab	C313.1	1. Determine the valve and port timing diagram of SI engine & CI engine (L5)
		C313.2	2. Determine the performance parameters for 4-stroke C.I engine&4-stroke S.I engine. (L5)
		C313.3	3. Evaluate and Prepare heat balance sheet for twin cyclinder C.I engine. (L5)
		C313.4	4. Apply the concept of Morse test on SI engine.(multi cylinder). (L3)
		C313.5	5. Analyse the efficiency of reciprocating air compressor. (L4)
C314	Machine Tools Lab	C314.1	1. Explain the lathe working principle and can perform various operations to prepare different shapes of products (L2).
		C314.2	2. Operate drilling machine and can perform various operations to prepare different shapes of products (L3).
		C314.3	3. Operate shaper, slotting and planning machine and can perform various operations to prepare different shapes of products (L3).
		C314.4	4. Explain the surface grinding machine and can perform various operations to prepare different shapes of products (L2).
		C314.5	5. Operate milling machine, with understanding working principle and can perform various operations to prepare different shapes of products (L3).
III YEAR -II SEMESTER			
C315	CAD/CAM	C315.1	1. Apply the basics of geometric representation and transformations in CAD/CAM. (L3)
		C315.2	2. Choose geometric modelling methods for building CAD models. (L1)
		C315.3	3. Apply the concepts of parametric representation to curves and surfaces, create surfaces such as Coons, Bezier and B-spline. (L3)
		C315.4	4. Compare NC, CNC and DNC. (L4)
		C315.5	5. Summarize the principles of robotics AR,VR and AI in CIM. (L2)
C316	Heat Transfer	C316.1	Apply the concepts of different modes of heat transfer. (L3)
		C316.2	Apply knowledge of conduction heat transfer in the design of insulation of furnaces and

			pipes. (L3)
		C316.3	Analyze free and forced convection phenomena in external and internal flows. (L4)
		C316.4	Design of thermal shields using the concepts of black body and non-black body radiation. (L5)
		C316.5	Apply the basics of mass transfer for applications in diffusion of gases. (L3)
C317	Finite Element Methods	C317.1	1. Understand the concepts behind variational methods and weighted residual methods in FEM. (L1)
		C317.2	2. Identify the applications and characteristics of FEA elements for trusses & beams. (L1)
		C317.3	3. Apply the formulation techniques to solve 2D problems using triangle and axi – symmetric elements. (L3)
		C317.4	4. Formulate and solve heat transfer problems. (L2)
		C317.5	5. Identify how the finite element method expands beyond the structural domain, for problems involving dynamics. (L1)
C318	Refrigeration & Air Conditioning	C318.1	1. analyze various refrigerating cycles (L4)
		C318.2	2. evaluate the performance of various cycles.(L5)
		C318.3	3. evaluate cooling load calculations.(L5)
		C318.4	4. Explain various refrigerant properties and psychrometric processes. (L5)
		C318.5	5. select the appropriate process and equipment for the required comfort and industrial air-conditioning. (L3)
C319	Renewable Energy Sources	C319.1	Explain the basics concepts of solar radiation, solar collectors and photo voltaic power generation.(L2)
		C319.2	Explain production of power from MHD and wind energy. (L2)
		C319.3	Summarize the principle and applications of tidal, wave and OTEC systems. (L2)
		C319.4	Compare different energy conversion systems and choose the most appropriate conversion system based on the local conditions.(L4)
		C319.5	Explain pollution prevention measures in various energy systems. (L20
C320	Advanced Mechanics of Solids	C320.1	1. Apply the concepts of stress and strain to machine numbers. (L3)
		C320.2	2. Determine modes of failure of materials. (L2)
		C320.3	3. Solve the bending stresses of non symmetrical bending of beams. (L3)
		C320.4	4. Estimate the torsion in machine members.(L4)
		C320.5	5. Analyse contact stresses in the different members.(L3)

C321	Design for Manufacturing & Assembly	C321.1	1. Design mechanical components with economical consideration.(L4)
		C321.2	2. Identify the necessity for redesigning components out of manufacturing considerations.(L1)
		C321.3	3. Consider the manufacturing considerations while designing cast, forged weld and sheet metal components.(L2)
		C321.4	4. Design plastic parts with manufacturing considerations.(L4)
		C321.5	5. Understand contemporary issues and their impact on design for manufacturing and assembly.(L2)
C322	Manufacturing Methods in Precision Engineering	C322.1	1. Classify different surface treatment methods.(L2)
		C322.2	2. Explain processing of powder metals, glass and super conductors. (L2)
		C322.3	3. Explain ceramics applications. (L2)
		C322.4	4. Explain the mechanisms like E-Manufacturing, nanotechnology, and micromachining, high speed machining.(L3)
		C322.5	**5.** Explain different liquefied, solidified and particulate methods for MMC, CMC, Polymer matrix composites. (L3)
C323	Industrial Psychology	C323.1	1. State the essentials of psychology at workplace and gain insights about work place behavior. (L2)
		C323.2	2. Analyze key concepts and theoretical perspectives in industrial psychology. (L2)
		C323.3	3. Study the job amenities and their impact on work environment. (L3)
		C323.4	4. Examine the performance and behavior of consumer. (L4)
		C323.5	5. Estimate the various causes and consequences of stress.
C324	Automobile Engineering.	C324.1	Identify different parts of automobile. (L1)
		C324.2	Explain the working of various parts like engine, transmission, clutch, brakes. (L2)
		C324.3	Describe the working of steering and the suspension systems. (L2)
		C324.4	Summarize the environmental implications of automobile emissions. (L1)
		C324.5	Outline the future developments in the automobile industry.(L2)
C325	Cryogenic Engineering	C325.1	1. Understand properties of material at cryogenic temperatures. (L1)
		C325.2	2. Summarise various liquefaction systems available (L2)
		C325.3	3. Analyse on different gas liquefaction systems and cryogenic refrigeration systems (L4)

		C325.4	4. familiarize with various design aspects of cryogenic storage and transfer lines (L2)
		C325.5	5. compute the application of cryogenics in real life situations (L4)
C326	Power Transmission in Hybrid and Electric Vehicles	C326.1	1. Explain the working of hybrid and electric vehicles. (L2)
		C326.2	2. Select a suitable drive scheme for developing a hybrid and electric vehicles depending on resources. (L4)
		C326.3	3. Develop the electric propulsion unit and its control for application of electric vehicles. (L4)
		C326.4	4. Choose proper energy storage systems for vehicle applications. (L3)
		C326.5	5. Design and develop basic schemes of electric vehicles and hybrid electric vehicles. (L3)
C327	Mechanical Vibrations	C327.1	1. find natural frequency of un-damped single degree freedom systems(L1)
		C327.2	2. Calculate transmissibility and isolation.(L3)
		C327.3	3. analyze the two degree freedom, multi degree freedom system with and without damping(L4)
		C327.4	4. Solve the Natural Frequencies Rayleigh and Dunkerleys method (L3)
		C327.5	5. Measure vibration parameters & use mechanical exciters and electrodynamic shaker. (L4)
C328	Automation in Manufacturing	C328.1	1. Apply the knowledge of an automation and process control strategies. (L3)
		C328.2	2. Illustrate the automated flow lines and assembly line balancing. (L2)
		C328.3	3. Utilize the basic material handling systems. (L3)
		C328.4	4. Classify the process industries, discrete manufacturing industries and distinguish continuous, discrete control systems.(L2)
		C328.5	5. Compare process industries, discrete manufacturing industries, and continuous, discrete control systems(L2)
C329	Rapid Prototyping	C329.1	1. Use techniques for processing of CAD models for rapid prototyping. (L3)
		C329.2	2. Understand and apply fundamentals of rapid prototyping techniques. ((L3)
		C329.3	3. Use appropriate tooling for rapid prototyping process. (L3)
		C329.4	4. Use rapid prototyping techniques for reverse engineering. (L3)
		C329.5	5. Identify Various Pre – Processing, Processing and Post Processing errors in RP processes. (L3)
C330	Entrepreneurship& Incubation	C330.1	Enhance innovative ideation and design thinking capability.(L3)
		C330.2	Construct lean canvas based on the marketing / technical and financial feasibility.(L3)
		C330.3	Examine and build customer value proposition. (L4)

		C330.4	Acquire knowledge on business incubation. (L3)
		C330.5	Identify the schemes and support provided by financial institutions. (L4)
C331	Industrial Management	C331.1	Establish the idea of a virtual engineer by portraying the role of an Industrial Engineer.(L6)
		C331.2	Define plant maintenance and determine the preventive and breakdown measures.(L1)
		C331.3	Study the analytical, computational and experimental practices in Work Study.(L3)
		C331.4	Ascertain the methods of sampling and their applications in industry especially in Quality Checking. (L1)
		C331.5	Educate functions and responsibilities of Human Resource Management in an Organization.(L3)
C332	Gas Dynamics and Jet Propulsion	C332.1	1. Explain sonic velocity, mach number and continuity and momentum equations for a control volume (L2)
		C332.2	2. Identify stagnation properties, performance of nozzle and nozzle efficiencies. (L1)
		C332.3	3. Analyze the gas flow in different situations with and without friction. (L4)
		C332.4	4. Identify the effects of heat transfer on flow parameters. (L1)
		C332.5	5. Analyze the gas flow in air jets propulsion and rocket engines. (L4)
C333	Wind Energy Systems	C333.1	Infer the wind energy potential of India and in Global (L1).
		C333.2	Apply different statistical models for wind data analysis (L3).
		C333.3	Analyse different momentum theories for aerofoil design (L4).
		C333.4	Utilize different wind machining parameters for designing rotor (L3).
		C333.5	Analyse the feasibility of wind farm (L4).
C334	Industrial Robotics	C334.1	Explain fundamentals of Robots. (L2)
		C334.2	Apply kinematics and differential motions and velocities. (L3)
		C334.3	Demonstrate control of manipulators. (L2)
		C335.4	Understand robot vision. (L2)
		C335.5	Develop robot cell design and programming. (L3)

C335	World Class Manufacturing	C335.1	1. Apply the knowledge of competitiveness and challenges in manufacturing(L3)
		C335.2	2. Apply cutting edge technology on world class manufacturing(L3)
		C335.3	3. Make use of different tools for world class manufacturing(L3)
		C335.4	4. Determine manufacturing management practices; it infrastructure and practices(L1)
		C335.5	5. Adopt planning methodology and issues in strategic planning of WCM performance measurement. (L6)
C336	Industrial Safety and Hazard Management	C336.1	1. Analyze the effect of release of toxic substances (L4)
		C336.2	2. Understand the industrial laws, regulations and source models. (L2)
		C336.3	3. Apply the methods of prevention of fire and explosions. (L3)
		C336.4	4. Understand the relief and its sizing methods. (L2)
		C336.5	5. Understand the methods of hazard identification and preventive measures.(L200
C337	Business ethics and Corporate Governance	C337.1	Recognize the importance of business ethics in the organizations.(L2)
		C337.2	Apply various ethical codes in Business organizations.(L3)
		C337.3	Analyze the financial conditions and Business Ethics in different functional areas. (L4)
		C337.4	Examine the models of Indian corporate governance.(L4)
		C337.5	Compare and contrast various international approaches related to corporate governance. (L2)
C338	Production Planning control	C338.1	1. Explain the concepts of production and service systems(L2)
		C338.2	2. Apply principles and techniques in the design, planning and control of these systems to optimize/make best use of resources in achieving their objectives.(L3)
		C338.3	3. Identify different strategies employed in manufacturing and service industries to plan production and control inventory, Measure the effectiveness, identify likely areas for improvement, develop and implement improved planning and control methods for production systems(L1)
		C338.4	4. Explain the concepts of Routing and their methods, and concepts of Routing(L2)
		C338.5	5. Explain the concepts of scheduling and their methods, and concepts of dispatching.(L20
C339	Heat Transfer Lab	C339.1	Evaluate heat transfer through lagged pipe, insulating powder and Drop and Film wise condensation. (L4)
		C339.2	Experiment the Thermal conductivity of a given metal Rod and Determine the overall heat transfer coefficient for a composite slab. (L4)
		C339.3	Measure the Heat transfer coefficient for Pin Fin, Forced convection, Natural Convection (L3

		C339.4	Design the Fins and Heat Exchangers(L5)
		C339.5	Test Emissivity, Stefan Boltzmann Constant. (L3)
C340	CAE Lab	C340.1	1. Apply the knowledge from various software to design components. (L4)
		C340.2	2. Apply the knowledge from various software to analyse components. (L4)
		C340.3	3. Utility of the tools like ANSYS or FLUENT in solving real time problems and day to day problems. (L2)
		C340.4	4. Use of these tools for any engineering and real time applications.(L6)
		C340.5	5. Acquire knowledge on utilizing these tools for a better project in their curriculum as well as they will be prepared to handle industry problems with confidence when it matters to use these tools in their employment. (L1)
C341	Theory of Machines Lab	C341.1	1. Calculate critical speed of shaft, by varying different speeds at which the shaft tends to vibrates i.e. at which resonance occurs.(L4)
		C341.2	2. Determine the working of different governors. And determine the different characteristic curves for governor. (L3)
		C341.3	3. Determine the frequency of undamped free vibration of an equivalent spring mass system. (L3)
		C341.4	4. To do dynamic analysis of mechanical systems such as planar four-bar mechanism, reciprocating mechanism, flywheel, gear trains, governor and rotary systems(L1)
		C341.5	5. Determine the mechanical advantage, velocity ratio and efficiency of screw jack(L3)
IV YEAR - I SEMESTER				

IV YEAR - I SEMESTER

C401	Mechatronics	C401.1	1. understand about technologies behind modern mechatronics systems(L1)
		C401.2	2. Explain about fundamentals of Solid state electronic devices(L2)
		C401.3	3. Elaborate about fundamentals of actuating systems(L2)
		C401.4	4. Analyse about Digital electronics and systems(L4)
		C401.5	5. Apply System interfacing and data acquisition(L3)
C402	Engineering Metrology	C402.1	1. Analyze the design tolerances and fits for selected product quality. (L4)
		C402.2	2. choose appropriate method and instruments for inspection of various gear elements and thread elements. (L2)
		C402.3	3. understand the standards of length, angles, (L2)
		C402.4	4. understand the evaluation of surface finish and measure the parts with various comparators.(L2)
		C402.5	5. The quality of the machine tool with alignment test can also be evaluated.(L5)

C403	Operations Research	C403.1	1. develop mathematical models for practical problems. (L3)
		C403.2	2. apply linear programming to transportation problems. (L3)
		C403.3	3. solve games using various techniques. (L3)
		C403.4	4. solve production scheduling and develop inventory policies. (L6)
		C403.5	5. apply optimality conditions for constrained and unconstrained nonlinear problems. (L3)
C404	Computational Fluid Dynamics	C404.1	Understand and be able to numerically solve the governing equations for fluid flow (L1)
		C404.2	Analyse different CFD method to solve engineering problems (L4).
		C404.3	Understand how grids are generated and Understand how to assess stability and conduct a grid-convergence assessment (L1)
		C404.4	Apply finite difference and finite element methods to fluid flow problems (L4)
		C404.5	Understand and apply turbulence models to engineering fluid flow problems (L4)
C405	Alternative fuels and Emission Control in Automotives	C405.1	Explain the properties of alcohol fuels and gaseous fuels. (L3)
		C405.2	Predict the problems by using vegetable oils in diesel engines (L6)
		C405.3	Identify various emissions from SI engines (L3)
		C405.4	Identify various emissions from CI engines (L3)
		C405.5	Choose the use of various emission measuring instruments (L3)
C406	Condition Monitoring	C406.1	1. Summarize the theoretical and practical aspects of condition monitoring. (L2)
		C406.2	2. Develop the ability to plan for experimental testing of vibration monitoring. (L3)
		C406.3	3. Evaluate the thermal monitoring techniques.(L4)
		C406.4	4. Evaluate the wear monitoring techniques.(L4)
		C406.5	5. Identifying the faults in rolling elements.(L3)
C407	Non Destructive Evaluation	C407.1	1. Comprehensive, theory based understanding of the techniques and methods of non destructive testing. (L2)
		C407.2	2. Apply methods of non destructive testing to evaluate products of railways, automobiles, aircrafts, chemical industries etc. (L4)
		C407.3	3. Ability to communicate their conclusions clearly to specialist and non-specialist audiences. (L2)
		C407.4	4. Differentiate various defect types and select the appropriate NDT methods for better evaluation. (L1)

		C407.5	5. Sound knowledge of various types of testing methods. (L1)
C408	Flexible Manufacturing Processes	C408.1	Classify and distinguish FMS and other manufacturing systems.
		C408.2	Analyze processing stations and material handling systems used in FMS Environments.
		C408.3	Design and analyze FMS using simulation and analytical techniques.
		C408.4	Develop management and control systems for tools, material handling and Configurations in FMS.
		C408.5	Analyze the production management problems in planning, loading, scheduling, Routing and breakdown in a typical FMS.
C409	Organizational Behaviour.	C409.1	Applicability of the concept of individual behavior in the organization. (L3)
		C409.2	Enhance learning and interpersonal skills among employees within the organization. (L2)
		C409.3	Indicate the applicability of analyzing the complexities associated with management of individual behavior in the organization. (L3)
		C409.4	Analyze the complexities associated with personality and motivational factors of group behavior in the organization. (L4)
		C409.5	Assess conflicts and resolving methods in the organization. (L2)
C410	Operations Management	C410.1	Recognize the importance of operations management.(L2)
		C410.2	Analyze the product development and flexible manufacturing process. (L4)
		C410.3	Comprehend the planning, budgeting and controlling of material management. (L2)
		C410.4	Examine the Facilitating planning tools and techniques. (L4)
		C410.5	Apply the design of environment reliability engineering in the organization.(L3)
C411	MEMS	C411.1	1. Understand about difference in behavior of elements when size is reduced to micro scale level.(L1)
		C411.2	2. Explain the working of wireless technology.(L2)
		C411.3	3. Understand about manufacturing complications during micro fabrication.(L1)
		C411.4	4. Understand about manufacturing complications during micro fabrication.(L1)
		C411.5	5. Explain about chemical and bio medical systems. (L2)
C412	Nano Technology	C412.1	1. Identify different nano materials and nano techniques . (L3)
		C412.2	2. Identify the Mechanical electrical and thermal properties of nano materials.(L3)
		C412.3	3. Outline the Synthesis techniques for preparation of nano particle. (L2)

		C412.4	4. Examine the various characterization techniques.(L3)
		C412.5	5. Summarize the Characteristics of carbon allotropes (L3)
C413	Sensors for Intelligent Manufacturing.	C413.1	Classify various sensors used in intelligent manufacturing. (L2)
		C413.2	Describe sensors used in computer integrated manufacturing and machine sensors.(L3)
		C413.3	Discuss sensors used in precision manufacturing. (L3)
		C413.4	Identify reasons behind machinery faults. (L3)
		C413.5	Discuss advanced sensors in intelligent manufacturing. (L3)
C414	Internet of Things (IoT)	C414.1	1. lIlustrate the architecture and principles in Internet of Things .
		C414.2	2. Outline the Arduino platform and its applications.
		C414.3	3. Develop applications using Raspberry Pi .
		C414.4	4. Select protocols for a specific IoT application.
		C414.5	5. Utilize the cloud platform and APIs for IoT application
C415	Engineering Metrology Lab	C415.1	1. Develop quality standards of engineering products in industries.(L6)
		C415.2	2. Demonstrate work in quality control departments of industries and to ensure quality of products.(L3)
		C415.3	3. Analyze the measurement of the surface roughness and perform alignment tests(L4)
		C415.4	4. Devlop the ability to apply the principles in instruments and measuring techniques(L6)
		C415.5	5. Demonstrate Thread inspection with two wire/ three wire method(L3)
C416	Mechatronics Lab	C416.1	1. Measure load, displacement and temperature using analogue and digital sensors.(L2)
		C416.2	2. Develop plc programs for Control of traffic lights and water level.(L3)
		C416.3	3. Develop plc programs for Control of lifts and Conveyor belts.(L3)
		C416.4	4. Simulate and analyse pid Controllers for a physical system using mat lab.(L4)
		C416.5	5. Develop pneumatic and hydraulic circuits using automaton studio.(L3)
IV YEAR - II SEMESTER			
C417	Energy Consumption and Management	C417.1	1. Explain energy utilization and energy auditing methods (L2)
		C417.2	2. analyze electrical systems performance of electric motors and lighting systems.(L4)
		C417.3	3. examine energy conservation methods in thermal systems.(L4)
		C417.4	4. Estimate efficiency of major utilities such as fans, pumps, compressed air systems, hvac and d.g. sets. (L4)
		C417.5	5. Analyze the different principles of energy management, programs, energy demand and energy pricing. (L4)

C418	Intellectual Property Rights & Patents	C418.1	Knowledge on Intellectual Property Law, International instruments and recent trends.(L3)
		C418.2	Describe the various principles, Laws and rights afforded by Copyrights. (L2)
		C418.3	Analyze Patent Requirements, Patent Law, Infringement and Litigation.(L4)
		C418.4	Outline the registration Processes of Trade Mark and requirements of Trade Secrets. (L2)
		C418.5	Comprehend applicability of Cyber Laws and E-Commerce. (L4)
C419	Image Processing	C419.1	Analyze various types of images using mathematical models.(L4)
		C419.2	Compare image enhancement methods in spatial and frequency domains.(L2)
		C419.3	Experiment with various types of segmentation algorithms are applied for given image(L3)
		C419.4	Justify the importance of DCT and wavelet transform techniques for image compression.(L5)
		C419.5	Discuss various types of color image processing models are used for color images.(L3)
C420	Data Base Management System	C420.1	1. Understand File System Vs Databases.
		C420.2	2. Design and implement ER-model and Relational models.
		C420.3	3. Construct simple and Complex queries using SQL.
		C420.4	4. Analyze schema refinement techniques.
		C420.5	5. Design and build database system for a given real world problem
C421	Total Quality Management	C421.1	1. Develop an understanding on quality Management philosophies and frameworks
		C421.2	2. Adopt TQM methodologies for continuous improvement of quality
		C421.3	3. Measure the cost of poor quality, process effectiveness and efficiency to identify areas for improvement
		C421.4	4. Apply benchmarking and business process reengineering to improve management processes.
		C421.5	5. Determine the product maintenance and their need of improvement
C422	Supply Chain Management	C422.1	1. Explain the strategies and models of Supply Chain Management
		C422.2	2. Apply the forecasting techniques to assess the demand requirements
		C422.3	3. Choose the criteria for Supply Chain Management decisions
		C422.4	4. Explain the transportation techniques and network modeling
		C422.5	5. Explain the production planning and scheduling techniques
C423	Product Design & Development	C423.1	1. Understand the integration of customer, designer, material supplier and process planner, Competitor and costumer.(L1)
		C423.2	2. Determine the development of concepts to design a product. (L2)
		C423.3	3. Analyze the fundamental and incidental interactions, related system level and design issues. (L4)
		C423.4	4. Simulating product performance and manufacturing processing electronically.(L4)
		C423.5	5. Estimate the manufacturing cost for reducing the component costs and assembly costs. (L4)

		C424.1	1. Demonstrate the polymer, metal matrix, ceramic and fiber reinforced composites for Engineering Applications. **(L1)**
C424	Advanced Materials	C424.2	2**.** Demonstrate the polymer, thermosetting and thermoplastic composites for Engineering Applications. **(L1)**
		C424.3	3. Select the best manufacturing methods for manufacturing of composite. **(L1)**
		C424.4	4. Analyse macro mechanically for a lamina. **(L4)**
		C424.5	5. Demonstrate the best suitable materials for propulsions, Human body parts and machine structures (L2)
C425	JAVA	C425.1	1. Understand the environment of JRE and Control Statements.
		C425.2	2. Implement real world objects using class Hierarchy.
		C425.3	3. Implement generic data structures for iterating distinct objects.
		C425.4	4. Implement error handling through exceptions and file handling through streams.
		C425.5	5. Design thread-safe GUI applications for data communication between objects