Sl. No.	Course Name	Curriculum	Deployment Strategy and tool	Cross-cutting issues integrated Tool	CO, PO, PSO
1	TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL	Educate the students To ha an insight into Fourier serie Fourier transforms, Laplac transforms, Difference equations and Z-transform Also develop the proficien variational calculus and so ODE's arising in engineerir applications, using numeric methods.	1. Chalk and talk method the good 2. PPT be used	**Professional ethics** **Human values** **Mathematical knowledge**	CO1: Use Laplace transform and inverse Laplace transform in solving differential/ integral equation arising in network analysis, control systems and other fields of engineering. CO2: Demonstrate Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory. CO3: Make use of

| | | | | Fourier transform and Z-transform to illustrate discrete/continuous function arising in wave and heat propagation, signals and systems.

CO4: Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.

CO5:Determine the extremals of functionals using calculus of variations and solve

PSO
1. problems arising in dynamics of rigid bodies and vibrational analysis.. Will be able to analyze, interpret and provide solutions to |
|---|---|---|---|---|

					engineering and social problems. 2. . Adapt to the dynamic challenges and scenario in the industries
2	MECHANICS OF MATERIALS	Educate the student To kno the different types of stress and strains developed in th member subjected to axial bending, shear, torsion & thermal loads. To know behaviour & properties of engineering materials. To understand the stresse developed in bars, compou bars, beams, shafts, and cylinders. To understand the concept calculation of shear force a bending moment for beam with different supports. To expose the students to concepts of Buckling of columns and strain energy	1. Chalk and talk Method the good 2. PPT be used 3. Videos	**Professional ethics** **Human values** **Engineering knowledge**	CO1: Understand simple, compound, thermal stresses and strains their relations and strain energy. CO2: Analyse structural members for stresses, strains and deformations. CO3: Analyse the structural members subjected to bending and shear loads. CO4: Analyse shafts subjected to twisting loads. CO5: Analyse the short columns for stability. PSO

					1.problems arising in dynamics of rigid bodies and vibrational analysis.. Will be able to analyze, interpret and provide solutions to engineering and social problems. 2. Adapt to the dynamic challenges and scenario in the industries
3	BASIC THERMODYNAMICS	Make student ti understand Learn about thermodynamic system and its equilibrium Understand various forms energy - heat transfer and Study the basic laws of thermodynamics including, zeroth law, first law and se law. Interpret the behaviour of substances and its applica in practical problems. Study of Ideal and real gas and evaluation of thermodynamic properties	1. Chalk and talk Method the good 2. PPT be used 3. Videos	**Professional ethics** **Human values** **Engineering knowledge**	CO1: Explain fundamentals of thermodynamics and evaluate energy interactions across the boundary of thermodynamic systems. CO2: Evaluate the feasibility of cyclic and non-cyclic processes using 2nd law of thermodynamics. CO3: Apply the

				knowledge of entropy, reversibility and irreversibility to solve numerical problems and
				apply 1st law of thermodynamics to closed and open systems and determine quantity of energy
				transfers and change in properties.
				CO4: Interpret the behavior of pure substances and its application in practical problems.
				CO5: Recognize differences between ideal and real gases and evaluate thermodynamic properties of
				ideal and real gas mixtures using various relations.

					PSO 1.problems arising in dynamics of rigid bodies and vibrational analysis.. Will be able to analyze, interpret and provide solutions to engineering and social problems. 2. Adapt to the dynamic challenges and scenario in the industries
4	MATERIAL SCIENCE	The foundation for understanding the structure behaviour of materials com in mechanical engineering. Topics to explore the mechanical properties of m and their alloys, polymers, ceramics, smart materials and composites. To understand modifications material properties by heat treatment processes. Selections of different mate for various applications are highlighted. Impart knowledge of various failure modes of materials.	1. Chalk and talk Method the good 2. PPT be used 3. Videos	**Professional ethics** **Human values** **Engineering knowledge**	CO1: Understand the mechanical properties of metals and their alloys. CO2: Analyze the various modes of failure and understand the microstructures of ferrous and nonferrous materials.

					CO3: Describe the processes of heat treatment of various alloys.
					CO4: Acquire the Knowledge of composite materials and their production process as well as applications.
					CO5: Understand the properties and potentialities of various materials available and material selection Procedures.
					PSO 1.problems arising in dynamics of rigid bodies and vibrational analysis.. Will be able to analyze, interpret and provide solutions to engineering and social problems. 2. Adapt to the dynamic challenges and scenario in the industries

| 5 | METAL CUTTING AND FORMING | To enrich the knowledge pertaining to relative motion mechanics required for various machine tools. To introduce students to different machine tools to produce components having different shapes and sizes. To develop the knowledge of mechanics of machining process and effect of various parameters on machining. To acquaint with the basic knowledge on fundamentals metal forming processes To study various metal form processes. | 1. Chalk and talk Method the good 2. PPT be used 3. Videos | **Professional ethics** **Human values** **Engineering knowledge** | CO1: Explain the construction & specification of various machine tools. CO2: Discuss different cutting tool materials, tool nomenclature & surface finish. CO3: Apply mechanics of machining process to evaluate machining time. CO4: Analyze tool wear mechanisms and equations to enhance tool life and minimize machining cost. CO5: Understand the concepts of different metal forming processes. |

					CO6: Apply the concepts of design of sheet metal dies to design different dies for simple sheet metal components. PSO 1.problems arising in dynamics of rigid bodies and vibrational analysis.. Will be able to analyze, interpret and provide solutions to engineering and social problems. 2. Adapt to the dynamic challenges and scenario in the industries
6	COMPUTER AIDED MACHINE DRAWING	To acquire the knowledge of CAD software and its featur To familiarize the students v Indian Standards on drawin practices. To impart knowledge of thre forms, fasteners, keys, joint and couplings. To make the students understand and interpret drawings of machine components leading to preparation of assembly drawings manually and usir	1. Chalk and talk Method the good 2. PPT be used 3. Videos 4.Software solid edege 2.0	**Professional ethics** **Human values** **Engineering knowledge**	CO1: Identify the national and international standards pertaining to machine drawing. CO2: Understand the importance of the linking functional and

| | | CAD packages.
To acquire the knowledge of limits, tolerance and fits and indicate them on machine drawings. | | | visualization aspects in the preparation of the part drawings

CO3: Apply limits and tolerances to assemblies and choose appropriate fits for given assemblies.

CO4: Interpret the Machining and surface finish symbols on the component drawings.

CO5: Preparation of the part or assembly drawings as per the conventions.

PSO 1.problems arising in dynamics of rigid bodies and vibrational analysis.. Will be able to analyze, interpret and provide solutions to engineering and social problems. |

					2. Adapt to the dynamic challenges and scenario in the industries
7	MECHANICAL MEASUREMENTS AND METROLOGY	To understand the concept of metrology and standards of measurement. To equip with knowledge of limits, fits, tolerances and gauging To acquire knowledge of line and Angular measurements Screw thread and gear measurement & comparators. To understand the knowledge measurement systems and methods with emphasis on different Transducers, intermediate modifying and terminating devices. To understand the measure of Force, Torque, Pressure, Temperature and Strain.	1. Chalk and talk Method the good 2. PPT be used 3. Videos	**Professional ethics Human values Engineering knowledge**	CO1: Understand the objectives of metrology, methods of measurement, standards of measurement & various measurement parameters. CO2: Explain tolerance, limits of size, fits, geometric and position tolerances, gauges and their design CO3: Understand the working principle of different types of comparators. CO3: Describe measurement of

				major & minor diameter, pitch, angle and effective diameter of screw threads.
				CO4: Explain measurement systems, transducers, intermediate modifying devices and terminating devices..
				CO5: Describe functioning of force, torque, pressure, strain and temperature measuring devices.
				PSO 1.problems arising in dynamics of rigid bodies and vibrational analysis.. Will be able to analyze, interpret and provide solutions to engineering and social problems. 2. Adapt to the dynamic challenges

					and scenario in the industries
8	METAL CASTING AND WELDING	To provide adequate knowle of quality test methods conducted on welded and c components. To provide knowledge of va casting process in manufacturing. To provide in-depth knowled on metallurgical aspects du solidification of metal and a To provide detailed informat about the moulding process To impart knowledge of vari joining process used in manufacturing. To impart knowledge about behaviour of materials durir welding, and the effect of process parameters in welding,	1. Chalk and talk Method the good 2. PPT be used 3. Videos	**Professional ethics Human values Engineering knowledge**	CO1: Describe the casting process and prepare different types of cast products. CO2: Acquire knowledge on Pattern, Core, Gating, Riser system and to use Jolt, Squeeze, Sand Slinger Moulding machines. CO3: Compare the Gas fired pit, Resistance, Coreless, Electrical and Cupola Metal Furnaces. CO4: Compare the Gravity, Pressure die, Centrifugal, Squeeze, slush and

				Continuous Metal mold castings.
				CO5: Understand the Solidification process and Casting of Non-Ferrous Metals.
				CO6: Describe the Metal Arc, TIG, MIG, Submerged and Atomic Hydrogen Welding processes etc. used in manufacturing.
				CO7: Describe methods for the quality assurance of components made of casting and joining process
				PSO 1.problems arising in dynamics of rigid bodies and vibrational analysis.. Will be able to analyze, interpret and provide solutions to engineering and social problems.

					2. Adapt to the dynamic challenges and scenario in the industries
9	MATERIAL TESTING LAB	To learn the concept of the preparation of samples to perform characterization su as microstructure, volume fract of phases and grain size. To understand mechanical behaviour of various engineering materials by conducting standard tests. To learn material failure mo and the different loads caus failure. To learn the concepts of improving the mechanical properties of materials by different methods like heat treatment, surface treatment etc.	Chalk and talk Method Experimental analysis	**Professional ethics Human values Engineering knowledge**	Course Outcomes: At the end of the course, the student will be able to: CO1: Acquire experimentation skills in the field of material testing. CO2: Develop theoretical understanding of the mechanical properties of materials by performing experiments. CO3: Apply the knowledge to analyse a material failure and determine the failure inducing agent/s. CO4: Apply the knowledge of

				testing methods in related areas. CO5: Understand how to improve structure/behaviour of materials for various industrial applications. PSO 1.problems arising in dynamics of rigid bodies and vibrational analysis.. Will be able to analyze, interpret and provide solutions to engineering and social problems. 2. Adapt to the dynamic challenges and scenario in the industries
10	MECHANICAL MEASUREMENTS AND METROLOGY LAB	To illustrate the theoretical concepts taught in Mechanical Measurements & Metrology through experiments. To illustrate the use of various measuring tools & measuring techniques. To understand calibration techniques of various measuring devices.	Chalk and talk Method Experimental analysis	**Professional ethics Human values Engineering knowledge** CO1: Understand Calibration of pressure gauge, thermocouple, LVDT, load cell, micrometre. CO2: Apply concepts of Measurement of

				angle using Sine Centre/ Sine Bar/ Bevel Protractor, alignment using Autocollimator/ Roller set.
				CO3: Demonstrate measurements using Optical Projector/Tool maker microscope, Optical flats.
				CO4: Analyse tool forces using Lathe/Drill tool dynamometer.
				CO5: Analyse Screw thread parameters using 2-Wire or 3-Wire method, gear tooth profile using gear tooth Vernier/Gear tooth micrometre
				CO6: Understand the concepts of measurement of surface roughness.

					PSO 1.problems arising in dynamics of rigid bodies and vibrational analysis.. Will be able to analyze, interpret and provide solutions to engineering and social problems. 2. Adapt to the dynamic challenges and scenario in the industries

11	COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS	To provide an insight into applications of complex variables, conformal mapping and special functions arising in potential theory, quantum mechanics, heat conduction and field theory.
		To develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in digital signal processing, design engineering and microwave engineering.
			1. Chalk and talk method
			    the good
			2. PPT
			   be used
				**Professional ethics
				Human values
				Mathematical knowledge**
					CO1: Use Laplace transform and inverse Laplace transform in solving differential/ integral
					
					equation arising in network analysis, control systems and other fields of engineering.
					
					CO2: Demonstrate Fourier series to study the behaviour of periodic functions and their
					
					applications in system

				communications, digital signal processing and field theory.
				CO3: Make use of Fourier transform and Z-transform to illustrate discrete/continuous function arising in wave and heat propagation, signals and systems.
				CO4: Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.
				CO5:Determine the extremals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.

					PSO
					1.problems arising in dynamics of rigid bodies and vibrational analysis.. Will be able to analyze, interpret and provide solutions to engineering and social problems. 2. Adapt to the dynamic challenges and scenario in the industries
12	APPLIED THERMODYNAMICS	To understand the applications of the first and second laws of Thermodynamics to various gas processes and cycles. To understand fundamentals of I. C. Engines, Construction and working Principle of an Engine and Compare Actual, Fuel-Air and Air standard cycle Performance. To study Combustion in SI and CI engines and its controlling factor in order to extract maximum power. To know the concepts of testing of I. C. Engines	1. Chalk and talk Method the good 2. PPT be used 3. Videos	**Professional ethics Human values Engineering knowledge**	CO1: Apply thermodynamic concepts to analyze the performance of gas power cycles. CO2: Apply thermodynamic concepts to analyze the performance of vapour power cycles. CO3: Understand combustion of fuels and performance of I C engines.

		and methods to estimate Indicated, Brake and Frictional Power and efficiencies. To understand theory and performance Calculation of Positive displacement compressor. To understand the concepts related to Refrigeration and Air conditioning. To get conversant with Psychrometric Charts, Psychrometric processes, human comfort conditions.			CO4: Understand the principles and applications of refrigeration systems. CO5: Apply Thermodynamic concepts to determine performance parameters of refrigeration and airconditioning systems. CO6: Understand the working principle of Air compressors and Steam nozzles, applications, relevance of air and identify methods for performance improvement. PSO 1.problems arising in dynamics of rigid bodies and vibrational

					analysis.. Will be able to analyze, interpret and provide solutions to engineering and social problems. 2. Adapt to the dynamic challenges and scenario in the industries
13	FLUID MECHANICS	To have a working knowledge of the basic properties of fluids and understand the continuum approximation. To calculate the forces exerted by a fluid at rest on submerged surfaces and understand the force of buoyancy. To understand the flow characteristic and dynamics of flow field for various engineering applications. To know how velocity changes and energy transfers in fluid flows are related to forces and torques and to understand why designing for minimum loss of energy in fluid flows is so important. To discuss laminar and turbulent flow and appreciate their differences and the	1. Chalk and talk Method the good 2. PPT be used 3. Videos	**Professional ethics Human values Engineering knowledge**	CO1: Identify and calculate the key fluid properties used in the analysis of fluid behavior. CO2: Explain the principles of pressure, buoyancy and floatation CO3: Apply the knowledge of fluid statics, kinematics and dynamics while addressing problems of mechanical and chemical engineering. CO4: Describe the

| | | concept of boundary layer theory. To understand the concept of dynamic similarity and how to apply it to experimental modelling. To appreciate the consequences of compressibility in gas flow and understand the effects of friction and heat transfer on compressible flows. | | | principles of fluid kinematics and dynamics.

CO5: Explain the concept of boundary layer in fluid flow and apply dimensional analysis to form

dimensionless numbers in terms of input output variables.

CO6: Illustrate and explain the basic concept of compressible flow and CFD

PSO
1.problems arising in dynamics of rigid bodies and vibrational analysis.. Will be able to analyze, interpret and provide solutions to engineering and social problems.
2. Adapt to the dynamic challenges and scenario in the industries |

| 14 | KINEMATICS OF MACHINES | To understand the concept of machines, mechanisms and related terminologies. To expose the students to various mechanisms and motion transmission elements used in Mechanical Engineering. To analyze a mechanism for displacement, velocity and acceleration at any point in a moving link. To understand the theory of cams, gears and gear trains. | 1. Chalk and talk Method the good 2. PPT be used 3. Videos | **Professional ethics Human values Engineering knowledge** | CO1: Knowledge of mechanisms and their motion. CO2: Understand the inversions of four bar mechanisms. CO3: Analyse the velocity, acceleration of links and joints of mechanisms. CO4: Analysis of cam follower motion for the motion specifications CO5: Understand the working of the spur gears. CO6: Analyse the gear trains speed ratio and torque PSO 1.problems arising in dynamics of rigid bodies and |

					vibrational analysis.. Will be able to analyze, interpret and provide solutions to engineering and social problems. 2. Adapt to the dynamic challenges and scenario in the industries
15	WORKSHOP AND MACHINE SHOP PRACTICE	To guide students to use fitting tools to perform fitting operations. To provide an insight to different machine tools, accessories and attachments. To train students into fitting and machining operations to enrich their practical skills. To inculcate team qualities and expose students to shop floor activities. To educate students about ethical, environmental and safety standards.	1. Chalk and talk Method the good 2. PPT be used 3. Videos	**Professional ethics Human values Engineering knowledge**	CO1: To read working drawings, understand operational symbols and execute machining operations. CO2: Prepare fitting models according to drawings using hand tools- V-block, marking gauge, files, hack saw, drills etc. CO3: Understand integral parts of lathe, shaping and milling machines and various

				accessories and attachments used.
				CO4: Select cutting parameters like cutting speed, feed, depth of cut, and tooling for various machining operations.
				CO5: Perform cylindrical turning operations such as plain turning, taper turning, step turning, thread Cutting, facing, knurling, internal thread cutting, eccentric turning and estimate cutting time.
				CO6: Perform machining operations such as plain shaping, inclined shaping, keyway cutting, Indexing andGear cutting and estimate

				cutting time. PSO 1.problems arising in dynamics of rigid bodies and vibrational analysis.. Will be able to analyze, interpret and provide solutions to engineering and social problems. 2. Adapt to the dynamic challenges and scenario in the industries
16	FOUNDRY, FORGING AND WELDING LAB	To provide an insight into different sand preparation and foundry equipment. To provide an insight into different forging tools and equipment and arc welding tools and equipment. To provide training to students to enhance their practical skills in welding, forging and hand moulding.	1. Chalk and talk Method the good 2. PPT be used 3. Videos	**Professional ethics Human values Engineering knowledge**	CO1.Demonstrate various skills in preparation of molding sand for conducting tensile, shear and CO2.compression tests using Universal sand testing machine. CO3.Demonstrate skills in determining permeability, clay content and Grain

					Fineness Number of base sands.
					CO4.Demonstrate skills in preparation of forging models involving upsetting, drawing and bending operations.
					PSO 1.problems arising in dynamics of rigid bodies and vibrational analysis.. Will be able to analyze, interpret and provide solutions to engineering and social problems. 2. Adapt to the dynamic challenges and scenario in the industries
17	CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND CYBER LAW (CPC)	Learning Objectives: To know the fundamental political codes, structure, procedures, powers, and duties of Indian government institutions, fundamental rights, directive principles, and the duties of citizens Understand engineering ethics and their responsibilities; identify	1. Chalk and talk Method the good 2. PPT be used 3. Videos	**Professional ethics Human values Engineering knowledge**	CO1: Have constitutional knowledge and legal literacy. CO2: Understand Engineering and Professional ethics and responsibilities

		their individual roles and ethical responsibilities towards society. Know about the cybercrimes and cyber laws for cyber safety measures.			of Engineers. CO3: Understand the the cybercrimes and cyber laws for cyber safety measures. PSO 1.problems arising in dynamics of rigid bodies and vibrational analysis.. Will be able to analyze, interpret and provide solutions to engineering and social problems. 2. Adapt to the dynamic challenges and scenario in the industries
18	MANAGEMENT AND ECONOMICS	To help the students to understand the fundamental concepts and principles of management; the basic roles, skills, functions of management, various organizational structures and basic knowledge of marketing. To impart knowledge, with respect to concepts,	1. Chalk and talk Method the good 2. PPT be used 3. Videos	**Professional ethics** **Human values** **Engineering knowledge**	CO1: Understand needs, functions, roles, scope and evolution of Management CO2: Understand importance, purpose of Planning and

| | | principles and practical applications of Economics, which govern the functioning of a firm/organization under different market conditions. | | | hierarchy of planning and also54nalyse its types.

CO3: Discuss Decision making, Organizing, Staffing, Directing and Controlling.

CO4: Select the best economic model from various available alternatives.

CO5: Understand various interest rate methods and implement the suitable one.

CO6: Estimate various depreciation values of commodities.

CO7: Prepare the project reports effectively |
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| **19** | DESIGN OF MACHINE ELEMENTS I | To understand the various steps involved in the Design Process. To explain the principles | 1. Chalk and talk Method the good 2. PPT be used | **Professional ethics Human values Engineering knowledge** | CO1: Apply the concepts of |

| | | involved in design of machine elements, subjected to different kinds of forces, from the considerations of strength, rigidity, functional and manufacturing requirements. To understand and interpret different failure modes and application of appropriate criteria for design of machine elements. To learn to use national and international standards, standard practices, standard data, catalogs, and standard components used in design of machine elements. Develop the capability to design elements like shafts, couplings, welded joints, screwed joints, and power screws. | | | selection of materials for given mechanical components.

CO2: List the functions and uses of machine elements used in mechanical systems.

CO3: Apply codes and standards in the design of machine elements and select an element based on the

Manufacturer's catalogue.

CO4: Analyse the performance and failure modes of mechanical components subjected to combined

loading and fatigue loading using the concepts of theories of failure. |
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					CO5: Demonstrate the application of engineering design tools to the design of machine components like

shafts, couplings, power screws, fasteners, welded and riveted joints.

CO6: Understand the art of working in a team. |
| 20 | DYNAMICS OF MACHINES | To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms. To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism. To understand the effect of Dynamics of undesirable vibrations. To understand the principles in mechanisms used for speed control and stability control. To know the concepts of modelling mechanical systems using spring, | 1. Chalk and talk Method the good 2. PPT be used | **Professional ethics Human values Engineering knowledge** | CO1: Analyse the mechanisms for static and dynamic equilibrium.

CO2: Carry out the balancing of rotating and reciprocating masses

CO3: Analyse different types of governors used in real life situation. |

		mass and damper elements. To compute the natural and damped frequencies of free 1-DOF mechanical systems To analyze the vibrational motion of 1-DOF mechanical systems under harmonic excitation conditions.			CO4: Analyse the gyroscopic effects on disks, airplanes, stability of ships, two and four wheelers CO5: Understand the free and forced vibration phenomenon. CO6: Determine the natural frequency, force and motion transmitted in vibrating systems.
21	TURBO MACHINES	Understand typical design of Turbo machine, their working principle, application and thermodynamics process involved. Study the conversion of fluid energy to mechanical energy in Turbo machine with utilization factor and degree of reaction. Analyse various designs of steam turbine and their working principle. Study the various designs of hydraulic turbine based on the working			CO1: Model studies and thermodynamics analysis of turbomachines. CO2: Analyse the energy transfer in Turbo machine with degree of reaction and utilisation factor. CO3: Classify,

		principle. Understand the various aspects in design of power absorbing machine			analyse and understand various type of steam turbine. CO4: Classify, analyse and understand various type of hydraulic turbine. CO5: Understand the concept of radial power absorbing machine and the problems involved during its operation.
22	FLUID POWER ENGINEERING	To provide an insight into the capabilities of hydraulic and pneumatic fluid power. To understand concepts and relationships surrounding force, pressure, energy and power in fluid power systems. To examine concepts cantering on sources of hydraulic power, rotary and linear actuators, distribution systems, hydraulic flow in pipes, and control components	1. Chalk and talk method the good 2. PPT be used	**Professional ethics** **Human values** **Mathematical knowledge**	CO1: Identify and analyse the functional requirements of a fluid power transmission system for a given application. CO2: Visualize how a hydraulic/pneumati

		in fluid power systems. Exposure to build and interpret hydraulic and pneumatic circuits related to industrial applications. To familiarize with logic controls and trouble shooting.			c circuit will work to accomplish the function. CO3: Design an appropriate hydraulic or pneumatic circuit or combination circuit like electro-hydraulics, electro- pneumatics for a given application. CO4: Select and size the different components of the circuit. CO5: Develop a comprehensive circuit diagram by integrating the components selected for the given application
23	OPERATIONS MANAGEMENT	To get acquainted with the basic aspects of Production Management.	1. Chalk and talk method the good	**Professional ethics** **Human values** **Mathematical knowledge**	CO1: Explain the concept and scope

| | | The expose the students to various aspects of planning, organising and controlling operations Management.
To understand different operational issues in manufacturing and services organisations.
To understand different problem-solving methodologies and Production Management techniques. | 2. PPT
be used | | of operations management in a business context

CO2: Recognize the role of Operations management among various business functions and its role in the

organizations' strategic planning and gaining competitive advantage.

CO3: Analyze the appropriateness and applicability of a range of operations management systems/models in

decision making.

CO4: Assess a range of strategies for improving the efficiency and effectiveness of organizational operations.

CO5: Evaluate a |

				selection of frameworks used in the design and delivery of operations
24	FLUID MECHANICS AND MACHINES LAB	This course will provide a basic understanding of flow measurements using various types of flow measuring devices, calibration and losses associated with these devices. Energy conversion principles, analysis and understanding of hydraulic turbines and pumps will be discussed. Application of these concepts for these machines will be demonstrated. Performance analysis will be carried out using characteristic curves.	1. Chalk and talk method the good 2. PPT be used	**Professional ethics** **Human values** **Mathematical knowledge**	CO1: Perform experiments to determine the coefficient of discharge of flow measuring devices. CO2: Conduct experiments on hydraulic turbines and pumps to draw characteristics. CO3: Test basic performance parameters of hydraulic turbines and pumps and execute the knowledge in real life situations. CO4: Determine the energy flow pattern through the

					hydraulic turbines and pumps. CO5: Exhibit his competency towards preventive maintenance of hydraulic machines.

25	ENERGY CONVERSION LABORATORY	This course will provide a basic understanding of fuel properties and its measurements using various types of measuring devices Energy conversion principles, analysis and understanding of I C Engines will be discussed. Application of these concepts for these machines will be demonstrated. Performance analysis will be carried out using characteristic curves. Exhaust emissions of I C Engines will be measured and compared with the standards.	1. Chalk and talk method
			    the good
			2. PPT
			    be used
				**Professional ethics
				Human values
				Mathematical knowledge**
					CO1: Perform experiments to determine the properties of fuels and oils.
					
					CO2: Conduct experiments on engines and draw characteristics.
					
					CO3: Test basic performance parameters of I.C. Engine and implement the knowledge in industry.
					
					CO4: Identify exhaust emission, factors affecting them and exhibit his

					competency towards preventive maintenance of IC engines.
26	COMPUTER AIDED MODELLING AND ANALYSIS LAB	To acquire basic understanding of Modeling and Analysis software To understand the concepts of different kinds of loading on bars, trusses and beams, and analyze the results pertaining to various parameters like stresses and deformations. To lean to apply the basic principles to carry out dynamic analysis to know the natural frequencies of different kind of beams.	1. Chalk and talk method the good 2. PPT be used	**Professional ethics Human values Mathematical knowledge**	CO1: Use the modern tools to formulate the problem, create geometry, descritize, apply boundary conditions to solve problems of bars, truss, beams, and plate to find stresses with different-loading conditions. CO2: Demonstrate the ability to obtain deflection of beams subjected to point, uniformly distributed and varying loads and use the available

| | | | | results to draw shear force and bending moment diagrams.

CO3: Analyze and solve 1D and 2D heat transfer conduction and convection problems with different boundary conditions.

CO4: Carry out dynamic analysis and finding natural frequencies of beams, plates, and bars for various boundary conditions and also carry out dynamic analysis with forcing functions. |
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| 27 | HEAT TRANSFER LAB | The primary objective of this course is to provide the fundamental knowledge necessary to understand the behavior of thermal systems. This course provides a | 1. Chalk and talk method the good 2. PPT be used | **Professional ethics Human values Mathematical knowledge** | CO1: Determine the thermal conductivity of a metal rod and |

		detailed experimental analysis, including the application and heat transfer through solids, fluids, and vacuum. Convection, conduction, and radiation heat transfer in one and two dimensional steady and unsteady systems are examined.			overall heat transfer coefficient of composite slabs. CO2: Determine convective heat transfer coefficient for free and forced convection and correlate with theoretical values. CO3: Evaluate temperature distribution characteristics of steady and transient heat conduction through solid cylinder experimentally. CO4: Determine surface emissivity of a test plate and Stefan Boltzmann constant CO5: Estimate performance of a refrigerator and

					effectiveness of a fin and Double pipe heat exchanger
28	NON CONVENTIONAL ENERGY SOURCES	To introduce the concepts of solar energy, its radiation, collection, storage and application. To introduce the concepts and applications of Wind energy, Biomass energy, Geothermal energy and Ocean energy as alternative energy sources. To explore society's present needs and future energy demands. To examine energy sources and systems, including fossil fuels and nuclear energy, and then focus on alternate, renewable energy sources such as solar, biomass (conversions), wind power, geothermal, etc. To get exposed to energy conservation methods.	1. Chalk and talk method the good 2. PPT be used	**Professional ethics Human values Mathematical knowledge**	CO1: Describe the environmental aspects of non-conventional energy resources. In Comparison with various conventional energy systems, their prospects and limitations. CO2: Know the need of renewable energy resources, historical and latest developments. CO3: Describe the use of solar energy and the various components used in the energy production with respect to applications

				like-heating, cooling, desalination, power generation, drying, cooking etc.
				CO4: Appreciate the need of Wind Energy and the various components used in energy generation and
				know the classifications.
				CO5: Understand the concept of Biomass energy resources and their classification, types of biogas Plantsapplications
				CO6: Compare Solar, Wind and bio energy systems, their prospects, Advantages and limitations.
				CO7: Acquire the knowledge of fuel cells, wave power, tidal power and

				geothermal principles and applications
29	NON-TRADITIONAL MACHINING	TTo learn various concepts related to modern machining processes & their applications. To appreciate the differences between conventional and non-conventional machining processes. To acquire a functional understanding of non-traditional manufacturing equipment. To know about various process parameters and their influence on performance and their applications. To impart knowledge on various types of energy involved in non-traditional machining processes	1. Chalk and talk method the good 2. PPT be used	**Professional ethics Human values Mathematical knowledge**	CO1: Understand the compare traditional and non-traditional machining process and recognize the need for Non- traditional machining process. CO2: Understand the constructional features, performance parameters, process characteristics, applications, advantages and limitations of USM, AJM and WJM. CO3: Identify the need of Chemical and electro-chemical machining process along with the constructional

| | | | | features, process parameters, process characteristics, applications, advantages and limitations.

CO4: Understand the constructional feature of the equipment, process parameters, process characteristics,

applications, advantages and limitations EDM & PAM.

CO5: Understand the LBM equipment, LBM parameters, and characteristics. EBM equipment and mechanism of metal removal, applications, advantages and limitations LBM & EBM. |
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30	HEAT TRANSFER	Study the modes of heat transfer.
		Learn how to formulate and solve 1-D steady and unsteady heat conduction problems.
		Apply empirical correlations for fully-developed laminar, turbulent internal flows and external boundary layer convective flow problems.
		Study the basic principles of heat exchanger analysis and thermal design.
		Understand the principles of boiling and condensation including radiation heat transfer related engineering problems.
			1. Chalk and talk method
			    the good
			2. PPT
			   be used
				**Professional ethics
				Human values
				Mathematical knowledge**
					CO1: Understand the modes of heat transfer and apply the basic laws to formulate engineering systems.
					
					CO2: Understand and apply the basic laws of heat transfer to extended surface, composite material and
					
					unsteady state heat transfer problems.
					
					CO3: Analyze heat conduction through numerical methods and apply the fundamental principle to solve
					
					radiation heat transfer problems.
					
					CO4: Analyze heat transfer due to free and forced convective heat transfer.

					CO5: Understand the design and performance analysis of heat exchangers and their practical applications, Condensation and Boiling phenomena.
31	DESIGN OF MACHINE ELEMENTS II	To understand various elements involved in a mechanical system. To analyze various forces acting on the elements of a mechanical system and design them using appropriate techniques, codes, and standards. To select transmission elements like gears, belts, pulleys, bearings from the manufacturers' catalogue. To design a mechanical system integrating machine elements. To produce assembly and working drawings of various mechanical systems involving machine elements like belts, pulleys, gears, springs, bearings, clutches and brakes.	1. Chalk and talk method the good 2. PPT be used	**Professional ethics** **Human values** **Mathematical knowledge**	CO1: Apply design principles for the design of mechanical systems involving springs, belts, pulleys, and wire ropes. CO2: Design different types of gears and simple gear boxes for relevant applications. CO3: Understand the design principles of brakes and clutches.

				CO4: Apply design concepts of hydrodynamic bearings for different applications and select Anti friction bearings for different applications using the manufacturers, catalogue. CO6: Apply engineering design tools to product design. CO7: Become good design engineers through learning the art of working in a team.

32	FINITE ELEMENT METHODS	To learn the basic principles of finite element analysis procedure
		To understand the design and heat transfer problems with application of FEM.
		Solve 1 D, 2 D and
			1. Chalk and talk method
			    the good
			2. PPT
			    be used
				**Professional ethics
				Human values
				Mathematical knowledge**
					CO1: Identify the application and characteristics of FEA elements such as bars, beams, plane and

		dynamic problems using Finite Element Analysis approach. To learn the theory and characteristics of finite elements that represent engineering structures. To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses.			isoparametric elements. CO2: Develop element characteristic equation and generation of global equation. CO3: Formulate and solve Axi-symmetric and heat transfer problems. CO4: Apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axi-symmetric and dynamic problems
33	Kannada Kali(Non – Kannadigas)	Learners are Non – Kannadigas, so this course will make them, • To Read and understand the simple words in Kannada language • To learn Vyavaharika	1. Chalk and talk method the good 2. PPT be used	**Professional ethics** **Human values** **Mathematical knowledge**	

		Kannada (Kannada for Communication) • will create a some interest on Kannada Language and Literature			
34	Kannada Manasu (Kannadigas)	Learners are – Kannadigas course will make them, • To know about grammar And also create interest in kannada literature and also brief on governance in kannada	1. Chalk and talk method the good 2. PPT be used	**Professional ethics Human values Mathematical knowledge**	
	2017 scheme				
35	Energy Engineering	Understand energy scenario,energy sources and their utilization Learn about energy conversion methods and their analysis Study the principles of renewable energy conversion systems Understand the concept of green energy and zero energy.	1. Chalk and talk method the good 2. PPT be used 3.vedios	**Professional ethics Human values Mathematical knowledge**	1. Summarize the basic concepts of thermal energy systems, 2. Identify renewable energy sources and their utilization. 3. Understand the basic concepts of solar radiation and analyze the working of solar PV and thermal systems. 4. Understand

				principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, biogas. 5. Understand the concepts and applications of fuel cells, thermoelectric convertor and MHD generator. 6. Identify methods of energy storage for specific applications
36	FLUID POWER SYSTEMS	To provide an insight into the capabilities of hydraulic and pneumatic fluid power. To understand concepts and relationships surrounding force, pressure, energy and power in fluid power systems. To examine concepts centering on sources of hydraulic power, rotary and linear actuators, distribution systems, hydraulic flow in pipes, and control components in fluid power systems.	1. Chalk and talk method the good 2. PPT be used 3.videos 4. Field training	**Professional ethics** **Human values** **Mathematical knowledge**	1. Identify and analyse the functional requirements of a fluid power transmission system for a given application. 2. Visualize how a hydraulic/pneumatic circuit will work to accomplish the

		Exposure to build and interpret hydraulic and pneumatic circuits related to industrial applications. To familiarize with logic controls and troubleshooting			function. 3. Design an appropriate hydraulic or pneumatic circuit or combination circuit like electro-hydraulics, electro-pneumatics for a given application. 4. Select and size the different components of the circuit. 5. Develop a comprehensive circuit diagramby integrating the components selected for the given application.
37	CONTROL ENGINEERING	Modeling of mechanical, hydraulic, pneumatic and electrical systems. Representation of system elements by blocks and its reduction Transient and steady state	1. Chalk and talk method the good 2. PPT be used 3.vedios	**Professional ethics** **Human values** **Mathematical knowledge**	1. Recognize control system and its types , control actions 2. Determine the

		response analysis of a system.\n\nFrequency response analysis using polar plot.\nFrequency response analysis using bode plot.\n\nAnalysis of the system using root locus plots.\nDifferent system compensators and variable characteristics of linear systems.			system governing equations for physical models(Electrical, Thermal, Mechanical, Electro Mechanical)\n\n3. Calculate the gain of the system using block diagram and signal flow graph\n\n4. Illustrate the response of 1st and 2nd order systems\n\n5. Determine the stability of transfer functions in complex domain and frequency domain\n\n6. Employ state equations to study the controllability and observability
38	TRIBOLOGY	To educate the students on theimportance of friction, the related theories/laws of sliding and rolling friction and the effect of viscosity of lubricants.	1. Chalk and talk method\n the good\n2. PPT be used\n3.videos	**Professional ethics**\n**Human values**\n**Mathematical knowledge**	1. Understand the fundamentals of tribology and associated

		To expose the students to the consequences of wear, wear mechanisms, wear theories and analysis of wear problems. Tomake the students understand the principles of lubrication, lubrication regimes, theories of hydrodynamic and the advanced lubrication techniques. To expose the students to the factors influencing the selection of bearing materials fordifferent sliding applications. To introduce the concepts of surface engineering and its importance in tribology.			parameters. 2. Apply concepts of tribology for the performance analysis and design of components experiencing relative motion. 3. Analyse the requirements and design hydrodynamic journal and plane slider bearings for a given application. 4. Select proper bearing materials and lubricants for a given tribological application. 5. Apply the principles of surface engineering for different applications of tribology.
39	SMART MATERIALS and MEMS	This course provides a detailed overview to smart materials, piezoelectric materials structures and its	1. Chalk and talk method the good 2. PPT be used 3.videos	**Professional ethics** **Human values** **Mathematical knowledge**	1. Describe the methods of controlling

| | | characteristics. The study of Smart structures and modelling helps in Vibration control using smart materials in various applications. Helps to understand the principles and concepts of using MEMS, ER & MR Fluids for various applications. | | | vibration using smart systems and fabrication methods of MEMS.

2. Explain the principle concepts of Smart materials, structures, Fibre optics, ER & MR Fluids, Biomimetics and MEMS with principles of working.

3. Analyze the properties of smart structures, MEMS, with the applications and select suitable procedure for fabrication.

4. Summarize the methods and uses of Micro fabrications, Biomimetics, types of polymers used in MEMS, Fibre optics, piezoelectric sensing and actuation. |

40	Automotive Electronics	1. Basics of electronic control of internal combustion engines and the drives 2. Understand principle of working of sensors and actuators used in automobiles for control 3. Diagnostics and safety systems in automobiles	1. Chalk and talk method the good 2. PPT be used 3.videos	**Professional ethics** **Human values** **Mathematical knowledge**	1. Explain the electronics systems used for control of automobiles 2. Select sensors, actuators and control systems used in automobiles 3. Diagnose the faults in the sub systems and systems used automobile
41	MECHATRONICS	Understand the evolution and development of Mechatronics as a discipline. • Substantiate the need for interdisciplinary study in technology education. • Understand the applications of microprocessors in various systems and to know the functions of each element • Demonstrate the integration philosophy in view of Mechatronics technology	1. Chalk and talk method the good 2. PPT be used 3.videos	**Professional ethics** **Human values** **Mathematical knowledge**	1. Illustrate various components of Mechatronics systems. 2. Assess various control systems used in automation. 3. Develop mechanical, hydraulic, pneumatic and electrical control systems.

| 42 | OPERATIONS RESEARCH | 1. To enable the students to understand the scientific methods of providing various departments of an organization with a quantitative basis of decision making.
2. To enable the students to understand the importance of various tools and techniques in finding optimal solutions to problems involving limited resources in the form of Men, Materials and machinery. | 1. Chalk and talk method
    the good
2. PPT be used
3.videos | **Professional ethics
Human values
Mathematical knowledge** | 1. Understand the meaning, definitions, scope, need, phases and techniques of operations research.

2. Formulate as L.P.P and derive optimal solutions to linear programming problems by graphical method, Simplex method, Big-M method and Dual Simplex method.

3. Formulate as Transportation and Assignment problems and derive optimum solutions for transportation, Assignment and travelling salesman problems., Solve problems on game theory for pure and mixed strategy under a competitive environment., Solve waiting line |

				problems for M/M/1 and M/M/K queuing models. 4. Construct network diagram and determine critical path floats for deterministic and PERT networks including crashing of Networks. 5. Determine minimum processing times for sequencing of n jobs-2 machines, n jobs-3machines,n jobs-m machines and 2 jobs-n machines using Johnson's algorithm.
43	ADDITIVE MANUFACTURING	1. Understand the additive manufacturing process, polymerization and powder metallurgy process 2. Understand characterisation techniques in additive manufacturing. 3. Acquire knowledge on	1. Chalk and talk method the good 2. PPT be used 3.videos	**Professional ethics** **Human values** **Mathematical knowledge**	1. Understand the different process of Additive Manufacturing. using Polymer, Powder and Nano materials

		CNC and Automation.			manufacturing. 2. Analyse the different characterization techniques. 3. Describe the various NC, CNC machine programing and Automation techniques.
44	PRODUCT LIFE CYCLE MANAGEMENT	Familiarize with various strategies of PLM Understand the concept of product design and simulation. Develop New product development,product structure and supporting systems Interpret the technology forecasting and product innovation and development in business processes. Understand product building and Product Configuration.	1. Chalk and talk Method the good 2. PPT be used 3.videos	**Professional ethics** **Human values** **Mathematical knowledge**	Explain the various strategies of PLM and Product Data Management Describe decomposition of product design and model simulation Apply the concept of New Product Development and its structuring. Analyze the technological forecasting and the tools in the innovation.

					Apply the virtual product development and model analysis
45	Finite Element Analysis	To learn basic principles of finite element analysis procedure. To learn the theory and characteristics of finite elements that represent engineering structures. To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses.	1. Chalk and talk Method the good 2. PPT be used 3.Videos 4.Software	**Professional ethics** **Human values** **Mathematical knowledge**	1. Understand the concepts behind formulation methods in FEM. 2. Identify the application and characteristics of FEA elements such as bars, beams, plane andiso-parametric elements. 3.Develop element characteristic equation and generation of global equation. 4.Able to apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axi symmetric and

					dynamic problems and solve them displacements, stress and strains induced.
46	Computer Integrated Manufacturing	To impart knowledge of CIM andAutomation and different concepts of automation by developing mathematical models. To make students to understand the Computer Applications in Design and Manufacturing [CAD / CAM) leading to Computer integrated systems. Enable them to perform various transformations of entities on display devices. To expose students to automated flow lines,assemblylines,Line Balancing Techniques,and Flexible Manufacturing Systems. To expose students to computer aided process planning, material requirement planning, capacity planning etc. To expose the students to CNC Machine Tools,CNC part programming, and industrial robots. To introduce the students to concepts of Additive Manufacturing, Internet	1. Chalk and talk Method the good 2. PPT be used 3.Videos 4.Software	**Professional ethics Human values Mathematical knowledge**	Able to define Automation, CIM, CAD, CAM and explain the differences between these concepts.

Solve simple problems of transformations of entities on computer screen.

Explain the basics of automated manufacturing industries through mathematical models and analyze different types of automated flow lines.

Analyze the automated flow linesto reduce down time and enhance productivity. |

		of Things, and Industry 4.0leading to Smart Factory.			Explain the use of different computer applications in manufacturing, and able to prepare part programs for simple jobs on CNC machine tools and robot programming. Visualize and appreciate the modern trends in Manufacturing like additive manufacturing, Industry 4.0 and applications of Internet of Things leading to Smart Manufacturing.
47	Heat Transfer	Study the modes of heat transfer. Learn how to formulate and solve 1-D steady and unsteady heat conduction problems. Apply empirical correlations for fully-developed laminar, turbulent internal flows and external boundary layer convective flow problems. Study the basic principles of heat exchanger	1. Chalk and talk Method the good 2. PPT be used 3.Videos 4.Software	**Professional ethics** **Human values** **Mathematical knowledge**	Understand the basic modes of heat transfer. Compute temperature distribution in steady-state and unsteady-state heat conduction

| | | analysis and thermal design. Understand the principles of boiling and condensation including radiation heat transfer related engineering problems. | | | Understand and interpret heat transfer through extended surfaces.

Interpret and compute forced and free convective heat transfer.

Explain the principles of radiation heat transfer and understand the numerical formula for heat conduction problems.

Design heat exchangers using LMTD and NTU methods. |
|---|---|---|---|---|---|
| **48** | DESIGN OF MACHINE ELEMENTS II | To understand various elements involved in a mechanical system. To analyze various forces acting on the elements of a mechanical system and design them using appropriate techniques, codes, and standards. To select transmission elements like gears, belts, pulleys,bearings from the manufacturers‟ | 1. Chalk and talk Method the good 2. PPT be used 3.Videos 4.Software | **Professional ethics Human values Mathematical knowledge** | Apply engineering design tools to product design.

Design mechanical systems involving springs,belts and pulleys.

Design different |

		catalogue. To design completely a mechanical system integrating machine elements. To produce assembly and working drawings of various mechanical systems involving machine elements like belts, pulleys, gears, springs, bearings, clutches and brakes.			types of gears and simple gear boxes for different applications. Design brakes and clutches. Design hydrodynamic bearings for different applications. Select Anti friction bearings for different applications using the manufacturers, catalogue. Develop proficiency to generate production drawings using CAD software. Become good design engineers through learning the art of working in a team with morality and ethics.

| 49 | AUTOMOBILE ENGINEERING | The layout and arrangement of principal parts of an automobile The working of transmission and brake systems The operation and working of steering and suspension systems To know the Injection system and its advancements To know the automobile emissions and its effects on environment | 1. Chalk and talk Method the good 2. PPT be used 3.Videos 4.Software | **Professional ethics Human values Mathematical knowledge** | To identify the different parts of an automobile and it's working

To understand the working of transmission and braking systems

To comprehend the working of steering and suspension systems

To learn various types of fuels and injection systems

To know the cause of automobile emissions,its effects on the environment and methods to reduce the emissions. |
|---|---|---|---|---|---|
| 50 | INDUSTRIAL SAFETY | Students will be able to recognize and evaluate occupational safety and health hazards in the workplace, and to determine appropriate hazard controls following the hierarchy of controls. Students will furthermore | 1. Chalk and talk Method the good 2. PPT be used 3.Videos 4.Software | **Professional ethics Human values Mathematical knowledge** | Understand the basic safety terms.

Identify the hazards around the work environment and industries. |

		be able to analyze the effects of workplace exposures, injuries and illnesses, fatalities and the methods to prevent incidents using the hierarchy of controls, effective safety and health management systems and task-oriented training.			Use the safe measures while performing work in and around the work area of the available laboratories. Able to recognize the sign boards and its application. Able to demonstrate the portable extinguishers used for different class of fires. Able to write the case studies by sharing experience of the employees working in housekeeping, laboratories like workshops, electrical labs, machine shops, electronics and computer laboratories. Able to understand and report the case

					studies from various references (text books, news report, journals, visiting industries like power stations, manufacturing and maintenance).
51	TOTAL QUALITY MANAGEMENT	1. Understand various approaches to TQM 2. Understand the characteristics of quality leader and his role. 3. Develop feedback and suggestion systems for quality management. 4. Enhance the knowledge in Tools and Techniques of quality management	1. Chalk and talk Method the good 2. PPT be used 3.Videos 4.Software	**Professional ethics** **Human values** **Mathematical knowledge**	1. Explain the various approaches of TQM 2. Infer the customer perception of quality 3. Analyze customer needs and perceptions to design feedback systems. 4. Apply statistical tools for continuous improvement of systems 5. Apply the tools and technique for effective implementation of TQM.

| 52 | MANAGEMENT AND ENGINEERING ECONOMICS | Examine the meaning, importance, nature of management, its difference between management and administration and role of managers in management. Examine the meaning characteristics principles and process of organizing. Describe effective communication process, its importance, types and purpose for running an organization. Explain the importance of engineering economics, Law of demand and supply in engineering decision making. Describe various interest rate factors and implement the same for economic decision making. Examine different economic analysis methods-NPW, EAW, IRR, FW for decision making. Discuss different component of costs and methods of cost estimation. Explain depreciation, different methods of computing depreciation. Discuss taxation concepts-income tax and corporate taxes. | | | 1. Explain the development of management and the role it plays at different levels in an organization.

2. Comprehend the process and role of effective planning, organizing and staffing for the development of an organization.

3. Understand the necessity of good leadership, communication and coordination for establishing effective control in an organization.

4. Understand engineering economics demand supply and its importance in economics decision making and problem solving.

5. Calculate present |

					worth, annual worth and IRR for different alternatives in economic decision making. 6. Understand the procedure involved in estimation of cost for a simple component, product costing and depreciation, its methods
53	DYNAMICS OF MACHINERY	1. To gain the knowledge static and dynamic equilibrium conditions of mechanisms subjected forces and couple, with and without friction. 2. Analyze the mechanisms for static and dynamic equilibrium. 3. To understand the balancing principles of rotating and reciprocating masses, governors and gyroscopes. 4. Analyze the balancing of rotating and reciprocating masses, governors and gyroscopes. 5. To understand vibrations characteristics of single degree of freedom systems. 6. Characterize the single	1. Chalk and talk Method the good 2. PPT be used 3.Videos 4.Software	**Professional ethics Human values Mathematical knowledge**	1. Determine the forces and couples for static and dynamic conditions of four bar and slider crank mechanisms to keep the system in equilibrium. 2. Determine magnitude and angular position of balancing masses under static and dynamic condition of rotating masses in same and

| | | degree freedom systems subjected to free and forced vibrations with and without damping. | | | different planes.

3. Determine unbalanced primary, secondary forces and couples in single and multi-cylinder engine.

4. Determine sensitiveness, isochronism, effort and power of porter and hartnell governors.

5. Determine gyroscopic couple and effects related to 2, 4 wheeler, plane disc, ship and aeroplanes.

6. Understand types of vibration, SHM and methods of finding natural frequencies of simple mechanical systems.

7. Determine equation of motion, natural frequency, |
|---|---|---|---|---|---|

					damping factor, logarithmic decrement of damped free vibration (SDOF) systems.

8. Determine the natural frequency, force and motion transmissibility of single degree freedom systems.

9. Determine equation of motion of rotating and reciprocating unbalance systems, magnification factor, and transmissibility of forced vibration (SDOF) systems. |
| 54 | | TURBO MACHINES | The course aims at giving an overview of different types of turbomachinery used for energy transformation, such as pumps, fans, compressors, as well as hydraulic and steam turbines.
Explain the working principles of turbomachines and apply | 1. Chalk and talk Method the good
2. PPT be used
3.Videos
4.Software | **Professional ethics**
Human values
Mathematical knowledge | Able to give precise definition of turbomachinery

Identify various types of turbo machinery

Apply the Euler"s |

		it to various types of machines It will focus on application of turbo machinery in power generation, power absorption and transportation sectors.			equation for turbomachinery to analyse energy transfer in turbomachines Understand the principle of operation of pumps, fans, compressors and turbines. Perform the preliminary design of turbomachines (pumps, rotary compressors and turbines) Analyze the performance of turbo machinery.
55	DESIGN OF MACHINE ELEMENTS – I	1. to understand mechanical design procedure, materials, codes and use of standards 2. to design machine components for static, impact and fatigue strength. 3. To design fasteners, shafts, joints, couplings, keys, threaded fasteners riveted joints, welded	1. Chalk and talk Method the good 2. PPT be used 3.Videos 4.Software	**Professional ethics Human values Mathematical knowledge**	1. Describe the design process, choose materials. 2. Apply the codes and standards in design process. 3. Analyze the behavior of

		joints and power screws.			machine components under static, impact, fatigue loading using failure theories. 4. Design shafts, joints, couplings. 5. Design of riveted and welded joints. 6. Design of threaded fasteners and power screws
56	NON TRADITIONAL MACHINING	compare traditional and non-traditional machining process andrecognize the need for Non-traditional machining process To know constructional features, performance parameters, process characteristics, applications, advantages and limitations Know about Chemical and electro-chemical machining	1. Chalk and talk Method the good 2. PPT be used 3.Videos 4.Software	**Professional ethics Human values Mathematical knowledge**	1. Understand the compare traditional and non-traditional machining process and recognize the need for Non-traditional machining process. 2. Understand the constructional features, performance parameters, process characteristics,

	process,EDM,PAM along with the constructional features, process parameters, process characteristics, applications, advantages and limitations. To know about LBM equipment, LBM parameters, and characteristics. EBM equipment and mechanism of metal removal, applications, advantages and limitations			applications, advantages and limitations of USM, AJM and WJM. 3. Identify the need of Chemical and electro-chemical machining process along with the constructional features, process parameters, process characteristics, applications, advantages and limitations. 4. Understand the constructional features of the equipment, process parameters, process characteristics, applications, advantages and limitations EDM & PAM. 5. Understand the LBM equipment, LBM parameters, and characteristics. EBM equipment

					and mechanism of metal removal, applications, advantages and limitations LBM & EBM.
57	AUTOMATION & ROBOTICS	To identify potential areas for automation and justify need for automation. To select suitable major control components required to automate a process or an activity To study the various parts of robots and fields of robotics. To study the various kinematics and inverse kinematics of robots. To study the control of robots for some specific applications.	1. Chalk and talk Method the good 2. PPT be used 3. Videos 4. Software	**Professional ethics** **Human values** **Mathematical knowledge**	To identify potential areas for automation and justify need for automation. To select suitable major control components required to automate a process or an activity To study the various parts of robots and fields of robotics. To study the various kinematics and inverse kinematics of robots. To study the control of robots for some specific

					applications.
58	PROJECT MANAGEMENT	1. Understand the selection, prioritization and initiation of individual projects and strategic role of project management. 2. Understand the work breakdown structure by integrating it with organization. 3. Understand the scheduling and uncertainty in projects. 4. Students will be able to understand risk management planning using project quality tools. 5. Understand the activities like purchasing, acquisitions, contracting, partnering and collaborations related to performing projects. 6. Determine project progress and results through balanced scorecard approach 7. Draw the network diagram to calculate the duration of the project and reduce it using crashing.	1. Chalk and talk Method the good 2. PPT be used 3.Videos 4.Software	**Professional ethics** **Human values** **Mathematical knowledge**	1. Understand the selection, prioritization and initiation of individual projects and strategic role of project management. 2. Understand the work breakdown structure by integrating it with organization. 3. Understand the scheduling and uncertainty in projects. 4. Students will be able to understand risk management planning using project quality tools. 5. Understand the activities like purchasing,

					acquisitions, contracting, partnering and collaborations related to performing projects. 6. Determine project progress and results through balanced scorecard approach 7. Draw the network diagram to calculate the duration of the project and reduce it using crashing.
59	MATERIAL SCIENCE	The foundation for understanding the structure and various modes of failure in materials common in mechanical engineering. Topics are designed to explore the mechanical properties of metals and their alloys, polymers, ceramics ,smart materials and composites. The means of modifying such properties, as well as the processing and failure of materials. Concepts of use of	1. Chalk and talk Method the good 2. PPT be used 3.Videos 4.Software	**Professional ethics Human values Mathematical knowledge**	Describe the mechanical properties of metals, their alloys and various modes of failure. Understand the microstructures of ferrous and non-ferrous materials to

		materials for various applications are highlighted.			mechanical properties.

Explain the processes of heat treatment of various alloys.

Understand the properties and potentialities of various materials available and material selection procedures.

Know about composite materials and their processing as well as applications. |
| **60** | BASIC THERMODYNAMICS | Learn about thermodynamic systems and boundaries Study the basic laws of thermodynamics including, conservation of mass, conservation of energy or first law , second law and Zeroth law. Understand various forms of energy including heat transfer and work | 1. Chalk and talk Method the good 2. PPT be used 3.Videos 4.Software | **Professional ethics Human values Mathematical knowledge** | Explain thermodynamic systems, properties, Zeroth law of thermodynamics, temperature scales and energy interactions.

Determine heat, |

		Identify various types of properties (e.g., extensive and intensive properties) Use tables, equations, and charts, in evaluation of thermodynamic properties Apply conservation of mass, first law, and second law in thermodynamic analysis of systems (e.g., turbines, pumps, compressors, heat exchangers, etc.) Enhance their problem solving skills in thermal engineering			work, internal energy, enthalpy for flow & non flow process using First and Second Law of Thermodynamics. Interpret behavior of pure substances and its applications to practical problems. Determine change in internal energy, change in enthalpy and change in entropy using TD relations for ideal gases. Calculate Thermodynamics properties of real gases at all ranges of pressure, temperatures using modified equation of state including Vander Waals equation, Redlich Wong equation and Beattie-

| 61 | MECHANICS OF MATERIALS | Classify the stresses into various categories and define elastic properties of materials and compute stress and strain intensities caused by applied loads in simple and compound sections and temperature changes. Derive the equations for principal stress and maximum in-plane shear stress and calculate their magnitude and direction. Draw Mohr circle for plane stress system and interpret this circle. Determine the shear force, bending moment and draw shear force and bending moment diagrams, describe behavior of beams under lateral loads. Explain the structural behavior of members subjected to torque, Calculate twist and stress induced in shafts subjected to bending and torsion. Understand the concept of stability and derive crippling loads for columns. Understand the concept of strain energy and compute strain energy for applied loads. | 1. Chalk and talk Method the good
2. PPT be used
3.Videos
4.Software | **Professional ethics**
Human values
Mathematical knowledge | Understand simple, compound, thermal stresses and strains their relations, Poisson's ratio, Hooke's law, mechanical properties including elastic constants and their relations.

Determine stresses, strains and deformations in bars with varying circular and rectangular cross-sections subjected to normal and temperature loads

Determine plane stress, principal stress, maximum shear stress and their orientations using analytical method and Mohr's circle

Determine the dimensions of structural members |

				including beams, bars and rods using Energy methods and also stress distribution in thick and thin cylinders
				Draw SFD and BMD for different beams including cantilever beams, simply supported beams and overhanging beams subjected to UDL, UVL, Point loads and couples
				Determine dimensions, bending stress, shear stress and its distribution in beams of circular, rectangular, symmetrical I and T sections subjected to point loads and UDL
				Determine the dimensions of shafts based on torsional strength,

					rigidity and flexibility and also elastic stability of columns using Rankin's and Euler's theory
62	METAL CASTING AND WELDING	To provide detailed information about the moulding processes. To provide knowledge of various casting process in manufacturing. To impart knowledge of various joining process used in manufacturing. To provide adequate knowledge of quality test methods conducted on welded and casted components.	1. Chalk and talk Method the good 2. PPT be used 3.Videos 4.Software	**Professional ethics Human values Mathematical knowledge**	Describe the casting process, preparation of Green, Core, dry sand molds and Sweep, Shell, Investment and plaster molds. Explain the Pattern, Core, Gating, Riser system and Jolt, Squeeze, Sand Slinger Molding Machines. Compare the Gas fired pit, Resistance, Coreless, Electrical and Cupola Metal Furnaces. Compare the Gravity, Pressure die, Centrifugal, Squeeze, slush and Continuous Metal

				mold castings.
				Explain the Solidification process and Casting of Non-Ferrous Metals.
				Describe the Metal Arc, TIG, MIG, Submerged and Atomic Hydrogen Welding processes used in manufacturing.
				Explain the Resistance spot, Seam, Butt, Projection, Friction, Explosive, Thermit, Laser and Electron Beam Special type of welding process used in manufacturing.
				Describe the Metallurgical aspects in Welding and inspection methods for the quality assurance of components made of casting and

				joining process.
63	MACHINE TOOLS AND OPERATIONS	To introduce students to different machine tools in order to produce components having different shapes and sizes. To enrich the knowledge pertaining to relative motion and mechanics required for various machine tools. To develop the knowledge on mechanics of machining process and effect of various parameters on economics of machining.	1. Chalk and talk Method the good 2. PPT be used 3.Videos 4.Software	**Professional ethics** **Human values** **Mathematical knowledge**	Explain the construction & specification of various machine tools. Describe various machining processes pertaining to relative motions between tool & work piece. Discuss different cutting tool materials, tool nomenclature & surface finish. Apply mechanics of machining process to evaluate machining time. Analyze tool wear mechanisms and equations to enhance tool life and minimize machining cost.
63	COMPUTER AIDED MACHINE DRAWING	To acquire the knowledge of CAD software and its	1. Chalk and talk Method the good	**Professional ethics** **Human values**	Sections of

	features. To inculcate understanding of the theory of projection and make drawings using orthographic projections and sectional views To familiarize the students with Indian Standardson drawing practices. To impart knowledge of thread forms, fasteners, keys,joints and couplings. To make the students understand and interpret drawings of machine components so as to prepare assembly drawings either manually and using CAD packages. To acquire the knowledge of limits,tolerances and fitspertaining to machine drawings.	2. PPT be used 3.Videos 4.Software	**Mathematical knowledge**	pyramids, prisms, cubes, cones and cylinders resting on their bases in 2D Orthographic views of machine parts with and without sectioning in 2D. Sectional views for threads with terminologies of ISO Metric, BSW, square and acme, sellers and American standard threads in 2D. Hexagonal and square headed bolt and nut with washer, stud bolts with nut and lock nut, flanged nut, slotted nut, taper and split pin for locking counter sunk head screw, grub screw, Allen screw assemblies in 2D Parallel key, Taper key, and Woodruff

				Key as per the ISO standards in 2D
				single and double riveted lap joints, butt joints with single/double cover straps, cotter and knuckle joint for two rods in 2D
				Sketch split muff, protected type flanged, pin type flexible, Oldham's and universal couplings in 2D
				assemblies from the part drawings with limits ,fits and tolerance given for Plummer block, Ram bottom safety valve, I.C. Engine connecting rod, Screw Jack, Tailstock of lathe, Machine Vice and Lathe square tool post in 2D and 3D

| 64 | MECHANICAL MEASUREMENTS AND METROLOGY | Understand metrology, its advancements & measuring instruments, Acquire knowledge on different standards of length, calibration of End Bars, linear and angular measurements, Screw thread and gear measurement & comparators. Equip with knowledge of limits, fits, tolerances and gauging. Acquire knowledge of measurement systems and methods with emphasis on different transducers, intermediate modifying and terminating devices. Understand the measurement of Force, Torque, Pressure, Temperature and Strain. | 1. Chalk and talk Method the good 2. PPT be used 3.Videos 4.Software | **Professional ethics Human values Mathematical knowledge** | Understand the objectives of metrology, methods of measurement, selection of measuring instruments, standards of measurement and calibration of end bars. Describe slip gauges, wringing of slip gauges and building of slip gauges, angle measurement using sine bar, sine center, angle gauges, optical instruments and straightness measurement using Autocollimator. Explain tolerance, limits of size, fits, geometric and position tolerances, gauges and their design. Understand the principle of Johnson |

				Mikrokator, sigma comparator, dial indicator, LVDT, back pressure gauges, Solex comparators and Zeiss Ultra Optimeter
				Describe measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2 – wire, 3 – wire methods, screw thread gauges and tool maker's microscope.
				Explain measurement of tooth thickness using constant chord method, addendum comparator methods and base tangent method, composite error using gear roll tester and

					measurement of pitch, concentricity, run out and involute profile
65	KINEMATICS OF MACHINES	1. Familiarize with mechanisms and motion analysis of mechanisms. 2. Understand methods of mechanism motion analysis and their characteristics. 3. Analyse motion of planar mechanisms, gears, gear trains and cams.	1. Chalk and talk Method the good 2. PPT be used 3.Videos 4.Software	**Professional ethics Human values Mathematical knowledge**	1. Identify mechanisms with basic understanding of motion. 2. Comprehend motion analysis of planar mechanisms, gears, gear trains and cams. 3. Carry out motion analysis of planar mechanisms, gears, gear trains and cams.
66	APPLIED THERMODYNAMICS	To have a working knowledge of basic performance of Gas power cycles. To Calculate the forces exerted by a fluid at rest on submerged surfaces and understand the force of buoyancy To understand and evaluate the performance	1. Chalk and talk Method the good 2. PPT be used 3.Videos 4.Software	**Professional ethics Human values Mathematical knowledge**	Apply thermodynamic concepts to analyze the performance of gas power cycles including propulsion systems.

		of steam power cycles their various Engineering applications To know how fuel burns and their thermodymic properties. To Understand mechanism of power transfer through belt, rope, chain and gear drives in I C Engines To determine performance parameters of refrigeration and air-conditioning systems. Evaluate the performance parameters of reciprocating air compressor as a function of receiver pressure.			Evaluate the performance of steam turbine components. Understand combustion of fuels and combustion processes in I C engines including alternate fuels and pollution effect on environment. Apply thermodynamic concepts to analyze turbo machines. Determine performance parameters of refrigeration and air-conditioning systems. Understand the principles and applications of refrigeration systems. Analyze air-conditioning

					processes using the principles of psychrometry and Evaluate cooling and heating loads in an air- conditioning system. Understand the working, applications, relevance of air and identify methods for performance improvement.
67	FLUID MECHANICS	To have a working knowledge of the basic properties of fluids and understand the continuum approximation To Calculate the forces exerted by a fluid at rest on submerged surfaces and understand the force of buoyancy To understand the flow characteristic and dynamics of flow field for various Engineering applications To know how velocity changes and energy transfers in fluid flows are related to forces and torques and to understand	1. Chalk and talk Method the good 2. PPT be used 3.Videos 4.Software	**Professional ethics** **Human values** **Mathematical knowledge**	Identify and calculate the key fluid properties used in the analysis of fluid behavior. Understand and apply the principles of pressure, buoyancy and floatation Apply the knowledge of fluid statics, kinematics and dynamics while

		why designing for minimum loss of energy in fluid flows is so important. To discuss the main properties of laminar and turbulent pipe flow and appreciate their differences and the concept of boundary layer theory. Understand the concept of dynamic similarity and how to apply it to experimental modeling To appreciate the consequences of compressibility in gas flow and understand the effects of friction and heat transfer on compressible flows			addressing problems of mechanical and chemical engineering. Understand and apply the principles of fluid kinematics and dynamics. Understand the concept of boundary layer in fluid flow and apply dimensional analysis to form dimensionless numbers in terms of input output variables. Understand the basic concept of compressible flow and CFD
			1. Chalk and talk Method the good 2. PPT be used 3.Videos 4.Software	**Professional ethics** **Human values** **Mathematical knowledge**	

			1. Chalk and talk Method the good 2. PPT be used 3.Videos 4.Software	**Professional ethics** **Human values** **Mathematical knowledge**	