MECHANICAL ENGINEERING	
Course Code	**18EGDL15/18EGDL25 - ENGINEERING GRAPHICS AND DESIGN**
CO1	Produce computer generated drawings using CAD software.
CO2	Prepare drawings as per BIS following the conventions mentioned in the relevant codes.
CO3	Apply the knowledge of orthographic projections to represent engineering information/concepts and preset the same in the form of drawings.
CO4	Read and evaluate engineering drawings.
CO5	Create isometric drawings of simple objects reading the orthographic projections of those objects.
Course Code	**18ME15/25-ELEMENTS OF MECHANICAL ENGINEERING**
CO1	Identify different sources of energy and their conversion process.
CO2	Explain the working principle of hydraulic turbines, pumps, IC engines and refrigeration.
CO3	Recognize various metal joining processes and power transmission elements
CO4	Understand the properties of common engineering materials and their applications in engineering industry.
CO5	Discuss the working of conventional machine tools, machining processes, tools and accessories.
CO6	Describe the advanced manufacturing systems.
Course Code	**18ME32 - MECHANICS OF MATERIALS**
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.
Course Code	**18ME33 - BASIC THERMODYNAMICS**
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.
Course Code	**18ME34 - MATERIAL SCIENCE**
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

Course Code	18ME35B - METAL CASTING AND WELDING
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.
Course Code	**18ME36B - MECHANICAL MEASUREMENTS AND METROLOGY**
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.
CO4	Describe measurement of major & minor diameter, pitch, angle and effective diameter of screw threads.
CO5	Explain measurement systems, transducers, intermediate modifying devices and terminating devices
CO6	Describe functioning of force, torque, pressure, strain and temperature measuring devices
Course Code	**18MEL37B - MECHANICAL MEASUREMENTS AND METROLOGY LAB**
CO1	Understand Calibration of pressure gauge, thermocouple, LVDT, load cell, micrometer.
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.
Course Code	**18MEL38B - FOUNDRY, FORGING AND WELDING LAB**
CO1	Demonstrate various skills in preparation of molding sand for conducting tensile, shear and compression tests using Universal sand testing machine.
CO2	Demonstrate skills in determining permeability, clay content and Grain Fineness Number of base sands.
CO3	Demonstrate skills in preparation of forging models involving upsetting, drawing and bending operations.
Course Code	**18ME42 - APPLIED THERMODYNAMICS**
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.
CO4	Understand the principles and applications of refrigeration systems.
CO5	Apply Thermodynamic concepts to determine performance parameters of refrigeration and air conditioning systems.
CO6	Understand the working principle of Air compressors and Steam nozzles, applications, relevance of air and identify methods for performance improvement.

Course Code	18ME43 - FLUID MECHANICS
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 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
Course Code	**18ME44 - KINEMATICS OF MACHINES**
CO1	Knowledge of mechanisms and their motion.
CO2	Analyse the velocity, acceleration of links and joints of mechanisms.
CO3	Analysis of cam follower motion for the motion specifications.
CO4	Understand the working of the spur gears.
CO5	Analyse the gear trains speed ratio and torque.
CO6	Understand the inversions of four bar mechanisms.
Course Code	**18ME45A - METAL CUTTING AND FORMING**
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.
Course Code	**18ME46A - COMPUTER AIDED MACHINE DRAWING**
CO1	Identify the national and international standards pertaining to machine drawing.
CO2	Understand the importance of the linking functional and 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.
Course Code	**18MEL47A - MATERIAL TESTING LAB**
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 analyze 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/behavior of materials for various industrial applications.
Course Code	**18MEL48A - WORKSHOP AND MACHINE SHOP PRACTICE**
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 and Gear cutting and estimate cutting time.
Course Code	**18ME51 - MANAGEMENT AND ECONOMICS**
CO1	Understand needs, functions, roles, scope and evolution of Management
CO2	Understand importance, purpose of Planning and 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.
Course Code	**18ME52 - DESIGN OF MACHINE ELEMENTS I**
CO1	Apply the concepts of 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	Analyze the performance and failure modes of mechanical components subjected to combined loading and fatigue loading using the concepts of theories of failure.
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.
Course Code	**18ME53 - DYNAMICS OF MACHINES**
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.
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.
Course Code	**18ME54 - TURBO MACHINES**
CO1	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, 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.
Course Code	**18ME55 - FLUID POWER ENGINEERING**
CO1	CO1: Identify and analyse the functional requirements of a fluid power transmission system for a given application.
CO2	Visualize how a hydraulic/pneumatic 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.
Course Code	**18ME56 - OPERATIONS MANAGEMENT**
CO1	Explain the concept and scope 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
Course Code	**18MEL57 - FLUID MECHANICS AND MACHINES LAB**
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.
Course Code	**18MEL58 - ENERGY CONVERSION LABORATORY**
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.
Course Code	**18MEL59 - ENVIRONMENTAL STUDIES**
CO1	Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale
CO2	Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
CO3	Demonstrate ecology knowledge of a complex relationship between biotic and abiotic components.
CO4	Apply their ecological knowledge to illustrate an and graph a problem and describe the realities that managers face when dealing with complex issues.

Course Code	18ME61 - FINITE ELEMENT METHODS
CO1	Identify the application and characteristics of FEA elements such as bars, beams, plane and 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
Course Code	**18ME62 - DESIGN OF MACHINE ELEMENTS II**
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
CO5	Apply engineering design tools to product design.
CO6	Become good design engineers through learning the art of working in a team.
Course Code	**18ME63 - HEAT TRANSFER**
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
Course Code	**18ME641 - NON-TRADITIONAL MACHINING**
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.
Course Code	**18ME653 - RENEWABLE ENERGY RESOURCES (OPEN ELECTIVE)**
CO1	Discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy.
CO2	Outline energy from sun, energy reaching the Earth's surface and solar thermal energy applications.
CO3	Discuss types of solar collectors, their configurations, solar cell system, its characteristics and their applications.
CO4	Explain generation of energy from hydrogen, wind, geothermal system, solid waste and agriculture refuse.
CO5	Discuss production of energy from biomass, biogas.
CO6	Summarize tidal energy resources, sea wave energy and ocean thermal energy.

Course Code	18MEL66 - COMPUTER AIDED MODELLING AND ANALYSIS LAB
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.
Course Code	**18MEL67 - HEAT TRANSFER LAB**
CO1	Determine the thermal conductivity of a metal rod and 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
Course Code	**18ME71 - CONTROL ENGINEERING**
CO1	Identify the type of control and control actions.
CO2	Develop the mathematical model of the physical systems.
CO3	Estimate the response and error in response of first and second order systems subjected standard input signals.
CO4	Represent the complex physical system using block diagram and signal flow graph and obtain transfer function
CO5	Analyse a linear feedback control system for stability using Hurwitz criterion, Routh's criterion and root Locus technique in complex domain.
Course Code	**18ME72 - COMPUTER AIDED DESIGN AND MANUFACTURING**
CO1	CO1: Define Automation, CIM, CAD, CAM and explain the differences between these concepts. Solve simple problems of transformations of entities on computer screen
CO2	Explain the basics of automated manufacturing industries through mathematical models and analyzedifferent types of automated flow lines.
CO3	Analyse the automated flow lines to reduce time and enhance productivity.
CO4	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.
CO5	Visualize and appreciate the modern trends in Manufacturing like additive manufacturing, Industry 4.0 and applications of Internet of Things leading to Smart Manufacturing.
Course Code	**18ME732 - AUTOMATION & ROBOTICS**
CO1	Translate and simulate a real time activity using modern tools and discuss the Benefits of automation.
CO2	Identify suitable automation hardware for the given application
CO3	Recommend appropriate modelling and simulation tool for the given manufacturing Application.
CO4	Explain the basic principles of Robotic technology, configurations, control and Programming of Robots.
CO5	Explain the basic principles of programming and apply it for typical Pick & place, Loading & unloading and palletizing applications
Course Code	**18ME741 - ADDITIVE MANUFACTURING**

CO1	Demonstrate the knowledge of the broad range of AM processes, devices, capabilities and materials that are available.
CO2	Demonstrate the knowledge of the broad range of AM processes, devices, capabilities and materials that are available.
CO3	Understand the various software tools, processes and techniques that enable advanced/additive manufacturing.
CO4	Apply the concepts of additive manufacturing to design and create components that satisfy product development/prototyping requirements, using advanced/additive manufacturing devices and processes.
CO5	Understand characterization techniques in additive manufacturing.
CO6	Understand the latest trends and business opportunities in additive manufacturing.
Course Code	**18ME753 - DISASTERS MANAGEMENT (OPEN ELECTIVE)**
CO1	Discuss disaster management plan, cyclones and their hazard potential
CO2	Understand the role of IMD and cyclone prediction and cyclone warning system in India
CO3	Understand the role of different institutions defence and other services in natural disaster management
CO4	Understand the role of Central Water Commission in river water sharing, Draught, its assessment and draught management plan
CO5	Understand occurrence of earth quake, Tsunamis and thunderstorms.
Course Code	**18MEL76 - COMPUTRE AIDED MANUFACTURING LAB**
Course Code	**18MEL77 - DESIGN LAB**
CO1	Compute the natural frequency of the free and forced vibration of single degree freedom systems, critical speed of shafts.
CO2	Carry out balancing of rotating masses
CO3	Analyse the governor characteristics.
CO4	Determine stresses in disk, beams, plates and hook using photo elastic bench.
CO5	Determination of Pressure distribution in Journal bearing
CO6	Analyse the stress and strains using strain gauges in compression and bending test and stress distribution in curved beams.
Course Code	**18ME81 - ENERGY ENGINEERING**
CO1	Understand the construction and working of steam generators and their accessories.
CO2	Identify renewable energy sources and their utilization.
CO3	Understand principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, nuclear, hydel and tidal.
Course Code	**18ME822 - TRIBOLOGY**
CO1	Understand the fundamentals of tribology and associated parameters.
CO2	Apply concepts of tribology for the performance analysis and design of components experiencing relative motion
CO3	Analyse the requirements and design hydrodynamic journal and plane slider bearings for a given application.
CO4	Select proper bearing materials and lubricants for a given tribological application.
CO5	Apply the principles of surface engineering for different applications of tribology.

MECHANICAL ENGINEERING	
Course Code 20MTP12	FINITE ELEMENT METHOD IN HEAT TRANSFER
CO1	Establish the mathematical models for the complex analysis problems and predict the nature of solution.
CO2	Formulate the element characteristic for linear and nonlinear matrices and vectors.
CO3	Identify the boundary conditions and their incorporation in to the FE equations.
CO4	Solve the problems with simple geometries, with hand calculations involving the fundamental concepts.
CO5	Interpret the analysis results for the improvement or modification of the system.
Course Code 20 MTP13	**ADVANCED FLUID MECHANICS**
CO1	Illustrate the basic concepts fluid flow and their governing equations
CO2	Analyse the laminar and turbulent flow problems.
CO3	Analyse one dimensional incompressible and compressible fluid flow Problems
CO4	Distinguish normal and oblique shocks and their governing Equations.
CO5	Describe the instruments and methods for flow measurements
Course Code 20MTP14	**COMBUSTION THERMODYNAMICS**
CO1	Understand the basic thermodynamic concepts for combustion phenomena.
CO2	Describe the fuel energy conversion systems.
CO3	Apply the concept of flam flow mechanism in combustion process.
CO4	knowledge of adiabatic flame temperature in the design of combustion devices.
CO5	Identify the phenomenon of flame stabilization in laminar and turbulent flames.
Course Code 20 MTP15	**ADVANCED POWER PLANT CYCLES**
CO1	Distinguish the various power plant cycle and their working principles.
CO2	Describe the working principles of different components of power plant.
CO3	Explain the concepts of power generation by nuclear power plant.
CO4	Illustrate the concept of hydroelectric power generation.
CO5	Explain the concept of pollution and its effects.

Course Code 20 MTPL16	THERMAL ENGINEERING MEASUREMENT LABORATORY
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	Identify exhaust emission, factors affecting them and report the remedies.
CO5	Determine the energy flow pattern through the hydraulic machines and I C Engine
CO6	Exhibit his competency towards preventive maintenance of IC engines.
Course Code 20RMI17	**RESEARCH METHODOLOGY AND IPR**
CO1	Discuss research methodology and the technique of defining a research problem
CO2	Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review.
CO3	Explain various research designs, sampling designs, measurement and scaling techniques and also different methods of data collections.
CO4	Explain several parametric tests of hypotheses, Chi-square test, art of interpretation and writing research reports
CO5	Discuss various forms of the intellectual property, its relevance and business impact in the changing global business environment and leading International Instruments concerning IPR.■
Course Code 20 MTP21	**ADVANCED HEAT TRANSFER**
CO1	Describe the different modes of heat transfer with both physics and the mathematical concept.
CO2	Use the concepts of radiation heat transfer for enclosure analysis.
CO3	Explain the concepts of Boundary layer.
CO4	Formulate mathematical functions for two-dimensional and three dimensional heat conduction problems.
CO5	Describe the free and forced convection problems in real time applications.
Course Code 20 MTP22	**STEAM AND GAS TURBINES**
CO1	Describe the working principles of Gas and steam turbines nozzle and diffusers.

CO2	Explain the principles of thermodynamic concept to determine the performance of steam and gas turbines.
CO3	Illustrate the concepts of axial flow and centrifugal compressors.
CO4	Differentiate axial flow and radial flow gas turbines for their analysis.
CO5	Identify the various losses associated with the turbines.
Course Code 20MTP23	**REFRIGERATION AND AIR CONDITIONING**
CO1	Understand concepts of refrigeration and air-conditioning process and systems.
CO2	Employ the theoretical principles to simple, complex vapour compression and vapour absorption refrigeration systems.
CO3	Understand conventional and alternate refrigerants and their impact on environment.
CO4	Apply the heat load calculation to design the air-conditioning systems.
CO5	Describe the concepts to design air distribution systems.
Course Code 20MTP241	**ENERGY CONSERVATION AND MANAGEMENT**
CO1	Understand the various energy conservation and improvement techniques.
CO2	Illustrate the Energy scenario.
CO3	Employ the principles of thermal engineering and energy management to improve the Performance of thermal systems.
CO4	Assess energy projects on the basis of economic and financial criteria.
CO5	Describe methods of energy production for improved utilization
Course Code 20MTP251	**SOLAR THERMAL TECHNOLOGIES AND ITS APPLICATIONS**
CO1	Analyse the energy concepts on solar devices for various thermal properties.
CO2	Analyse the solar thermal devices for various tracking modes.
CO3	Evaluate the performance of various solar thermal technologies.
Course Code 20 MTPL26	**SIMULATION LABORATORY**
Course Code 20MTP27	**TECHNICAL SEMINAR**
Course Code 20MTP31	**DESIGN OF HEAT TRANSFER EQUIPMENTS FOR THERMAL POWER PLANT**
CO1	Understand the physics and the mathematical treatment of typical heat exchangers.
CO2	Employ LMTD and Effectiveness methods in the design of heat exchangers and analyze the importance of LMTD approach over AMTD approach.
CO3	Examine the performance of double-pipe counter flow (hair-pin) heat exchangers.
CO4	Design and analyze the shell and tube heat exchanger.

CO5	Understand the fundamental, physical and mathematical aspects of boiling and condensation.
CO6	Classify cooling towers and explain their technical features.
Course Code 20MTP322	**THEORY OF IC ENGINES**
CO1	Distinguish different Fuel-air and actual cycles.
CO2	Demonstrate the different types of injection and carburetor systems
CO3	Formulate the flow and combustion phenomenon for modeling
CO4	Identify the various types of emissions, noise and their control systems
CO5	Recommend the suitable alternative fuel for IC Engine.
Course Code 20MTP332	**NON-CONVENTIONAL ENERGY SOURCES**
CO1	Describe the need of renewable energy resources, historical and latest developments.
CO2	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.
CO3	Appreciate the need of Wind Energy, wave power, tidal power, ocean thermal power and geothermal and the various components used in energy generation.
CO4	Understand the concept of Biomass energy resources and their classification, types of biogas Plants applications
Course Code 20MTP34	**PROJECT WORK PHASE – 1**
CO1	Demonstrate a sound technical knowledge of their selected project topic.
CO2	Undertake problem identification, formulation, and solution.
CO3	Design engineering solutions to complex problems utilising a systems approach.
CO4	Communicate with engineers and the community at large in written an oral forms.
CO5	Demonstrate the knowledge, skills and attitudes of a professional engineer.
Course Code 20MTP35	**MINI PROJECT**
CO1	Present the mini-project and be able to defend it.
CO2	Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
CO3	Habituated to critical thinking and use problem solving skills
CO4	Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
CO5	Work in a team to achieve common goal.
CO6	Learn on their own, reflect on their learning and take appropriate actions to improve it.

Course Code 20MTPI36	INTERNSHIP / PROFESSIONAL PRACTICE
CO1	Gain practical experience within industry in which the internship is done.
CO2	Acquire knowledge of the industry in which the internship is done.
CO3	Apply knowledge and skills learned to classroom work.
CO4	Develop a greater understanding about career options while more clearly defining personal career goals.
CO5	Experience the activities and functions of professionals.
CO6	Develop and refine oral and written communication skills.
CO7	Identify areas for future knowledge and skill development.
CO8	Expand intellectual capacity, credibility, judgment, intuition.
CO9	Acquire the knowledge of administration, marketing, finance and economics
Course Code 20MTP41	**PROJECT WORK PHASE -2**
CO1	Present the project and be able to defend it.
CO2	Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
CO3	Habituated to critical thinking and use problem solving skills
CO4	Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
CO5	Work in a team to achieve common goal.
CO6	Learn on their own, reflect on their learning and take appropriate actions to improve it.