B.E (Mechanical Engineering) Program

B.E. Program Outcomes (PO's)

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

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

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

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

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

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

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

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

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

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear

ASSOCIATE PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana.

instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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

R-20 & R-22

B.E – Mechanical Engineering Department Vision

To be the destination for aspiring young minds to become globally competitive, enlightened, innovative, immediate contributors to the industry and successful in higher studies in the field of mechanical engineering.

Department Mission

1. To impart quality and innovative education in mechanical engineering with basic and specialised training, internships to meet the current and emerging needs of the industry.

2. To prepare the students for successful professional career by inculcating ethical, entrepreneurial and leadership qualities.

3. To foster Research and Development environment by disseminating knowledge and technology by involving the students in publications, sponsored projects, and consultancy.

B.E – Mechanical Engineering Program Educational Objectives (PEO's):

After Four years of graduation graduates will have

1. Ample technical knowledge and skills for a successful career in Mechanical Engineering and product development, design, development and implementation of engineering systems, services, and processes.
2. Capability to develop competitive technologies and find solutions to industry, societal challenges, and engineering problems with ethical and professional standards.
3. Ability to be entrepreneurial, innovative in the context of global scenarios of technological challenges and environmental issues.
4. To pursue life-long learning and to adapt to the changing industry requirements.
5. To be a team player, lead and engage diverse teams through effective communication, inter-personal and project management skills.

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B.E – Mechanical Engineering Program Specific Outcomes (PSO's):

The graduates will be able to

1. Apply their learning to design and develop basic mechanical systems and processes.
2. Select manufacturing processes and their appropriate parameters for the production of typical engineering components.
3. Apply the concepts of mechanical engineering in power generation, aerospace, environmental, bio-medical, automotive, sustainable energy systems and with suitable safety precautions.

R-18

B.E – Mechanical Engineering Department Vision

To be a Pace Setter in the field of Mechanical Engineering by providing conducive environment for understanding and applying its principles to cater the needs of Society.

Department Mission

To impart quality & innovative technical education to the students of Mechanical Engineering for their professional achievements in Consultancy, R&D and to become successful Entrepreneur enabling them to serve the society in general and the industry.

B.E – Mechanical Engineering Program Educational Objectives (PEO's):

1. The graduating students from mechanical engineering will have a widespread knowledge in basic sciences and fundamentals of mechanical engineering to be able to solve application-level problems pertaining to society.

2. The graduating students from mechanical engineering will have knowledge in core areas in mechanical engineering like Design Engineering, Industrial Engineering, Manufacturing Engineering, and Thermal Engineering.

3. The programme prepares the graduates to acquire competency for research in core areas and in interdisciplinary research activities like environment & sustainability.

4. The graduating students from Mechanical Engineering will inculcate professional & ethical values, teamwork, leadership skills, moral responsibility, industrial relations and communication skills.

5. The graduating students from mechanical engineering will be enriched in project, finance management and technical knowhow skills.

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B.E – Mechanical Engineering Program Specific Outcomes (PSO's):

1. The graduates will be able to apply specific program principles to the specification, fabrication, test, operation, or documentation of basic mechanical systems or processes

2. The student will be able to apply his knowledge in Analysis, design, development, implementation, or oversight of more advanced mechanical systems or processes and able to do research with this basic knowledge in engineering.

3. The student will be able to inculcate leadership qualities and grow as a successful entrepreneur and gain understanding of global and contemporary issues related to engineering

R-16

B.E – Mechanical Engineering Department Vision

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Department of Mechanical Engineering
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Department of MechanicalCourse Outcomes

Statements for B.E (Mech) - R22

SNo	Course		Course Outcomes Statements
	Code	Name	
1.	22MT C02	CALCULUS	Apply the Matrix Methods to solve system of linear equations.
			Analyze the geometrical interpretation of Mean value theorems and curvature.
			Determine the extreme values of functions of two variables.
			Find the shape of the curve, surface areas and volumes of revolution.
			Examine the convergence and divergence of infinite Series.
2.	22CY C01	CHEMISTRY	Identify the microscopic chemistry in terms of molecular orbitals, intermolecular forces and rate of chemical reactions.
			Discuss the properties and processes using thermodynamic functions, electrochemical cells and their role in batteries and fuel cells.
			Illustrate the major chemical reactions that are used in the synthesis of organic molecules.
			Classify the various methods used in treatment of water for domestic and industrial use.
			Outline the synthesis of various Engineering materials & Drugs.
3	22EE C01	BASIC ELECTRICAL ENGINEERING	Understand the concepts of Kirchhoff's laws and their application various theorems to get solution of simple dc circuits.
			Predict the steady state response of RLC circuits with AC single phase/three phase supply.
			Infer the basics of single phase transformer.
			Describe the construction, working principle of DC machine and 3-phase Induction motor.
			Acquire the knowledge of electrical wires, cables, earthing, Electrical safety precautions to be followed in electrical installations and electric shock and its safety and energy calculations.
4.	22CS C01	PROGRAMMING FOR PROBLEM SOLVING	Understand real world problems and develop computer solutions for those problems.
			Understand the basics of Python.
			Apply Python for solving basic programming solutions.
			Create algorithms/flowcharts for solving real-time problems.
			Build and manage dictionaries to manage data.
			Handle data using files
5.	22CY C02	CHEMISTRY LAB	Identify the basic chemical methods to analyse the substances quantitatively & qualitatively.
			Estimate the amount of chemical substances by volumetric analysis.
			Determine the rate constants of reactions from concentration of reactants/ products as a function of time.
			Calculate the concentration and amount of various substances using instrumental techniques.
			Develop the basic drug molecules and polymeric compounds.
6.	22MB C02	COMMUNITY ENGAGEMENT	Gain an understanding of Rural life, Culture and Social realities.
			Develop a sense of empathy and bonds of mutuality with Local Communities.
			Appreciate significant contributions of Local communities to Indian Society and Economy.
			Exhibit the knowledge of Rural Institutions and contributing to Community's Socio-Economic improvements.
			Utilise the opportunities provided by Rural Development Programmes.

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7.	22CS C02	PROBLEM SOLVING AND PROGRAMMING LAB	Understand various Python program development Environments Demonstrate the concepts of Python. Implement algorithms/flowcharts using Python to solve real-world problems. Build and manage dictionaries to manage data. Write Python functions to facilitate code reuse. Use Python to handle files and memory.
8.	22ME C37	ROBOTICS AND DRONES LAB	Demonstrate knowledge of the relationship between mechanical structures of robotics and their operational workspace characteristics Understand mechanical components, motors, sensors and electronic circuits of robots and build robots. Demonstrate knowledge of robot controllers. Use Linux environment for robotic programming. Write Python scripts to control robots using Python and Open CV.
9.	22EE C02	BASIC ELECTRICAL ENGINEERING LAB	Comprehend the circuit analysis techniques using various circuital laws and theorems. Analyse the parameters of the given coil and measurement of power and energy in AC circuits Determine the turns ration/performance parameters of single-phase transformer Infer the characteristics of DC shunt motor different tests. Illustrate different parts and their function of electrical components, equipment and machines
10.	22MT C05	VECTOR CALCULUS AND DIFFERENTIAL EQUATIONS	Apply the vector differential operators to Scalars and Vector functions. Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems. Calculate the solutions of first order linear differential equations. Solve higher order linear differential equations. Find solution of algebraic, transcendental and ODE by Numerical Methods
11.	22PY C05	MECHANICS AND MATERIALS SCIENCE	Compare the various types of oscillations Demonstrate rotational motion of rigid body Classify different types of crystals and their imperfections Identify magnetic and dielectric materials for engineering applications Make use of lasers and superconductors in technological applications
12.	22CE C01	ENGINEERING MECHANICS	Calculate the components and resultant of coplanar forces system and Draw free body diagrams to analyze the forces in the given structure Understand the mechanism of friction and can solve friction problems Analyse simple trusses for forces in various members of a truss. Determine the centroid of plane areas, composite areas and centres of gravity of bodies. Determine moments of inertia, product of inertia of plane and composite areas and mass moments of inertia of elementary bodies
13.	22EG C01	ENGLISH	Illustrate the nature, process and types of communication and communicate effectively without barriers. Construct and compose coherent paragraphs, emails and adhering to appropriate mobile etiquette. Apply techniques of precision to write a précis and formal letters by using acceptable grammar and appropriate vocabulary. Distinguish formal from informal reports and demonstrate advanced writing skills by drafting formal reports. Critique passages by applying effective reading techniques

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14.	22PYC08	MECHANICS AND MATERIALS SCIENCE LABORATORY	Estimate the error in an experimental measurement
			Make use of lasers and optical fibers in engineering applications
			Recall the physical properties of dielectrics and magnetic materials
			Find the mechanical properties of solids and viscosity of liquids
			Demonstrate the motion of electrons in electric and magnetic fields
15.	22EGC02	ENGLISH LAB	Define the speech sounds in English and understand the nuances of pronunciation in English
			Apply stress correctly and speak with the proper tone, intonation and rhythm.
			Analyze listening comprehension texts to enhance their listening skills.
			Determine the context and speak appropriately in various situations
			Design and present effective posters while working in teams ,and discuss and participate in Group discussions.
16.	22MEC01	CAD AND DRAFTING	Become conversant with appropriate use of CAD software for drafting.
			Recognize BIS, ISO Standards and conventions in Engineering Drafting.
			Construct the projections of points, lines, planes, solids
			Analyse the internal details of solids through sectional views
			Create an isometric projections and views
17.	22MEC38	DIGITAL FABRICATION LAB	Understand safety measures to be followed in workshop to avoid accidents.
			Identify various tools used in fitting, carpentry, tin smithy, house wiring, welding, casting and machining processes.
			Make a given model by using workshop trades including fitting, carpentry, tinsmithy and House wiring.
			Perform various operations in welding, machining and casting processes.
			Conceptualize and produce simple device/mechanism of their choice
18.	22MTC10	PARTIAL DIFFERENTIAL EQUATIONS AND STATISTICS	Calculate the Euler's coefficients for Fourier series expansion of a function.
			Solve Linear and Non-Linear PDE's.
			Solve One-Dimension Wave and Heat equations and Two Dimension Laplace equation.
			Use the basic probability for fitting the Random phenomenon.
			Analyze the random fluctuations of probability distribution and Principles of Least Squares approximationsfor the given data.
19.	22CSC35	DATA STRUCTURES USING PYTHON	Understand classes, objects, linear data structures, nonlinear data structures, time complexity.
			Use python packages to work with datasets.
			Implement sorting, searching algorithms and analyse their performance.
			Build solutions for problems using linear, nonlinear data structures and hashing.
			Apply pattern matching algorithms for real time problems.
22.	22MEC02	MATERIAL SCIENCE AND METALLURGY	Understand the crystal structure and various imperfections of crystals.
			Related material failure by fatigue and creep.
			Interpret phase diagrams and TTT diagrams.
			Understand the methods of improvement of mechanical properties by various heat treatment operations.
			Differentiate the properties and applications of ceramics, polymers and composites.

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21.	22MEC03	STRENGTH OF MATERIALS	Determine stresses and strains in members subjected to axial loads and temperature changes.
			Draw shear force, bending moment diagrams for different types of beams and calculate stresses and strains due to simple bending.
			Determine slope and deflection for various configurations of beams using different methods, analyze stress, strain and deflection due to torsion in circular members.
			Analyze shear stress distribution in different sections of beams and find out principal stresses and strains.
			Find out stresses and strains in thin, thick cylindrical shells and able to calculate critical buckling loads in columns and struts.
22.	22MEC04	THERMODYNAMICS	Understand the concepts of system, thermodynamic properties, thermodynamic equilibrium and various methods of pressure and temperature measurements.
			Apply the first law of thermodynamics to various thermodynamic processes along with the applications of steady flow energy equation.
			Apply the Second law of thermodynamics to analyze heat pumps, refrigerators, heat engines and to evaluate entropy changes.
			Evaluate the properties of pure substances and analyze the performance of steam power cycles.
			Evaluate performance of air standard cycles and analyze the properties of gas mixtures.
23.	22MEC05	HEAT TRANSFER	Estimate heat transfer through composite slabs and cylinders with and without heat generation.
			Estimate the heat transfer through rectangular straight and pin fins; and temperature distribution in unsteady state conduction.
			Estimate the heat transfer in case flow over plates, cylinders and flow through tubes.
			Estimate radiation heat exchange between surfaces in different situations and the effect of radiation shield.
			Estimate the effectiveness of heat exchanger by LMTD, NTU methods and acquire knowledge of boiling and condensation phenomenon.
24.	22EEM01	UNIVERSAL HUMAN VALUES-II: UNDERSTANDING HARMONY	Become familiar about themselves, and their surroundings (family, society, nature).
			Develop empathy and respect for diversity by gaining an appreciation for different cultures, perspectives, and identities
			Exhibit responsible and ethical behavior by adhering to principles of integrity, honesty, compassion, and justice.
			Recognize their role as global citizens.
			Exhibit a sense of social responsibility.
25.	22CEM01	ENVIRONMENTAL SCIENCE (MANDATORY COURSE)	Identify the natural resources and realise the importance of water, food, forest, mineral, energy, land resources and effects of over utilisation.
			Understand the concept of ecosystems and realise the importance of interlinking of food chains.
			Contribute for the conservation of bio-diversity.
			Suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
			Follow the environmental ethics and contribute to the mitigation and management of environmental disasters
26.	22MEC06	MATERIAL SCIENCE AND METALLURGY LAB	Identify crystal structure of various metals.
			Measure hardness and can correlate with microstructure.
			Perform a suitable heat treatment operation based on desired properties.
			Underlines the importance of grain size in evaluating the desired mechanical properties.

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			Correlate the heat treatment methods and the mechanical properties obtained.
27.	22MEC07	STRENGTH OF MATERIALS LAB	Draw stress-strain curve for an isotropic material and understand the salient features of it.
			Determine the Young's modulus of various beam materials and leaf spring by conducting load-deflection test.
			Rigidity modulus of a given shaft specimen by torsion test and shear modulus of closely coiled helical spring.
			Evaluate hardness of different materials using different scales
			Find the compressive and crushing strengths of concrete cubes and bricks
28.	22CSC36	DATA STRUCTURES USING PYTHON LAB	Demonstrate Classes, Objects, linear data structures, nonlinear data structures.
			Store, retrieve and visualize datasets using Python built-in packages.
			Evaluate the performance of sorting techniques.
			Build optimal solutions using linear data structures, nonlinear data structures and hashing.
			Apply pattern matching algorithms for real time problems.
29.	22MEC08	HEAT TRANSFER LAB	Determine thermal conductivities, thermal resistances of conducting and insulating materials.
			Determine the experimental value of heat transfer coefficients in natural and forced convection modes and compare the results with analytical values.
			Determine the Stefan-Boltzmann constant and the value of emissivity of a grey plate.
			Calculate the heat transfer coefficient of heat exchanger for various configurations.
			Calculate the heat transfer coefficient in boiling and condensation heat transfer.
30.	22MEI01	MOOCs/TRAINING/INTERNSHIP	Understand Engineer's responsibilities and ethics.
			Use various materials, processes, products and quality control.
			Provide innovative solutions to solve real world problems.
			Acquire knowledge in technical reports writing and presentation.
			Apply technical knowledge to real world industrial/rural situations.
31.	22MEC09	KINEMATICS OF MACHINES	Understand basic elements of mechanisms and their motion characteristics, DOF.
			Analyze Velocity and Acceleration of various mechanisms.
			Understand and Evaluate Principles involved in functioning of pivots, collars, clutches, belts, brakes and dynamometers.
			Design displacement diagrams and cam profile diagram for followers executing different types of motions and various configurations of followers.
			Select gear and gear train depending on application.
32.	22MEC10	APPLIED THERMODYNAMICS	Estimate the power required and efficiency of reciprocating air compressor using the principles of thermodynamics.
			Understand the working principle of I.C engines and their performance evaluation.
			Understand the concepts of normal, abnormal combustion and the functioning of engine systemslike cooling, lubrication and ignition.
			Understand the types of boilers and their performance.

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			Determine the efficiency of Rankine cycle with performance improvement techniques; Understand the nozzle performance and the condition for the maximum discharge.
33.	22MEC11	FLUID MECHANICS AND HYDRAULIC MACHINES	Determine the various properties of fluids
			Understand the laws related to fluid flow and their applications
			Acquire the knowledge of the functionality and performance of reciprocating pumps.
			Acquire knowledge in the functionality, performance and testing of hydraulic turbines
			Estimate the performance and testing of centrifugal pumps
34.	22MEC12	MANUFACTURING PROCESSES	Define various terms related to manufacturing processes
			Demonstrate the understanding of various manufacturing processes
			Solve simple problems such as riser design and sheet metal calculations
			Compare various manufacturing processes
			Choose suitable manufacturing process for a given component
35.	22MEE01	POWER PLANT ENGINEERING	Identify different handling equipment used in steam plant.
			Understand various coal combustion methods.
			Recognize different types of dams, spill ways and hydroelectric power plants.
			Classify nuclear power plants based on moderator and coolant.
			Analyze economics related to power plants and effect of pollutants
36.	22MEE02	PRODUCTION AND OPERATIONS MANAGEMENT	Understand the role of production system and its design in production and operationsmanagement.
			Apply forecasting techniques for predicting demand
			Use aggregate planning, master scheduling and materials requirement planning in aproduction system
			Compare various inventory control techniques used in production system.
			Apply the quality control tools to improve performance of production system
37.	22MEE03	ENTREPRENEURSHIP	Understand the concept and essence of entrepreneurship.
			Identify business opportunities and nature of enterprise.
			Analyze the feasibility of new business plan.
			Apply project management techniques like PERT and CPM for effective planning andexecution of projects.
			Use behavioral, leadership and time management aspects in entrepreneurial journey
38.	22MEE04	MECHATRONICS AND AUTOMATION	Apply the methodology of choosing the suitable sensor for a mechatronics system.
			Select the suitable actuator for various electrical and mechanical systems.
			Design a microcontroller and microprocessor with emphasis on process controllers (P, PD, PI and PID) for a mechatronics system
			Design an automated system for industrial applications.
			Integrate the concepts of AI and IOT while designing a robotic automated system for various industrial applications

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39.	22EGM01	INDIAN CONSTITUTION AND FUNDAMENTAL PRINCIPLES	Understand the history of framing of the Indian Constitution and its features.
			Assess the realization of Fundamental Rights and Directive Principles of State Policy.
			Analyze the challenges to federal system and position of the President and the Prime Minister in the Union Government.
			Underline the role of the Legislature and the Judiciary in Union Government and their mutual relations.
			Evolve the development of the local governments in India and assess the role of Collector in district administration
40.		COMPUTER AIDED MACHINE DRAWING	Understand the representation of materials and conventions used in machine drawing
			Draw the orthographic projections and sectional views of machine parts.
			Draw the different types of fasteners.
			Construct an assembly drawing using part drawings of machine components.
			Represent tolerances and the levels of surface finish of machine elements and prepare the process sheet
41	22MEC14	FLUID MECHANICS AND HYDRAULIC MACHINES LAB	Carry out discharge measurements
			Determine the energy loss in conduits.
			Calculate forces and work done by a jet on fixed or moving, flat and curved blades.
			Demonstrate the characteristics curves of turbines.
			Evaluate the performance characteristics of pumps
42.	22MEC15	MANUFACTURING PROCESSES LAB	Test the moulding sand and analyze the same.
			Test the bead geometry and correlate the results to the input parameters.
			Use TIG, MIG and spot welding machines and experiment with them.
			Test the formability characteristics of a given sheet metal.
			Demonstrate the understanding of various types of dies.
43.	22MEC16	APPLIED THERMODYNAMICS LAB	Evaluate the performance of petrol and diesel engines.
			Estimate the conversion of heat supplied by the fuel to various other forms of energy in an I.C engine.
			Determine the performance of multi stage reciprocating air compressor.
			Determination of fuel properties of liquids fuels
			Determination of performance parameters and pollution levels of an alternative fuel
44.	22MEC17	DYNAMICS OF MACHINES	Apply the concept of dynamically equivalent link and determine the fluctuation of energy forflywheel applications in engines.
			Understand the gyroscopic effects in ships, aero planes and two wheelers and also able to Analyze the characteristics of various centrifugal governors.
			Analyze balancing problems in rotating and reciprocating machinery
			Understand free and forced vibrations of single degree freedom systems
			Understand free and forced vibrations of two-degreefreedom linear and Torsional systems

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45.	22MEC18	METAL CUTTING AND MACHINE TOOL ENGINEERING	Describe tool geometry, select tool material for machining of various materials and identify the types of chips. Calculate cutting forces, MRR, power consumption under different cutting conditions
			Classify the mechanisms of tool wear, estimate tool life using Taylor's equation under various cutting conditions and the application of cutting fluid.
			Identify the basic parts, specifications, operations of various machine tools.
			Describe the finishing and super finishing operations and the framework required.
			Analyze methods of unconventional machining and identify suitable method for a given component and understand jigs & fixtures
46.	22MEC19	DESIGN OF MACHINE ELEMENTS	Understand the standards, codes, various design considerations, failure criteria of members and design for static loads.
			Design machine members subjected to fluctuating and impact loads.
			Recommend suitable shafts, couplings and belt drives for a given application.
			Design and suggest permanent joints for a given application.
			Design of temporary fasteners.
47.	22MEC20	CAD/CAM	Understand the applications of computer in design, manufacturing, and geometric transformation techniques
			Demonstrate the knowledge of mathematical representation of various curves and surfaces and understand the concepts of solid modelling techniques.
			Write the CNC part program for simple components.
			Distinguish various NC systems and demonstrate the fundamentals knowledge of robotics
			Understand the elements of an automated manufacturing environment
48	22MEE05	REFRIGERATION AND AIR CONDITIONING	Distinguish different types of refrigerants and evaluate the performance of different aircraft refrigeration systems
			Analyze the performance of vapour compression refrigeration systems and improvement methods.
			Understand the Vapour absorption, steam-jet and non-conventional refrigeration systems.
			Analyze air-conditioning processes using the principles of Psychrometry.
			Evaluate heating and cooling loads in air-conditioning systems.
49.	22MEE06	ROBOTIC ENGINEERING	Understand the basic components and specifications of the Robots
			Solve the problems of transformations, direct and inverse kinematics of robots
			Analyze forces in links and joints of a robot and find the singularities, Jacobian and trajectoryplanning of a robot for various tasks
			Recommend sensors and controllers for finding position and orientation to take corrective actionbased on feedback
			Design an intelligent robot using machine vision and sensors to perform an assigned task.
50.	22MEE07	ENGINEERING RESEARCH METHODOLOGY	Define research problem
			Review and assess the quality of literature from various sources.
			Understand and develop various research designs.
			Collect and analyze the data using statistical techniques.
			Apply creative thinking and innovative skills.

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51.	22MEE08	PRODUCT DESIGN AND PROCESS PLANNING	Define the needs of the customer while designing a new product or modifying existing product inthecompetitive environment.
			Understand creativity, brainstorming and ergonomic concepts.
			Apply the concept of design for manufacture, assembly, maintenance, reliability and product life cycle in developing a product.
			Implement the Intellectual Property Rights to a new product or a process.
			Evaluate and recommend an effective Process Plan and principles of value engineering to newproduct development.
52.	22CAO01	FOUNDATIONS OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	Enumerate the history and foundations of Artificial Intelligence.
			Apply the basic principles of AI in problem solving.
			Choose the appropriate representation of Knowledge.
			Enumerate the Perspectives and Issues in Machine Learning.
			Identify issues in Decision Tree Learning.
53.	22CSO02	INTRODUCTION TO DATABASE MANAGEMENT SYSTEMS	Understand the fundamental concepts of database and design using ER model.
			Apply SQL to find solutions to basic queries.
			Identify the inference rules for functional dependencies and apply the principles of normal forms to decompose the relations in a database.
			Understand the concepts like data storage, indexing and transaction processing.
			Analyze concurrency control and recovery mechanisms.
54.	22CIO03	BASICS OF CYBER SECURITY	Demonstrate an understanding of cybersecurity by effectively analysing and evaluating the security implications of various scenarios.
			Identify and describe different types of cyber offenses, understand the techniques used by cybercriminals, and analyse the potential impact of these attacks on individuals, organizations, and society.
			Analyse and evaluate the legal framework of cyber laws in India.
			Analyse the significance of digital evidence in cyber forensics.
			Evaluate the organizational implications of cyber security by assessing the costs associated with cybercrimes
55.	22EGO03	INDIAN TRADITIONAL KNOWLEDGE	Understand philosophy of Indian culture.
			Distinguish the Indian languages and literature.
			Learn the philosophy of ancient, medieval, and modern India.
			Acquire the information about the fine arts in India.
			Know the contribution of scientists of different eras.
56.	22MEC21	DYNAMICS AND VIBRATIONS LAB	Analyze the cam profile for different motion characteristics.
			Examine the performance of governors and the gyroscopic effect on vehicles.
			Evaluate the static and dynamic balancing masses in a rotating mass system.
			Determine the natural frequency of different single degree freedom vibrating systems.

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			Determine the natural frequency of two degree freedom vibrating systems
57.	22MEC22	METAL CUTTING AND MACHINE TOOL ENGINEERING LAB	Identify tool geometry and grind to a given tool signature.
			Perform various machining operations to produce components of different shapes and using jigs &fixtures.
			Determine the shear angle at various cutting conditions.
			Evaluate cutting forces using dynamometer, estimate MRR & power consumption under different cutting conditions.
			Plan and create components of utility using various manufacturing facilities in the laboratory.
58.	22MEC23	CAD/CAM LAB	Make use of Apply constraints to assemble the components using CAD software
			Demonstrate the knowledge splines
			Demonstrate the knowledge of surface modelling
			Select tools required for performing specific job on CNC mill and CNC lathe
			Write CNC part program to generate tool path for different machining operations
59.	22EGC03	EMPLOYABILITY SKILLS	Become effective communicators
			Write resumes
			Be assertive and set short term and long term goals
			Make the transition smoothly from campus to work
			Enrich their vocabulary
60.	22MEI02	INDUSTRIAL/RURAL INTERNSHIP	Understand Engineer's responsibilities and ethics
			Use various materials, processes, products and quality control.
			Provide innovative solutions to solve real world problems.
			Acquire knowledge in technical reports writing and presentation
			Apply technical knowledge to real world industrial/rural situations
61.	22MEC24	METROLOGY AND INSTRUMENTATION	Understand the need, accuracy and associated concepts of linear and angular measurements
			Select appropriate gauges for inspection and design
			Calculate surface roughness by using appropriate instruments.
			Analyze and interpret the types of errors, strain measurement and instrument characteristics.
			Evaluate measuring methods and devices for displacement, pressure & temperature.
62.	22MEC25	MACHINE DESIGN	Understand the design procedure of helical and leaf springs under static and fluctuating loads.
			Design the spur and helical gears based on beam strength and wear strength.
			Demonstrate the ability in designing sliding contact bearings & selection of rolling contact bearings.
			Design of IC engine piston, connecting rod and crank shaft.
			Analyze the curved beams and selection of chain drives for a given application
63.	22MEC26	THERMAL TURBO MACHINES	Design various configurations of nozzles and diffusers with the principles of Gas Dynamics.
			Design the ducts for friction with the principles of Fanno Flow.
			Estimate the power required for various types of rotary compressors
			Determine the various efficiencies related to Steam Turbines.

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			Determine the power output of the Gas Turbine and understand the working principle of jet and rocketpropulsion.
64.	22MEC27	FINITE ELEMENT ANALYSIS	Understand FE method for solving field problems using energy formulations.
			Analyze bars, trusses and beams for static and dynamic analysis.
			Formulate 2D structural components using triangular element for plane stress, plane strain and axi-symmetric problems.
			Derive stiffness matrix for 4 node quadrilateral element for static analysis and 3 Delements.
			Solve heat transfer problems and apply finite element analysis software for engineering solutions.
65.	22MEC36	FUNDAMENTALS OF DESIGN THINKING	Understand design thinking and its phases as a tool of innovation
			Empathize on the needs of the users
			Define the problems for stimulating ideation
			Ideate on problems to propose solutions by working as a design thinking team
			Prototype and test the proposed solutions focusing on local or global societal problems
66.	22MEE09	COMPUTATIONAL FLUID DYNAMICS	Describe and develop mathematical models for flow phenomena.
			Apply Finite Difference Method for fluid flow and heat transfer problems Classify PDE for fluid flow and heat transfer applications.
			Use different solvers based on applications
			Solve fluid flow and heat transfer problems using commercial CFD tools for turbulence models
			Formulate numerical equations by Finite Volume Method for fluid flow and heat transfer problems
67.	22MEE10	ADDITIVE MANUFACTURING	Understand the fundamental concepts of Additive manufacturing
			Demonstrate the knowledge of various Additive Manufacturing Processes.
			Analyze preprocessing and identify different post processing techniques in AM
			Demonstrate the design rules for product development through Additive Manufacturing
			Create awareness of Additive manufacturing in various applications.
68.	22MEE11	MODERN MACHINING AND FORMING METHODS	Select the non -conventional machining process for a particular application
			Demonstrate the capability of comparison of various non-conventional machining methods
			Describe the various non-conventional machining processes
			Exhibit the proficiency of selecting working media for various non - conventional machining processes
			Exhibit the basic understanding of non-conventional forming processes
69.	22MEE12	INDUSTRIAL SAFETY AND MAINTENANCE	Identify the causes for industrial accidents and suggest preventive measures.
			Identify the basic tools and requirements of different maintenance procedures.
			Apply different techniques to reduce and prevent Wear and corrosion in Industry.
			Identify different types of faults present in various equipments like machine tools, IC Engines, boilers etc.
			Apply periodic and preventive maintenance techniques as required for industrial equipments like motors, pumps and air compressors and machine tools etc.

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70.	22MEC29	METROLOGY AND INSTRUMENTATION LAB	Measure the linear dimension by using appropriate method & device.
			Demonstrate the knowledge of angular measurements and use measuring instruments as per requirements.
			Determine the gear and screw thread parameters using profile projector and tool makers' microscope.
			Design and test plain limit gauges for a given specimen.
			Evaluate and estimate the measurement of flatness, roundness and surface roughness.
71.	22MEC30	THERMAL ENGINEERING LAB	Determine the overall efficiency of Turbo compressors.
			Evaluate the performance parameters of refrigeration systems.
			Estimation of pressure distribution for convergent and divergent nozzle.
			Measurement of pressure distribution over an airfoil surface using subsonic type wind tunnel.
			Estimation of Lift and Drag forces of aerofoil structure using subsonic type wind tunnel.
72.	22MEC31N	FINITE ELEMENT ANALYSIS LAB	Apply basics of Theory of Elasticity to continuum problems.
			Analyze finite elements for 1D, 2D and 3D structures subjected to linear static analysis.
			Solve heat transfer problems.
			Examine problems of limited complexity in buckling and dynamic analysis.
			Evaluate solutions to practical problems by finite element analysis software.
73.	22MEC35	MINI PROJECT	Analyse and Interpret Literature insights with the purpose of formulating a problem definition.
			Plan, analyze, Design and implement a project.
			Find an optimum solution of problem defined by using latest Technologies.
			Plan to complete the work as a team with passion and focus.
			Prepare and present the Report in the department.
74.	22MEC28	OPERATIONS RESEARCH	Understand the concepts of linear programming problems and Solve
			Solve the given transportation problem.
			Develop optimum pair of operations and resources by using Assignment technique.
			Analyze project management techniques like CPM and PERT to plan and execute projectssuccessfully.
			Apply sequencing and queuing theory concepts for industry applicarions.
75.	22MEE13	AUTOMOBILE ENGINEERING	Identify principal parts of an automobile and its layout.
			Understand the various systems in automobile like engine cooling, lubrication, ignition, electricaland air conditioning systems.
			Understand the various suspension and steering systems.
			Analyze the functioning of drive train, transmission and braking systems.
			Understand the importance of alternative power trains for pollution control.
76.	22MEE14	CONTROL SYSTEMS THEORY	Students should be able apply major equations of linearized models and their transfer function
			Student are learned to apply Final-value Theorem to determine the steady-state response
			Students should be able to understand how to construct Bode and polar plots for transferfunctions
			Students should be able to understand the applications of Nyquist criteria to find Gain and phasemargins.
			Demonstrate the effect of damping on the plant using the DC position control system.

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77.	22MEE15	MECHANICAL VIBRATIONS	Apply Newton's law of motion and energy method to get governing differential equations of vibrating systems.
			Analyze response of machine members in forced vibration with different excitation frequencies, Recommend suitable vibration parameters for isolation and compute critical speeds.
			Analyze mode shape and decoupling of equation of motion for 2 degree of freedom systems.
			Predict natural frequency and mode shape for all continuous systems.
			Understand working principles of vibration measuring instruments.
78.	22MEE16	SUPPLY CHAIN MANAGEMENT	Understand fundamentals of supply chain and its key concepts.
			Design an effective supply chain network.
			Understand the essence of demand and supply and associated gaps.
			Apply inventory management techniques.
			Evaluate pricing and revenue management systems.
79.	22MEE17	RENEWABLE ENERGY SOURCES	Recognise the importance of renewable energy and solar geometry.
			Select the solar collector based on the application.
			Understand the working principles of wind power plants.
			Understand the principles of geothermal and biogas plants.
			Distinguish wave, tidal and OTEC energy.
80.	22MEE18	DIGITAL MANUFACTURING AND INDUSTRY 4.0	Understand the Basics and applications of Digital Manufacturing and Industry 4.0.
			Understand the role of Additive Manufacturing, Virtual prototyping and Reverse Engineering processesand their adaptability to Digital Manufacturing.
			Understand the concepts of digital manufacturing based product life cycle and its management.
			Understand the concept of Industry 4.0 and allied technologies.
			Understand the basics of Internet of things and cloud computing pertaining the fourth industrialrevolution.
81.	22MEE19	COMPOSITE MATERIALS AND TESTING	Understand composite materials, classification, types of matrix and fibre materials.
			Understand types of analyses, stress strain relationships for different materials and characterization of UD lamina.
			Understand the variation of properties with orientation and failure theories of UD lamina.
			Analyze the laminates for stresses and strains using CLT.
			Summarize the various fabrication methods of composite materials and measurements of properties through tests.
82.	22MEE20	PRINCIPLES OF INDUSTRIAL ENGINEERING	Conceptualize the essence of industrial engineering techniques.
			Select and design plant location and layouts.
			Plan, execute and control production related issues.
			Analyze and choose right inventory control techniques.
			Plot control charts and apply quality control tools.
83.	22CHO01	FUEL CELLS AND BATTERIES	Apply know-how of thermodynamics, electrochemistry and principle of fuel cell
			Understand the different types of fuel cell
			Understand the components of hydrogen-based fuel cell
			Explain the application of fuel cell in transport, stationary and portable sector
			Understand the impact of this technology in a global and societal context

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84.	22CSO01	INTRODUCTION TO WEB TECHNOLOGIES	Understand the technologies required for developing web application. Identify and choose HTML tags, CSS and java scripts to develop well-structured and easily maintained web pages. Design and Develop interactive and innovative web pages using various platforms/technologies like HTML, CSS, XML, JAVASCRIPT. Create and deploy web applications in web server by using Django concepts. Evaluate different web applications to implement optimal solutions for real time problems
85.	22ITO02	PRINCIPLES OF INTERNET OF THINGS	Comprehend the terminology, protocols and communication models of IoT. Define the various IoT enabling technologies and differentiate between M2M and IoT. Acquire the basics of Python Scripting Language used in developing IoT applications. Describe the steps involved in IoT system design methodology. Design simple IoT systems using Raspberry Pi board and interfacing sensors with Raspberry Pi.
86.	22EGO01	TECHNICAL WRITING SKILLS	Communicate effectively, without barriers and understand aspects of technical communication. Differentiate between general writing and technical writing and write error free sentences using technology specific words. Apply techniques of writing in business correspondence and in writing articles. Draft technical reports and technical proposals. Prepare agenda and minutes of a meeting and demonstrate effective technical presentation skills.
87.	22MBC01	ENGINEERING ECONOMICS AND ACCOUNTANCY	Apply fundamental knowledge of Managerial Economics concepts and tools. Analyze various aspects of Demand Analysis, Supply and Demand Forecasting. Understand Production and Cost relationships to make best use of resources available. Apply Accountancy Concepts and Conventions and preparation of Final Accounts. Evaluate Capital and Capital Budgeting decision based on any technique.
88.	22MEC32	PROJECT PART – I	Identify a topic in advanced areas of Mechanical / Allied fields of Engineering. Review literature to identify the gaps, define the objectives and scope of the work. Generate innovative ideas for societal benefit and Nation building. Develop prototypes/models, experimental setup and software systems necessary to meet the objectives. Prepare a technical report and present before the departmental committee
89.	22EEO06	WASTE MANAGEMENT	Categorize the waste based on the physical and chemical properties. Explain the Hazardous Waste Management and Treatment process. Illustrate the Environmental Risk Assessment, methods, mitigation and control. Interpret the Biological Treatment of Solid and Hazardous Waste. Identify the waste disposal options, describe the design and construction, Operation, Monitoring, Closure of Landfills.

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90.	22ITO03	INTRODUCTION TO CLOUD COMPUTING	Understand the characteristics and models in Cloud computing.
			Asses Cloud services applications and the challenges associated with Cloud Computing.
			Apply various cloud services and deployment models and virtualization techniques for business.
			Analyze the concepts of cloud storage and demonstrate their use.
			Evaluate various cloud programming models and apply them in virtual office management
91.	22EGO02	GENDER SENSITIZATION	Understand the difference between "Sex" and "Gender" and be able to explain socially constructed theories of identity.
			Recognize shifting definitions of "Man" and "Women" in relation to evolving notions of "Masculinity" and "Femininity".
			Appreciate women's contributions to society historically, culturally and politically.
			Analyze the contemporary system of privilege and oppressions, with special attention to the ways in which gender intersects with race, class, sexuality, ethnicity, ability, religion, and nationality.
			Demonstrate an understanding of personal life, the workplace, the community and active civic engagement through classroom learning
92.	22CIO02	FUNDAMENTALS OF BLOCKCHAIN TECHNOLOGY	Explain the fundamental concepts and principles of blockchain technology.
			Describe the decentralisation and cryptographic primitives.
			Understand bitcoin and its limitations
			Analyse smart contracts and Ethereum blockchain
			Evaluate the potential applications and impact of blockchain technology in different sectors.
93.	22MEC33	TECHINICAL SEMINAR	Identify the recent advances in the field of engineering/technology.
			Develop the skills and expertise in report writing.
			Compile the content and prepare comprehensive report.
			Demonstrate skills required for preparation of a technical report.
			Present technical know-how and professional skills before the committee.
94.	22MEC34	PROJECT PART-II	Summarize the literature review for the identified problem.
			Identify methods and materials to carry out experiments/ develop code/simulation.
			Integrate the methodology and engineering tools adopted for solving the problem.
			Analyze and discuss the results to draw valid conclusions.
			Exhibit knowledge, skill, attitude and technical knowhow in preparing report as per format and presenting as a professional engineer.

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(Autonomous)

Gandipet, Hyderabad -75

Department of MechanicalCourse Outcomes

Statements for B.E (Mech) - R20

SNo	Course		Course Outcomes Statements
	Code	Name	
1.	20MT C05	CALCULUS	Apply the Matrix Methods to solve system of linear equations.
			Analyse the geometrical interpretation of Mean value theorems.
			Determine the extreme values of functions of two variables.
			Examine the convergence and divergence of infinite Series.
			Calculate the Euler's coefficients for Fourier series of a function
2.	20CY C01	CHEMISTRY	Identify the microscopic chemistry in terms of molecular orbitals, intermolecular forces and rate of chemical reactions.
			Discuss the properties and processes using thermodynamic functions, electrochemical cells and their role in batteries and fuel cells.
			Illustrate the major chemical reactions that are used in the synthesis of organic molecules.
			Classify the various methods used in treatment of water for domestic and industrial use.
			Outline the synthesis of various Engineering materials & Drugs.
3.	20CE C01	ENGINEERING MECHANICS – I	Calculate the components and resultant of coplanar forces system.
			Understand free body diagram and apply equilibrium equations to solve for unknown forces.
			Apply concepts of friction for solving engineering problems.
			Analyse simple trusses for forces in various members of a truss.
			Determine centroid for elementary, composite figures and bodies.
4.	20CS C01	PROGRAMMING FOR PROBLEM SOLVING	Identify and understand the computing environments for scientific and mathematical problems.
			Formulate solutions to problems with alternate approaches and represent them using algorithms / Flowcharts.
			Choose data types and control structures to solve mathematical and scientific problem.
			Decompose a problem into modules and use functions to implement the modules.
			Apply arrays, pointers, structures, and unions to solve mathematical and scientific problems.
			Develop applications using file I/O
5.	20CY C02	CHEMISTRY LAB	Identify the basic chemical methods to analyse the substances quantitatively & qualitatively.
			Estimate the amount of chemical substances by volumetric analysis.
			Determine the rate constants of reactions from concentration of reactants/ products as a function of time
			Calculate the concentration and amount of various substances using instrumental techniques.
			Develop the basic drug molecules and polymeric compounds.
6.	20CS C02	PROGRAMMING FOR PROBLEM SOLVING LAB	Identify and setup program development environment.
			Design and test programs to solve mathematical and scientific problems
			Identify and rectify the syntax errors and debug program for semantic errors
			Implement modular programs using functions
			Represent data in arrays, pointers, structures and manipulate them through a program

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			Create, read, and write to and from simple text files.
7.	20ME C02	WORKSHOP / MANUFACTURING PRACTICE	Understand safety measures to be followed in workshop to avoid accidents.
			Identify various tools used in fitting, carpentry, tin smithy, house wiring, welding, casting and machining processes.
			Make a given model by using workshop trades including fitting, carpentry, tinsmithy and House wiring.
			Perform various operations in welding, machining and casting processes.
			Conceptualize and produce simple device/mechanism of their choice.
8.	20ME C03	ENGINEERING EXPLORATION	Understand the role of an engineer as a problem solver.
			Identify multi-disciplinary approaches in solving an engineering problem.
			Build simple systems using engineering design process.
			Analyze engineering solutions from ethical and sustainability perspectives.
			Use basics of engineering project management skills in doing projects.
9.	20MT C06	VECTOR CALCULUS AND DIFFERENTIAL EQUATIONS	Calculate the areas and volumes.
			Apply the vector differential operators to Scalars and Vector functions.
			Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems.
			Calculate the solutions of first order linear differential equations.
			Solve higher order linear differential equations.
10.	20EG C01	ENGLISH	Illustrate the nature, process and types of communication and communicate effectively without barriers.
			Construct and compose coherent paragraphs, emails and adhering to appropriate mobile etiquette.
			Apply techniques of precision to write a précis and formal letters by using acceptable grammar and appropriate vocabulary.
			Distinguish formal from informal reports and demonstrate advanced writing skills by drafting formal reports.
			Critique passages by applying effective reading techniques
11.	20PY C05	MECHANICS AND MATERIALS SCIENCE	Compare the various types of oscillations
			Demonstrate rotational motion of rigid body
			Classify different types of crystals and their imperfections
			Identify magnetic and dielectric materials for engineering applications
			Make use of lasers and superconductors in technological applications
12.	20EEC01	BASIC ELECTRICALENGINEERING	Understand the concepts of Kirchhoff's laws and to apply them in superposition, Thevenin's and Norton's theorems to get the solution of simple dc circuits
			Obtain the steady state response of RLC circuits with AC input and to acquire the basics, relationship between voltage and current in three phase circuits.
			Understand the principle of operation, the EMF and torque equations and classification of AC and DC machines
			Explain various tests and speed control methods to determine the characteristic of DC and AC machines.
			Acquire the knowledge of electrical wiring, types of wires, cables used and Electrical safety precautions to be followed in electrical installations.
			Recognize importance of earthing, methods of earthing and various low-tension switchgear used in electrical installations

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13.	20EG C02	ENGLISH LAB	Define the speech sounds in English and understand the nuances of pronunciation in English
			Apply stress correctly and speak with the proper tone, intonation and rhythm.
			Analyze IELTS and TOEFL listening comprehension texts to enhance their listening skills.
			Determine the context and speak appropriately in various situations.
			Design and present effective posters while working in teams ,and discuss and participate in Group discussions.
14.	20PY C08	MECHANICS AND MATERIALS SCIENCELAB	Estimate the error in an experimental measurement
			Make use of lasers and optical fibers in engineering applications
			Recall the physical properties of dielectrics and magnetic materials
			Find the mechanical properties of solids and viscosity of liquids
			Demonstrate the motion of electrons in electric and magnetic fields
15.	20EE C02	BASIC ELECTRICAL ENGINEERING LAB	Get an exposure to common electrical components, their ratings and basic electrical measuring equipment.
			Make electrical connections by wires of appropriate ratings and able to measure electric power and energy.
			Comprehend the circuit analysis techniques using various circuital laws and theorems.
			Determine the parameters of the given coil and calculate the time response of RL & RC series circuits.
			Recognize the basic characteristics of transformer and components of switchgear.
			Understand the basic characteristics of dc and ac machine by conducting different types of tests on them.
16.	20ME C01	CAD AND DRAFTING	Become conversant with appropriate use of CAD software for drafting
			Recognize BIS, ISO Standards and conventions in Engineering Drafting.
			Construct the projections of points, lines, planes, solids
			Analyse the internal details of solids through sectional views
			Create an isometric projections and views
17.	20MBC02	COMMUNITY ENGAGEMENT	Gain an understanding of Rural life, Culture and Social realities.
			Develop a sense of empathy and bonds of mutuality with Local Communities.
			Appreciate significant contributions of Local communities to Indian Society and Economy.
			Exhibit the knowledge of Rural Institutions and contributing to Community's Socio-Economic improvements.
			Utilise the opportunities provided by Rural Development Programmes.
18.	20ME C16	DYNAMICS OF MACHINES	Apply the concept of dynamically equivalent link and determine the fluctuation of energy for flywheel applications in engines and punching presses.
			Understand the gyroscopic effects in ships, aero planes and road vehicles.
			Analyze the characteristics of various centrifugal governors.
			Analyze balancing problems in rotating and reciprocating machinery.
			Understand free and forced vibrations of single degree freedom systems and two-degree freedom linear systems.

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19.	20ME C17	APPLIED THERMODYNAMICS AND HEAT TRANSFER	Estimate the power required and efficiency of reciprocating air compressor using the principles of thermodynamics.
			Understand the working principle of I.C engines and evaluate the performance of I.C. engines.
			Understand the concepts of normal, abnormal combustion and the functioning of engine systems like cooling, lubrication and ignition.
			Estimate the heat transfer through composite slabs, composite cylinders and understand the dimensionless numbers used in convection.
			Understand the basic principles of heat exchangers, radiation, boiling and condensation.
20.	20ME C18	DESIGN OF MACHINE ELEMENTS	Understand the standards, codes, various design considerations, failure criteria of members and design for static loads.
			Design machine members subjected to fluctuating and impact loads.
			Recommend suitable shafts, couplings and belt drives for a given application.
			Design and suggest permanent joints for a given application.
			Design of temporary fasteners.
21.	20ME C19	CAD/CAM	Understand the applications of computer in design, manufacturing, and geometric transformation techniques.
			Demonstrate the knowledge of mathematical representation of various curves and surfaces and to model engineering components using solid modelling techniques.
			Distinguish various NC systems and write the CNC part program for simple components.
			Demonstrate the fundamentals knowledge of robotics.
			Understand the elements of a modern manufacturing environment.
20.	20ME E05	REFRIGERATION AND AIR CONDITIONING	Distinguish different types of refrigerants and evaluate the performance of different aircraft refrigeration systems.
			Analyze the performance of vapour compression refrigeration systems and improvement methods.
			Understand the Vapour absorption, steam-jet and non-conventional refrigeration systems.
			Analyze air-conditioning processes using the principles of Psychrometry.
			Evaluate heating and cooling loads in air-conditioning systems.
23.	20ME E06	ROBOTIC ENGINEERING	Understand the basic components and specifications of the Robots.
			Solve the problems of transformations, direct and inverse kinematics of robots .
			Analyze forces in links and joints of a robot and find the singularities, Jacobian and trajectory planning of a robot for various tasks.
			Recommend sensors and controllers for finding position and orientation to take corrective action based on feedback.
			Design an intelligent robot using machine vision and sensors to perform an assigned task.
24.	20MEE07	RESEARCH METHODOLOGY AND INNOVATION	Define research problem.
			Review and assess the quality of literature from various sources.
			Understand and develop various research designs.
			Collect and analyze the data using statistical techniques.
			Apply creative thinking and innovative skills in research.
25.	20ME E08	PRODUCT DESIGN AND PROCESS PLANNING	Define the needs of the customer while designing a new product or modifying existing product in the competitive environment.
			Understand creativity, brainstorming and ergonomic concepts.
			Apply the concept of design for manufacture, assembly, maintenance, reliability and product life cycle in developing a product.
			Implement the Intellectual Property Rights to a new product or a process.
			Evaluate and recommend an effective Process Plan and principles of

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			value engineering to new product development.
26.	20ITO01	OBJECT ORIENTED PROGRAMMING USING JAVA	To understand fundamentals of object-oriented programming paradigm.
			To apply knowledge of string handling, interfaces, packages and inner classes.
			To implement Exception handling mechanisms and Multithreading.
			To demonstrate knowledge on collection framework, stream classes.
			To develop web applications using Servlets and JSP.
27.	20CSO09	FUNDAMENTALS OF DATABASE MANAGEMENT SYSTEMS	Classify the difference between FMS and DBMS; describe the roles of different users and the structure of the DBMS. Design the database logically using ER modeling
			Outline the schema of the relational database and key constraints. Develop queries using DDL, DML and DCL of SQL.
			Identify the inference rules for functional dependencies and apply the principles of normal forms to decompose the relations in a database.
			Summarize the concepts of dense, sparse, ISAM and B+ tree indexing and get familiar with states and properties of transactions.
			Interpret the locking, time stamp, graph and validation-based protocols for concurrency control.
			Summarize log-based recovery techniques to increase the robustness of the database, identify to resolve the deadlocks in the transactions.
28	20EEO03	ENERGY AUDITING	Know the current energy scenario and various energy sources
			Understand the concepts of energy auditing.
			Evaluate the performance of existing engineering systems
			Explore the methods of improving energy efficiency in different engineering systems
			Design different energy efficient appliances.
29.	20BTO01	BIOLOGY FOR ENGINEERS	Appraise the values of Biology in classical and modern time
			Develop modern instruments related to skeletal, nervous, and circulatory system.
			Apply concept of respiratory, excretory, and assisted reproductive process for developing related instruments.
			Illustrate the modern interdisciplinary tools related to medical biotechnology and bioremediation.
			Summarize the basic knowledge about nucleic acids, proteins and their sequencing.
30.	20MTO04B	NUMERICAL METHODS	Apply numerical methods to find roots of algebraic and transcendental equations.
			Derive the solutions when system of equations has more than two unknowns and learn to reduce the instability of equations.
			Apply interpolation and extrapolation techniques to fit the numerical tabulated data.
			Find numerical integration by using Simpson's 1/3 rd, 3/8thand Weddle's rules.
			Apply numerical methods to Solve ODE using Taylor, Picard's , Euler's, modified Euler's, Rungakutta methods.
31.	20MEC20	DYNAMICS AND VIBRATIONS LAB	Analyze the cam profile for different motion characteristics.
			Examine the performance of governors and the gyroscopic effect on vehicles.
			Evaluate the static and dynamic balancing masses in a rotating mass system.
			Determine the natural frequency of different single degree freedom vibrating systems
			Determine the natural frequency of two degree freedom vibrating systems

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32.	20ME C21	APPLIED THERMODYNAMICS AND HEAT TRANSFER LAB	Evaluate the performance of petrol and diesel engines.
			Estimate the conversion of heat supplied by the fuel to various other forms of energy in an I.C engine.
			Determine the performance of multi stage reciprocating air compressor.
			Estimate the thermal conductivity of a material and the value of convection heat transfer coefficient under natural/forced convection.
			Determine the Stefan - Boltzmann constant, emissivity of grey plate and overall heat transfer coefficient of heat exchanger.
33.	20ME C20	CAD/CAM LAB	Make use of appropriate features to generate 3D model using CAD software
			Apply constraints to assemble the components
			Demonstrate the knowledge splines and surface modelling
			Select tools required for performing specific job on CNC mill and CNC lathe
			Write CNC part program to generate tool path for different machining operations
34.	20ME C23	METROLOGY AND INSTRUMENTATION	Understand the need, accuracy and associated concepts of linear and angular measurements.
			Select appropriate gauges for inspection and design.
			Calculate surface roughness by using appropriate instruments.
			Analyze and interpret the types of errors, strain measurement and instrument characteristics.
			Evaluate measuring methods and devices for displacement, pressure & temperature.
35.	20ME C24	MACHINE DESIGN	Understand the design procedure of helical, leaf springs under static and fluctuating loads.
			Design the spur, helical and bevel gears based on beam strength and wear strength.
			Demonstrate the ability in designing sliding contact bearings & selection of rolling contact bearings.
			Design of IC engine piston, connecting rod and crank shaft.
			Analyze the curved beams and selection of chain drives for a given application.
36.	20ME C25	THERMAL TURBO MACHINES	Design various configurations of nozzles and diffusers with the principles of Gas Dynamics.
			Design the ducts for friction with the principles of Fanno Flow.
			Estimate the power required for various types of rotary compressors.
			Determine the various efficiencies related to Steam Turbines.
			Determine the power output of the Gas Turbine and understand the working principle of jet and rocket propulsion.
37.	20ME C26	FINITE ELEMENT ANALYSIS	Understand FE method for solving field problems using energy formulations.
			Analyze bars, trusses, beams and circular shafts for static and dynamic analysis.
			Formulate 2D structural components using triangular element for plane stress, plane strain and axi- Symmetric problems.
			Derive stiffness matrix for 4 node quadrilateral isoparametric element for static analysis and 3 D elements.
			Solve heat transfer problems and apply finite element analysis software for engineering solutions.
38.	20ME E09	COMPUTATIONAL FLUID DYNAMICS	Describe and develop mathematical models for flow phenomena.
			Apply Finite Difference Method for fluid flow and heat transfer problems Classify PDE for fluid flow and heat transfer applications.
			Use different solvers based on applications
			Solve fluid flow and heat transfer problems using commercial CFD tools for turbulence models

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			Formulate numerical equations by Finite Volume Method for fluid flow and heat transfer problems
39.	20ME E10	ADDITIVE MANUFACTURING	Understand the fundamental concepts of Additive manufacturing
			Demonstrate the knowledge of various Additive Manufacturing Processes.
			Analyze preprocessing and identify different post processing techniques in AM
			Demonstrate the design rules for product development through Additive manufacturing.
			Create awareness of Additive manufacturing in various applications.
40.	20ME E11	OPERATIONS RESEARCH	Understand the concepts of linear programming problems and Solve.
			Solve the given transportation problem.
			Develop optimum pair of operations and resources by using Assignment technique.
			Analyze project management techniques like CPM and PERT to plan and execute projects successfully.
			Apply sequencing and queuing theory concepts for industry applications.
41.	20ME E12	INDUTRIAL SAFETY AND MAINTENANCE	Identify the causes for industrial accidents and suggest preventive measures.
			Identify the basic tools and requirements of different maintenance procedures.
			Apply different techniques to reduce and prevent Wear and corrosion in Industry.
			Identify different types of faults present in various equipments like machine tools, IC Engines, boilers etc.
			Apply periodic and preventive maintenance techniques as required for industrial equipments like motors, pumps and air compressors and machine tools etc.
42.	20ME C27	METROLOGY AND INSTRUMENTATION LAB	Measure the linear dimension by using appropriate method & device.
			Demonstrate the knowledge of angular measurements and use measuring instruments as per requirements
			Determine the gear and screw thread parameters using profile projector and tool makers' microscope.
			Design and test plain limit gauges for a given specimen.
			Evaluate and estimate the measurement of flatness, roundness and surface roughness.
43.	20ME C28	MACHINE DRAWING LAB	Understand the importance and need of machine drawing in industries.
			Model different machine components using CAD software.
			Draw a detailed dra.
			wing of a component to facilitate its manufacture.
			Analyze aspects of orthographic views in the preparation of the part/assembly drawings.
			Identify the sequence of steps to assemble the machine/system components
44.	20ME C29	PRODUCTION DRAWING LAB	Interpret the working drawing/ industrial blueprint of various components.
			Identify the different parts of the object with dimensional tolerances
			Create the various part drawings using solid modelling package
			Use the various functions of modelling soft ware: annotations, sheet making etc.
			Prepare Bill of materials for assembly and process sheet in manufacturing industry.

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45.	20ME C30	THERMAL ENGINEERING LAB	Determine thermal conductivity of a metal rod and critical heat flux of a copper wire.
			Estimate the convective heat transfer coefficients for phase change heat transfer and effectiveness of cross flow heat exchanger.
			Determine the overall efficiency of centrifugal/axial-flow compressor.
			Study of COP of refrigeration/air conditioning tutor.
			Determine the - pressure distribution in a nozzle/cylinder/aero-foil; lift and drag forces for different geometrical profiles.
46.	20ME C31	FINITE ELEMENT ANALYSIS LAB	Apply basics of Theory of Elasticity to continuum problems.
			Analyze finite elements like 1D, 2D and 3D structures for linear static analysis.
			Solve heat transfer problems.
			Examine problems of limited complexity in buckling and dynamic analysis.
			Evaluate solutions to practical problems by finite element software.
47.	20EG CO3	EMPLOYABILITY SKILLS	Become effective communicators, participate in group discussions with confidence and be able to make presentations in a professional context.
			Write resumes, prepare and face interviews confidently.
			Be assertive and set short term and long term goals, learn to mange time effectively and deal with stress.
			Make the transition smoothly from campus to work, use media with etiquette and understand the academic ethics.
			Enrich their vocabulary, frame accurate sentences and comprehend passages confidently.
48.	20ME E13	AUTOMOBILE ENGINEERING	Identify principal parts of an automobile and its layout.
			Understand the various systems in automobile like engine cooling, lubrication, ignition, electrical and air conditioning systems with the principles of thermodynamics.
			Understand the various suspension and steering systems.
			Analyse the functioning of drive train, transmission and braking systems.
			Understand the importance of alternative power trains for pollution control.
49.	20ME E14	CONTROL SYSTEMS THEORY	Understand control system, modeling and transfer functions of different systems.
			Apply the concept of block diagram and signal flow graphs to different systems.
			Differentiate between time domain and frequency domain techniques.
			Examine the stability of a system using different approaches.
			Analyze the system in state space and to find out the controllability and observability.
50.	20ME E15	MECHANICAL VIBRATIONS	Apply Newton's law of motion and energy method to get governing differential equations of vibrating systems.
			Analyze response of machine members in forced vibration with different excitation frequencies, Recommend suitable vibration parameters for isolation and compute critical speeds.
			Analyze mode shape and decoupling of equation of motion for 2 degree of freedom systems.
			Predict natural frequency and mode shape for all continuous systems.
			Understand working principles of vibration measuring instruments.
51.	20MEE16	SUPPLY CHAIN MANAGEMENT	Understand fundamentals of supply chain and its key concepts.
			Design an effective supply chain network.
			Understand the essence of demand and supply and associated gaps.
			Apply inventory management techniques.
			Evaluate pricing and revenue management systems.

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52.	20ME E17	RENEWABLE ENERGY SOURCES	Recognize the importance of renewable energy and solar geometry.
			Select the solar collector based on the application.
			Understand the working principles of wind power plants.
			Understand the principles of geothermal and biogas plants.
			Distinguish wave, tidal and OTEC energy.
53.	20ME E18	DIGITAL MANUFACTURING AND INDUSTRY 4.0	Understand the Basics and applications of Digital Manufacturing and Industry 4.0.
			Understand the role of Additive Manufacturing, Virtual prototyping and Reverse Engineering processes and their adaptability to Digital Manufacturing.
			Understand the concepts of digital manufacturing based product life cycle and its management.
			Understand the concept of Industry 4.0 and allied technologies.
			Understand the basics of Internet of things and cloud computing pertaining the fourth industrial revolution.
54.	20ME E19	COMPOSITE MATERIALS AND TESTING	Understand composite materials, classification, types of matrix and fibre materials.
			Understand types of analyses, stress strain relationships for different materials and characterization of UD lamina.
			Understand the variation of properties with orientation and failure theories of UD lamina.
			Analyze the laminates for stresses and strains using CLT.
			Summarize the various fabrication methods of composite materials and measurements of properties through tests.
55.	20ME E20	BLOCK CHAIN TECHNOLOGY	State the basic concepts and design primitives of blockchain.
			Understand the significance of Consensus mechanisms.
			Understand different types of blockchain.
			Demonstrate the significance of blockchain in financial, supply chain and government sector based use cases.
			Analyze the applications of Blockchain in industry & governance
56.	20CS O05	BASICS OF ARTIFICIAL INTELLIGENCE	Differentiate between a rudimentary Problem and an AI problem, its Characteristics and problem-solving Techniques.
			Compare and contrast the various knowledge representation schemes of AI.
			Appraise knowledge in Uncertainty and Probabilistic reasoning approaches.
			Understand the different learning techniques
			Apply the AI techniques to solve the real-world problems.
57.	20CH O06	FUNDAMENTALS OF FUEL CELLS	Apply know-how of thermodynamics, electro-chemistry and principle of fuel cell.
			Understand the different types of fuel cell.
			Understand the components of hydrogen-based fuel cell.
			Evaluate the performance of fuel cells.
			Explain the application of fuel cell in transport, stationary and portable sector.
			Understand the impact of this technology in a global and societal context.
58.	20CE O02	DISASTER AND RISK REDUCTION MANAGEMENT	Identify and understand the concepts of hazards, causes and impacts of disasters.
			Develop a critical capacity to evaluate the principles and practices of disaster risk reduction and management.
			Develop a deep awareness of disaster resilience, risk mitigation, and recovery policies as they arise from natural hazards around the globe.
			Apply knowledge about existing global frameworks and existing agreements and role of community in successful Disaster Risk Reduction

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			Evaluate DM study including data search, analysis and presentation as a case study.
59.	20EC O05	SYSTEM AUTOMATION AND CONTROL	Understand the features of various automatic and process control systems.
			Define and analyze various measuring parameters in the industry.
			Compare performance of various controllers (P, PD, PI, and PID).
			Illustrate the role of digital computers in automation.
			Develop various robot structures for different applications.
60.	20EG O01	TECHNICAL WRITING SKILLS	Communicate effectively, without barriers and understand aspects of technical communication.
			Differentiate between general writing and technical writing and write error free sentences using technology specific words
			Apply techniques of writing in business correspondence and in writing articles.
			Draft technical reports and technical proposals.
			Prepare agenda and minutes of a meeting and demonstrate effective technical presentation skills.
61.	20IT O02	PRINCIPLES OF INTERNET OF THINGS	Comprehend the terminology, protocols and communication models of IoT.
			Define the various IoT enabling technologies and differentiate between M2M and IoT.
			Acquire the basics of Python Scripting Language used in developing IoT applications.
			Describe the steps involved in IoT system design methodology.
			Design simple IoT systems using Raspberry Pi board and interfacing sensors with Raspberry Pi.
62.	20CSO02	INTRODUCTION TO WEB TECHNOLOGY	Understand the technologies required for developing web application.
			Identify and choose XHTML tags, CSS and java scripts to develop well-structured and easily maintained web pages.
			Design and Develop interactive and innovative web pages using various platforms/technologies like XHTML, CSS, XML, JAVASCRIPT.
			Create and deploy web applications in web server by using server-side programming concepts like PHP
			Build a data driven web site using Databases.
			Evaluate different web applications to implement optimal solutions for real time problems
63.	20EC O04	PRINCIPLES OF EMBEDDED SYSTEMS	Understand hardware and software details of embedded system
			Analyze the architecture and instruction set of embedded processors.
			Develop the embedded system design cycle
			Apply various debugging tools for embedded system applications.
			Design different case studies for embedded applications

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64.	20PY O01	HISTORY OF SCIENCE AND TECHNOLOGY	Demonstrate the process of beginning of science and civilization, knowledge acquisition and philosophical approach of science and its advancements in the Stone Ages and Antiquity period.
			Illustrate the advancements in science and technology in the medieval period across Asia and Arab countries and decline and revival of science in Europe.
			Explain the scientific approach and its advances of the Europeans and how the role of engineer during the industrial revolution and the major advancements.
			Make use of the advancements in the field of science and technology by adopting new philosophies of 19th and first half of 20th century in finding ethical solutions to the societal problems.
			Interpret the changes in specializations of science and the technology and build the relation between information and society from second half of 20th century onwards.
65.	20AD O01	INTRODUCTION TO PYTHON PROGRAMMING	Explore data operations on list, tuple and dictionary in python.
			Understand deployment of models on different datasets.
			Apply supervised, unsupervised, resembling and NLP models on different datasets.
			Perform data analysis using python packages.
			Build and evaluate the models using python programming.
66.	20EG M04	GENDER SENSITIZATION	Understand the difference between "Sex" and "Gender" and be able to explain socially constructed theories of identity.
			Recognize shifting definitions of "Man" and "Women" in relation to evolving notions of "Masculinity" and "Femininity".
			Appreciate women's contributions to society historically, culturally and politically.
			Analyze the contemporary system of privilege and oppressions, with special attention to the ways gender intersects with race, class, sexuality, ethnicity, ability, religion, and nationality.
			Demonstrate an understanding of personal life, the workplace, the community and active civic engagement through classroom learning.
67.	20MB C01	ENGINEERING ECONOMICS AND ACCOUNTANCY	Apply fundamental knowledge of Managerial Economics concepts and tools.
			Analyze various aspects of Demand Analysis, Supply and Demand Forecasting.
			Understand Production and Cost relationships to make best use of resources available.
			Apply Accountancy Concepts and Conventions and preparation of Final Accounts.
			Evaluate Capital and Capital Budgeting decision based on any technique.
68.	20ME C33	PROJECT PART-I	Identify a topic in advanced areas of Mechanical / Allied fields of Engineering.
			Review literature to identify the gaps, define the objectives and scope of the work.
			Generate innovative ideas for societal benefit and Nation building.
			Develop prototypes/models, experimental setup and software systems necessary to meet the objectives.
			Prepare a technical report and present before the departmental committee

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69.	20IT O03	INTRODUCTION TO CLOUD COMPUTING	Understand the characteristics and models in Cloud computing.
			Asses Cloud services applications and the challenges associated with Cloud Computing.
			Apply various cloud services and deployment models and virtualization techniques for business.
			Analyze the concepts of cloud storage and demonstrate their use.
			Evaluate various cloud programming models and apply them in virtual office management.
70.	20CS O08	BASICS OF MACHINE LEARNING	Define the basic concepts related to Python and Machine Learning
			Describe the feature engineering methods, regression techniques and classification methods
			Apply Python packages for data visualization, text and time series data analysis using NLP toolkit
			Evaluate and interpret the results of the various machine learning techniques
			Solve real world problems using deep learning framework.
71.	20EC O06	MEMS AND ITS APPLICATIONS	Understand various materials used for MEMS
			Design the micro devices and systems using the MEMS fabrication process.
			Analyze the operation of different Sensors and Actuators.
			Interpret the micro devices and systems using Polymer MEMs.
			Apply different MEMS devices in various disciplines.
72.	20EE O05	WASTE MANAGEMENT	Categorize the waste based on the physical and chemical properties.
			Explain the Hazardous Waste Management and Treatment process.
			Illustrate the Environmental Risk Assessment, methods, mitigation and control.
			Interpret the Biological Treatment of Solid and Hazardous Waste.
			Identify the waste disposal options, describe the design and construction, Operation, Monitoring, Closure of Landfills
73.	20BT O02	BIOMATERIALS FOR ENGINEERS	Explain types and properties of Biomaterials.
			Compare the techniques for manufacture of metallic Biomaterials and their use in health care industry.
			Outline the physiological properties and various techniques for manufacture of ceramic biomaterials.
			Illustrate the preparation of polymer and composite Biomaterials.
			Apply the different type of Biomaterials in health industry.
74.	20ME C34	TECHNICAL SEMINAR	Identify the recent advances in the field of engineering/technology.
			Develop the skills and expertise in report writing.
			Compile the content and prepare comprehensive report.
			Demonstrate skills required for preparation of a technical report.
			Present technical know-how and professional skills before the committee.
75.	20ME C35	PROJECT PART-2	Summarize the literature review for the identified problem.
			Identify methods and materials to carry out experiments/ develop code/simulation.
			Integrate the methodology and engineering tools adopted for solving the problem.
			Analyze and discuss the results to draw valid conclusions.
			Exhibit knowledge, skill, attitude and technical knowhow in preparing report as per format and presenting as a professional engineer.

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