DEPARTMENT OF MECHANICAL ENGINEERING

Vision

To develop proficient engineering graduates having excellence and capability to deal with the fundamentals / challenges by imparting quality technical education in the field of Mechanical Engineering.

Mission

To enhance the knowledge and skills with quality education in Mechanical Engineering discipline in a progressive academic to contribute for the development of society and nation.

Program Outcomes

PO1 - Apply basic knowledge in mechanical engineering
PO2 - An ability to use the techniques, skills and modern engineering tools necessary for engineering practices.
PO3 - Design mechanical systems and processes that meet desired specification and requirements
PO4 - Identify, formulate and solve mechanical engineering Problems.
PO5 - Understand and demonstrate and ethical responsibilities
PO6 - Communicate effectively in both verbal and written form in English
PO7 - Understand the impact of engineering advances in society and demonstrate awareness of contemporary issues
PO8 - Apply engineering solutions in global societal contexts
PO9 - Coordinate, organize, monitor and control mechanical engineering related project /task
PO10 - An ability function on multi-disciplinary teams

Program Educational Objectives (PEOs)

PEO1 - To train the stakeholders (Students) with sufficient and engineering knowledge in the domain of Mechanical Engineering to cope up with the problem associated in design, analysis and production of the innovative products in engineering sector.
PEO2 - To train the stakeholders(Students) with sound base and fundamentals in Engineering Science and Technology for bright carrier in Mechanical Engineering and to prepare themselves for higher studies
PEO3 - To provide soft skills, multi-disciplinary approach and strong ethics values to the stake holders to make them fit in every aspect of the society.
PEO4 - As per the fast changing global Trends and dement to make the students aware and assist for offering employment in various sectors.

Program Specific Outcomes (PSOs)

PSO1 - Students will be able to apply and utilize the acquired mechanical Engineering Knowledge for advancement in social, economic and environmental fields.
PSO2 - Students will be able to apply Knowledge in the field of Engineering Mechanics, thermal. Fluid sciences and manufacturing processes to solve engineering problems by using advanced technology.
PSO3 - Students will be able to apply the principles of design, analysis and implementation of mechanical mechanism/processes which have been learned as a part of the curriculum.

III SEM – Manufacturing Processes Lab

Course Outcomes

CO1	Build a strong understanding of core engineering concepts by analysing, applying, and evaluating branch-specific topics in engineering applications
CO2	Understand the relevance and importance of the different manufacturing techniques and real life application in industry
CO3	Design the gating and riser system needed for casting and requirement to achieves defects free casting
CO4	analyse the welding process behaviour and requirement to achieve sound welded joint while welding different similar and dissimilar engineering material
CO5	Understand the plastic, glass and ceramic processing

List of Experiments

1	Study of Cupola furnace
2	Study of Moulding Techniques
3	Study of Casting Processes
4	Study of Pattern Making
5	Study of Joining Processes
6	Study of Forming Processes
7	Study of Drawing Processes
8	One Job – Pattern Making
9	One Job – Casting
10	One Job – on TIG/MIG/Resistance welding
11	Demonstration on Plastic, Glass and Ceramic Processing (Industrial Visit)

Content beyond the syllabus

1	Alternative Furnace Technologies – Comparison of cupola furnaces with induction furnaces and electric arc furnaces.
2	Laser & Electron Beam Welding – Advanced welding techniques used in aerospace and automotive industries.

III SEM – Machine Drawing and Solid Modelling

Course Outcomes

CO1	Build a solid foundation for interpreting machine drawings, enabling clear and effective communication of engineering designs. Like line, dimension, tolerances, symbols etc.
CO2	Create 2-D detailing, sectional views of machine elements from given isometric view.
CO3	Understand and apply concepts of GD&T for creating part and assembly drawing

List of Experiments

1	Lines & Conventions Of Various Materials
2	Conventional Representation Of Common Features
3	Orthographic Projections
4	Sectional Orthographic Projection
5	Shaft Coupling
6	Assembly Drawing Of Screw Jack.
7	Disassembly Drawing Of Tail Stock
8	Production Drawing And Process Sheet

Content beyond the syllabus

1	CAD Modeling & Drafting: Use of software like AutoCAD, SolidWorks, or CATIA for advanced 2D/3D drafting.
2	3D Printing & Additive Manufacturing Considerations in Drawings (Overhangs, supports, etc.).

IV SEM – Machining Processes Laboratory

Course Outcomes

CO1	Understand basic cutting tools.
CO2	Understand Working of lathe and turning operation
CO3	Demonstrate Shaping and planning operation
CO4	Understand Milling and drilling operation
CO5	Demonstrate Grinding and surface finishing

List of Experiments

1	Study of Single Point Cutting Tool.
2	Study of Various forces on single point cutting tools.
3	Study of multiple point cutting tools (milling, drilling)
4	Study of Lathe Machine.
5	Study of Shaper mechanisms.
6	Study of milling machine
7	One Job on Milling.
8	One Job on Drilling, Boring
9	One Job on Thread Cutting, Taper Turning.
10	One Job on Surface Grinding

Content beyond the syllabus

1	Tool Wear & Failure Analysis – Understanding crater wear, flank wear, and built-up edge (BUE).
2	Cutting Fluid Application & Minimum Quantity Lubrication (MQL) – Sustainable machining practices.

IV SEM – Material Testing Laboratory

Course Outcomes

CO1	Analyze the Microstructure and investigate various properties of ferrorous and Non ferrous Materials. Analyse the stress strain behaviour of materials
CO2	Analyse the effect of tensile, shearing force and can utilized the gained while tackling real life engineering problems for different types of Materials
CO3	Understand Microstructures and their Applications for various uses
CO4	Measure torsional strength, hardness of material
CO5	Analyze the various important concepts learnt while designing components

List of Experiments

1	To study the Metallurgical Microscopes & Preparation of specimen for metallographic examination.
2	Micro-structural examination of different types of Steels
3	Micro-structural study of White Cast Iron and Grey Cast Iron
4	Micro-structural study of Malleable Cast Iron and Nodular Cast Iron
5	Study of Universal Testing Machine
6	Determination of tensile properties of ductile material
7	Determination of properties of brittle material
8	Compression test on materials
9	Shear test on metals
10	Impact test on materials
11	Torsion test of metal shaft
12	Determination of bending strength by deflection of beam
13	Measurement of hardness with the help of Rockwell Hardness Tester
14	Measurement of hardness with the help of Brinell Hardness Tester

Content beyond the syllabus

1	Aluminum & Titanium Alloys – Microstructural Examination & Applications
2	Nondestructive Testing (NDT) – Ultrasonic, Magnetic Particle, & Eddy Current Testing

IV SEM – Computer Programming Laboratory

Course Outcomes

CO1	Understand and explore concepts in basic programming like data types, input/output functions, operators, programming constructs and user defined functions.
CO2	Develop capabilities of writing. „C" programs in optimized, robust and reusable code
CO3	Apply appropriate concepts of data structures like arrays, structures implement programs for various applications

List of Experiments

1	Development of programs in C To find area/surface area, volume for Planes, Solids.(Applications for cost involved for painting surface of any plane(square, rectangular, hexagonal etc), costing based on metal sheet material required for manufacturing cylinder(ends open/closed/one end open), cone, cube etc. with varying quantity of products)
2	Development of programs in C To find Stress with given force and cross sectional area(square, rectangle, circular etc)
3	Development of programs in C To find angular velocities and acceleration of the output and coupler link for four bar chain mechanism.
4	Development of programs in C for given inner, outer radii for single plate clutch and axial force calculate minimum, maximum, and average pressure acting on clutch plate. (or calculating Inner outer radii, width of friction lining, axial force etc. for single/multi plate clutch or similar type of simple calculation programme for block brake.
5	Development of programs in C for Addition, Multiplication Matrices.
6	Development of programs in C for any Numerical methods like Newton Raphson, Gauss- Elimination, Gauss-Jordan, Crout's method and Gauss-Seidel Method. Development of programs in C/C++ for any Numerical methods like Taylor's series method, Runge Kutta method, Euler's modified method, Milne's predictor corrector method, Iterative methods for eigen value & eigen vector determination.
7	Development of programs in C To determine type of flow of fluid(laminar/turbulent/transient) on the basis of Reynolds's Number
8	Development of programs in C To calculate specific density, specific weight, weight if specific gravity is given for liquid

Content beyond the syllabus

1	C Program for Compound Structures: Develop programs for cost estimation of complex structures, like multi-part geometries or hollow sections (like beams, trusses, etc.)
2	Cost Estimation with Optimization: Build a program that calculates the cost based on material usage, then uses optimization methods (like linear programming) to minimize costs for bulk production.

V SEM – Heat Transfer Laboratory

Course Outcomes

CO1	Interpret and determine the heat transfer rates through various cross-sections and mediums in different modes.
CO2	Illustrate, tabulate, analyze experimental data, and draw interpretation and conclusions
CO3	Examine & calculate radiation heat transfer and utilize that knowledge in designing any heat transfer application.
CO4	Understand heat exchanger analysis.
CO5	Interpret and select the proper heat exchangers per system requirements.

List of Experiments

1	To determine the thermal conductivity of insulating material.
2	To determine the thermal conductivity of metal bar.
3	Determination of thermal conductivity of composite wall.
4	Determination of Stefan Boltzmann constant.
5	Determination of heat transfer coefficient in natural convection for vertical tube.
6	To determine heat transfer coefficient in forced convection for fluid flowing through a duct.
7	Determination of temperature distribution & heat transfer rate from fin under free and forced convection.
8	Determination of emissivity of non-black body.
9	To determine the effectiveness of a concentric tube heat exchanger.
10	To determine the critical heat flux.
11	Determination of heat transfer rate in unsteady state heat transfer.
12	To determine the heat transfer coefficient in film wise and drop wise condensation.
13	Determination of performance of shell and tube heat exchanger using computer-based setup,
14	Minimum 2-3 virtual experiment to be conducted.
15	Study of various types of Heat Exchangers.

Content beyond the syllabus

1	Temperature Dependent Thermal Conductivity – Explore how thermal conductivity changes with temperature and how it affects heat transfer.
2	Finite Element Method (FEM) for Heat Transfer – Implement FEM for solving complex heat transfer problems, including temperature distribution and heat flow in irregular geometries.

V SEM – Mechanical Measurement & Metrology Laboratory

Course Outcomes

CO1	Evaluate & perform the instrumentation.
CO2	Make use of the instrumentation for measurement of thermal properties.
CO3	Determine the response from the instruments also can be able to calibrate the instruments.
CO4	Evaluate & calculate the limits and allowances to obtain the proper fit.
CO5	Identify the surface roughness using optical flat.

List of Experiments

1	Static characteristic of at least one Instrument.
2	Static calibration of at least one Instrument.
3	3, 4 & 5.-Measurement of parameters by minimum three different types of Instruments
4	Measurement of Linear, Angular dimensions (Using Vernier, Sine bar, Clinometers)
5	Measurement of Flatness & Straightness.
6	Study and Measurement of Parameters using Toolmaker's microscope
7	Study and Measurement of Parameters using Optical profile projector
8	Use of Optical flat
9	Design of Limit gauge

Content beyond the syllabus

1	Study the differences in accuracy, precision, and usability between digital and analog devices (Vernier calipers, micrometers, and digital gauges).
2	Explore the resolution and sensitivity of different instruments (e.g., digital micrometers, laser displacement sensors) and their impact on measurement accuracy.

VI SEM – Automation In Production Laboratory

Course Outcomes

CO1	Recognize automation, corroborating this knowledge with case studies on automation systems. study and analyze the material handling systems, robots and GT
CO2	Demonstrate NC programming (manual/apt)
CO3	Simulate program on CNC milling/ lathe
CO4	Understand the Work on CNC milling/ lathe

List of Experiments

1	Practice Programming on Manual Part Program
2	Simulation on CNC lathe (at least two Complex Geometric) (May be performed in group)
3	Simulation on CNC milling (at least two Complex Geometries) (May be performed in group}
4	Performance on CNC lathe (at least two Complex Geometric) (May be performed in group).
5	Performance on CNC milling (at least two Complex Geometries) (May be performed in group)
6	Performance/Study Practical on Robot.
7	Part Coding and Group Technology
8	Study of FMS
9	Study of Automated inspection

Content beyond the syllabus

1	Develop and simulate part programs for complex geometries, such as helical shapes, undercuts, or intricate profiles. Consider multi-axis operations like turning and milling in one program.
2	Program and machine parts on a CNC lathe. Start with parts requiring a few operations and gradually move to more complex geometries involving tool changes, threading, and precision finishing.

VI SEM – Energy Conversion Laboratory

Course Outcomes

CO1	Understand and identify the different components of I.C. engine, air compressor and Vapour Compression Refrigeration system (VCRS)
CO2	Demonstrate and determine the performance parameters of I.C. engine and preparation of its Heat balance sheet
CO3	Determine B.E, IP, and F.P. by using Morse Test on Multi cylinder C.I. Engine or S.I. Engine
CO4	Demonstrate and determine the performance parameters of Vapour Compression Refrigeration system.
CO5	Analyse the performance parameters of Multistage reciprocating air compressor

List of Experiments

1	Study and demonstration of Internal Combustion (I.C) engine and its components.
2	Study and demonstration of Valve Timing diagrams for I.C. engine.
3	Study and demonstration of fuel injection systems and ignition systems of I.C. Engines.
4	Performance testing of two stroke / Four stroke Multi cylinder C.I. or S.I. engine
5	Preparation of heat Balance Sheet for C.I. or S.I. engine
6	Performance testing of variable compression ratio engine
7	Morse test on Multi cylinder C.I. or S.I. engine
8	Study & demonstration on household refrigerator.
9	Performance testing of vapour compression refrigeration system
10	Study of vapour absorption refrigeration system
11	Demonstration to study Psychometric Processes on mini-air conditioning tutor.
12	Performance testing of multi stage Reciprocating air compressor
13	Performance testing of Centrifugal or Axial flow air Compressor

Content beyond the syllabus

1	Study the thermodynamic cycles involved in I.C. engines, including the Otto and Diesel cycles. Explore concepts like compression ratio, fuel efficiency, thermal efficiency, and the effects of various factors like engine load and RPM on efficiency.
2	Study the effect of valve timing on the performance of I.C. engines. Learn to simulate valve timing for different operational scenarios (low RPM, high RPM, and high load). Explore modern variable valve timing technologies like VVT-i, VTEC, and VANOS.

VI SEM – Dynamics of Machines Laboratory

Course Outcomes

CO1	Demonstrate the concept of gyroscopic effect through the working model.
CO2	Analyse the performance of mechanisms and Perform dynamic force analysis of linkages and cams.
CO3	Demonstrate record and interpret data of vibration characteristics of mechanical vibratory systems.
CO4	Determine & analysis of brakes, dynamometers and flywheels.
CO5	Identify the importance of safety, team work and effective communication for conduction of activity.

List of Experiments

1	Dynamic balancing of rotating masses (study of wheel balancing machine along with performance by visiting any automobile workshop).
2	Determination of jump speed of a cam follower mechanism
3	Critical speed of shafts.
4	Performance characteristics of Gyroscope.
5	Determination of natural frequency of Free longitudinal vibration of single DOF system
6	Torsional vibration of single and two rotor system.
7	Dynamic force analysis of four bar mechanisms OR Dynamic force analysis of slider crank mechanism.
8	Performance analysis of quick return motion mechanism in a machine tool in college workshop
9	Performance on flywheel of an engine in IC engine laboratory.
10	Performance of dynamometer in IC engine lab
11	Determination of braking efficiency of two wheeled vehicle

Content beyond the syllabus

1	Study the principles of dynamic balancing, which ensures that rotating machinery (like wheels or engines) operates smoothly, preventing excessive wear, vibrations, or failure. Understand the concept of balancing forces and moments.
2	Calculate and determine the jump speed by analyzing the cam profiles, follower motion, and velocity acceleration curves.

VII SEM – Mechatronic Laboratory

Course Outcomes

CO1	Identify and explain various solid state electronic devices, sensors and actuators.
CO2	Describe and demonstrate the conversion of signal from Analog to digital and vice versa.
CO3	Implement ladder logic programming using PLC to develop various mechatronics applications
CO4	Interpret and demonstrate various electro-pneumatic and electro-hydraulic systems using graphical symbols and circuit diagram
CO5	Identify and explain various solid state electronic devices, sensors and actuators.

List of Experiments

1	Identification & study of solid state electronic devices.
2	Identification, study & demonstration of different sensors.
3	Identification, study & demonstration of different actuators.
4	Demonstration of working of various digital to analog and analog to digital Converters.
5	Development of ladder diagram, programming using PLC for any of the following. a) Motor start and stop by using two different sensors. b) Simulation of a pedestrian traffic controller. c) Simulation of four road junction traffic controller. d) Lift/elevator control. e) Washing machine control. f) Tank level control. g) Soft drink vending machine control h) Any other suitable application.
6	Trace, interpret and demonstrate working of electro pneumatic systems.
7	Trace, interpret and demonstrate working of electro hydraulic systems.
8	Demonstration of vibration measurement system using data acquisition system and LabVIEW software.

Content beyond the syllabus

1	Study forward and reverse bias behavior, applications in rectifiers and voltage regulation.
2	Study logic gates, operational amplifiers, voltage regulators, and microcontrollers.

VII SEM – Computer Aided Design Laboratory

Course Outcomes

CO1	Formulate logic in the form of an algorithm to construct geometric entities and generate a computer program for the same.
CO2	Develop finite element model of an engineering problem, apply loading conditions and boundary conditions, and solve it for analysis of its performance in simulated condition using Analysis software
CO3	Formulate the computer program for 2D and 3D Transformation on any object.
CO4	Generate 2-D and 3-D geometric model of Engineering object using construction and modifying commands using CAD software.

List of Experiments

1	2-D Geometric modeling of an Engineering object, demonstrating Boolean operations like add, subtract and PAN, ZOOM, ROTATE commands
2	3-D Geometric Modeling of an Engineering object, demonstrating extrude, revolve and loft commands.
3	Generation of at least two simple solid models showing geometric propertics using any CAD software.
4	Generation of any Assembly model along with animation.
5	Static structural analysis using 1-D bar element by standard FE package.
6	Static structural analysis using 1-D truss element by standard FE package.
7	Static structural analysis using beam element by standard FE package.
8	Programs for generation of entities like Line, Circle, Ellipse using Bressenhams algorithms.
9	Programs for 2-D & 3-D transformations.
10	Generation of Bezier curve in CAD software using parametric equation.
11	Generation of cubic spline curve in CAD software using parametric equation.

Content beyond the syllabus

1	Use CAD software (AutoCAD, SolidWorks, or Fusion 360) to demonstrate these operations with simple shapes (e.g., rectangles, circles, or polygons).
2	Create a 3D model of a simple machine part, like a bracket, by extruding and revolving basic 2D shapes.

VII SEM – Advancement in Automobile Engineering Laboratory

Course Outcomes

CO1	Make students understand the basic concepts, requirement and working of various components of automobile
CO2	Make students understand the assembling and disassembling procedure of Engine clutch, brakes and the process of wheel alignment, balancing and battery testing
CO3	Understand and identify components of transmission system, brakes, steering and suspension systems.
CO4	Explain automotive electronics to students, focusing on the latest advancements in the automotive industry.
CO5	Describe students on the significance of safety considerations in automobiles, as well as the importance of maintenance and overhauling.

List of Experiments

1	To prepare a report on visit to automobile engineering industry service center / any industry related to automobile components or systems.
2	Demonstration and study of Chassis layout and frame used in any one automobile.
3	To assemble and disassemble of single or multi cylinder engine and identify its components
4	To assemble and disassemble multi-plate clutch
5	To assemble and disassemble mechanical brakes and identify its components.
6	To identify battery condition using battery tester and its restoration.
7	To prepare a report on process of wheel alignment and balancing
8	Demonstration and study of air suspension system. Identify its components and study about the functions of each components.
9	Demonstration and study of different types of steering systems
10	Study of heating, ventilation and air conditioning system in a given car
11	To prepare a report on pre-delivery inspection (PDI), free service schedule of a Carwith checklist of work to be carried in PDI. 1^{st},$2^{nd}$and 3^{rd} free service.
12	Detail study of electric vehicle. Identify its components and study about the functions of each components.

Content beyond the syllabus

1	Prepare a report discussing the service center's operations, types of services offered, equipment used, and any key learnings from the visit.
2	Understand the role of air suspension in vehicle performance and comfort, and identify common issues.

VII SEM – Computational Fluid Dynamics Laboratory

Course Outcomes

CO1	Explain the fundamentals of fluid flow and thermal simulations.
CO2	Select different boundary conditions, mesh generation techniques to simulate fluid flow and thermal problem.
CO3	Solve fluid flow and thermal analysis problems using commercial software package for different geometry and configurations.
CO4	Analyse the results obtained using post processing to make meaningful inferences

List of Experiments

1	Flow Analysis over an Air foil.
2	Investigate the convective heat transfer characteristics inside a pipe with a known fluid flow rate and temperature difference.
3	Study the flow behaviour and pressure distribution in a convergent-divergent nozzle to understand the principles of supersonic flow.
4	Simulate the flow around a cylinder and examine the formation of vortex shedding and its effects on drag and lift forces.
5	Evaluate the mixing performance and residence time distribution in a stirred tank reactor under different impeller configurations and rotational speeds.
6	Simulate the aerodynamic behaviour of a simplified car model to analyse drag and lift forces, and identify regions of flow separation.
7	Investigate the heat transfer characteristics and flow patterns in a rectangular enclosure with differentially heated walls, considering natural convection.
8	Analyse the flow rate measurement accuracy of a Venturimeter by evaluating the pressure drop across the device and correlating it with the known flow rates.
9	Study the pressure drop and flow characteristics in a pipe bend to analyse the effects of curvature and investigate secondary flow patterns.
10	Analyse the heat transfer performance and effectiveness of a finned heat exchanger design by considering various fin geometries and flow rates.

Content beyond the syllabus

1	Investigate the effects of pipe material, flow rate, and wall roughness on heat transfer rates.
2	Study the Kármán vortex street phenomenon.

VIII SEM – Finite Element MethodLaboratory

Course Outcomes

CO1	Analyse the finite element problems using commercial software and understand the fundamental use of finite element pre-processor, solver and post-processor.
CO2	Demonstrate the ability to evaluate and interpret Finite Element Analysis results for the design and evaluation of ID and 2D finite element formulations.
CO3	Understand the Finite Element Modelling aspects of the Frequency response problem for solving engineering design problems.

List of Experiments

1	Static structural analysis of Axially loaded bar with 1-D finite elements using standard FEA package.
2	Static structural analysis of bar under the influence of self-weight using I-D finite elements using standard FEA package
3	Static structural analysis of bar under applied torque using 1-D finite elements using standard FEA package.
4	Static structural analysis of 1D truss using standard FEA package
5	Static structural analysis with 2-D Plate (CST) element using standard FEA package.
6	Static structural analysis of a beam under transverse loading using standard FEA package.
7	Dynamic structural analysis to determine natural frequency and mode shapes, using standard FEA package.
8	Thermal analysis to estimate nodal temperatures using standard FEA package.
9	Post-processing techniques used in commercial solvers like Radioss, Optistruct, Ansys.

Content beyond the syllabus

1	Analyzing results in the context of the design objectives (e.g., factor of safety, thermal performance, etc.).
2	Compare results from simulations with analytical solutions (e.g., bending of a beam, truss analysis) to ensure the accuracy of your FEA model.

VIII SEM – Computer Integrated Manufacturing Laboratory

Course Outcomes

CO1	Ability to Recognize automation and CIM, CIM wheel, hardware, software, components of CIM
CO2	Evaluate & apply fundamentals of G.T and FMS
CO3	Evaluate & apply fundamentals of CAPP and CAQC
CO4	Evaluate & develop CNC programs for manufacturing applications

List of Experiments

1	Introduction to CIM. (Product Development Cycle, CIM Wheel)
2	Introduction to NC. (Basic components, classification)
3	Simulation on CNC Lathe & CNC Milling (one program each)
4	Manual Part Programming-Lathe
5	Manual Part Programming-Milling
6	Manual Part Programming by using Sub routine & Canned Cycles
7	Study of CAPP Systems (Retrieval & Generative)
8	Part classification and Coding using G.T.
9	Study of F. M.S
10	Study of different quality measurement tools

Content beyond the syllabus

1	Study the overall architecture of a CIM system, including how various subsystems (e.g., design, manufacturing, inspection, and logistics) are integrated into a seamless workflow.
2	Study how FEA can be used alongside CNC simulations to predict the stresses and strains on parts during machining, improving the part design process.

VIII SEM – Refrigeration and Air Conditioning Laboratory

Course Outcomes

CO1	Evaluate the performance of vapour compression refrigeration systems.
CO2	Analyse the components of refrigeration system and Absorption Refrigeration System.
CO3	Synthesize the concept of compound refrigeration system.
CO4	Understand the maintenance and analysis of refrigeration system.
CO5	Identify the concept of Psychometrics and comfort air conditioning

List of Experiments

1	To perform experiments on vapour compression test rig to determine COP of the system.
2	Detailed study of various refrigerants, their classification, properties and characteristic.
3	Demonstration and Study of the classification, characteristic and applications of various types of Compressor.
4	Demonstration and study of various air-conditioning system.
5	Study and demonstration of various psychometric processes.
6	To perform experiments on Air-conditioning test rig to determine its COP.
7	Demonstration of use of various tools and equipment's used for installation, maintenance & repair of refrigeration systems.
8	Testing and charging of vapour compression refrigeration system.
9	To perform experiments on Air Cooler to obtain its performance
10	Design of Ducts for a 100 bedded Hospital Hotel.
11	HVAC Design and selection of air conditioning system for commercial building, supermarkets, restaurants, laboratory, etc.
12	Report on visit to refrigeration plant/AC plant/cold storage plant.

Content beyond the syllabus

1	Study how magnetocaloric effects are used in refrigeration instead of traditional compressors and refrigerants.
2	Study the phase-out of high-GWP refrigerants like R-134a and R-410A under the Kigali Amendment.

VIII SEM – CNC and Robotics Laboratory

Course Outcomes

CO1	Understand the programming of CNC and Robotic system.
CO2	understand advanced material handling system
CO3	Recognize automation, sensors and controller technology

List of Experiments

1	Performance based on Simulation for lathe
2	Performance based on Simulation for CNC milling
3	Performance based on turning operation on CNC lathe machine
4	Performance based on milling operation on CNC milling machine
5	Performance based on pick and place using robot.
6	Performance based on mini conveyor belt for material handling using robot.
7	Performance based categorizing colour objects using colour sensor and robot.
8	Performance based on detection of objects in front of the photoelectric switch (Proximity Sensor) by using robot.

Content beyond the syllabus

1	Explore toolpath optimization for complex surfaces and deep cavities.
2	Explore AI-based predictive maintenance for CNC machines.

Programme Outcome (PO's) of M. Tech. CAD-CAM Engineering

PO1 - Apply the knowledge of mathematics, science, engineering fundamentals, and mechanical engineering to the solution of complex engineering problems.
PO2 - Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 - Design solutions for complex mechanical engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
PO4 - 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 - Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex mechanical engineering activities with an understanding of the limitations.
PO6- Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
PO7 - Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8 - Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9 - Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10 - Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11 - 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 - 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.

Programme Educational Objectives (PEOs) of PG CAD-CAM Engineering

The educational objectives of the postgraduate Programme of PG CAD-CAM Engineering are:

PEO1 - To prepare learners with a solid foundation in mathematics, sciences, and technical skills needed to analyse and design in engineering problems.
PEO2 - To be able to explore areas of research, application & innovation and make impact in different types of institutional settings such as corporate entities, government bodies, NGOs, inter-government organizations, & start-ups.
PEO3 - To prepare learners to apply knowledge, strong reasoning, and quantitative skills to design and implement creative and sustainable solutions.
PEO4 - To prepare learners to effectively use modern equipment's & programming tools to solve real life problems that are technically sound, economically feasible and socially acceptable.
PEO5 - To prepare learners for successful professional career, to excel in higher studies and or to become entrepreneur.
PEO6 - To be able to continuously learn and update one's knowledge, engage in lifelong learning habits and acquire latest knowledge to perform in current work settings.
PEO7 - To prepare learners to become responsible citizens by serving the community locally, nationally, and internationally.

Programme Educational Objectives (PEOs) of PG CAD-CAM Engineering

PSO1 - Apply mechanical engineering and interdisciplinary knowledge for analysing, designing and manufacturing products to address the needs of the society.
PSO2 - Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.

M-Tech [CAD-CAM Engineering] Computer Graphics for CAD-CAM Lab

Course Outcomes

CO1	Demonstrate basics of computer Graphics like drawing line, arc etc., Drawing of spline curves, Creation of surfaces.
CO2	Interrelate the Algorithms for 3D viewing, Available drawing standards

List of Experiments

1	Programs for generation of entities like Line, Circle, Ellipse using Bressenham's algorithms.
2	Programs for 2-D & 3-D transformations
3	2-D Geometric modeling of an Engineering object, demonstrating Boolean operations like add, subtract and PAN, ZOOM, ROTATE commands
4	3-D Geometric Modeling of an Engineering object, demonstrating extrude, revolve and loft commands.
5	Generation of at least two simple solid models showing geometric properties using any CAD software.
6	Generation of any Assembly model along with animation.
7	Program for synthetic Curve generation like Bezier, spline etc
8	Program for generation of surface.

Content beyond the syllabus

1	Implement a basic NURBS curve and surface representation using control points, weights, and knots.
2	Develop a simple mesh generation algorithm that divides a 2D or 3D object into smaller elements for FEA.

M-Tech [CAD-CAM Engineering] CNC & Robotics Lab

Course Outcomes

CO1	Understand NC,CNC and DNC manufacturing and generate manual part program for CNC machining.
CO2	Conceptualize the Industrial robotics and its various applications

List of Experiments

1	Concepts of NC, CNC, DNC. Classification of CNC machines, Machine configurations, Types of control, CNC controller's characteristics, Interpolators. Cutting tool materials, carbide inserts classification, qualified, semi qualified and preset tooling, tooling system for Machining centre and Turning centre, work holding devices, of CNC Machines.
2	programming and operation of a turning center
3	part programming and operations of a machine center/milling machine
4	Manual part program by using Sub routing and canned cycle.
5	Practice in APT based NC programming languages
6	Fundamental of robot, anatomy, configuration, control, sensor, and gripper
7	Practice in robot programming and its languages
8	Preparation of various reports and route sheets.
9	At least two application of robot

Content beyond the syllabus

1	Implement a simulation of an adaptive control system where the CNC machine adjusts the speed/feed rate based on feedback from sensors during machining.
2	Implement a simulation comparing standard and high-speed machining to highlight the impact on production time, quality, and tooling life.

M-Tech [CAD-CAM Engineering] Advanced Finite Elements Analysis Lab

Course Outcomes

CO1	Outlining the Engineering Analysis tool FEA, its application in Linear static Analysis and 2D problems
CO2	Relating the Finite Element modeling and simulation Techniques
CO3	Examining the use of FEA in structural vibration and thermal Analysis
CO4	Annotating the Finite Element Software - ANSYS

List of Experiments

1	Any two problem using bar element
2	Any two problems using truss element
3	Any two problems using CST element
4	Any one problem using axis symmetric element
5	Any one problem of free vibration analysis using bar element
6	Any one problem of Torsion of Prismatic bars.
7	Any one problem on Steady State Heat conduction.

Content beyond the syllabus

1	Analyze the deformation and stress distribution in a bar element under large deformations where the material exhibits nonlinear stress-strain behavior (such as plastic deformation or hyperelastic materials).
2	Simulate a triangular plate under large deformations, such as bending and stretching, using nonlinear CST elements.

M-Tech [CAD-CAM Engineering] Mechatronics Lab

Course Outcomes

CO1	Interpreting the sensors and transducers, used in mechanical engineering
CO2	Journaling how microprocessors can be used to do simple applications in mechanical engineering
CO3	Associating with PLC and its applications

List of Experiments

1	Identification & study of solid state electronic devices.
2	Identification, study & demonstration of different sensors.
3	Identification, study & demonstration of different actuators.
4	Programming of microprocessor using 8085 instructions
5	Demonstration of working of various digital to analog and analog to digital Converters- applications - temperature control - stepper motor control - traffic light controller
6	Development of ladder diagram, programming using PLC for any of the following. a) Motor start and stop by using two different sensors. b) Simulation of a pedestrian traffic controller. c) Simulation of four road junction traffic controller. d) Lift / elevator control. e) Washing machine control. f) Tank level control. g) Soft drink vending machine control h) Any other suitable application.
7	Trace, interpret and demonstrate working of electro pneumatic systems.
8	Trace, interpret and demonstrate working of electro hydraulic systems.

Content beyond the syllabus

1	Study the application of wide-bandgap semiconductors in power electronics, high-efficiency devices, and energy systems. Explore the advantages of GaN and SiC over traditional silicon devices in terms of high temperature, voltage, and frequency operation.
2	Explore advanced topics related to I/O management, especially how memory-mapped and port-mapped I/O differ in practical applications.