B.Tech Mechanical Engineering

Program Outcomes

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **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 the public health and safety, and the cultural, societal, and environmental considerations.

4. **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.

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

6. **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.

7. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

8. **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.

9. **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.

B.TECH MECHANICAL ENGINEERING

Program Specific Outcomes

PSO 1: Apply their knowledge in the domain of engineering mechanics, thermal engineering, fluid mechanics and other subjects to solve engineering problems utilizing advanced technology.

PSO 2: Successfully apply the principles of design, analysis and implementation of mechanical systems/processes.

PSO 3: Develop and implement new ideas on product design and development with the help of modern CAD/CAM/CAE tools, while ensuring best manufacturing practices.

PSO 4: Design mechanical devices to meet diversified needs of industries

Course Outcome

Paper Code	**ME 205**
Paper Title	**ADVANCED MATHS**
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	To provide detailed of matrices which is applied for solving system of linear equations and useful in various fields of technology
CO2	To provide understanding of existence of n'th order derivative
CO3	To build ability to solve numerically system of linear equations, algebraic and transcendental equations.
CO4	To provide an overview of the experimental aspect of applied mathematics.

Course Outcome

Paper Code	**ME 201**
Paper Title	**MECHANICS OF SOLID**
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Find the basic mechanical properties of material, tension, compression, torsion, bending and combined stress using the fundamental concepts of stress, strain and elastic behavior of materials.
CO2	Apply the stress- strain distributions, diagrammatically representation of shear force & bending moment for different beams under various load conditions by using suitable methods.
CO3	Analyze the slope and deflections for different cross sectional beams and columns, torsion effect for shaft and springs under different load conditions.
CO4	Solve the engineering problems by applying mechanical engineering concepts and theories.

Course Outcome

Paper Code	**ME 201**
Paper Title	**ENGINERING THERMODYNAMICS**
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	The students will be able to define the terms temperature, entropy and enthalpy.
CO2	The students will be able to explain the refrigeration and heat pump cycle The students will be able to explain properties of pure substance.
CO3	The students will be able to understand working of different-different engines.

Course Outcome

Paper Code	**ME 251**
Paper Title	MECHANICS OF SOLIDS LAB
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	To determine the youngs modulus for ductile materials.
CO2	Analyze the various points on stress strain diagram.
CO3	Calculate & Compare the hardness values for various materials.
CO4	Apply the concept of impact loading and to determine impact values for various materials.

Course Outcome

Paper Code	**ME 253**
Paper Title	**Industry Oriented Thermal Engineering Laboratory**
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Identify the various fuel characterizations through experimental testing
CO2	Analyze the performance characteristics of an internal combustion engines
CO3	Evaluate the performance parameters of refrigeration systems
CO4	Analyze the air compressor characteristics

Course Outcome

Paper Code	**ME 257**
Paper Title	**MATERIAL SCIENCE LAB**
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	To differentiate between various materials
CO2	To understand structure of various material.
CO3	To Study of Iron-Carbon Equilibrium Diagram .

Course Outcome

Paper Code	**ME 257**
Paper Title	**APPLIED MATERIAL SCIENCE**
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	To apply concept of Crystal structure, miller indices, lattices, imperfections, elementarytreatment of point and line defects and their relation to mechanical properties.
CO2	To understand the Principles and purpose of heat treatment of plain carbon steels, annealing,normalizing, hardening, tempering, isothermal treatment, case hardening – carburizing, nitriding etc, precipitating hardening of aluminum alloys..
CO3	To understand different types of corrosion, Galvanic cell, rusting of Iron, Methods of protection from corrosion.

Course Outcome

Paper Code	**ME 211**
Paper Title	**MANUFACTURING TECHNOLOGY**
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Apply the concept of different types of casting in manufacturing of product.
CO2	Apply the concept of different types of welding in manufacturing of product.
CO3	Apply the concept of smithy and forging in manufacturing of product.
CO4	Apply the concept of bench work and fitting in manufacturing of product.

Course Outcome

Paper Code	**ME 259**
Paper Title	MANUFACTURING TECHNOLOGY LAB
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	To provide various angles on single point cutting tool by using grinding machine.
CO2	Able to perform various operation on different different machine.
CO3	To Calculate Speed, Feed and Depth of cut.

Course Outcome

Paper Code	**ME 213**
Paper Title	**MANUFACTURING MACHINES**
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Various types of lathe: Centre lathe, facing lathe, gap-bed lathe, capstan and turret lathe
CO2	Constructional features of bench drilling machine, radial drilling machine,multi-spindle drilling machine, feed mechanism, work holding devices, Tool – holding devices. Different drilling operations Implementation of stack and queue using array, using link list
CO3	Different types of grinding machines: cylindrical, surface and centre-less grinding machines, basic constructional features and mechanism

Course Outcome

Paper Code	**ME 261**
Paper Title	**MACHINE PRACTICE LAB**
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	*Student will be required to submit written report indicating the learning achieved by Hands on assembly/Disassembly.*
CO2	Understand integral parts of lathe, shaping and milling machines and various accessories and attachments used. Select cutting parameters like cutting speed, feed, depth of cut, and tooling for various machining operations
CO3	Perform cylindrical turning operations such as plain turning, taper turning, step turning, thread Cutting, facing, knurling, internal thread cutting, eccentric turning and estimate cutting time.

Course Outcome

Paper Code	ME 202
Paper Title	Mechanics of Fluids
Course outcomes	*Upon successful completion of the course, students would be able to:*
CO1	Enrich the concept of fluid mechanics and hydraulic machines
CO2	Demonstrate the classical experiments in fluid mechanics and hydraulic machinery
CO3	Correlate various flow measuring devices such as Venturimeter, orifice meter and notches etc.
CO4	Discuss the performance characteristics of turbines and pumps

Course Outcome

Paper Code	ME 204
Paper Title	MACHINE ELEMENT DESIGN
Course outcomes	*Upon successful completion of the course, students would be able to:*
CO1	Ability to apply Knowledge of Engineering Graphics, Machine Drawing, Basic Science and Basic Applied Mathematics, Basic Machining Processes, Material Science, for design procedures of Mechanical components use in Industries and incorporated in Machine Design.
CO2	Develop Logical and Analytical ability to apply Knowledge of various theories of failures for design of Mechanical components use in Industries like Joints, Bolts, Shafts etc. and Understand and develop analytical ability to design shaft subjected to combined loading.
CO3	Understand different welded and riveted joints structure and able to apply its knowledge to analyze its strength when subjected to simple, coplanar and eccentric loading.
CO4	Understand different stress in Power Screws and Bolted Joints and able to apply its knowledge for design of screw jack and simple bolted joint

Course Outcome

Paper Code	ME 210
Paper Title	INTERNAL COMBUSTION ENGINE
Course outcomes	*Upon successful completion of the course, students would be able to:*
CO1	Students will be able to know the basics Air Standard Cycles.
CO2	Apply the various functions in various problems. Also able to short out these problems.

CO3	Students will demonstrate the ability to perform a thermodynamic analysis of Otto, Diesel, and Dual cycle models.
CO4	Students will demonstrate an understanding of the generation of undesirable exhaust emissions and methods used to reduce them.

Course Outcome

Paper Code	**ME**
Paper Title	**KINEMATICS OF MACHINES**
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	To understand the degree of freedom
CO2	To analyze different mechanism of various machines.
CO3	To understand why the smaller pulley made as input.
CO4	To analyze gear, how the step by step modification was done in gears and at present how many types of gears are available in the market & Need of gear trains.

Course Outcome

Paper Code	**ME 252**
Paper Title	**Fluid Mechanics Lab**
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Able to understand meta-centric height of a floating body.
CO2	Able to determine head loss in pipe flow.
CO3	Able to understand working of pitot tube, Venturi meter ,and nozzle meter.

Course Outcome

Paper Code	**ME 258**
Paper Title	Industry Oriented Internal Combustion Engine Lab
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	To prepare variable speed performance test of a multi-cylinder/single cylinder petrol engine/diesel engine and
CO2	Able to understand Working of petrol and diesel engines
CO3	To find the indicated horse power (IHP) on multi-cylinder petrol engine/diesel engine by Morse Test.
	Understand the complete operation of 2 stroke and 4 stroke I.C engines which can be further confirmed through V.T.D and P.T.D

Course Outcome

Paper Code	**ME 260**
Paper Title	Design/Simulation Lab(Software CREO/CATIA)
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Re-create part drawings, sectional views and assembly drawings as per standards
CO2	Calculate the natural frequency and mode shape analysis of 2D components and beams.
CO3	Simulate the working principle of air conditioning system, hydraulic and pneumatic cylinder and cam follower mechanisms using CERO

Course Outcome

Paper Code	**ME 256**
Paper Title	**Kinematics of Machines Lab**
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Able to understand Mechanism of various machine.
CO2	Able to understand working principle of dynamometers, Brakes and Clutches.
CO3	Able to analyse velocity and acceleration diagram of various mechanism.

Course Outcome

Paper Code	**ME 212**
Paper Title	**Instrumentation & Control**
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	After undergoing the course the student can select appropriate device for the measurement of parameters like temperature, pressure, speed, stress, humidity, flow velocity etc., and justify its use through characteristics and performance.
CO2	Elucidate the construction and working of various industrial parameters / devices used to measure pressure, sound and flow
CO3	Explicate the construction and working of various industrial parameters / devices used to measure temperature, level, vibration, viscosity and humidity

Course Outcome

Paper Code	ME 250
Paper Title	Instrumentation & Control Lab
Course outcomes	*Upon successful completion of the course, students would be able to:*
CO1	Ability to understand control theory and apply them to electrical engineering problems
CO2	Ability to analyze the various types of converters.
CO3	Ability to understand the basic concepts of bridge networks.

Course Outcome

Paper Code	ME 250
Paper Title	INDUSTRIAL ENGINEERING
Course outcomes	*Upon successful completion of the course, students would be able to:*
CO1	understand human factor in the application of work study
CO2	To draw the operation chart; flow process chart; flow diagrams; string diagram; man machine chart; two hand chart; Simon chart
CO3	Integrated system of people, materials, information, equipment, and energy to meet desired needs within realistic constraints (such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability).
CO4	Understand the impact of engineering solutions in a global, economic, environmental, and societal context.

Course Outcome

Paper Code	ME 262
Paper Title	INDUSTRIAL ENGINEERING LAB
Course outcomes	*Upon successful completion of the course, students would be able to:*
CO1	Determination of time standard for a given job using stopwatch time- study.
CO2	Preparation of flow process chart, operation process chart and man-machine charts for an existing setup and development of an improved process.
CO3	To carry out a work sampling study
CO4	To conduct process capability study for a machine in the workshop.

Course Outcome

Paper Code	ME 317
Paper Title	Hydraulic Machinery
Course outcomes	*Upon successful completion of the course, students would be able to:*
CO1	To know the different types of flows and channels
CO2	To understand the performance of turbines and pumps.
CO3	To make the student is expected to prepare models for prototypes of hydraulic structures.
CO4	To make the student is expected to have thorough knowledge on the selection of turbines and pumps for practical purposes

Outcome

Paper Code	ME 307
Paper Title	DYNAMICS OF MACHINES
Course outcomes	*Upon successful completion of the course, students would be able to:*
CO1	Apply the concept of governors and their applications to solve the problem in engineering field.
CO2	Apply the concept of gears to solve the problem in engineering field.
CO3	Apply the concept of gears trains to solve the problem in engineering field.
CO4	Apply the concept of gyroscopes to solve the problem in engineering field.

Course Outcome

Paper Code	ME 315
Paper Title	Machining Science and Machine Tool
Course outcomes	*Upon successful completion of the course, students would be able to:*
CO1	The course provides students with fundamental knowledge and principles in material removal processes.
CO2	To demonstrate the fundamentals of machining processes and machine tools.
CO3	To develop fundamental knowledge on tool materials, cutting fluids and tool wear mechanisms.
CO4	To apply knowledge of basic mathematics to calculate the machining parameters for different machining processes.

Course Outcome

Paper Code	**ME 303**
Paper Title	**MACHINE DESIGN**
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Be able to analyze the stress and strain on mechanical components; and understand, identify and quantify failure modes for mechanical parts
CO2	Demonstrate knowledge on basic machine elements used in machine design; design machine elements to withstand the loads and deformations for a given application, while considering additional specifications.
CO3	Be able to approach a design problem successfully, taking decisions when there is not a unique answer
CO4	Be proficient in the use of software for analysis and design.

Course Outcome

Paper Code	**ME 351**
Paper Title	**Dynamics of Machine Lab**
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Students will become familiar with kinematics and different motions of machines.
CO2	Students get to know the automotive vehicle mechanism.
CO3	Students will be able understand the brake and dynamometers construction and their working.
CO4	Students will be able to understand the concept of cams and gyroscopes.

Course Outcome

Paper Code	**ME 355**
Paper Title	INDUSTRY ORIENTED PRODUCTION PROCESS LAB
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	To provide various angles on single point cutting tool by using grinding

	machine.
CO2	Able to perform various operation on different different machine.
CO3	To make various threads on workpiece and also calculate pitch and angle.

Course Outcome

Paper Code	**ME 363**
Paper Title	**Hydraulic Machines Lab**
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Student will be able to utilize the knowledge in the design of water supply pipe networks and measure the rate of flow in pipes and channels.
CO2	Students will have confidence in the hydraulic design of turbines and should be able to identify suitable pumps and turbines for different working conditions
CO3	Analyze a variety of practical fluid-flow devices and utilize fluid mechanics principles in design
CO4	To provide exposure to modern computational techniques in fluid dynamics

Course Outcome

Paper Code	**ME 363**
Paper Title	**FUNDAMENTALS OF AERODYNAMICS**
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Study of Aerodynamic forces and moments over the body surface, concept of lift and drag, dimensionless force and moment coefficient, centre of pressure of an airfoil
CO2	Student will be able to understand blade theory and isentropic flow concepts
CO3	Measurement and analysis of shock wave relation.
CO4	Fanno line tables; entropy change; choking due to friction; flow through long ducts; Diabatic flow .

Course Outcome

Paper Code	**ME 311**
Paper Title	**MECHANICAL VIBRATION & NOISE ENGINEERING**
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Study of Scope of vibration, important terminology and classification, Degrees of freedom, Harmonic motion; vectorial representation
CO2	Detailed study of Forced vibrations of single degree of freedom systems. Forced vibration with constant harmonic excitation.
CO3	Sound level and subjective response to sound; Frequency dependent human response to sound.

Course Outcome

Paper Code	**ME 311**
Paper Title	**MECHANICAL VIBRATION & NOISE ENGINEERING LAB**
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	To determine, Degrees of freedom, Harmonic motion of various vibrating equipments
CO2	Able to understand about the natural frequency.
CO3	Calculate damped undamped vibrations of machinery

Course Outcome

Paper Code	**ME 302**
Paper Title	EMPLOYABILITY SKILL
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Introspect & develop a planned approach towards his career & life in general.
CO2	Have clarity on his career exploration process and to match his skills and interests with a chosen career path.
CO3	Develop thinking ability and polish his expression in group discussions

Course Outcome

Paper Code	ME 302
Paper Title	HEAT AND MASS TRANSFER
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Understand the basic concept of laws of heat transfer
CO2	Analyze the laws of heat transfer in different heat exchangers of different shapes
CO3	Have detailed understanding of natural and forced convection.

Course Outcome

Paper Code	ME 306
Paper Title	AUTOMOBILE ENGINEERING
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Selection of power plant for automotive vehicle, requirements of vehicle. Characteristics of various power plants
CO2	Understanding Principle of friction clutch, single and multiplate clutches, centrifugal clutch. Friction materials
CO3	Study of various types of Wheels, Tyres and Brakes

Course Outcome

Paper Code	ME 316
Paper Title	Finite Element Analysis
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	To learn the theory and characteristics of finite elements that represent engineering structures.
CO2	To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses.
CO3	Understand and perform engineering analysis of machine systems

Course Objective

Course Title: Project Oriented Heat & Mass Transfer Lab

CO1- To Study & Perform Various Experiments On Heat And Mass Transfer Equipments

CO2- To understand the fundamentals of heat transfer mechanisms in fluids and solids and their applications in various heat transfer equipment in process industries.

CO3- Determine thermal properties of material by applying 1-D steady state heat transfer equation

Course Outcome

Paper Code	**ME 352**
Paper Title	**Project Oriented Heat & Mass Transfer Lab**
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Understand the basic concept of laws of heat transfer
CO2	Analyze the laws of heat transfer in different heat exchangers of different shapes.
CO3	Have detailed understanding of natural and forced convection
CO4	Have an understanding of thermal radiation

Course Outcome

Paper Code	**ME 352**
Paper Title	AUTOMOBILE ENGG. LAB
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Disassembly of various parts.
CO2	Assembly of various automobile parts
CO3	Study of various automobile mechanisms

Course Outcome

Paper Code	**ME 362**
Paper Title	**Software Lab (Solidwork/ANSYS)**
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	You will be know how to simulate and validate the performance of products of all manufacturing sectors including automotive, power electronic products, electronic equipment, electromechanical devices, and electrical systems.

CO2	You will know how to simulate every structural aspect, including linear static analysis, of a single part of a complex assembly with hundreds of components interacting through contacts or relative motions.
CO3	You will know how to perform fluid flow analysis to know the impact of fluid flows on your product while manufacturing and when used by customers in real world applications.

Course Outcome

Paper Code	**ME 308**
Paper Title	GAS DYNAMICS AND PROPULSION
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Study of Aerodynamic forces and moments over the body surface, concept of lift and drag, dimensionless force and moment coefficient, centre of pressure of an airfoil
CO2	Student will be able to understand blade theory and isentropic flow concepts
CO3	Measurement and analysis of shock wave relation.
CO4	Fanno line tables; entropy change; choking due to friction; flow through long ducts; Diabatic flow .

Course Outcome

Paper Code	**ME 304**
Paper Title	Mechatronics
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Mechatronics, scope of Mechatronics, application, process control automation and N/c Machines.
CO2	Student will be able to know the concept of Hydraulic And Pneumatic Actuation Systems
CO3	Student will be able to understand Sensors and transducers and application .
CO4	Design of Mechatronic systems

Course Outcome

Paper Code	ME 320
Paper Title	Engineering Metrology and Measurement
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	To be familiar with the different instruments that is available for linear, angular, roundness and roughness measurements.
CO2	To be able to select and use the appropriate measuring instrument according to a specific requirement (in terms of accuracy, etc.
CO3	TO determination of straightness error of straight edge with the help of spirit level and auto collimator
CO4	To understand different types of irregularities, standard measures for assessment and measurement of surface finish.

Course Outcome

Paper Code	ME 364
Paper Title	Metrology Lab
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	To be familiar with the different instruments that is available for linear, angular, roundness and roughness measurements.
CO2	To be able to select and use the appropriate measuring instrument according to a specific requirement (in terms of accuracy, etc.)
CO3	TO determination of straightness error of straight edge with the help of spirit level and auto collimator
CO4	To understand different types of irregularities, standard measures for assessment and measurement of surface finish.

properties, psychometric relations, psychometric charts, psychometric processes, cooling coils, By-pass factor and air washer.

Course Outcome

Paper Code	ME 401
Paper Title	REFRIGERATION AND AIR - CONDITIONING
Course outcomes	***Upon successful completion of the course, students would be able to:***

CO1	Student will be able to distinguish the properties and parameters Simple Vapour absorption system, Electrolux Refrigerator, Analysis of Ammonia absorption refrigeration system, Lithium Bromide Absorption Refrigeration System
CO2	Psychometric properties, psychometric relations, psychometric charts, psychometric processes, cooling coils, By-pass factor and air washer.
CO3	Internal heat gain, system heat gain, RSHF, ERSHF, GSHF, cooling load estimation, heating load estimation, psychometric calculation for cooling, selection of air conditioning, apparatus for cooling and dehumidification, Air conditioning system.

Course Outcome

Paper Code	**ME 409**
Paper Title	Renewable Energy Technology
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Students in this Course learn how environmental forces such as the wind and sun are used to reduce consumption of fossil fuels and other limited natural resources.
CO2	Associate's degree Course s teach everything from the electrical construction of photovoltaic systems to the mechanical workings of wave-driven turbines.
CO3	Students interested in renewable energy technology learn how to perform cost-to-benefit analyses, evaluate potential locations for system installations and repair existing systems.

Course Outcome

Paper Code	**ME 405**
Paper Title	OPERATION RESEARCH
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Be able to understand the characteristics of different types of decision-making environments and the appropriate decision making approaches and tools to be used in each type.
CO2	Be able to design new simple models, like: CPM, PERT to improve decision – making and develop critical thinking and objective analysis of decision problems.
CO3	Be able to build and solve Queuing Models and simulation

Course Outcome

Paper Code	**ME 451**
Paper Title	REFRIGERATION AND AIR CONDITIONING LAB
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	The students will have a thorough understanding Refrigeration and second law of Thermodynamics, Refrigeration effect and unit of Refrigeration, Heat pump, reversed Carnot cycle.
CO2	Student will be able to distinguish the properties and parameters Simple Vapour absorption system, Electrolux Refrigerator, Analysis of Ammonia absorption refrigeration system, Lithium Bromide Absorption Refrigeration System
CO3	Internal heat gain, system heat gain, RSHF, ERSHF, GSHF, cooling load estimation, heating load estimation, psychometric calculation for cooling, selection of air conditioning, apparatus for cooling and dehumidification, Air conditioning system.

Course Outcome

Paper Code	**ME 459**
Paper Title	Course ing Software Lab(MATLAB)
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Understand the basics of MATLAB
CO2	Break a complex task up into smaller, simpler tasks
CO3	Tabulate results and Analyse

Course Outcome

Paper Code	**ME 403**
Paper Title	Power Plant Technologies
Course outcomes	***Upon successful completion of the course, students would be able to:***

CO1	To study about generation of electrical power
CO2	Understand to calculate the power consumption
CO3	To study various types of power plant

Course Outcome

Paper Code	**ME 413**
Paper Title	COMPUTATIONAL FLUID DYNAMICS
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	To solve partial differential equations.
CO2	To converting derivatives to discrete algebraic expressions, spatial derivatives & time derivatives
CO3	To analyze stability of FD equation
CO4	Implementation of FEM to various realistic problems.

Course Outcome

Paper Code	**ME**
Paper Title	**Advanced Innovation and New Product Development**
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Understand the integration of customer requirements in product design
CO2	Apply structural approach to concept generation, selection and testing
CO3	Understand various aspects of design such as industrial design, design for manufacture , economic analysis and product architecture

Course Outcome

Paper Code	**HS 402**
Paper Title	**INTELLECTUAL PROPERTY RIGHT**
Course outcomes	***Upon successful completion of the course, students would be able to:***

CO1	To encourage research, scholarship, and a spirit of inquiry, thereby generating new knowledge.

Course Outcome

Paper Code	**ME 406**
Paper Title	Computer Aided Mechanical Design
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	They will be able to understand Overview of Computer Graphics, Picture representation, Coordinate Systems, Output Graphcis Display devices. Raster Scan Graphics .
CO2	They will be able to understand Wire frame models, Parametric representation of curves, Plane curves : line, circle, ellipse, parabola and hyperbola. Space curves : Cubic spline curve, Bezier Curve and B Spline Curves. Blending of Curves.
CO3	They will be able to understand Two and three dimensional transformation of Geometric models: Translation, Scaling Reflection, Rotation and Shearing. Homogeneous Representation, Combined Transformation. Projection of Geometric models: Parallel and Perspective Projection.

Course Outcome

Paper Code	**ME 404**
Paper Title	**CNC Machines & Course ming**
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Understand fundamentals of NC/CNC
CO2	Learn and Write NC Part Course ming
CO3	Hands –on experience on MasterCAM
CO4	Understand machines like Chucking and Turning Centres,Machining Centres

Course Outcome

Paper Code	**ME 414**
Paper Title	**Non-Conventional Machining Methods**
Course	***Upon successful completion of the course, students would be able to:***

outcomes	
CO1	Understand the need of Non Traditional Machining Processes and able to Classify various processes
CO2	Recognize the role of mechanical energy in non-traditional machining processes.
CO3	Apply the knowledge on machining electrically conductive material through electrical energy in non-traditional machining processes
CO4	Understand the concept of machining the hard material using chemical energy andelectrochemical energy.

Course Outcome

Paper Code	**ME 418**
Paper Title	Operation Management
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Identify the elements of operations management and various transformation processes to enhance productivity and competitiveness.
CO2	Analyze and evaluate various facility alternatives and their capacity decisions, develop a balanced line of production & scheduling and sequencing techniques in operation environments
CO3	Develop aggregate capacity plans and MPS in operation environments.
CO4	Plan and implement suitable quality control measures in Quality Circles to TQM.

Course Outcome

Paper Code	**ME 462**
Paper Title	CAM LAB
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Re-create part drawings, sectional views and assembly drawings as per standards
CO2	Draw 3D and Assembly drawing using CAD software
CO3	Simulate the working principle of air conditioning system, hydraulic and pneumatic cylinder and cam follower mechanisms using MATLAB
CO4	Demonstrate manual part Course ming with G and M codes using CAM

.

Course Outcome

Paper Code	ME 464
Paper Title	SOLAR LAB
Course outcomes	*Upon successful completion of the course, students would be able to:*
CO1	The working principle behind the existing collector systems practically.
CO2	The domestic and industrial purposes and usages of solar gadgets available.
CO3	The various radiation measuring instruments and storages related to solar thermal studies.

Course Outcome

Paper Code	ME 464
Paper Title	ROBOTICS ENGINEERING
Course outcomes	*Upon successful completion of the course, students would be able to:*
CO1	An ability to understand the fundamental concept robotics.
CO2	An ability to know the concepts about Evolution of Robots and Robotics, Laws of Robotics, What is and What is not a Robot, Progressive Advancement in Robots.
CO3	An ability to understand the Coordinate Frames, Description of Objects in Space, Transformation of Vectors, Inverting a Homogeneous Transform, Fundamental Rotation Matrices.

Course Outcome

Paper Code	ME 412
Paper Title	**Reliability and Maintenance**
Course outcomes	*Upon successful completion of the course, students would be able to:*
CO1	Able to estimating the likely reliability of new designs, and for analysing reliability data
CO2	Use control charts to analyze for improving the process quality.
CO3	Acquire basic knowledge of total quality management
CO4	Advise on the acquisition, installation and operation of machinery

Course Outcome

Paper Code	**ME 422**
Paper Title	**Design & Manufacturing of Plastic Products**
Course outcomes	***Upon successful completion of the course, students would be able to:***
CO1	Rationalize bulk properties and processes using thermodynamic considerations.
CO2	Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
Co3	Analyze microscopic chemistry in terms of atomic and molecular orbital and intermolecular forces
Co4	Rationalize periodic properties such as ionization potential, electro negativity, oxidation states and electro negativity.

Teaching Scheme

Year: I **Semester: I**

(Autumn)

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CIE	ESE
A		**University Core**							
1	PC 101	Proficiency in Co-curricular Activities	2	0	0	0	0	0	100
2	FD 102	Foundation Course-I	1	2	0	0	3	25	75
3	EN 105	Professional Communication I	2	2	0	0	3	40	60
4	EN 151	Professional Communication Lab	1	0	0	2	2	60	40
B		**Program Core**							
5	**PY 103**	Physics	4	3	1	0	3	40	60
6	MA 103	Mathematics – I	4	3	1	0	3	40	60
7	EE 105	Basic Electrical Engineering	4	3	1	0	3	40	60
8	CP 107	Programming for Problem Solving	3	3	0	0	3	40	60
9	CP 153	Programming for Problem Solving Lab	1	0	0	2	3	60	40
10	EE 151	Electrical and Electronics Engineering Lab	1	0	0	2	3	60	40
11	ME 157	Engineering Graphics & Design Lab	2	0	0	3	3	60	40
12	PY 152	Engineering Physics Lab	1	0	0	3	3	60	40
C		**University/Open Elective**							
		Students can choose elective from the attached list.							
		Total	**26**						

NOTE: The University Electives are apart from minimum credits required for award of degree.

L= Lecture **T=Tutorial** **CIE=Continuous Internal Evaluation**
S= Seminar **P= Practical** **ESE= End Semester Examination**

Members of BoS, EE **Convener, BoS Engg.**

Year: I **Semester: II**

(Spring)

S. No.	Course Code	Course Name	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
				L	T/S	P		CIE	ESE
A		**University Core**							
1	PC 102	Proficiency in Co-Curricular Activities	2	0	0	0	0	0	100
2	FD 104	Foundation Course –II	1	1	0	0	3	25	75
3	EM 102	Employability Skills–I	1	0	2	0	0	60	40
4	EN 106	Professional Communication II	2	2	0	0	3	40	60
B		**Program Core**							
5	EC 106	Basic Electronics Engineering	3	3	0	0	3	40	60
6	MA 104	Mathematics – II	4	3	1	0	3	40	60
7	CY 102	Chemistry	3	3	0	0	3	40	60
8	CY 152	Chemistry lab	1	0	0	2	3	60	40
9	ME 158	Workshop Manufacturing Practices	2	0	0	3	3	60	40
C		**University/Open Elective**							
		Students can choose elective from the attached list.							

		Total	**19**						

NOTE: The University Electives are apart from minimum credits required for award of degree.

L= Lecture **T=Tutorial** **CIE=Continuous Internal Evaluation**
S= Seminar **P= Practical** **ESE= End Semester Examination**

Members of BoS, EE **Convener, BoS Engg.**

SURESH GYAN VIHAR UNIVERSITY, JAGATPURA JAIPUR.

B.Tech Syllabus 3rd Sem Session 2020-2024 (Onwards)

S.NO	Course Code	Course Name	Credit	Contact Hours/Week			Exam Hours	Weightage (%)	
				L	T	P		CE	ESE
		UNIVERSITY CORE							
1	HS 203	Economics and Social Sciences	2	2	0	0	3	40	60
2	EM 201	Employability Skill-II	1	0	2	0	3	60	40
3	PC 201	Proficiency in Co-Curricular Activities(PCA) III	2	0	0	0	0		100
		PROGRAME CORE							
4	ME 201	Mechanics of Solids	4	3	1	0	3	40	60
5	ME 203	Engineering Thermodynamics	4	3	1	0	3	40	60
6	ME 251	Mechanics of Solid Lab	2	0	0	2	3	60	40
7	ME 253	Industry Oriented Thermal Engineering Laboratory	2	0	0	2	3	60	40
8	ME 257	Material Science Lab	1	0	0	2	3	60	40
9	ME 207	Applied Material Science	3	3	0	0	3	40	60

10	MA 205	Advance Maths	3	3	0	0	3	40	60
		PROGRAME ELECTIVE (Select one subject & one lab)							
11	ME 211	Manufacturing Technology	2	2	0	0	3	40	60
12	ME 259	Manufacturing Technology Lab	1	0	0	2	3	60	40
13	ME 213	Manufacturing Machines	2	2	0	0	3	40	60
14	ME 261	Machine Practice Lab	1	0	0	2	3	60	40
		UNIVERSITY ELECTIVE							
15	Student can opt from "List of University Elective"								
		TOTAL	27	14	4	6			

Theory (18 Credit) + Lab (06 Credit) +Proficiency in Co-curricular Activities (2 Credit) + Employability skills (01 credit) = 27 Credit

L= Lecture **T=Tutorial** **CE=Continuous Evaluation**

S= Seminar **P= Practical** **ESE= End Semester Examination**

SURESH GYAN VIHAR UNIVERSITY, JAGATPURA JAIPUR.

Department Of Mechanical Engineering

B.Tech Syllabus 4th Sem Session 2020-2024 (Onwards)

To be implemented in session 2021-2022

S.NO	Course Code	Course Name	Credit	Contact Hours/Week			Exam Hours	Weightage (%)	
				L	T	P		CE	ESE
		UNIVERSITY CORE							
1	EM 202	Employability Skill-III	1	0	2	0	3	60	40
2	PC 202	Proficiency in Co-Curricular Activities(PCA) IV	2	0	0	0	0	0	100
		PROGRAME CORE							
1	ME202	Mechanics of Fluids	4	3	1	0	3	40	60
2	ME 204	Machine Element Design	4	3	1	0	3	40	60
3	ME 210	Internal Combustion Engine	3	3	0	0	3	40	60
4	ME256	Kinematics of Machines	3	3	0	0	3	40	60
5	ME 252	Fluid Mechanics Lab	2	0	0	2	3	60	40
6	ME258	Industry Oriented Internal Combustion Engine Lab	2	0	0	2	3	60	40
7	ME 260	Design/Simulation Lab(Software CREO/CATIA)	1	0	0	2	3	60	40
8	ME 256	Kinematics of Machines Lab	2	0	0	2	3	60	40
		PROGRAME ELECTIVE (Select one subject with one lab)							
9	ME212	Instrumentation & Control	2	2	0		3	40	60
10	ME 250	Instrumentation & Control Lab	1	0	0	2	3	60	40
11	ME 216	Industrial Engineering	2	2	0	0	3	40	60
12	ME 262	Industrial Engineering Lab	1	0	0	2	3	60	40

		UNIVERSITY ELECTIVE							
13	Student can opt from "List of University Elective"								
		TOTAL	27	14	4	10			
Note:- Summer Training: Professional Project Training for 30 days after 4th Semester Exams is compulsory.									

Theory (16 Credit) + Lab (08 Credit) +Proficiency in Co-curricular Activities (2 Credit) + Employability skills (01 credit) = 27 Credit

L= Lecture **T=Tutorial** **CE=Continuous Evaluation**

S= Seminar **P= Practical** **ESE= End Semester Examination**

SURESH GYAN VIHAR UNIVERSITY, JAGATPURA JAIPUR.

Department Of Mechanical Engineering B.Tech Syllabus 5th Sem Session 2020-2024 (Onwards)

To be implemented in session 2022 - 2023

S.NO	Course Code	Course Name	Credit	Contact Hours/Week			Exam Hours	Weightage (%)	
				L	T	P		CE	ESE
		UNIVERSITY CORE							
1	EM 301	Employability Skill-IV	1	0	2	0	3	60	40
2	PC 301	Proficiency in Co-Curricular Activities (PCA) V	2	0	0	0	0	0	100
		PROGRAME CORE							
3	ME 317	Hydraulic Machines	3	3	0	0	3	40	60
4	ME 307	Dynamics of Machines	3	3	0	0	3	40	60
5	ME 315	Machining Science and Machine Tools	3	3	0	0	3	40	60
6	ME 303	Machine Design	4	3	1	0	3	40	60
7	ME 351	Dynamics of Machine Lab	1	0	0	2	2	60	40
8	ME 355	Industry Oriented Production Process Lab	2	0	0	2	2	60	40
9	ME 363	Hydraulic Machines Lab	1	0	0	2	2	60	40
10	PT 301	Practical Training Seminar I	1	0	0	2	2		100
		PROGRAME ELECTIVE (Select one subject & one lab)							
11	ME 309	Fundamental of Aerodynamics	4	3	1	0	3	40	60
12	ME 311	Mechanical Vibration & Noise Engineering	4	3	1	0	3	40	60
13	ME 357	Mechanical Vibration Lab	2	0	0	2	3	60	40

		UNIVERSITY ELECTIVE							
14	Student can opt from "List of University Elective"								
		TOTAL	27	15	4	10			

Theory (17 Credit) + Lab (07 Credit) +Proficiency in Co-curricular Activities (2 Credit) + Employability skills (01 credit) = 27 Credit

Department Of Mechanical Engineering B.Tech Syllabus 6th Sem Session 2020-2024 (Onwards)

To be implemented in session 2022 -2023

S.NO	Course Code	Course Name	Credit	Contact Hours			Exam Hours	Weightage (%)	
				L	T	P		CE	ESE
		UNIVERSITY CORE							
1	EM 302	Employability Skills -V	1	0	2	0	3	60	40

2	PC 302	Proficiency in Co-Curricular Activities(PCA) VI	2	0	0	0	0		100
		PROGRAME CORE							
3	ME 302	Heat & Mass Transfer	4	3	1	0	3	40	60
4	ME 306	Automobile Engineering	3	3	0	0	3	40	60
5	ME 316	Finite Element Analysis	3	3	0	0	3	40	60
6	ME 352	Project Oriented Heat & Mass Transfer Lab	2	0	0	2	3	60	40
7	ME 354	Automobile lab	1	0	0	2	3	60	40
8	ME 362	Software Lab (Solidwork/ANSYS)	1	0	0	2	3	60	40
9	PE 302	Project Stage-I (Minor Project)	3	0	0	2	3	60	40
		PROGRAME ELECTIVE (Select two Subjects & one Lab)							
10	ME 308	Gas Dynamics & Propulsion	3	3	0	0	3	40	60
11	ME 304	Mechatronics	3	3	0	0	3	40	60
12	ME 320	Engg. Metrology and Measurement	3	3	0	0	3	40	60
13	ME 364	Metrology Lab	1	0	0	2	3	60	40
		UNIVERSITY ELECTIVE							
14	Student can opt from “List of University Elective”								
		TOTAL	27	15	3	10			
Note:- Industrial training for 45 days after 6th Semester Exams is compulsory.									

Theory (16 Credit) + Lab (08 Credit) +Proficiency in Co-curricular Activities (2 Credit) + Employability skills (01 credit) = 27 Credit

L= Lecture **T=Tutorial** **CE=Continuous Evaluation**

S= Seminar **P= Practical** **ESE= End Semester Examination**

SURESH GYAN VIHAR UNIVERSITY, JAGATPURA JAIPUR.

Department Of Mechanical Engineering B.Tech Syllabus 7th Sem Session 2020-2024 (Onwards)

To be implemented in session 2023-2024

S.NO	Course Code	Course Name	Credit	Contact Hours/Week			Exam Hours	Weightage (%)	
				L	T	P		CE	ESE
		UNIVERSITY CORE							
1	EM 401	Employability Skills-VI	1	0	2	0	3	60	40
2	PC 401	Proficiency in Co-Curricular Activities(PCA) VII	2	0	0	0	0		100
		PROGRAME CORE							
3	ME 401	Refrigeration & Air-conditioning	4	3	1	0	3	40	60
4	ME 409	Renewable Energy Technology	3	3	0	0	3	40	60
5	ME 405	Operation Research	4	3	1	0	3	40	60
6	ME 451	Refrigeration & Air-Conditioning Lab	2	0	0	2	3	60	40
7	ME 459	Programming Software Lab (MATLAB)	2	0	0	2	3	60	40
8	PT 401	Practical Training Seminar II	1	0	0	2	3		100
9	PE 401	Project Stage-II	3	0	0	2	3	60	40
		PROGRAME ELECTIVE (Select any TWO Subject)							
10.	ME 403	Power Plant Technologies	3	3	0	0	3	40	60
11	ME 413	Computational Fluid Dynamics (use ANSYS CFX/ FLUENT software for tutorials)	3	3	0	0	3	40	60
12	ME 417	Engineering Nano Technology	3	3	0	0	3	40	60
13	ME 419	Non Destructive Evaluation & Testing	3	3	0	0	3	40	60
14	****	Digital Manufacturing	3	3	0	0	3	40	60

15	ME 425	Advanced Innovation and New Product Development	3	3	0	0	3	40	60
		UNIVERSITY ELECTIVE							
16	Student can opt from "List of University Elective"								
		TOTAL	28	15	4	8			

Theory (19 Credit) + Lab (4 Credit) +Project (3) + Seminar (1) Proficiency in Co-curricular Activities (2 Credit) + Employability skills (01 credit) = 28 Credit

SURESH GYAN VIHAR UNIVERSITY, JAGATPURA JAIPUR.

Department Of Mechanical Engineering B.Tech Syllabus 8th Sem Session 2020-2024 (Onwards)

To be implemented in session 2023-2024

S.NO	Course Code	Course Name	Credit	Contact Hours/Week			Exam Hours	Weightage (%)	
				L	T	P		CE	ESE

		UNIVERSITY CORE							
1	EM 402	Employability Skills-VII	1	1	2	0	3	60	40
2	HS 402	Intellectual Property Right	2	2	0	0	3	40	60
		PROGRAME CORE							
3	ME 406	Computer Aided Mechanical Design	4	3	1	0	3	40	60
4	ME 404	CNC Machines & Programming	4	3	1	0	3	40	60
5	ME 414	Non-Conventional Machining Methods	3	3	0	0	3	40	60
6	ME 462	CAM lab	1	0	0	2	3	60	40
7	ME 464	Solar Lab	1	0	0	2	3	60	40
8	SM 402	B.Tech seminar	1	0	0	2	3	60	40
		PROGRAME ELECTIVE **(Select any ONE Subjects)**							
9	ME 402	Robotics Engineering	3	3	0	0	3	40	60
10	ME 418	Operation Management	3	3	0	0	3	40	60
11	ME 412	Reliability & Maintenance Engg	3	3	0	0	3	40	60
12	ME 422	Design & Manufacturing of Plastic Products	3	3	0	0	3	40	60
		UNIVERSITY ELECTIVE							
13		Student can opt from “List of University Elective”							
		TOTAL	20	15	4	8			

Theory (19 Credit) + Lab (02Credit)+ seminar(01 Credit) = 22 Credit

L= Lecture **T=Tutorial** **CE=Continuous Evaluation**

S= Seminar **P= Practical** **ESE= End Semester Examination**

Semester I

Course Title: **PHYSICS**		Course Code	**: PY 103**
Semester	: **I**	Core / Elective	: **Core**
Teaching Scheme in Hrs (L:T:P)	**: 3:1:0**	Credits	: **4 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **48**
Continuous Internal Evaluation	: **40 Marks**	ESE	: **60 Marks**
Programmes: **B.Tech (All)**			

Pre-requisites:

Semiconductor physics

Course Objectives:

- To impart knowledge in basic concepts of physics relevant to engineering applications.
- To Introduce advances in technology for engineering applications

Course Content:

Topic and Contents	**Hours**	**Marks**
Physics		
UNIT-1: Interference of light	7	12
Michelson's Interferometer: Production of circular & straight line fringes; Determination of wavelength of light; Determination of wavelength separation of two nearby wavelengths. Optical technology: Elementary idea of anti-reflection coating and interference filters.		
UNIT-2: Diffraction and Polarization	8	12
Fraunhofer Diffraction at Single Slit. Diffraction grating: Construction, theory and spectrum; Determination of wavelength of light. Resolving power: Raleigh criterion; Resolving power of diffraction grating and telescope. Plane, circularly and elliptically polarized light on the basis of electric (light) vector: Malus law; Double Refraction; Phase retardation plates and their use in production and detection of circularly and elliptically polarized light; Optical activity and laws of optical rotation; specific rotation and its measurement using half-shade device.		
UNIT-3: **Element of Material science and Quantum Mechanics**	7	12
Bonding in solids; covalent bonding and Metallic bonding; Classification of solids as Insulators, Semiconductors and Conductors; X-Ray diffraction and Bragg's Law. Hall Effect: Theory, Hall Coefficient and applications. Compton effect & quantum nature of light; Derivation of time dependent and time independent Schrodinger's Wave Equation; Physical interpretation of wave function and its properties; boundary conditions; Particle in one dimensional box.		
UNIT-4: Coherence and Optical	7	12
Fibers: Spatial and temporal coherence; Coherence length; Coherence time and 'Q'		

factor for light; Visibility as a measure of Coherence and spectral purity; Optical fiber as optical wave guide; Numerical aperture; Maximum angle of acceptance and applications of optical fiber.		
UNIT 5: Laser and Holography	7	12
Theory of laser action; Einstein's coefficients; Components of laser; Threshold conditions for laser action; Theory, Design and applications of He-Ne and semiconductor lasers; Holography versus photography, Basic theory of holography; basic requirement of a Holographic laboratory; Applications of Holography in microscopy and interferometry.		
TOTAL	**36**	**60**

Reference:

1. Engineering Physics: Malik and Singh (Tata McGraw Hill)
2. Engineering Physics: Naidu (Pearson)
3. Optics : Ajay Ghatak (Tata McGraw Hill)
4. Concept of Modern Phyiscs: A. Baiser (Tata McGraw Hill)
5. Fundamental of Optics : Jetkins and White (Tata McGraw Hill)
6. Material Science: Smith (McGraw Hill)

Course Outcomes:

At the end of this course students will demonstrate the ability to

- To design and conduct simple experiments as well as analyze and interpret data in.
- Capability to understand advanced topics in engineering engineering
- Apply quantum physics to electrical phenomena

Course Title: **MATHEMATICS – I**		Course Code	: **MA 103**
Semester	: **I**	Core / Elective	: **Core**
Teaching Scheme in Hrs (L:T:P)	**: 3:1:0**	Credits	: **4 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **48**
Continuous Internal Evaluation	: **40 Marks**	ESE	: **60 Marks**
Programmes: **B.Tech (All)**			

Pre-requisites:

Knowledge of Mathematics, up-to Senior Secondary School level.

Course Objectives:

- To introduce the idea of applying differential and integral calculus to notions of curvature and to improper integrals. Apart from some applications it gives a basic introduction on Beta and Gamma functions.
- To introduce the fourier series that is fundamental to application of analysis to Engineering problems.
- To develop the tool of power series and Fourier series for learning advanced Engineering Mathematics.
- To familiarize the student with functions of several variables that is essential in most branches of engineering.

Course Content:

Topic and Contents	Hours	Marks
UNIT 1: Calculus	7	12
Improper integrals (Beta and Gamma functions) and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.		
UNIT 2: Sequences and Series	6	12
Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions.		
UNIT 3: Fourier Series	7	12
Periodic functions, Fourier series, Euler‟s formula, Change of intervals, Half range sine and cosine series, Parseval‟s theorem.		
UNIT 4: Multivariable Calculus (Differentiation)	8	12
Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.		
UNIT 5: Multivariable Calculus (Integration)	8	12
Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Centre of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.		
TOTAL	**36**	**60**

Reference:

Text Book : Engg. Mathematics-1 by Y.N. Gaur & C.L. Koul

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Course Title: **BASIC ELECTRICAL ENGINEERING**	Course Code: **EE 105**
Semester : **I**	Core / Elective: **Program Core**
Teaching Scheme in Hrs (L:T:P) : **3:1:0**	Credits : 4 **Credits**
Type of course: **Lecture + Tutorials + Assignments**	Total Contact Hours : **48**
Continuous Internal Evaluation : **40 Marks**	ESE : **60 Marks**
Programmes: **Common to all B. Tech. Engineering Programmes**	

Pre-requisites:

Basics of Mathematics of Higher Secondary Level to include Algebra, Geometry, Trigonometry, Differential and Integral Calculus. Magnetism, Electrostatics and Electromagnetism, Current, Voltage, Electricity. Basic knowledge of semiconductors, Particle and Wave, nature of electromagnetic energy. Use of scientific calculator.

Course Objectives:

- Impart basic knowledge of electrical quantities such as D.C. and A.C. Current voltage, power, energy and frequency.
- Provide working knowledge for the analysis of D.C. and A.C. circuits required for all branches of engineers.
- Develop skills to identify the type of generators and motors required for practical application.
- Highlight importance of transformers and transmission and distribution of electric power.
- Provide knowledge of basic communication systems and different types of transducers
- Design simple electronic circuits.

Course Content:

Topic and Contents	Hours	Marks
UNIT-1**: D.C. Circuits**	7	12
Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.		
UNITS-2: A.C Circuits	7	12

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.		
UNITS-3: Transformers	7	12
Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.		
UNIT-4: Electrical Machines	7	12
Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.		
UNIT 5: Power Converters & Installation Ckt.	8	12
DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.		
TOTAL	**36**	**60**

Reference Books

1. Basic Electrical and Electronics Engineering by Sukhija and Nagsarkar, Oxford Publication
2. Basic Electrical & Electronics Engineering by Kothari, Nagrath, TMH
3. Basic Electrical & Electronics Engineering by V. Jagathesan, K. Vinod Kumar & R. Saravan Kumar, Wiley India.
4. Basic Electrical & Electronics Engineering by Prasad/Sivanagraju, Cengage learning Indian Edition
5. Basic Electrical and Electronics Engineering by Muthusubrmaniam, TMH
6. Fundamentals of Electrical and Electronics Engineering by Ghosh, Smarajit, PHI India
7. Basic Electrical & Electronics Engineering by Ravish Singh, TMH
8. Electrical and Electronic Technology by Edward Hughes et al, Pearson Publication
9. Basic Electrical Engineering by A. E. Fitzgerald, TMH
10. Fundamental of Electrical Engineering by Leonard S. Bobrow, Oxford

Course outcomes:

On successful completion of the course, the student will be able to:

- To understand and analyze basic Electric and Magnetic circuits
- To study the working principles of Electrical Machines and Power Converters.
- To introduce components of Low Voltage Electrical Installations

Course Title: **PROGRAMMING FOR PROBLEM SOLVING**	Course Code : **CP 107**

Semester	: **I**	Core / Elective	: **Core**
Teaching Scheme in Hrs (L:T:P)	**: 3:0:0**	Credits	: **3 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	ESE	: **60 Marks**
Programmes: **B.Tech (All)**			

Pre-requisites:

Knowledge of Mathematics, up-to Senior Secondary School level.

Course Objectives:

This course enables the students to apply the knowledge of Mathematics in various Engineering fields by improving the ability to apply knowledge of mathematics on engineering problems. It introduces the basic concepts required to understand, programming, basic algorithm, branching, loop and pointers.

.**Course Content:**

Topic and Contents	Hours	Marks
UNIT 1: Introduction To Programming	7	12
Introduction to Programming (Flow chart/pseudocode, compilation etc.), Variables (including data types).		
UNIT 2: Conditional Branching And Loops	7	12
Writing and evaluation of conditionals and consequent branching Iteration and loops.		
UNIT 3: Arrays And Basic Algorithm	8	12
Arrays (1-D, 2-D), Character arrays and Strings properties. Searching, Basic Sorting Algorithms, Finding roots of equations, idea of time complexity.		
UNIT 4: Function And Recursion	7	12
Functions (including using built in libraries), Recursion with example programs such as Quick sort, Ackerman function etc		
UNIT 5: Structure And Pointers	7	12
Pointers, Structures (including self referential structures e.g., linked list, notional introduction)		
TOTAL	**36**	**60**

Reference:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary

Value Problems, 9th Edn., Wiley India, 2009.
4. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
5. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
6. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
7. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.
8. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
9. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Course outcomes:

The course will enable the students

- To formulate simple algorithms for arithmetic and logical problems
- To translate the algorithms to programs (in C language)
- To test and execute the programs and correct syntax and logical errors
- To implement conditional branching, iteration and recursion
- To decompose a problem into functions and synthesize a complete program using divide and conquer approach
- To use arrays, pointers and structures to formulate algorithms and programs
- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems

Course Title: **ELECTRICAL AND ELECTRONICS ENGINEERING LAB**	Course Code: **EE 151**
Semester : **I**	Core / Elective: **Program Core**
Teaching Scheme in Hrs (L:T:P) : **0:0:2**	Credits : 1 **Credits**
Type of course: **Labs**	Total Contact Hours : **20**
Continuous Internal Evaluation : **60 Marks**	ESE : **40 Marks**
Programmes: **Common to all B. Tech. Engineering Programmes**	

List of Experiments

Note: A minimum of 10 experiments from the following should be performed

1.	Verification of Kirchhoff's laws
2	Verification of (i) Superposition theorem (ii) The Thevenin's Theorem (iii) Maximum Power Transfer Theorem
3	Measurement of power and power factor in a single phase ac series inductive circuit and study improvement of power factor using capacitor
4	Study of phenomenon of resonance in RLC series circuit and obtain resonant frequency.
5	Measurement of power in a 3- phase circuit by two wattmeter method.
6	Determination of parameters of ac single phase series RLC circuit.

7	Determination of (i) Voltage ratio (ii) polarity and (iii) efficiency by load test of a single phase transformer
8	To study speed control of dc shunt motor using (i) armature voltage control (ii) field flux control
9	Determination of efficiency of a dc shunt motor by load test.
10	To study input/output characteristics of a BJT.
11	To measure energy by a single phase energy meter and determine error.
12	To study P-N diode characteristics.
13	To study full wave and half wave rectifier circuits with and without capacitor and determine ripple factors
14	To study various logic gates (TTL)
15	. To study Operational Amplifier as Adder and Subtractor
16	To study transistor as a switch
17	To study Function generator and CRO.
18	House Wiring with electric safety measures.

Project: To fabricate a functional electrical/electronic project with a given circuit diagram, using various components soldered on a PCB/Zero PCB. Students should submit project report in a file with headings: objective, principle of working, list of components with cost, circuit diagram, difficulties experienced and conclusion. The project will be evaluated after a presentation given by the students.

Laboratory Outcomes: The students are expected to

- Get an exposure to common electrical components and their ratings.
- Make electrical connections by wires of appropriate ratings.
- Understand the usage of common electrical measuring instruments.
- Understand the basic characteristics of transformers and electrical machines.
- Get an exposure to the working of power electronic converters.

Course Title: **ENGINEERING PHYSICS LAB**	Course Code**: PY 152**
Semester : **I**	Core / Elective: **Program Core**
Teaching Scheme in Hrs (L:T:P) : **0:0:2**	Credits : 1 **Credits**
Type of course: **Lab**	Total Contact Hours : **20**
Continuous Internal Evaluation : **60 Marks**	ESE : **40 Marks**
Programmes: **Common to all B. Tech. Engineering Programmes**	

Course Objectives:

- In this lab students gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
- It learns the usage of electrical and optical systems for various measurements.
- It apply the analytical techniques and graphical analysis to the experimental data

Any 10

S. No.	LIST OF PRACTICALS
1	To determine the dispersive power of material of prism
2	To determine the wavelength of sodium light by Newton's rings experiment
3	To determine the specific rotation of glucose / cane sugar solution using polarimeter
4	To determine the wavelength of prominent lines of white light by plane diffraction grating
5	To determine the wavelength of sodium light with the help of Michelson interferometer
6	To study the profile of He-Ne Laser
7	To determine the Numerical Aperture of optical fiber
8	To determine the fringe width and distance between coherent sources by Fresnel's bi-prism experiment
9	To determine the band gap in a semiconductor using a P.N. junction diode
10	To convert a galvanometer into an ammeter.
11	To convert a galvanometer into a voltmeter
12	To draw the plateau characteristic of a Geiger Muller Counter using a radioactive source.
13	To determine the height of an object with the help of sextant
14	To determine high resistance by method of leakage with the help of ballistic galvanometer
15	To determine the specific resistance of a given of a wire with the help of Carry Foster's Bridge

Reference:

1. R. K. Agrawal, Garima Jain Text Book of "Physics practical's" part I, Krishna Publication
2. R. K. Agrawal, Garima Jain Text Book of "Physics practical's" part II, Krishna publication

Laboratory Outcomes:

- Learn basics of instruments and how to calibrate them.
- Develop the circuit design understanding.
- To understand how laser works and its application in fiber communication.
- To understand the operation of semiconductor devices and its applications

Course Title: **PROGRAMMING FOR PROBLEM SOLVING LAB**	Course Code: **CP 153**
Semester : **I**	Core / Elective: **Program Core**
Teaching Scheme in Hrs (L:T:P) : **0:0:2**	Credits : 1 **Credits**
Type of course: **Labs**	Total Contact Hours : **20**
Continuous Internal Evaluation : **60 Marks**	ESE : **40 Marks**

Programmes: **Common to all B. Tech. Engineering Programmes**

S. No.	LIST OF PRACTICALS
1	Problem solving using computers: Lab1: Familiarization with programming environment
2	Variable types and type conversions: Lab 2: Simple computational problems using arithmetic expressions
3	Branching and logical expressions: Lab 3: Problems involving if-then-else structures
4	Loops, while and for loops: Lab 4: Iterative problems e.g., sum of series
5	1D Arrays: searching, sorting: Lab 5: 1D Array manipulation
6	2D arrays and Strings, memory structure: Lab 6: Matrix problems, String operations
7	Functions, call by value: Lab 7: Simple functions
8, 9	Numerical methods (Root finding, numerical differentiation, numerical integration): Lab 8 and 9: Numerical methods problems
10	Recursion, structure of recursive calls: Lab 10: Recursive functions
11	Pointers, structures and dynamic memory allocation Lab 11: Pointers and structures
12	File handling: Lab 12: File operations

Textbooks:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Laboratory Outcomes

- To formulate the algorithms for simple problems
- To translate given algorithms to a working and correct program
- To be able to correct syntax errors as reported by the compilers
- To be able to identify and correct logical errors encountered at run time
- To be able to write iterative as well as recursive programs
- To be able to represent data in arrays, strings and structures and manipulate them through a program
- To be able to declare pointers of different types and use them in defining self referential structures.
- To be able to create, read and write to and from simple text files.

Course Title: **ENGINEERING GRAPHICS & DESIGN**	Course Code: **ME 157**
Semester : **I**	Core / Elective: **Program Core**
Teaching Scheme in Hrs (L:T:P) : **0:0:3**	Credits : 2 **Credits**

Type of course: **Labs**	Total Contact Hours : **30**
Continuous Internal Evaluation : **60 Marks**	ESE : **40 Marks**
Programmes: **Common to all B. Tech. Engineering Programmes**	

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed to address:

- to prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- to prepare you to communicate effectively
- to prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice

S.N.	Contents of the Course
1.	Lines, Lettering, Dimensioning, Scales; Plain Scale, Diagonal Scale (Sheet-1)
2.	To draw curves; Parabola, Hyperbola, Ellipse (Sheet-1)
3.	Projection of Points & Lines; Orthographic Projection- 1st And 3rd Angle Projection, Projection of Surfaces– Hexagon (Sheet-1)
4.	Projection of Solids; Cube, Pyramid, Prism, Cylinder, Cone, Full & Half Sectional Views of Solids (Sheet-1)
5.	To study of AutoCAD 2D cammand: Cartesian and Polar coordinate system, Absolute and Relative coordinates; Basic editing commands: Line, Point, Trace, Rectangle, Polygon, Circle, Arc, Ellipse, , Erase, Display commands: Zoom, Pan, unit, line type, line weight, rayline, Xline
6.	To study of AutoCAD 2D cammand: Polyline, Move, Copy, Offset, Fillet, Chamfer, Trim, Extend, Mirror, break, join, extend, stretch, dimension, text, area, boundary, explode, hatch, filter, layer, block, print
7.	To draw Orthographic Projections drawing using AutoCAD (2 Problems)
8.	To draw Sectional Views using AutoCAD (2 Problems)
9.	To draw assembly drawing of simple machine elements like rigid or flexible coupling, muff coupling, plummer block, footstep bearing, bracket using AutoCAD (2 Drawing)
10.	To study of AutoCAD 3D cammand: Box, Cylinder, Sphere, Cone,Wedge,Toros,Pyramid,Extrude,Helix,Sweep,Loft,Revolve,Mirror 3D (1 Problems)

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modelling
- Exposure to computer-aided geometric design

Reference:

1. Narayana, K.L. and Kannaiah, P. Text Book of Engineering Drawing"Engineering Graphics", Scitech Publication
2. Bhatt, N.D. "Elementary Engineering Drawing", Charotar Book Stall, Anand, 1998 • Lakshminarayanan, V. and Vaish Wanar, R.S., "Engineering Graphics", Jain Brothers, New Delhi, 1998
3. Chandra, A.M. and Chandra Satish, "Engineering Graphics", Narosa, 1998 • Jolhe, "Engineering Graphics", Tata McGraw-Hill- WBUT Series

Semester II

Course Title: **ENGLISH**		Course Code	**: EN 108**
Semester	: **II**	Core / Elective	: **Core**
Teaching Scheme in Hrs (L:T:P)	**: 3:0:0**	Credits	: **2 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	ESE	: **60 Marks**
Programmes: **B.Tech (All)**			

Pre-requisites:

Knowledge of English, up-to Senior Secondary School level.

Course Objectives:

- This course develops the ability to understand the role of communication in personal & professional success.
- Develop awareness of appropriate communication strategies and ability to prepare and present messages with a specific intent.
- Analyze and learn variety of communication acts. And ethically use, document and integrate sources.

Course Content:

Topic and Contents	Hours	Marks
UNIT 1: Vocabulary Building	8	12
The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms, and standard abbreviations.		
UNIT 2: Basic Writing Skills	7	12
Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely		
UNIT 3: Identifying Common Errors In Writing	7	12

Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés.		
UNIT 4: Nature, Style Of Sensible Writing	7	12
Describing, Defining, Classifying, Providing examples or evidence, Writing introduction and conclusion		
UNIT 5: Writing Practice	7	12
Comprehension, Précis Writing, Essay Writing.		
TOTAL	**36**	**60**

Reference:

1. Practical English Usage. Michael Swan. OUP.1995
2. Remedial English Grammar. F.T. Wood Macmillan.2007 (iii)On Writing Well. William Zinsser. Harper Resource Book. 2001
3. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006
4. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011
5. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Course outcomes:

On successful completion of the course, the student will be able to:

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Course Title: **MATHEMATICS – II**		Course Code	: MA 104
Semester	: **II**	Core / Elective	: **Core**
Teaching Scheme in Hrs (L:T:P)	**: 3:1:0**	Credits	: **4 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **48**
Continuous Internal Evaluation	: **40 Marks**	ESE	: **60 Marks**
Programmes: **B.Tech (All)**			

Pre-requisites:

Knowledge of Mathematics, up-to Senior Secondary School level.

Course Objectives:

The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines. More precisely, the objectives are:

- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.
- To introduce effective mathematical tools for the solutions of differential equations that model physical processes.
- To introduce the tools of differentiation and integration of functions of complex variable that are used in various techniques dealing engineering problems.

.**Course Content:**

Topic and Contents	Hours	Marks
UNIT 1: Matrices	8	12
Rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.		
UNIT 2: First Order Ordinary Differential Equations	7	12
Linear and Bernoulli‟s equations, Exact equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut‟s type.		
UNIT 3: Ordinary Differential Equations of Higher Orders	8	12
Linear Differential Equations of Higher order with constant coefficients, Simultaneous Linear Differential Equations, Second order linear differential equations with variable coefficients: Homogenous and Exact forms, one part of CF is known, Change of dependent and independent variables, method of variation of parameters, CauchyEuler equation; Power series solutions including Legendre differential equation and Bessel differential equations.		
UNIT 4: Partial Differential Equations	6	12
First order: Order and Degree, Formation; Linear Partial differential equations of First order, Lagrange‟s Form, Non Linear Partial Differential equations of first order, Charpit‟s method, Standard forms.		
UNIT 5: Partial Differential Equations	7	12
Higher order: Classification of Second order partial differential equations, Separation of variables method to simple problems in Cartesian coordinates including two dimensional Laplace, one dimensional Heat and one dimensional Wave equations.		
TOTAL	**36**	**60**

Reference:

1. D. Poole, “Linear Algebra: A Modern Introduction”, Brooks/Cole, 2005.
2. N.P. Bali and M. Goyal, “A text book of Engineering Mathematics”, Laxmi Publications, 2008.

3. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2010.
4. V. Krishnamurthy, V. P. Mainra and J. L. Arora, "An introduction to Linear Algebra", Affiliated East-West press, 2005.

Course outcomes:

On completion of this course, students are able

- Understand the design and analysis of continuous and discrete systems with the help of Fourier series and Harmonic analysis.
- Interpret the concept of rank of a matrix and apply it to solve the system of linear algebraic equations.
- Examine and recognize the use of Eigen values and Eigen vectors in various Complex Engineering Problems.
- Understand the concept of solid geometry (Sphere, Cone, and Cylinder) which arises in electromagnetic field theory, CAD-CAM, Computer graphics.
- To introduce the concept of Vector differentiation and integration that finds applications in various fields like solid mechanics, fluid flow, heat problems and potential theory.

Course Title: **CHEMISTRY**		Course Code	: **CY 102**
Semester	: **II**	Core / Elective	: **Core**
Teaching Scheme in Hrs (L:T:P)	**: 3:0:0**	Credits	: **3 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	ESE	: **60 Marks**
Programmes: **B.Tech (All)**			

Pre-requisites:

Knowledge of Mathematics, up-to Senior Secondary School level.

Course Objectives:

- To encourage basic engineering materials which are useful for different engineering and technology such as of Chemistry and knowledge is added
- To develop knowledge by teaching and modeling for engineering Materials
- Knowledge dissemination for Engineering by Chemicals and Materials
- Advanced materials are also the objective for Students
- Apply the concept of materials and Chemicals used to solve the engineering materials in different engineering field.
- Apply the processing in solving the problems of required materials.
- Solve the problem of advanced materials used the civil engineering computer science (memory materials) electrical ,EC Mechanical , VLSI using concepts of different properties.
- Evaluate the advanced engineering materials such as communication, networking high temperature using structures of chemicals.
- Apply and evaluate different concept in development and innovation in engineering field.
- Innovate new materials to solve basic concept of various technology.

Course Content:

Topic and Contents	Hours	Marks
UNIT 1: Atomic And Molecular Structure	8	12
Schrodinger equation. Particle in box solutions and their applications for conjugated molecules and nano particles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbital of diatomic molecules and plots of the multi-centre orbital. Equations for atomic and molecular orbital. Energy level diagrams of diatomic. Pi- molecular orbital of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.		
UNIT 2: Spectroscopic Techniques And Applications	7	12
Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques. Diffraction and scattering.		
UNIT 3: Intermolecular Forces And Potential Energy Surfaces Rays And Basic Algorithm, Use Of Free Energy In Chemical Equilibrium	8	12
Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, H_2F and HCN and trajectories on these surfaces . Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibrium. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.		
UNIT 4: Periodic Properties And Stereochemistry	7	12
Effective nuclear charge, penetration of orbital, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electro negativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries. Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds.		
UNIT 5: Organic Reactions And Synthesis Of Drug Molecule	6	12
Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a		

commonly used drug molecule.		
TOTAL	**36**	**60**

Reference:

1. B. H. Mahan, "University chemistry", Addison-Wesley Publishing Company, 1975.
2. M. J. Sienko and R. A. Plane, "Chemistry: Principles and Applications", McGraw Hill International, 1974.
3. C. N. Banwell, "Fundamentals of Molecular Spectroscopy", McGraw Hill Education, 1994.
4. B. L. Tembe, Kamaluddin and M. S. Krishnan, "Engineering Chemistry" (NPTEL).
5. K.P.C. Volhardt and N. E. Schore, "Organic Chemistry: Structure and Function" Freeman, 2010.

Course outcomes:

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Quantum theory is more than 100 years old and to understand phenomena at nanometer levels; one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyze microscopic chemistry in terms of atomic and molecular orbital and intermolecular forces.
- Rationalize bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalize periodic properties such as ionization potential, electro negativity, oxidation states and electro negativity.
- List major chemical reactions that are used in the synthesis of molecules.

Semester : **I**	Core / Elective: **Program Core**
Teaching Scheme in Hrs (L:T:P) : **3:0:0**	Credits : 3 **Credits**
Type of course: **Lecture + Tutorials + Assignments**	Total Contact Hours : **36**
Continuous Internal Evaluation : **40 Marks**	SEE : **60 Marks**
Programmes:	

Pre-requisites:

Semiconductor physics

Course Objectives:

- Impart basic knowledge of electronics quantities such as diode and transistors.
- Provide working knowledge of Transistor and Junction Diode for all branches of Engineering..
- Develop skills to identify the type of electronics in digital and analog system.
- Highlight importance of Communication system and Digital Electronics System.
- Design simple electronic circuits with Transistor and Junction.

Topic and Contents	Hours	Marks
UNIT 1: Semiconductor Devices and Applications	8	12
Introduction to P-N junction Diode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. Regulated power supply IC based on 78XX and 79XX series, Introduction to BJT, its input-output and transfer characteristics, BJT as a single stage CE amplifier, frequency response and bandwidth.		
UNIT 2: Operational Amplifier And Its Applications	7	12
Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator.		
UNIT 3: Timing Circuits And Oscillators	6	12
RC-timing circuits, IC 555 and its applications as astable and mono-stable multi-vibrators, positive feedback, Barkhausen's criteria for oscillation, R-C phase shift and Wein bridge oscillator.		
UNIT 4: Digital Electronics Fundamentals	8	12

Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K- map, Logic ICs, half and full adder/subtractor, multiplexers, de-multiplexers, flip-flops, shift registers, counters, Block diagram of microprocessor/microcontroller and their applications.		
UNIT 5: Electronic Communication Systems	7	12
The elements of communication system, IEEE frequency spectrum, and Transmission media: wired and wireless, need of modulation, AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram of GSM system.		
TOTAL	**36**	**60**

Reference:

1. Floyd ," Electronic Devices" Pearson Education 9th edition, 2012.
2. R.P. Jain , "Modern Digital Electronics", Tata Mc Graw Hill, 3rd Edition, 2007.
3. Frenzel, "Communication Electronics: Principles and Applications", Tata Mc Graw Hill, 3rd Edition, 2001.

Course Outcomes:

At the end of this course students will demonstrate the ability to

- Understand the principles of semiconductor devices and their applications.
- Design an application using Operational amplifier.
- Understand the working of timing circuits and oscillators.
- Understand logic gates, flip flop as a building block of digital systems.
- Learn the basics of Communication system.

Course Title: **CHEMISTRY LAB**	Course Code: **CY 152**
Semester : **I**	Core / Elective: **Program Core**
Teaching Scheme in Hrs (L:T:P) : **0:0:2**	Credits : 1 **Credits**
Type of course: **Labs**	Total Contact Hours : **20**
Continuous Internal Evaluation : **60 Marks**	ESE : **40 Marks**
Programmes: **Common to all B. Tech. Engineering Programmes**	

S. No.	LIST OF PRACTICALS
1	Determination of surface tension and viscosity
2	Thin layer chromatography
3	Ion exchange column for removal of hardness of water
4	Determination of chloride content of water

5	Colligative properties using freezing point depression
6	Determination of the rate constant of a reaction
7	Determination of cell constant and conductance of solutions
8	Potentiometry - determination of redox potentials and emfs.
9	Synthesis of a polymer/drug
10	Saponification/acid value of an oil
11	Chemical analysis of a salt
12	Lattice structures and packing of spheres
13	Models of potential energy surfaces
14	Chemical oscillations- Iodine clock reaction
15	Determination of the partition coefficient of a substance between two immiscible liquids
16	Adsorption of acetic acid by charcoal
17	Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg

Reference:

1. ogel's Textbook of Quantitative Chemical Analysis (Latest ed.), Revised by G.H. Jeffery, J. Bassett, J. Mendham & R.C. Denney
2. Applied Chemistry: Theory and Practice (Latest ed.), By O.P. Vermani & A.K. Narula.
3. Practical Physical Chemistry (Latest ed.), By B.D. Khosla, A. Gulati & V.C. Garg
4. Laboratory Manual on Engineering Chemistry (Latest ed.), By S.K. Bhasin and Sudha Rani

Laboratory Outcomes:

- The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.
- The students will learn to Estimate rate constants of reactions from concentration of reactants/products as a function of time
- Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
- Synthesize a small drug molecule and analyze a salt sample.

Course Title: **ENGLISH LANGUAGE LAB**	Course Code: **EN 152**
Semester : **II**	Core / Elective: **Program Core**
Teaching Scheme in Hrs (L:T:P) : **0:0:2**	Credits : 1 **Credits**
Type of course: **Labs**	Total Contact Hours : **20**
Continuous Internal Evaluation : **60 Marks**	ESE : **40 Marks**
Programmes: **Common to all B. Tech. Engineering Programmes**	

S. No.	LIST OF PRACTICALS

1	Listening Comprehension
2	Pronunciation, Intonation
3	Stress and Rhythm
4	Common Everyday Situations: Conversations and Dialogues
5	Communication at Workplace
6	Interviews
7	Formal Presentations

Course Title: : **WORKSHOP MANUFACTURING PRACTICES**	Course Code: **ME 158**
Semester : **II**	Core / Elective: **Program Core**
Teaching Scheme in Hrs (L:T:P) : **0:0:3**	Credits : **2 Credits**
Type of course: **Labs**	Total Contact Hours : **20**
Continuous Internal Evaluation : **60 Marks**	ESE : **40 Marks**
Programmes: **Common to all B. Tech. Engineering Programmes**	

Manufacturing is fundamental to the development of any engineering product. This course is intended to expose engineering students to different types of manufacturing/ fabrication processes, dealing with different materials such as metals, ceramics, plastics, wood, glass etc. While the actual practice of fabrication techniques is given more weightage, some lectures and video clips available on different methods of manufacturing are also included. The course intends to prepare students for:

- Understanding different manufacturing techniques and their relative advantages/ disadvantages with respect to different applications
- The selection of a suitable technique for meeting a specific fabrication need
- Acquire a minimum practical skill with respect to the different manufacturing methods and develop the confidence to design & fabricate small components for their project work and also to participate in various national and international technical competitions.

Course Objectives:

- Introduction to different manufacturing methods in different fields of engineering
- Practical exposure to different fabrication techniques
- Creation of simple components using different materials
- Exposure to some of the advanced and latest manufacturing techniques being

employed in the industry

S.N.	Contents of the Course
1.	To study different types of measuring tools used in workshop and determine least counts of vernier calipers, micrometers and vernier height gauges.
2.	To prepare a multi-operation job on a lathe involving facing, turning, step turning, chamfering & knurling
3.	To prepare horizontal surface/ vertical surface/ slots or V-grooves on a shaper/planner machine.
4.	To study different types of fitting tools and marking tools used in fitting shop.
5.	To prepare a model in fitting shop and make hole using drilling machine.
6.	To study various types of carpentry tools and type of pattern.
7.	To prepare two wooden joints; Lap & Bridle Joint
8.	To prepare a mould cavity by using a solid / single piece pattern.
9.	To prepare melting pouring and making an aluminium casting
10.	To prepare at least two welding joints; Butt/ Lap/T-Joint/ Corner Joint by arc welding

Laboratory Outcomes

- Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.
- Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
- They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
- By assembling different components, they will be able to produce small devices of their interest.
-

Suggested Text/Reference Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.

Course Title: : **EMPLOYABILITY SKILLS – I**	Course Code: **EM-102**
Semester : **II**	Core / Elective: **University Core**
Teaching Scheme in Hrs (L:T:P) : **2:0:0**	Credits : **1 Credits**
Type of course: **Labs**	Total Contact Hours : **25**
Continuous Internal Evaluation : **60 Marks**	ESE : **40 Marks**
Programmes: **Common to all B. Tech. Engineering Programmes**	

S.No.	Topic	Details	Contact Hrs
1	Motivation	Orientation for all & Importance of Soft Skills & Confidence in Business	1
2	Communication	Basics, Introduction, Barriers in Communication, Types, Verbal, Non-verbal, Face/Eye/Body Language, Interview Skills &Types	15
3	Attitude& Manners	Grooming & Etiquettes, Vales & Ethics, What is personality, Good Human Being, Confidence Building	9

Course Title: Economics and Social Sciences		Course Code	: HS 203
Semester	: **III**	Core / Elective	:**University Core**
Teaching Scheme in Hrs (L:T:P)	: 3**:0:0**	Credits	: **3 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.TECH (MECHANICAL ENGINEERING)**			

Course Objective

- To understand the significance of the economic aspects of engineering and to become proficient in the evaluation of engineering proposals in terms of worth and cost
- To help students to grasp various economics concepts and theories towards making economic decision.

Units	Course Contents	Hours
I	Definition of Economics - various definitions, Nature of Economic problem, Production possibility curve, Economic laws and their nature. Relation between Science, Engineering, Technology and Economics. Concepts and measurement of utility, Law of Diminishing Marginal Utility, Law of equi-marginal utility - its practical application and importance	7

II	Meaning of Demand, Individual and Market demand schedule, Law of demand, shape of demand curve, Elasticity of demand, measurement of elasticity of demand, factors effecting elasticity of demand, practical importance & applications of the concept of elasticity of demand. Meaning of production and factors of production; Law of variable proportions, Returns to scale, Internal and External economics and diseconomies of scale.	7
III	Various concepts of cost - Fixed cost, variable cost, average cost, marginal cost, money cost, real cost opportunity cost. Shape of average cost, marginal cost, total cost etc. in short run and long run. Meaning of Market, Types of Market - Perfect Competition, Monopoly, Oligoply, Monoplistic Competition (Main features of these markets)	7
IV	Supply and Law of Supply, Role of Demand & Supply in Price Determination and effect of changes in demand and supply on prices.	7
V	Nature and characteristics of Indian economy (brief and elementary introduction), Privatization - meaning, merits and demerits. Globalization of Indian economy - merits and demerits. Elementary Concepts of VAT, WTO, GATT & TRIPS agreement	7
	Total	35

Text Books:

1, Vengedasalam, Deviga. Madhavan, Karunagaran, Principles of Economics, Oxford University Press.

2. R. Paneer Seelvan, " Engineering Economics", PHI

3. Ahuja,H.L., "Principles of Micro Economics" , S.Chand & Company Ltd

4. Riggs,J.L., Bedworth and Randhwa, "Engineering Economics", McGraw Hill Education India

5.Paul, R.R., Money, Banking and International Trade, Kalyni Publishers

Ref. Books

1.Park, Chan.S, "Fundamental of Engineering Economics", Pearson.

2. Engineering Economy by William G.Sullivan, Elin M.Wicks, C. Patric Koelling, Pearson

3. Thuesen, G.J.,Fabrycky,. Engineering Economy, PHI.

4.Jhingan,M.L., "Macro Economic Theory", Vrinda Publications Ltd

Course Code: EM-201 **Course Name:** Employability Skills – II

LTPC: 0201**Total Contact Hours**: 25

COURSE CONTENTS

S.No.	Topic	Details	Contact Hrs
1	Communication	Role Play, Reading, Formal writing skills Listening, Interaction Process, Interpersonal Relationship	15
2	Attitude& Manners	Motivation, Team Building, Winning Strategy, CAN DO,	5
3	Preparation, presentation	Presentation skills, Preparation Skills,	4
4	Industry	Concept & Importance of SIP, Industrial Mentoring & Networking	1

Course Title: ADVANCED MATHS		Course Code	: MA 205
Semester	: **III**	Core / Elective	:**University Core**
Teaching Scheme in Hrs (L:T:P)	: 3**:0:0**	Credits	: **3 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.TECH (MECHANICAL ENGINEERING)**			

Pre-requisites:

Basic maths

Course Objectives:

To know advancement of maths in engineering field

Course Content:

Topic and Contents	Hours	Marks

	8	**20**
UNIT-1		
Boundary value problems: Method of separation of variables - in the solution of wave equation in one dimension, Laplace's equation in two dimensions, Diffusion equation in one dimension.		
UNITS-2	**07**	**20**
Transform calculus : Laplace transform with its simple properties, applications to the solutions of ordinary and partial differential equations having constant co-efficient with special reference to wave and diffusion equation		
UNITS-3	**07**	**20**
FOURIER TRANSFORM - Complex form of Fourier Transform and its inverse, Fourier sine and cosine transform and their inversion. Applications of Fourier Transform to solution of partial differential equations having constant coefficient with special reference to heat equation and wave equation.		
UNIT-4	**7**	**20**
Complex variable: Taylor's series, Laurent's series, poles, residues. Evaluations of simple definite real integrals using the theorem of residues. Simple contour integration.		
UNIT 5	**07**	**20**
Numerical Methods: Finite differences and interpolation Numerical Differentiation and Integration. Solution of Algebraic and transcendental equations by graphical method, trisection method, regula – falsi method and Newton raphson method.		
TOTAL	**36**	**100**

Course outcomes:

On successful completion of the course, the student will be able to:

1. Solve Advanced Mathematics problems in engineering field.

Course Title: **MECHANICS OF SOLID**	Course Code : **ME 201**

Semester	: IV	Core / Elective: PROGRAME CORE	
Teaching Scheme in Hrs (L:T:P)	: **3:1:0**	Credits	: **4 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.Tech Mechanical Engineering**			

Pre-requisites:

Basic mathematics and Engineering Mechanics

Course Objectives:

- To define the concept of load, stress, strain, stress vs strain diagram and elastic constant relationship.
- To Solve engineering problems through the relationship between stress and strain.
- To determine shear force and bending moment diagrams for variously loading Conditions
- Learn to solve problems for calculation of torsion and Twisting moment in solid and hollow circular shafts.

Course Content:

Topic and Contents	Hours	Marks
UNIT-1:	**8**	**20**
Introduction to Stress and strain: Definition of Stress, Normal Stress in axially loaded Bar, Stress on inclined sections in axially loaded bar, Shear Stress, Analysis of normal and shear stress, Deterministic design of members, probabilistic basis for structural design. Tension test and normal Strain, Stress strain relation and Hooke's law. Poisson's ratio, Thermal strain and deformation.	8	
UNIT-2	**7**	**20**
Stress as a tensor: stress at point, Cauchy stress tensor, equilibrium equations, analysis of deformation and definition of strain components **Some properties of Stress and Strain Tensor:** Principal stresses and strains, stress and strain invariants, Mohr's circle representation for plane stress and plane strain, thermal stresses and strains, volumetric stress and strain.	**7**	

UNIT-3	**7**	**20**
Application of Mechanics of Material in Different Problems: Shear Force and Bending Moment diagrams, Axially loaded members, Torsion of circular shafts, Stresses due to bending: pure bending theory, combined stresses. Deflections due to bending: moment-curvature relation, load-defection differential equation, area moment method, and superposition theorem, Stresses and deflections due to transverse shears, Springs: Helical and Leaf springs	7	
UNIT-4	**7**	**20**
Constitutive relations: An short introduction to material symmetry transformations, Isotropic material, true and engineering stress-strain curves, Material properties for isotropic materials and their relations. Theories of failures for isotropic materials,Buckling of columns; Concept of creep, fatigue and fracture.	7	
UNIT-5	**7**	**20**
Energy Methods: Strain energy due to axial, torsion, bending and transverse shear. Castigliano's theorem, reciprocity theorem etc.	7	
TOTAL	**26**	**100**

Refrences:

- S. C. Crandall, N. C. Dahl, and T. J. Lardner, An Introduction to the Mechanics of Solids, 2nd Ed, McGraw Hill, 1978.
- E. P. Popov, Engineering Mechanics of Solids, Prentice Hall, 1990.
- H. Shames, Introduction to Solid Mechanics, 2nd Ed, Prentice Hall, 1989.
- S. P. Timoshenko, Strength of Materials, Vols. 1 & 2, CBS publ., 1986.

Course outcomes:

On successful completion of the course, the student will be able to:

- Find the basic mechanical properties of material, tension, compression, torsion, bending and combined stress using the fundamental concepts of stress, strain and elastic behavior of materials.
- Apply the stress- strain distributions, diagrammatically representation of shear force & bending moment for different beams under various load conditions by using suitable methods.

- Analyze the slope and deflections for different cross sectional beams and columns, torsion effect for shaft and springs under different load conditions.
- Solve the engineering problems by applying mechanical engineering concepts and theories.

Course Title: **ENGINERING THERMODYNAMICS**		Course Code	: ME 203
Semester	: IV	Core / Elective: PROGRAME CORE	
Teaching Scheme in Hrs (L:T:P)	: **3:1:0**	Credits	: **4 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.Tech Mechanical Engineering**			

Pre-requisites:

Basic of physics, basic of mathematics, first and , Zeroth law of thermodynamics, Carnot engine, Work

Course Objectives:

To study about thermodynamic System, properties and their types & state, Definition of work process & cycle internal energy & enthalpy, Specific heats; internal energy, enthalpy, Reversible process; heat engine, heat pump, refrigerator; Kelvin-Planck & Clausius statements, Concept of entropy; the Need of entropy definition of entropy; Available energy, Otto, Diesel and Dual cycle, Third Law of Thermodynamics.

Course Content:

Topic and Contents	Hours	Marks
UNIT-1:	**7**	**20**
Thermodynamic Systems, properties & state, process & cycle Definition of work and its identification, work done at the moving boundary, Zeroth law. Thermodynamic Properties of Fluids: Pure substance, Concept of Phase, Graphical representation of p-v-T data, Properties of steam.		

Steam tables, Mollier chart		
UNIT-2:	**07**	**20**
First law for control mass & control volume for a cycle as well as for a change of state, internal energy & enthalpy, Specific heats; internal energy, enthalpy specific heat of ideal gases. First law analysis of some elementary processes. Steady and unsteady flow energy equations.		
UNIT-3:	**07**	**20**
Second Law of Thermodynamics: Heat engine, Heat pump and refrigerator, Second law of thermodynamics, Equivalence of the Kelvin-Plank and Clausius statements. Reversible and Irreversible Processes, Carnot engine, Efficiency of a Carnot engine, Carnot principle, thermodynamic temperature scale, Clausius Inequality. Entropy: Entropy, Calculation of Entropy change, Principle of entropy increase. Temperature-Entropy diagram, Second law analysis of a control volume.		
UNIT-4	**08**	**20**
Available energy, reversible work irreversibility for control mass and control volume processes; second law efficiency. Thermodynamic Relations: Thermodynamic variables, Independent and dependent variables, Maxwell's thermodynamic relations, Thermodynamic relations involving entropy, Thermodynamic relations involving enthalpy and internal energy, Joule-Thomson coefficient, Clapeyron equation.		
UNIT-5	**07**	**20**
Power Cycles: Otto cycle, Diesel cycle, Dual cycle, Brayton cycle and Ericsson cycle. Vapour power cycle: Rankine cycle, effect of operating conditions on its efficiency, properties of ideal working fluid in vapour power cycle, Reheat cycle, regenerative cycle, bleeding extraction cycle, feed water		

heating co-generation cycle.		
TOTAL	**36**	**100**

Reference:

- Sonntag R.E., Claus B. & Van Wylen G., "Fundamentals of Thermodynamics", John Wiley & Sons, 2000, 6th ed.
- GFC Rogers and Y R Mayhew, Engineering Thermodynamics Work and Heat Transfer 4e, Pearson 2003
- J P Howell and P O Bulkins, Fundamentals of Engineering Thermodynamics, McGraw Hill,1987
- Y A Cengal and M A Boles, Thermodynamics, An Engineering Approach, 4e Tata McGraw Hill, 2003.
- Michael J. Moran & Howard N. Shapiro, Fundaments of Engineering Thermodynamics, John Wiley & Sons, 2004, 4th ed

Course outcomes:

On successful completion of the course, the student will be able to:

1. The students will be able to define the terms temperature, entropy and enthalpy.
2. The students will be able to explain the refrigeration and heat pump cycle
3. The students will be able to explain properties of pure substance.
4. The students will be able to understand working of different-different engines.

Course Title: **MECHANICS OF SOLID LAB**		Course Code	: ME 251
Semester	: III	Core / Elective: PROGRAME CORE	
Teaching Scheme in Hrs (L:T:P)	: **0:0:3**	Credits	: **2 Credits**
Type of course	: **Lab Experiment**	Total Contact Hours	: **20**
Continuous Internal Evaluation	: **60 Marks**	SEE	: **40 Marks**
Programmes: **B.Tech Mechanical Engineering**			

Pre-requisites:

Engineering Mechanics, Mechanics of solids theory

Course Objectives:

TO PERFORM VARIOUS EXPERIMENTS ON MECHANICS OF SOLIDS

Course Content:

Topic and Contents	Hours	Marks
LIST OF EXPERIMENTS (ANY 10)	**20**	**100**
1. Izod Impact testing. 2. Rockwell Hardness Testing. 3. Spring Testing 4. Column Testing for buckling 5. Torsion Testing 6. Tensile Testing 7. Compression Testing 8. Shear Testing 9. Brinell Hardness Testing 10. Bending Test on UTM. 11. Study of Fatigue Testing Machine.	Two hours for each experiment	
TOTAL	**20**	**100**

Reference:

- S. C. Crandall, N. C. Dahl, and T. J. Lardner, An Introduction to the Mechanics of Solids, 2nd Ed, McGraw Hill, 1978.
- E. P. Popov, Engineering Mechanics of Solids, Prentice Hall, 1990.
- I. H. Shames, Introduction to Solid Mechanics, 2nd Ed, Prentice Hall, 1989.
- S. P. Timoshenko, Strength of Materials, Vols. 1 & 2, CBS publ., 1986.

Course outcomes:

On successful completion of the course, the student will be able to:

1. Various type of strength calculation
2. Calculation of hardness
3. Calculation of toughness

Course Title: **Industry Oriented Thermal Engineering Laboratory**	Course Code : ME 253

Semester	: III	Core / Elective: PROGRAME CORE	
Teaching Scheme in Hrs (L:T:P)	: **0:0:3**	Credits	: **2 Credits**
Type of course	: **Lab Experiment**	Total Contact Hours	: **30**
Continuous Internal Evaluation	: **60 Marks**	SEE	: **40 Marks**
Programmes: **B.Tech Mechanical Engineering**			

Pre-requisites:

ENGINEERING THERMODYNAMICS

Course Objectives:

TO STUDY & PERFORM VARIOUS EXPERIMENTS ON THERMAL EQUIPMENTS

Course Content:

Topic and Contents	Hours	Marks
LIST OF EXPERIMENTS (ANY 10)	**30**	**100**
1. Comparative study of four stroke diesel and petrol engines. 2. Comparative study of two stroke petrol and diesel engines. 3. Studies of fuel supply systems of diesel and petrol engines. 4. Study of cooling, lubrication and ignition system in diesel and petrol engines. 5. To study various types of Boilers and to study Boiler mounting and accessories. 6. To study various types of Dynamometers. 7. To study Multi Stage Air Compressors. 8. To find the BHP, Thermal efficiency of four stroke diesel engine.	THREE hours for each experiment	

9. To prepare a comparison sheet of various automobiles (4 Wheeler and 2 Wheeler). 10. To study BHP, Thermal efficiency of four stroke diesel engine.		
TOTAL	**30**	**100**

Reference:

1. Sonntag R.E., Claus B. & Van Wylen G., "Fundamentals of Thermodynamics", John Wiley & Sons, 2000, 6th ed.
2. GFC Rogers and Y R Mayhew, Engineering Thermodynamics Work and Heat Transfer 4e, Pearson 2003
3. J P Howell and P O Bulkins, Fundamentals of Engineering Thermodynamics, McGraw Hill,1987
4. Y A Cengal and M A Boles, Thermodynamics, An Engineering Approach, 4e Tata McGraw Hill, 2003.
5. Michael J. Moran & Howard N. Shapiro, Fundaments of Engineering Thermodynamics, John Wiley & Sons, 2004, 4th ed

Course outcomes:

On successful completion of the course, the student will be able to:

1. Comparative study of four stroke diesel and petrol engines.

2. Comparative study of two stroke petrol and diesel engines.

3. Studies of fuel supply systems of diesel and petrol engines.

4. Study of cooling, lubrication and ignition system in diesel and petrol engines.

5. To study various types of Boilers and to study Boiler mounting and accessories.

Course Title: MATERIAL SCIENCE LAB	Course Code : ME 257
Semester : III	Core / Elective: PROGRAME **ELECTIVE**
Teaching Scheme in Hrs (L:T:P) : **0:0:2**	Credits : **1 Credits**
Type of course : **Lab Experiment**	Total Contact Hours : **20**
Continuous Internal Evaluation : **60 Marks**	SEE : **40 Marks**
Programmes: **B.Tech Mechanical Engineering**	

Pre-requisites:

Workshop technology, Engineering mechanics, Engineering drawing

Course Objectives:

TO STUDY PROPERTIES OF VARIOUS MATERIALS THEIR STRUCTURE AND BEHAVIOUR OF PHASE DIAGRAM.

Course Content:

Topic and Contents	Hours	Marks
LIST OF EXPERIMENTS (ANY 10)	**30**	**100**
1. To study the Engineering Materials, significance and classifications. 2. Study of crystals structures, Study of Models BCC, FCC, HCP, stacking sequence, tetrahedral and Octahedral voids 3. To calculate the effective numbers of atoms, co-ordination no. packing factors, c/a ratio for BCC, FCC & HCP structures. 4. To prepare metallic samples for metallographic examination and to study the principle and construction of the Metallurgical Microscope. 5. Effect of carbon percentage on hardness of steel 6. Study of Phase Diagrams: concept of phase rule: Fe-C & Cu-Zn. 7. Study of Creep, Study of anistropy: Glass 'Fibre and Carbon' Fibre Composites. 9. Study of various types of fractures, Brittle fracture/ductile. 10. Study of Iron-Carbon Equilibrium Diagram and sketch the various structures present at room temperature.	Two hours for each experiment	
TOTAL	**30**	**100**

Reference:

1. William D. Callister, Material science and Engineering and Introduction, Wiley, 2006.

2.V. Raghavan, Materials Science and Engineering, Fifth Edition, Prentice Hall Of India, 2008.

3.G. E. Dieter, Mechanical Metallurgy, McGraw Hill, 1988.

4.W. F. Smith, Materials Science and Engineering (SIE), Tata-McGraw Hill, 2008.

5.AVNER, Introduction to Physical Metallurgy, Tata-McGraw Hill, 2008.

Course outcomes:

On successful completion of the course, the student will be able to:

1. To differentiate between various materials
2. To understand structure of various material.
3. To Study of Iron-Carbon Equilibrium Diagram .

Course Title: **APPLIED MATERIAL SCIENCE**		Course Code	: ME 207
Semester	: III	Core / Elective: PROGRAME ELECTIVE	
Teaching Scheme in Hrs (L:T:P)	: **3:0:0**	Credits	: **3 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.Tech Mechanical Engineering**			

Pre-requisites:

Element of Mechanical Engineering, Material Science

Course Objectives:

TO STUDY ABOUT BASICS OF MATERIAL, PROPERTIES AND THEIR STUCTURE.

Course Content:

Topic and Contents	Hours	Marks
UNIT-1:	**7**	**20**
Structure of metal: Crystal structure, miller indices, lattices, imperfections, elementarytreatment of point and line defects and their relation to mechanical properties. **Deformation**: Slip, twinning, effect of cold and hot working on mechanical properties, principles of recovery, re-crystallization and gain growth.		
UNIT-2:	**07**	**20**
Creep: Basic consideration in the selection of material for high and low temperature service,creep curve, effect of material variables on creep properties, brittle failure at low temperature. **Solidification**: Phases in metal system, lever rule, solidification of metal and alloys, solid solution, eutectic, eutectoid and inter-metallic compounds, Iron carbon equilibrium diagram, TTT-diagram		
UNIT-3:	**07**	**20**
Heat Treatment: Principles and purpose of heat treatment of plain carbon steels, annealing,normalizing, hardening, tempering, isothermal treatment, case hardening – carburizing, nitriding etc, precipitating hardening of aluminum alloys.		
UNIT-4:	**07**	**20**
Engineering Materials: Plain Carbon steels, Effects of alloying elements , properties, uses, springs, and wear resisting steels, IS standards codes for steels. Low alloy steels. Stainless, Magnetic materials for high and low temperature service. Brasses and bronzes; Aluminum base alloys. Bearing Materials,.		
UNIT-5:	**08**	**20**
Corrosion:Types of corrosion, Galvanic cell, rusting of Iron, Methods of protection from corrosion. **Composite Material**: General characteristics, Applications, Introduction to Fibers –glass, carbon, Kevlar 49 fibers. Matrix – Polymeric, Metallic, Ceramic Matrix, Coupling agents and fillers.		

Nano Material:		
TOTAL	**36**	**100**

Reference:

1. William D. Callister, Material science and Engineering and Introduction, Wiley, 2006.

2. V. Raghavan, Materials Science and Engineering, Fifth Edition, Prentice Hall Of India, 2008.

3. G. E. Dieter, Mechanical Metallurgy, McGraw Hill, 1988.

4. W. F. Smith, Materials Science and Engineering (SIE), Tata-McGraw Hill, 2008.

5. AVNER, Introduction to Physical Metallurgy, Tata-McGraw Hill, 2008.

Course outcomes:

On successful completion of the course, the student will be able to:

1. Crystal structure, miller indices, lattices, imperfections, elementarytreatment of point and line defects and their relation to mechanical properties.
2. Principles and purpose of heat treatment of plain carbon steels, annealing,normalizing, hardening, tempering, isothermal treatment, case hardening – carburizing, nitriding etc, precipitating hardening of aluminum alloys..
3. Types of corrosion, Galvanic cell, rusting of Iron, Methods of protection from corrosion.

Course Title: **MANUFACTURING TECHNOLOGY**		Course Code	: ME 211
Semester	: **III**	Core / Elective	: **Program Elective**
Teaching Scheme in Hrs (L:T:P)	: 3**:0:0**	Credits	: **3 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.Tech (Mechanical Engineering)**			

Pre-requisites:

Workshop technology, physics in Secondary Education, engineering drawing, engineering mechanics.

Course Objectives:

1. Apply the concept of different types of casting in manufacturing of product.
2. Apply the concept of different types of welding in manufacturing of product.
3. Apply the concept of smithy and forging in manufacturing of product.
4. Apply the concept of sheet metal work in manufacturing of product.
5. Apply the concept of bench work and fitting in manufacturing of product.

Course Content:

Topic and Contents	Hours	Marks
MANUFACTURING TECHNOLOGY		
UNIT I: METAL CASTING PROCESSES	08	20
Sand Casting Sand Mould – Type of patterns - Pattern Materials – Pattern allowances –Moulding sand Properties and testing – Cores –Types and applications – Moulding machines– Types and applications: Melting furnaces : Blast and Cupola Furnaces: Principle of special casting processes : Shell - investment – Ceramic mould – Pressure die casting - Centrifugal Casting - CO2 process – Stir casting; Defects in Sand casting		
UNIT II: METAL JOINING PROCESSES	07	20
Operating principle. basic equipment. merits and applications of : Fusion welding processes : Gas welding -Types – Flame characteristics; Manual metal arc welding – Gas Tungsten arc welding - Gas metal arc welding –Submerged arc welding – Electro slag welding: Operating principle and applications of : Resistance welding -Plasma arc welding – Thermit welding – Electron beam welding – Friction welding and Friction Stir Welding: Brazing and soldering: Weld defects: types.causes and cure.		

UNIT III: METAL FORMING PROCESSES	07	20
Hot working and cold working of metals – Forging processes – Open, impression and closed die forging –forging operations. Rolling of metals– Types of Rolling – Flat strip rolling – shape rolling operations – Defects in rolled parts. Principle of rod and wire drawing – Tube drawing – Principles of Extrusion – Types – Hot and Cold extrusion.		
UNIT IV: SHEET METAL PROCESSES	07	20
Sheet metal characteristics – shearing. bending and drawing operations – Stretch forming operations –Formability of sheet metal – Test methods –special forming processes- Working principle and applications –Hydro forming – Rubber pad forming – Metal spinning– Introduction of Explosive forming. magnetic pulse forming. peen forming. Super plastic forming – Micro forming		
UNIT IV: POWDER METALLURGY	07	20
Properties of Powder processed materials, Powder manufacturing, mechanical pulverization, sintering, Electrolytic Process, chemical reduction, atomization, properties of metal		

powders, compacting of powders sintering, advantages and applications of Powder metallurgy. **Rapid Prototyping Operations:** Introduction, subtractive processes, additive processes, Virtual Prototyping and applications		
TOTAL	**36**	**100**

Reference:

1 James S Campbell, Principles of Manufacturing Materials and Processes, Tata McGraw Hill, 1995.

2 F.C. Flemmings, Solidification processing, Tata McGraw Hill, 1982

3 M J Rao, Manufacturing Technology: Foundry, Forming and Welding, Tata McGraw Hill, 1987.

4 G E Linnert, Welding Metallurgy, AWS, 1994.

5 P C Pandey and C K Singh, Production Engineering Sciences, Standard Publishers Ltd. 1980.

Course outcomes:

On successful completion of the course, the student will be able to:

1. Apply the concept of different types of casting in manufacturing of product.
2. Apply the concept of different types of welding in manufacturing of product.
3. Apply the concept of smithy and forging in manufacturing of product.
4. Apply the concept of sheet metal work in manufacturing of product.
5. Apply the concept of bench work and fitting in manufacturing of product.

Course Title: MANUFACTURING TECHNOLOGY LAB		Course Code	: ME 259
Semester	: III	Core / Elective: PROGRAME ELECTIVE	
Teaching Scheme in Hrs (L:T:P)	: **0:0:2**	Credits	: **1 Credits**
Type of course	: **Lab Experiment**	Total Contact Hours	: **20**
Continuous Internal Evaluation	: **60 Marks**	SEE	: **40 Marks**
Programmes: **B.Tech Mechanical Engineering**			

Pre-requisites:

Mechanical Workshop and Various shops used in first year.

Course Objectives:

TO STUDY & PERFORM VARIOUS EXPERIMENTS BY USING VARIOUS MACHINES AND TOOL.

Course Content:

Topic and Contents	Hours	Marks
LIST OF EXPERIMENTS (ANY 10)	**20**	**100**
1. To study of lathe machine, lathe tools cutting speed, feed and depth of cut. 2. To perform step turning, knurling and chamfering on lathe machine as per drawing. 3. Taper turning by tailstock offset method as per drawing. 4. To prepare the job by eccentric turning on lathe machine. 5. To perform square threading, drilling and taper turning by compound rest as per drawing. 6. To study shaper machine, its mechanism and calculate quick return ratio. 7. To prepare mould of a given pattern requiring core and to cast it in aluminium. 8. To perform moisture test and clay content test. 9. Strength Test (compressive, Tensile, Shear Transverse etc. in green and dry conditions) and Hardness Test (Mould and Core). 10. To perform permeability test 11. A.F.S. Sieve analysis test.	Two hours for each experiment	

12. Hands-on practice on spot welding. 13. Hands-on practice on submerged arc welding 14. Hands-on practice on metal inert gas welding (MIG) and tungsten inert gas welding (TIG).		
TOTAL	**20**	**100**

Reference:

1. James S Campbell, Principles of Manufacturing Materials and Processes, Tata McGraw Hill, 1995.

2. F.C. Flemmings, Solidification processing, Tata McGraw Hill, 1982

3. M J Rao, Manufacturing Technology: Foundry, Forming and Welding, Tata McGraw Hill, 1987.

3. G E Linnert, Welding Metallurgy, AWS, 1994.

4. P C Pandey and C K Singh, Production Engineering Sciences, Standard Publishers Ltd. 1980.

Course outcomes:

On successful completion of the course, the student will be able to:

1. To provide various angles on single point cutting tool by using grinding machine.
2. Able to perform various operation on different different machine.
3. Calculate Speed, Feed and Depth of cut.

Course Title: MANUFACTURING MACHINES		Course Code	: ME 213
Semester	: III	Core / Elective: PROGRAME ELECTIVE	
Teaching Scheme in Hrs (L:T:P)	: **3:0:0**	Credits	: **3 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**

Programmes: **B.Tech Mechanical Engineering**

Pre-requisites:

Workshop technology, Basic knowledge of machine shop

Course Objectives:

- To develop the machinery product by various machines.
- To study and calculations of machinery operations
- These objectives facilitate a method to achieve Program Outcomes [1, 2, 3, 4, 5, 7]

Course Content:

Topic and Contents	Hours	Marks
UNIT-1:	**08**	**20**
Elements of metal cutting processes: Elements of tool geometry, cutting tool materials and applications.**Lathe**: Various types of lathe: Centre lathe, facing lathe, gap-bed lathe, capstan and turret lathe, CNC lathe, major difference between CNC lathe and conventional lathe. Major sub-assemblies of a lathe: Bed, headstock, tail stock, carriage consisting of saddle, cross-slide, compound slide, tool post and apron. Work holding devices: self centering three jaw chuck, independent four jaw chuck, collets, face plates, dog carriers, centers and mandrels.		
UNIT-2:	**07**	**20**
Lathe contd... Driving mechanisms, apron mechanism, thread cutting mechanism and calculations, features of half-nut engagement – disengagement, indexing dial mechanism. Operations on lathe: taper turning, related calculations, thread cutting, facing, under-cutting, drilling, boring, parting-off, knurling, chamfering.		
UNIT-3:	**07**	**20**

Drilling Machines: Constructional features of bench drilling machine, radial drilling machine, multi-spindle drilling machine, feed mechanism, work holding devices, Tool – holding devices. Different drilling operations: Drilling, reaming, counter boring and countersinking etc., estimation of drilling time.		
UNIT-4:	**07**	**20**
Milling Machines: Types of general purpose milling machines: horizontal, vertical and universal. Types of milling cutters and their applications, different milling operations, work holding devices: vice, clamps, chucks, dividing head and its use, simple, compound and differential indexing. Indexing calculations and machining time calculations. Introduction to machining centers		
UNIT-5:	**07**	**20**
Grinding Machines: Different types of grinding machines: cylindrical, surface and centre-less grinding machines, basic constructional features and mechanisms, specifications, different grinding operations, honing, lapping and super-finishing processes..		
TOTAL	**36**	**100**

Reference:

1. 1. P.N. Rao, "Manufacturing Technology: Metal Cutting & Machine Tools", Tata McGraw Hill, Delhi, 2004.
2. 2. B.S. Raghuwanshi, "Workshop Technology", Vol.2, Dhanpat Rai & Sons, 2003.
3. 3. Hazra Chandhari S.K., "Elements of Workshop Technology", Vol.2, Media Promoters, 2003.

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Course outcomes:

On successful completion of the course, the student will be able to:

1. Various types of lathe: Centre lathe, facing lathe, gap-bed lathe, capstan and turret lathe
2. Constructional features of bench drilling machine, radial drilling machine,multi-spindle drilling machine, feed mechanism, work holding devices, Tool – holding devices. Different drilling operations Implementation of stack and queue using array, using link lists
3. Different types of grinding machines: cylindrical, surface and centre-less grinding machines, basic constructional features and mechanism

Course Title: **MACHINE PRACTICE LAB**	Course Code : ME 261

Semester	: III	Core / Elective: PROGRAME **ELECTIVE**	
Teaching Scheme in Hrs (L:T:P)	: **0:0:2**	Credits	: **1 Credits**
Type of course	: **Lab Experiment**	Total Contact Hours	: **20**
Continuous Internal Evaluation	: **60 Marks**	SEE	: **40 Marks**
Programmes: **B.Tech Mechanical Engineering**			

To study of wide range of applications of mechanical engineering through assembly and disassembly of machines such as;

- Bicycle
- Sewing machine
- Printer
- Pumps
- Washing Machine
- Engines
- Air-conditioners
- Machine-tools

Note: *Student will be required to submit written report indicating the learning achieved by Hands on assembly/Disassembly.*

Course Code : EM-202 **Course Name :** Employability Skills – III

LTPC : 0201 **Total Contact Hours** : 25

COURSE CONTENTS

S.No.	Topic	Details	Contact Hrs
1	Communication	Negotiation & Reasoning, Interaction Process, Interpersonal Relationship	5
2	Quantitative	Number System, Ratio & Proportion, Partnership, Percentage, Profit &Loss	5
3	Reasoning,	Analytical Reasoning, Coding & Decoding, Series	5

4	Motivation	Mission, Vision ,Goal, Motivation & Types of Motivation Self Esteem, Winning strategies,	5
5	Preparation, presentation	Self Esteem, Preparation of CV, Writing Application, Placement Mantra	5

Course Title: **Mechanics of Fluids**		Course Code : ME202	
Semester	: IV	Core / Elective: PROGRAME CORE	
Teaching Scheme in Hrs (L:T:P)	: **3:1:0**	Credits	: **4 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.Tech Mechanical Engineering**			

Pre-requisites:

Basic of Physics, Basic of Mathematics, Pascal Law

Course Objectives:

1. TO STUDY ABOUT FLUID, PROPERTIES OF FLUID,STABILITY OF SUBMERGED BODIES,FLOTING BODIES, ORIFICE,NOZZLES AND WIRES, REYNOLD'S EXPERIMENT, DIFFERENT LOSS OF HEAD, MODEL SIMILITUDE, BOUNDARY LAYER, DIMENSIONLESS NUMBERS AND THEIR APPLICATIONS. DIFFERENT PRESSURE MEASURING INSTRUMENT AND THEIR PRATICAL USE.

Course Content:

Units	Course Contents	Hrs.
1	Introduction of fluid, fluid classifications, hypothesis of continuum, Shear stress in a moving fluid, molecular structure of material, fluid density, viscosity, causes of viscosity in gases and liquids, surface tension, capillary effect, vapor pressure, cavitation, compressibility and the bulk modulus	7

2	Fluid statics: pressure, manometer, hydrostatic forces on submerged on plane surfaces, stability of immersed and floating bodies, fluids in rigid body motion etc. Fluid kinematics: Lagrangian and Eulerian description of fluid flow, Velocity and Acceleration Fields, Fundamentals of flow visualization, streamlines, stream tubes, pathlines, streaklines and timelines, deformation of fluid elements	7
3	Orifice discharging free, Jet, vena contracts, co-efficient of contraction, velocity and discharge, coefficient of resistance. Orifices and mouthpieces Nozzles and weires. Flow Through Pipes : Reynold's experiment Darcy's Weisback equation. Loss of head due to sudden enlargements, contraction, entrance, exit obstruction, bend, pipe fittings. Total and Hydraulic grandient lines, Flow through pipe line. Pipes in series, parallel Transmission of power through pipes.	7
4	Laminar Flow: Simple solution of Navier Stokes equations. Hagen – Poiseuille flow. Plans Poiseuille flow and coutte flow. Turbulent Flow; Variation of friction factor with Reynold's number. The Prandt Mixing length hypothesis applied to pipe flow, velocity distribution in smooth pipes, Rough pipes. The Universal pipe friction laws, Colebrook. White formula. Dimensional Analysis: Buckingham variables, Model Similitude, Force ratio, Reynolds, Froude's Mach, Weber and Euler numbers and their applications. Undistorted model distorted model scale effect.	7

5	Boundary Layer: Description of the boundary layer. Boundary Layer thickness boundary layer separation and control. The Prandtl boundary layer equation. Solution for laminar boundary layer. The momentum equation for the boundary layer. The flat plate in uniform free stream with no pressures gradients. Approximate momentum analysis laminar boundary Aerofoils Theory. Flow round a body ; Drag skin friction drag, pressure drag, combined skin friction & pressure drag (Profile drag) wave drag, lift induced drag. Flow past sphere & Cylinder.	7

Reference:

F. M. White, 1999, Fluid Mechanics, 4th Ed, McGraw-Hill.

B. R. Munson, D. F. Young and T. H. Okhiishi, Fundamentals of Fluid Mechanics, 4th Ed, John Wiley, 2002.

R. W. Fox and A. T. McDonald, 1998, Introduction to Fluid Mechanics, 5th Ed, John Wiley.

S. W. Yuan, 1988, Foundations of Fluid Mechanics, Prentice Hall of India.

Pijush Kundu, 2002, Fluid Mechanics, 2nd Ed., Academic Press.

Irwing Shames, Mechanics of Fluids, 4th Ed., McGraw Hill.

Batchelor G.K., 2000, An Introduction to Fluid Dynamics,2nd edition, Cambridge University press,

Course outcomes:

On successful completion of the course, the student will be able to:

1. Study about the fluid
2. Study about measuring instrument
3. Pratical Application of Dimensionless Machine.
4. Study about Boundary Layer:

Course Title: **MACHINE ELEMENT DESIGN**		Course Code	: ME 204
Semester	: IV	Core / Elective: PROGRAME CORE	
Teaching Scheme in Hrs (L:T:P)	: **3:1:0**	Credits	: **4 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.Tech Mechanical Engineering**			

Pre-requisites:

Engineering mechanics, Mechanics of solids

Course Objectives:

TO STUDY ABOUT BASICS OF DESIGN OF VARIOUS ELEMENTS USED IN MACHINES

Course Content:

Topic and Contents	Hours	Marks
UNIT-1:	**8**	**20**

Materials: Properties and IS coding of various materials, Selection of material from properties and economic aspects. Manufacturing aspects in Design : Selection of manufacturing processes on the basis of design and economy, Influence of rate of production, standard size, Influence of limits, fits tolerances and surface finish. Change in the shape of the designed element to facilitate its production, Design of castings, working drawing.	08	
UNIT-2:	**7**	**20**
Design for strength: Allowable stresses, detailed discussion on factor of safety (factor of ignorance): Stress concentration. Causes & mitigation. Introduction of various design considerations like strength, stiffness, weight, cost, space etc. Concept of fatigue failures. Design of machine elements subjected to direct stress, Pin, cotter and keyed joints, Design of screw fastening.	**7**	
UNIT-3:	**7**	**20**
Design of members in Bending: Beams, levers and laminated springs. Design of members in torsion : Shafts and shaft couplings.		
UNIT-4:	**7**	**20**
Design of shafts, brackets under combined stresses, Calculation of transverse & torsional deflections. Screw fasteners subjected to eccentric loading.		
UNIT-5:	**7**	**20**
Jigs And Fixtures:- Introduction, definition and difference; usefulness of jigs and fixtures; design considerations; materials used; principles and methods of location; clamping elements; jig bushes; drilling jigs; fixtures for milling turning, boring and welding; assembly fixtures; indexing devices; economics of jigs and fixtures; complete design of a jig and a fixtures; complete design of a jig and a fixtures.		
TOTAL	**36**	**100**

Reference:

Elements of Machine Design, N.C.Pandya & C.S.Shah, Charotar Book Stall, Anand.

Design of Machine Elements; V.B.Bhandari, Tata McGraw Hill Publishing Co. Ltd.

'Mechanical Machine Design; R.C.Bahl & V.K.Goyal, Standard Publishing Distributors, Delhi

'Mechanical Engineering Design; J.E.Shigley,McGraw Hill Book Co.

Machine Design; K.K.Puraja, B.L.Juneja & N.C.Bhandari, Dhanpat Rai & Sons, Delhi

Course outcomes:

On successful completion of the course, the student will be able to:

1. Understand the types of design.
2. The ability to formulate and solve some of the physical problems of engineering.
3. Understand the stress and strain.
4. Understands the standards of design

Course Title: **INTERNAL COMBUSTION ENGINE**		Course Code	: ME 210
Semester	: IV	Core / Elective: PROGRAME CORE	
Teaching Scheme in Hrs (L:T:P)	: **3:0:0**	Credits	: **3 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.Tech Mechanical Engineering**			

Pre-requisites:

CYCLIC PROCESS AND ITS REQUIREMENT, BASIC PHYSICS, ENGINEERING PHYSICS, ENGINEERING THERMODYNAMICS,ENGINEERING FLUID MECHANICS, KINEMATIC OF MACHINE.

Course Objectives:

TO STUDY VARIES CYCLE OF INTERNAL COMBUSTION ENGINE,BASIC DIFFERENCE BETWEEN DEGREE OF FREEDOM,VARIOUS MECHANISM OF DIFFERENT- INTERNAL AND EXTERNAL COMBUSTION ENGINES;

CLASSIFICATION OF I.C. ENGINES, KNOCKING. COMPARISON OF KNOCKING IN S.I. AND C.I. ENGINES.STAGES OF COMBUSTION IN C.I. ENGINES;PERFORMANCE PARAMETERS: NECESSITY OF ENGINE COOLING AND LUBRICATING OIL;SUPERCHARGING AND TURBOCHARGING;MODERN DEVELOPMENTS IN IC

Course Content:

Units	Course Contents	Hrs.
1	Air Standard Cycles: Internal and external combustion engines; classification of I.C. Engines, Cycles of operation in four stroke and two stroke I.C. Engines, Wankel Engines, Assumptions made in air standard cycle; Otto cycle; diesel cycle, dual combustion cycle, comparison of Otto, diesel and dual combustion cycles; sterling and Ericsson cycles; air standard efficiency, specific work output, specific weight; work ratio; Mean effective pressure; deviation of actual engine cycle from ideal cycle	7
2	Normal & Abnormal Combustion. Pre-ignition.Detonation. Knocking. Comparison of knocking in S.I. and C.I. Engines. Rating of Fuels. Ignition limits; stages of combustion in S.I. Engines; Ignition lag; velocity of flame propagation; theories of detonation; octane rating of fuels; S.I. engine combustion chambers, Stages of combustion in C.I. Engines; delay period; variables affecting delay period; knock in C.I. engines, Cetane rating; C.I. engine combustion chambers	7
3	Gasoline Direct injection, Various Methods for stratification;,Honda CVCC engine. Types of Hydrocarbon, Gasoline, Diesel specifications, Alternate Fuels –Properties of CNG, LPG, Alcohol, Bio- Fuel as vehicular Fuels. **Carburetor:** Properties of air-petrol mixtures, Mixture requirement, S imple carburetor, limitation of simple carburetor, Modern carburetor, Main metering system, Idling system, Economizer system, Acceleration pump and cold starting systemInjection system, Electronic fuel injection, advantage and disadvantage of petrol injection, Multi point Fuel Injection System.	7
4	Performance parameters: BHP, IHP, mechanical efficiency, brake mean effective pressure and indicative mean effective pressure, torque, volumetric efficiency; specific fuel consumption (BSFC, ISFC), thermal efficiency; heat balance; Basic engine measurements; **Ignition System:** Battery and magneto ignition system and their comparative study, Spark plug heat range, Electronic ignition system, Firing order, Ignition	7

	timing, Centrifugal and vacuum ignition advance	
	Functions of a lubricating system, Types of lubrication system; mist, wet sump and dry sump systems; properties of lubricating oil; SAE rating of lubricants, engine performance and lubrication, Necessity of engine cooling; disadvantages of overcooling; cooling systems; air-cooling, water cooling radiators.; Lubrication; Cooling; Supercharging and Turbocharging;Modern developments in IC engines	7

Reference:

Course outcomes:

On successful completion of the course, the student will be able to:

1. Students will be able to know the basics Air Standard Cycles.
2. Apply the various functions in various problems. Also able to short out these problems.
3. Students will be able to know the ic engine parts.
4. Student will be know the modern developments in IC Engines.

Course Title: **KINEMATICS OF MACHINES**		Course Code	:
Semester	: IV	Core / Elective: PROGRAME CORE	
Teaching Scheme in Hrs (L:T:P)	: **3:0:0**	Credits	: **3 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.Tech Mechanical Engineering**			

Pre-requisites:

Basic Physics, Engineering Physics, Basic of Mathematics

Course Objectives:

TO STUDY ABOUT DEGREE OF FREEDOM,VARIOUS MECHANISM OF DIFFERENT-DIFFERENT MACHINES,GEARS AND GEAR TRAINS

Course Content:

Units	Course Contents	Hrs.
I	**BASICS OF MECHANISMS:** Classification of mechanisms , Basic kinematic concepts and definitions , Degree of freedom. Mobility of Mechanism – Kutzbach criterion, Grueblers criterion , Grashof s Law- Kinematic inversions of four-bar chain and slider crank chains , Transmission Angle , Description of some common mechanisms – Quick return mechanisms, Straight line generators, Universal Joint – rocker mechanisms.	7
II	**KINEMATICS OF LINKAGE MECHANISMS** Displacement. velocity and acceleration analysis of simple mechanisms – Graphical method– Velocity and acceleration polygons , Velocity analysis using instantaneous centres, kinematic analysis of simple mechanisms – Coincident points , Coriolis component of Acceleration , synthesis of mechanism- two and three position synthesis.	7
III	**FRICTION IN MACHINE ELEMENTS** Surface contacts – Sliding and Rolling friction , Friction drives – Friction in screw threads, Bearings and lubrication, Friction in Journal Bearing and Thrust Bearings, Friction clutches	7
IV	**BRAKES & DYNAMOMETERS** **Brakes:** Band, block and band & block brakes, braking action, braking system of automobiles. **Dynamometers:** Absorption and transmission type dynamometers, prony, rope and hydraulic dynamometers braking system of automobiles.	7
V	**KINEMATICS OF CAM MECHANISMS** Classification of cams and followers – Terminology and definitions – Displacement diagrams –Uniform velocity. parabolic. simple harmonic and cycloidal motions – Derivatives of follower motions – Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – sizing of cams.	7

Reference:

J. E. Shighley and J.J. Uicker, Theory of Machines and Mechanisms, McGraw Hill, 1995

A. K. Mallik, A. Ghosh, G. Dittrich, Kinematic analysis and synthesis of Mechanisms, CRC, 1994

A. G. Erdman and G. N. Sandor, Mechanism Design, Analysis and Synthesis Volume 1, PHI, Inc., 1997.

J. S. Rao and R. V. Dukkipati, Mechanism and Machine Theory, New Age International, 1992.

S. S. Rattan, Theory of Machines, Tata McGraw Hill,

Course outcomes:

On successful completion of the course, the student will be able to:

1. To understand the degree of freedom
2. To analyze different mechanism of various machines.
3. To understand why the smaller pulley made as input.
4. To analyze gear, how the step by step modification was done in gears and at present how many types of gears are available in the market & Need of gear trains.

Course Title: Fluid Mechanics Lab	Course Code : ME 252
Semester : IV	Core / Elective: PROGRAME CORE
Teaching Scheme in Hrs (L:T:P) : **0:0:3**	Credits : **2 Credits**
Type of course : **Lab Experiment**	Total Contact Hours : **20**
Continuous Internal Evaluation : **60 Marks**	SEE : **40 Marks**
Programmes: **B.Tech Mechanical Engineering**	

Pre-requisites:

Basic Physics, Fluid mechanics

Course Objectives:

TO STUDY & PERFORM VARIOUS EXPERIMENTS ON VARIOUS FLUID MECHANICS SETUP.

Course Content:

Topic and Contents	Hours	Marks
LIST OF EXPERIMENTS	**20**	**100**
LIST OF EXPERIMENT 1. Determine Metacentric height of a given body. 2. Determine Cd, Cv & Cc for given orifice. 3. Determine flow rate of water by V-notch. 4. Determine velocity of water by pitot tube.	Two hours for each experiment	

5. Verify Bernoulli's theorem. 6. Determine flow rate of air by Venturi meter 7. Determine flow rate of air by orifice meter 8. Determine head loss of given length of pipe. 9. Determine flow rate of air by nozzle meter.		
TOTAL	**20**	**100**

Reference:

- F. M. White, 1999, Fluid Mechanics, 4th Ed, McGraw-Hill.
- B. R. Munson, D. F. Young and T. H. Okhiishi, Fundamentals of Fluid Mechanics, 4th Ed, John Wiley, 2002.
- R. W. Fox and A. T. McDonald, 1998, Introduction to Fluid Mechanics, 5th Ed, John Wiley.
- S. W. Yuan, 1988, Foundations of Fluid Mechanics, Prentice Hall of India.
- Pijush Kundu, 2002, Fluid Mechanics, 2nd Ed., Academic Press.
- Irwing Shames, Mechanics of Fluids, 4th Ed., McGraw Hill.
- Batchelor G.K., 2000, An Introduction to Fluid Dynamics,2nd edition, Cambridge University press,

Course outcomes

On successful completion of the course, the student will be able to:

1. Able to understand meta-centric height of a floating body.
2. Able to determine head loss in pipe flow.
3. Able to understand working of pitot tube, Venturi meter ,and nozzle meter.

Course Title: Industry Oriented Internal Combustion Engine Lab	Course Code : ME 258
Semester : IV	Core / Elective: PROGRAME CORE
Teaching Scheme in Hrs (L:T:P) : **0:0:3**	Credits : **2 Credits**
Type of course : **Lab Experiment**	Total Contact Hours : **20**
Continuous Internal Evaluation : **60 Marks**	SEE : **40 Marks**
Programmes: **B.Tech Mechanical Engineering**	

Pre-requisites:

Internal combustion engine, Engineering thermodynamics, Fluid mechanics

Course Objectives:

TO STUDY & PERFORM VARIOUS EXPERIMENTS ON VARIOUS ENGINES.

Course Content:

Topic and Contents	Hours	Marks
LIST OF EXPERIMENTS (ANY 10)	**20**	**100**
LIST OF EXPERIMENT 1. To study the constructional details & working principles of two-stroke/ four stroke petrol engine. 2. To study the constructional detail & working of two-stroke/ four stroke diesel engine. 3. Analysis of exhaust gases from single cylinder/multi cylinder diesel/petrol engine by Orsat Apparatus. 4. To prepare heat balance sheet on multi-cylinder diesel engine/petrol engine. 5. To find the indicated horse power (IHP) on multi-cylinder petrol engine/diesel engine by Morse Test. 6. To prepare variable speed performance test of a multi-cylinder/single cylinder petrol engine/diesel engine and prepare the curves (i) bhp, ihp, fhp, vs speed (ii) volumetric efficiency & indicated specific fuel consumption vs speed. 7. To find fhp of a multi-cylinder diesel engine/petrol engine by Willian's line method & by motoring method.	Four hours for each experiment	

8.To perform constant speed performance test on a single cylinder/multi-cylinder diesel engine & draw curves of (i) bhp vs fuel rate, air rate and A/F and (ii) bhp vs mep, mech efficiency & sfc. 9.To measure CO & Hydrocarbons in the exhaust of 2- stroke / 4-stroke petrol engine. 10.To find intensity of smoke from a single cylinder / multi-cylinder diesel engine. 11.To draw the scavenging characteristic curves of single cylinder petrol engine. 12.To study the effects of secondary air flow on bhp, sfc, Mech. Efficiency & emission of a two-stroke petrol engine.		
TOTAL	**40**	**100**

1. R.P. Sharma and M.L. Mathur, "Internal Combustion Engine", Dhanpat Rai Publications

2. V. Ganeshan, "Internal Combustion Engine", Tata McGraw Hill

3. Angli M Course., "Automotive Engines", CBS Publications

4. Harper, "Fuel Systems Emission Control", CBS Publications

Course outcomes:

On successful completion of the course, the student will be able to:

1. To prepare variable speed performance test of a multi-cylinder/single cylinder petrol engine/diesel engine and
2. Able to understand Working of petrol and diesel engines.
3. To find the indicated horse power (IHP) on multi-cylinder petrol engine/diesel engine by Morse Test.

Course Title: Design/Simulation Lab(Software CREO/CATIA)	Course Code : ME 260
Semester : IV	Core / Elective: PROGRAME ELECTIVE
Teaching Scheme in Hrs (L:T:P) : **0:0:3**	Credits : **2 Credits**

Type of course	: **Lab Experiment**	Total Contact Hours	: **20**
Continuous Internal Evaluation	: **60 Marks**	SEE	: **40 Marks**
Programmes: **B.Tech Mechanical Engineering**			

LIST OF EXPERIMENTS

Introduction and different features of the CAD Software.

(a) 2-D Drafting.
(b) 3-D Modeling.
(c) 3-D Advanced Modeling.
(d) Assembly modeling.
(e) Feature Modification and Manipulation
(f) Detailing.
(g) Sheet Metal Operations.
(h) Surface Modeling

Course Title: Kinematics of Machines Lab		Course Code	: ME 256
Semester	: IV	Core / Elective: PROGRAME ELECTIVE	
Teaching Scheme in Hrs (L:T:P)	: **0:0:3**	Credits	: **2 Credits**
Type of course	: **Lab Experiment**	Total Contact Hours	: **20**
Continuous Internal Evaluation	: **60 Marks**	SEE	: **40 Marks**
Programmes: **B.Tech Mechanical Engineering**			

Pre-requisites:

KINEMATICS OF MACHINE,DYNAMICS OF MACHINE,ENGINEERING MECHANICS,BASIC PHYSICS.

Course Objectives:

TO STUDY & PERFORM VARIOUS EXPERIMENTS ON VARIOUS MECHANSIM.

Course Content:

Topic and Contents	Hours	Marks
LIST OF EXPERIMENTS (ANY 10)	**20**	**100**

LIST OF EXPERIMENT 1. To study inversion of four bar chain 2. Coupling Rod 3. Beam Engine 4. Steering Mechanism (a) Study of quick return mechanism.(Crank and Slotted lever mech.) (b) To draw velocity and acceleration diagram for Crank and slotted lever mechanism. 5. Study of inversion of Double slider chain Oldhan Coupling Scotch Yoke Elleptical Trammel 6. To plot displacement v/s θ curve for various cams. 7. Study of various cam- follower arrangements. 8. To determine co-efficient of friction. 9. Study of various types of dynamometers, Brakes and Clutches. 10. To determine moment of inertia of the given object using of Trifler suspension. 11. To Verify the relation T=I.W.Wp. for gyroscope.	Two hours for each experiment	
TOTAL	**20**	**100**

Course outcomes:

J. E. Shighley and J.J. Uicker, Theory of Machines and Mechanisms, McGraw Hill, 1995

A. K. Mallik, A. Ghosh, G. Dittrich, Kinematic analysis and synthesis of Mechanisms, CRC, 1994

A. G. Erdman and G. N. Sandor, Mechanism Design, Analysis and Synthesis Volume 1, PHI, Inc., 1997.

J. S. Rao and R. V. Dukkipati, Mechanism and Machine Theory, New Age International, 1992.

S. S. Rattan, Theory of Machines, Tata McGraw Hill,

On successful completion of the course, the student will be able to:

1. Able to understand Mechanism of various machine.
2. Able to understand working principle of dynamometers, Brakes and Clutches.
3. Able to analyse velocity and acceleration diagram of various mechanism.

Course Title: **Instrumentation & Control**	Course Code : ME 212
Semester : IV	Core / Elective: PROGRAME CORE
Teaching Scheme in Hrs (L:T:P) : **3:0:0**	Credits : **3 Credits**
Type of course : **Lecture + Assignments**	Total Contact Hours : **36**
Continuous Internal Evaluation : **40 Marks**	SEE : **60 Marks**
Programmes: **B.Tech Mechanical Engineering**	

Units	Course Contents	Hours
I	System configuration, basic characteristic, calibration, classification and performance characteristics of a instrumentation system, Specification and testing of dynamic response. Strain Measurement : Electric Strain Gauges - Types ; Selection and Installation, Strain gauge circuits; temperature compensation and calibration; Use of Strain Gauges on Rotating Shafts, Load Cells, Mechanical and Optical Strain Gauges.	7
II	Various Mechanical, Electro- Mechanical & Photoelectrical Sensors for sensing of Displacement, Velocity, Acceleration, Torque, Force, Temperature from Low to High Range, flow, level of fluid , pressure, angular speed, voltage, frequency and current. Introduction to Multi-Channel Data-Acquisition System, Measurement Pods, Interface Hardware, Data Analysis Software, Interfacing.	7
III	Concepts and examples of automatic control systems, systems by differential equations, transfer function, block diagram, open and feedback control systems, signal flow graphs & its constructions. Control System components, error sensing devices and	7

	servo motors.	
IV	Control for mechanical systems & processes ; speed control system for steam/gas turbines. A constant tension ;reeling system, Electro-mechanical systems. Thermal systems, Pneumatic systems; Mathematical Models of physical systems, Feedback characteristics of Control Systems. Time response analysis; transient response analysis, time response specifications, steady state-error.	7
V	Concepts of stability, Routh- Hurwiz stability criterion, relative stability. The root locus technique, use of construction rules without any derivation. Frequency response analysis, Polar plots; stability in frequency domain, Bode / Logrithmic plots. Nyquist stability criterion.	7
	Total	**35**

Reference Books:

1. Mechanical Measurements and Instrumentation, A.K. Sawhney, Puneet Sawhney, Dhanpat Rai
2. Mechanical Measurements, Thomas G. Backwith, N. Lewis Buck, Roy, D., Marangoni, Narosa Publishing House
3. Industrial Instrumentation and Control, S.K.Singh, Tata McGraw Hill
4. Control Systems Engineering; I.J.Nagrath & M.Gopal, Wilay Eastern Limited
5. Automatic Control Engineering; Raxen, McGraw Hill, International Edition

Course Title: Instrumentation & Control Lab	Course Code : ME 250
Semester : IV	Core / Elective: PROGRAME ELECTIVE
Teaching Scheme in Hrs (L:T:P) : **0:0:3**	Credits : **2 Credits**
Type of course : **Lab Experiment**	Total Contact Hours : **20**
Continuous Internal Evaluation : **60 Marks**	SEE : **40 Marks**
Programmes: **B.Tech Mechanical Engineering**	

List of Experiments of I & C Lab

1. Measurement of strain using strain gauges, Load Cell Characteristics.
2. Measurement of displacement using LVDT.
3. Study the Characteristics of LDR, Photodiode, and Photo Transistor.
4. Measurement of electrical parameters using Bridges.
5. Measurement of distance using Ultrasonic sensor.

6. Temperature measurement using Thermocouple.
7. Familiarization with MATLAB control system tool box, Simulink tool box.
8. Determination of Step and Impulse response for first order control systems using MATLAB.
9. Block diagram reduction Technique implementation using MATLAB.
10. Stability analysis of control systems using MATLAB.

Course Title: **INDUSTRIAL ENGINEERING**		Course Code	: ME 216
Semester	: **IV**	Core / Elective	: **Core**
Teaching Scheme in Hrs (L:T:P)	: 3**:0:0**	Credits	: **3 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.TECH (MECHANICAL ENGINEERING)**			

Pre-requisites:

Basic math and understand the industry problems.

Course Objectives:

- understand how functions within an organisation is managed
- use some standard tools and techniques to solve engineering management problems
- appreciate the interaction between Engineering and Management functions

Course Content:

Topic and Contents	Hours	Marks
UNIT-1: **EVALUATION OF WORK STUDY**	8	20

Work of F.W. Taylor, Frank and Lillian Gilbreth and others; Productivity definition, Means of increasing productivity work study, Human Factor in the application of work Study. **Motion Study; Definition, aims;** Procedure for method study: selection of jobs; Recording Techniques: Micro motion study: Therbligs; Cychography and Chronocycle graph: Principles of motion economy. design of work place layout: Analysis in the form of a chart; operation chart; flow process chart; flow diagrams; string diagram; Man Machine chart; Two hand chart; Simon chart.	4 4	
UNITS-2: **Work Measurement (Time Study):**	07	20
Definition; uses; procedure; time study equipment; performance rating; allowances, number of cycles to be studied. Determination of standard time: Predetermined Motion Time Systems. **Job Evaluation:** Objective of job evaluation; Methods of Job evaluation; Non-quatative and quantative.	4 3	
UNITS-3: **Production Planning and Control:**	07	20
Types of production; function of production planning and control; planning Preplanning, sales forecasting; routing; Scheduling; dispatching and control with other departments. **Plant Location and Layout:** Selection of site, layout contributing factors. Facilities available from Govt. and autonomous agencies, Material handling system and equipments; layout according to the manufacturing system. Procedure and techniques of layout and line balancing.		
UNIT-4: **QUALITY CONTROL**	7	20
Operational and economic definition of quality control, objectives of quality control; Statistical quality control, Process capability studies: Control charts for variable, control charts for average outgoing quality		
UNIT 5: **Materials Managements**	07	20

Materials Managements: Field and Scope of materials management material planning and Programme. ARC control policy inverter, control Economic lot size, lead time and recorder point, Inventory models (Deterministic only) **Wages and incentives:** Characteristics of a Good wage for incentive system. Methods of wage payment Concept of wage incentive schemes, financial and non financial Holsely premium plan. Merric's Multiple piece rate system.		
TOTAL	**36**	**100**

Reference:

1. Introduction to Study, ILO Publishers.
2. Statistical Quality Control, Grant EL& Leawethwarts R.S., McGraw Hill.
3. Facility Layout& Location, Francis R.C.& White J.A.Prentice Hall.
4. Production and Operations Management, Adam Everett E& Ebert Ronald J.PHI
5. Production and operations management; E.W.S. Buffa and S.Kapoor.

Course outcomes:

On successful completion of the course, the student will be able to:

1. understand human factor in the application of work study
2. to draw the operation chart; flow process chart; flow diagrams; string diagram; man machine chart; two hand chart; Simon chart.
3. Integrated system of people, materials, information, equipment, and energy to meet desired needs within realistic constraints (such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability).
4. Understand the impact of engineering solutions in a global, economic, environmental, and societal context.

Course Title: **INDUSTRIAL ENGINEERING LAB**		Course Code	: ME 262
Semester	: **VI**	Core / Elective	: **Core**
Teaching Scheme in Hrs (L:T:P)	: 0**:0:2**	Credits	: **1 Credits**

Type of course : **Lab Experiment**	Total Contact Hours : **20**
Continuous Internal Evaluation : **60 Marks**	SEE : **40 Marks**
Programmes: **B.TECH (MECHANICAL ENGINEERING)**	

Pre-requisites:

Basics knowledge of industrial engineering

Course Objectives:

To study various experiments on industrial engineering.

Course Content:

Topic and Contents	Hours	Marks
LIST OF EXPERIMENTS	20	100
1. Determination of time standard for a given job using stopwatch time- study. 2. Preparation of flow process chart, operation process chart and man-machine charts for an existing setup and development of an improved process. 3. Study of existing layout of a workstation with respect to controls and displays and suggesting improved design from ergonomic viewpoint. 4. To carry out a work sampling study. 5. To conduct process capability study for a machine in the workshop. 6. To design a sampling scheme based on OC curve. 7. To conduct Shewart's experiments on known population 8. Generation of random numbers for system simulation such as facility planning, job shop scheduling etc..	Two hours for each experiment	

TOTAL	**20**	**100**

Reference:

6. Production and Operations Management, William Stevenson, Mc Graw Hill Pub
7. Fundamentals of Operations Management, N J Aquilano and Chase, Irwin Pub
8. Production and Operations Management, Heizer Render, Allyn and Bacon Pub
9. Production and Operations Management, Adam Everett E& Ebert Ronald J.PHI
10. Production and operations management; E.W.S. Buffa and S.Kapoor.

Course outcomes:

On successful completion of the course, the student will be able to:

5. Determination of time standard for a given job using stopwatch time- study.
6. Preparation of flow process chart, operation process chart and man-machine charts for an existing setup and development of an improved process.
7. To carry out a work sampling study.
8. To conduct process capability study for a machine in the workshop.
9. To design a sampling scheme based on OC curve.

Course Title: **Hydraulic Machinery**	Course Code : ME 317
Semester : V	Core / Elective: PROGRAME CORE
Teaching Scheme in Hrs (L:T:P) : **3:0:0**	Credits : **3 Credits**
Type of course : **Lecture + Assignments**	Total Contact Hours : **36**
Continuous Internal Evaluation : **40 Marks**	SEE : **60 Marks**
Programmes: **B.Tech Mechanical Engineering**	

Pre-requisites:

Engineering mechanics, Rotational mechanics, Fluid mechanics

Course Objectives:

TO STUDY ABOUT THE ROTATING MACHINES USED IN VARIOUS POWER CONSUMING AND GENERATING UNITS

Course Content:

Topic and Contents	Hours	Marks
UNIT-1:	**8**	**20**
Graphical Symbols and Circuit Diagrams ISO 1219, Symbols for energy supply and processing unit (Power Pack) ,Symbols for Hydraulics energy control units (Pressure, Flow and Direction), Symbols for Energy conversion units (Actuators) ,Symbols for accessories, Demonstration of Hydraulics circuits ,Hydraulic circuit with manual & solenoid DCV a cylinder ,Hydraulic motor, and cylinder, Demonstration of speed and direction changes in Hydraulic Circuit		
UNIT-2:	**07**	**20**
Hydraulic Pumps ,Functions and Operating principle Hydraulic pumps ,Differentiate b/w positive and non– positive displacement pumps ,Characteristics of standard Hydraulic pumps , Construction and Operating principle following pumps ; i. External and internal gear pumps i . Vane pumps iii. Axial piston pumps iv. Radial piston pumps Selection criteria of pumps, Flow rate and pump power , Efficiency, Hydraulic Cylinder , Operating Principle , Course curriculum , Components of a Hydraulic cylinder , Functions of Hydraulic cylinder , Design and operation , Types of cylinder Types of design i. Tie rod cylinders ii. Mill type cylinders Technical specification ,End positioning cushioning ,Cylinder mounting, Hydraulic Motors ,Functions of Hydraulic Motors Characteristics of standard Hydraulic Motors , Selection of Hydraulic motors , Calculations , Efficiency		

UNIT-3:	**07**	**20**
Pressure Control Valves, Pressure relief valve, pilot operated, pressure reducing valve , Pressure sequence valve, Directional Control Valve , Poppet Valves ,Types of spool valves Flow Control Valves, Throttle valves, pressure compensator, Meter-in flow control, Meter-out flow control, Check Valves , Filtration Technology ,Causes of contamination.		
UNIT-4:	**07**	**20**
Hydraulic Turbines: Classification of hydraulic turbines, impact of free jets, major and minor lossesin pipes, siphon, transmission power through pipe lines., specific speed and unit quantities. Design aspects of Pelton turbine- its construction, power and efficiency for ideal case, characteristic curves. Design aspects of reaction turbines, construction & setting, draft tube theory, characteristic curves, cavitations.		
UNIT-5:	**07**	**20**
Hydraulic systems: Hydraulic press, Hydraulic accumulator, Hydraulic Intensifier, Hydraulic Ram, Hydraulic lift, Hydraulic coupling, Hydraulic torque convertor Gear pump.		
TOTAL	**36**	**100**

Reference:

1. Engineering Fluid Mechanics K.L.Kumar, Eurasia Publishing House (P) Ltd.
2. Fluid Mechanics & Machine, F.M.White, John Wiley & Sons
3. Fluid Mechnaics & Machine, A.K. Jain
4. Fluid Mechanics, V.L.Streeper, McGraw Hill
5. Fluid Machanics with Applications. S.K.Gupta V.Gupta, New Age Publications

Course outcomes:

On successful completion of the course, the student will be able to:

1. Working principle of fluid machines

2. Working principle of compressors.
3. Working principle of turbines.
4. Use of turbo machines in non-conventional field

Course Title: **DYNAMICS OF MACHINES**		Course Code	: **ME 307**
Semester	: **V**	Core / Elective	: **Program Core**
Teaching Scheme in Hrs (L:T:P)	: **3:0:0**	Credits	: **3 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.TECH MECHANICAL ENGINEERING**			

Pre-requisites:

ENGINEERING MECHANICS, WORKSHOP LAB

Course Objectives:

6. Apply the concept of governors and their applications to solve the problem in engineering field.
7. Apply the concept of inertia force analysis to solve the problem in engineering field.
8. Apply the concept of gears to solve the problem in engineering field.
9. Apply the concept of gears trains to solve the problem in engineering field.
10. Apply the concept of gyroscopes to solve the problem in engineering field.

Course Content:

Units	Course Contents	Hours
I	**Governors:** Watt, Porter, Proell, Hartnell and spring controlled governors, governor effort, power, stability, inertia effects.	7
II	**Gyroscopes:** Effect of Gyroscopic Couple on an Aeroplane and Naval Ship, Stability of a Four Wheel drive Moving in a Curved Path.Stability of a Two Wheel Vehicle Taking a Turn. **Inertia force analysis:** inertia force, piston thrust and forces on connecting rod,	7

	turning moment diagram, flywheel.	
III	**Gears:** Law of gearing, terminology, tooth form, standard interchangeable tooth profile, minimum number of teeth on pinion in contact with gear or rack, interference and undercutting, bevel, helical and spiral gears.	7
IV	**Gear trains:** Simple, compound, reverted and epicyclic gear trains, analytical, tabular, graphical and vector methods for velocity ratio, gear boxes- sliding and constant mesh for automobiles.	7
V	**Balancing:** Balancing of rotating masses, balancing of reciprocating masses single cylinder engine, multi-cylinder inline engines, V-engines, concept of direct and reverse cranks, partial balancing of locomotives, IC engines, V engines and balancing machines.	7

Reference:

1. The Theory of Machines, Thoman Beaven, CBS publishers & Distributors, Delhi
2. Theory of Mechanisms and Machines; Jagdish lal, Metropolitian Book Co. Ltd, New Delhi
3. Theory of Machines; P.L. Ballaney, Khanna Publishers, Delhi

Course outcomes:

On successful completion of the course, the student will be able to:

1. Apply the concept of governors and their applications to solve the problem in engineering field.
2. Apply the concept of inertia force analysis to solve the problem in engineering field.
3. Apply the concept of gears to solve the problem in engineering field.
4. Apply the concept of gears trains to solve the problem in engineering field.
5. Apply the concept of gyroscopes to solve the problem in engineering field.

Course Title: Machining Science and Machine	Course Code : ME 315
Semester : V	Core / Elective: PROGRAME CORE
Teaching Scheme in Hrs (L:T:P) : **3:0:0**	Credits : **3 Credits**
Type of course : **Lecture + Assignments**	Total Contact Hours : **36**

Continuous Internal Evaluation : **40 Marks**	ESE : **60 Marks**
Programmes: **B.Tech Mechanical Engineering**	

Pre-requisites:

Casting,Welding and forming Process

Course Objectives:

- To develop the machinery product by various machines.
- To study and calculations of machinery operations
- To develop the Design, implement and refine products, services, processes and systems taking in consideration that constraints and particularities of the related communities
- These objectives facilitate a method to achieve Program Outcomes [1, 2, 3, 4, 5, 7]

Course Content:

Topic and Contents	Hours	Marks
UNIT-1:	**7**	**20**
MATERIALS AND GEOMETRY OF CUTTING TOOLS: Introduction, Desirable Properties of Tool Materials, Characteristics of Cutting Tool Materials, Cutting tool geometry, Chip flow direction, Tool angles specification systems, Cutting parameters and Tool geometry, Index able inserts, chip breakers, Tools of unusual geometry.		
UNIT-2:	**7**	**20**
MECHANICS OF METAL CUTTING: Merchant's circle diagram- determination of cutting and thrust forces; Coefficient of friction; shear plane angle, Velocity and force relationship, shear stress and strain and strain rate in orthogonal cutting, stress distribution along rake face, theories of Lee and Shaffer's, Oxley's, etc. Cutting force measuring techniques i.e dynamometer.		
UNIT-3:	**08**	**20**

THERMAL ASPECTS IN MACHINING AND CUTTING FLUID: Regions of heat generation; Heat In the Primary Shear Zone, Heat at the Tool/work Interface, Heat Flow at the Tool Clearance Face, Average shear plane temperature; Average chip-tool interface temperature; method of tool temperature measurement, temperature distribution in tool, Cutting Fluid: Types and composition of cutting fluids, selection of cutting fluid.		
UNIT-4:	**07**	**20**
TOOL WEAR, TOOL LIFE AND MACHINABILITY: Tool wear mechanisms, Types of tool damage during cutting, Wear and chipping characteristics of different tool materials, Tool wear equations, tool failure criteria, Tool life equations, Effect of process parameters on Tool life, Tool life testing, Machinability, Surface finish and surface integrity.		
UNIT-5:	**07**	**20**
Machine Tools: types and classification; NC, CNC etc., static, dynamic and thermal consideration in machine tools.		
TOTAL	**36**	**100**

Reference:

1. Manufacturing Science, Ghosh, A. and Mallik, A.K., Affiliated East West Press
2. Modern Machining Processes, P.C.Pandey, H.S.Shah, TMH
3. Machine Tool Design: N.K.Mehta, Tata McGraw Hill
4. Production Engineering Sciences by P.C.Pandey & C.K.Singh, Standard Publishers & Distributors Delhi
5. Production Engineering by P.C.Sharma, S.Chand & Co.Pvt, Ltd., New Delhi.
6. Fundamentals of tool design: F.W.Willson, Astme

Course outcomes:

On successful completion of the course, the student will be able to:

1. Study design of single point cutting tool
2. Study design of multi point cutting tool

Course Title: **MACHINE DESIGN**	Course Code : ME303

Semester	: **V**	Core / Elective	: **Core**
Teaching Scheme in Hrs (L:T:P)	: 3**:1:0**	Credits	: **4 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.TECH (MECHANICAL ENGINEERING)**			

Pre-requisites:

Properties of metal and non metal, strength of materials

Course Objectives:

11. Develop an ability to apply knowledge of mathematics, science, and engineering
12. To develop an ability to design a system, component, or process to meet desired needs within realistic constraints.
13. To develop an ability to identify, formulate, and solve engineering problems.
14. To develop an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Course Content:

Topic and Contents	Hours	Marks
UNIT-1	8	20
Mechanical Properties of Metals. Principal Stresses and Principal Planes. Determination of Principal Stresses for a Member Subjected to Bi-axial Stress. Application of Principal Stresses in Designing Machine Members. Combined Steady and Variable Stresses. Gerber Method for Combination of Stresses. Goodman Method for Combination of Stresses. Soderberg Method for Combination of Stresses.		
UNITS-2	7	20
Mechanical Drives: Selection of transmission, helical, bevel and worm gears, belt and chain drives.		

UNITS-3	7	20
Friction Clutches & Brakes: Common friction materials, shoe, band, cone and disc brakes their characteristics and design, friction clutches.	7	
UNIT-4	7	20
Bearings and Lubrication: Types of sliding bearing, materials, type of lubrication, design of sliding bearing, selection and application of rolling bearing, seals.	7	
UNIT 5	7	20
Hoisting Elements; Wire ropes, hooks, pulley **Engine parts**: Piston, connecting rod crank shaft	7	
TOTAL	**36**	**100**

Reference:

Text Books:

1. Maleeve Hartman and O.P.Grover, “Machine Design”, CBS Publication & Publishers

2. V.B. Bhandari, “Machine Design”, Tata McGraw Hill

3. P.C. Sharma and D.K Aggarwal., “Machine Design”, S.K. Kataria & Sons.

Reference Book:

1. Mahadevan, “Design Data Book”, CBS Publishers & Distributors

2. I.E. Shigley & C.R. Mischke, "Mechanical Engineering Design”, Tata McGraw Hill

Course outcomes:

On successful completion of the course, the student will be able to:

10. Be able to analyze the stress and strain on mechanical components; and understand, identify and quantify failure modes for mechanical parts
11. Demonstrate knowledge on basic machine elements used in machine design; design machine elements to withstand the loads and deformations for a given application, while considering additional specifications.

12. Be able to approach a design problem successfully, taking decisions when there is not a unique answer
13. Be proficient in the use of software for analysis and design.

Course Title: Dynamics of Machine Lab	Course Code : ME 351
Semester : V	Core / Elective: PROGRAME CORE
Teaching Scheme in Hrs (L:T:P) : **0:0:2**	Credits : **1 Credits**
Type of course : **Lab Experiment**	Total Contact Hours : **20**
Continuous Internal Evaluation : **60 Marks**	SEE : **40 Marks**
Programmes: **B.Tech Mechanical Engineering**	

Pre-requisites:

KINEMATICS AND DYNAMICS, KINEMATICS AND DYNAMICS LAB

Course Objectives:

TO STUDY & PERFORM VARIOUS EXPERIMENTS ON DYNAMICS OF MACHINE LAB EQUIPMENTS

Course Content:

Topic and Contents	Hours	Marks
LIST OF EXPERIMENTS (ANY 10)	**20**	**100**
1. To study inversion of four bar chain 2. Coupling Rod 3. Beam Engine 4. Steering Mechanism (a) Study of quick return mechanism.(Crank and Slotted lever mech.)	TWO hours for each experiment	

(b) To draw velocity and acceleration diagram for Crank and slotted lever mechanism. 5. Study of inversion of Double slider chain Oldhan Coupling, Scotch Yoke Elleptical Trammel 6. To plot displacement v/s θ curve for various cams. 7. Study of various cam- follower arrangements. 8. To determine co-efficient of friction. 9. Study of various types of dynamometers, Brakes and Clutches. 10. To determine moment of inertia of the given object using of Trifler suspension. 11. To Verify the relation T=I.W.Wp. for gyroscope.		
TOTAL	**20**	**100**

Reference:

4. The Theory of Machines, Thoman Beaven, CBS publishers & Distributors, Delhi
5. Theory of Mechanisms and Machines; Jagdish lal, Metropolitian Book Co. Ltd, New Delhi
6. Theory of Machines; P.L. Ballaney, Khanna Publishers, Delhi

Course outcomes:

On successful completion of the course, the student will be able to:

1. Students will become familiar with kinematics and different motions of machines.
2. Students get to know the automotive vehicle mechanism.
3. Students will be able understand the brake and dynamometers construction and their working.
4. Students will be able to understand the concept of cams and gyroscopes.

Course Title: INDUSTRY ORIENTED PRODUCTION PROCESS LAB	Course Code : ME 355
Semester : V	Core / Elective: PROGRAME CORE
Teaching Scheme in Hrs (L:T:P) : **0:0:3**	Credits : **2 Credits**

Type of course	: **Lab Experiment**	Total Contact Hours	: **30**
Continuous Internal Evaluation	: **60 Marks**	SEE	: **40 Marks**
Programmes: **B.Tech Mechanical Engineering**			

Pre-requisites:

Mechanical workshop, Casting, Welding and Forming.

Course Objectives:

TO STUDY & PERFORM VARIOUS EXPERIMENTS BY USING VARIOUS MACHINES AND TOOL.

Course Content:

Topic and Contents	Hours	Marks
LIST OF EXPERIMENTS (ANY 10)	**30**	**100**
1. To study of single point cutting tool geometry & to grind the tool to the given tool geometry. Write importance of various angles and to prepare a capacity chart of the Tool & cutter grinder. 2. Prepare a hexagonal/octagonal nut using indexing head on milling m/c and to cut bsw/ metrix internal threads on lathe (to meet with job). 3. To prepare the capacity chart for a lathe machine. 4. To cut multi-start square/metric thread. 5. To cut external metric threads & to mesh it with the nut (drg). 6. Prepare the process chart for the job. 7. To perpare the job by eccetric turning on lathe machine drawing. 8. To study shaper machine & its mechanism and calculate its quick return ratio. 9. To prepare a job on shaper from given mild Steel rod drawing 10. To study the effect of rake angle on chip thickness ratio and the shear angle in orthogonal machining. 11. Using drill dynamometer measure the torque and thrust force in drilling and to plot the characteristics, torque, force & power v/s speed & feeds.	Three hours for each experiment	

12. To measure effective diameter of a screw thread by three wire method. 13. To perform alignment test on a centre lathe 14. To calibrate pneumatic comparator and measure taper of a given work peice.		
TOTAL	**30**	**100**

Reference:

1. James S Campbell, Principles of Manufacturing Materials and Processes, Tata McGraw Hill, 1995.

2. F.C. Flemmings, Solidification processing, Tata McGraw Hill, 1982

3. M J Rao, Manufacturing Technology: Foundry, Forming and Welding, Tata McGraw Hill, 1987.

3. G E Linnert, Welding Metallurgy, AWS, 1994.

4. P C Pandey and C K Singh, Production Engineering Sciences, Standard Publishers Ltd. 1980.

Course outcomes:

On successful completion of the course, the student will be able to:

1. To provide various angles on single point cutting tool by using grinding machine.
2. Able to perform various operation on different different machine.
3. To make various threads on workpiece and also calculate pitch and angle.

Course Title: **Hydraulic Machines Lab**		Course Code	: ME 363
Semester	: V	Core / Elective: PROGRAME CORE	
Teaching Scheme in Hrs (L:T:P)	: **0:0:3**	Credits	: **2 Credits**
Type of course	: **Lab Experiment**	Total Contact Hours	: **30**
Continuous Internal Evaluation	: **60 Marks**	SEE	: **40 Marks**
Programmes: **B.Tech Mechanical Engineering**			

Course Content:

Topic and Contents	Hours	Marks
LIST OF EXPERIMENTS (ANY 10)	**20**	**100**
1. Impact of jet on vanes 2. Study of Hydraulic RAM. 3. Performance test on Pelton wheel turbine 4. Performance test on Francis turbine. 5. Performance characteristics of a single stage / multi-stage centrifugal pump. 6. Performance characteristics of a reciprocating pump. 7. Single-rod cylinder, pressure intensification 8. Single-rod cylinder, flow 9. Hydraulic motor 10. 4/3 directional valve 11. Check valve 12. Check valve, pilot operated 13. Throttle valve, adjustable 14. Throttle check valve 15. Flow control valve 16. Pressure relief valve, 17. direct operated 18. Pressure relief valve, 19. Pressure reducing valve 20. Pressure switch 21. Hydraulic accumulator 22. Regenerative circuit 23. Rapid speed/creep speed control	Two hours for each experiment	
TOTAL	**20**	**100**

Course Title: **FUNDAMENTALS OF AERODYNAMICS**		Course Code	: **ME 309**
Semester	: **V**	Core / Elective	**ELECTIVE**
Teaching Scheme in Hrs (L:T:P)	: 3**:1:0**	Credits	: **4 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.Tech Mechanical Engg.**			

Pre-requisites:

Basics in thermodynamics, fluid mechanics , basic mathematics

Course Objectives:

1. To study the various concepts of of Aerodynamic forces and moments
2. To apply the concepts of blade theory and isentropic flow
3. Measurement and analysis of shock wave relation.
4. Able to understand the different tables related to shock, steam etc.

Course Content:

Topic and Contents	Hours	Marks
UNIT-1: **Basic aerodynamics**	08	20
Aerodynamic forces and moments over the body surface, concept of lift and drag, dimensionless force and moment coefficient. centre of pressure of an aerofoil, nomenclature of aerofoil, angle of attack, circulation and lift over an-aerofoil, Kutta condition, Kelvin's circulation theorem.		
08		
UNITS-2: blade Theory	07	20
Symmetrical and non-symmetrical aerofoil. Energy transfer in terms of lift and drag. Cascade nomenclature, turbine cascade nomenclature, cascade lift and drag coefficient.		
UNITS-3: Isentropic flow	07	20
Velocity of sound; Mach angle; Mach number, steady isentropic flow through ducts; use of isentropic tables; condition for maximum discharge. Choked flow; flow through convergent and convergent-divergent nozzle, supersaturated flow in nozzle.		
UNIT-4: Adiabatic flow & flow with heat transfer	07	20

Adiabatic flow; Fanno line tables; entropy change; choking due to friction; flow through long ducts; Diabatic flow . Rayleigh line; use of tables; change in entropy; effect of change in stagnation temperature.		
UNIT 5: Normal shock	07	20
Plane stationary normal shock; Ranking-Hugoniot relations; increase in entropy; Prandtl's relations; change in stagnation pressure across the shock.		
	07	
TOTAL	**36**	**100**

Reference: 1.Compressible Flow by S.M.Yahya

2.Gas Dynamics, R.K.Prohit

3.Fundamentals Of Aerodynamics by Anderson

4.Basic concept of fluid mechanics by R.K.Bansal

Course outcomes:

On successful completion of the course, the student will be able to:

1.Study of Aerodynamic forces and moments over the body surface, concept of lift and drag, dimensionless force and moment coefficient, centre of pressure of an airfoil
2.Student will be able to understand blade theory and isentropic flow concepts
3.Measurement and analysis of shock wave relation.
4. Fanno line tables; entropy change; choking due to friction; flow through long ducts; Diabatic flow .
5.Student will be able to understand the different propulsion systems.

Reference Books:

1. Compressible Flow by S.M.Yahya
2. Gas Dynamics, R.K.Prohit
3. Fundamentals Of Aerodynamics by Anderson
4. Basic concept of fluid mechanics by R.K.Bansal

Semester	: V	Core / Elective: PROGRAME ELECTIVE	
Teaching Scheme in Hrs (L:T:P)	: **3:1:0**	Credits	: **4 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.Tech Mechanical Engineering**			

Pre-requisites:

Mathematics-I & II, DOM-I, Numerical Methods.

Course Objectives:

TO STUDY ABOUT THE HINDERED VIBERATION IN MACHINE TO GET BALANCED

Course Content:

Topic and Contents	Hours	Marks
UNIT-1:	**8**	**20**
Sound level and subjective response to sound; Frequency dependent human response to sound, Sound pressure dependent human response. Decibel scale; Decibel addition, subtraction and averaging. Relationship among sound power, sound intensity and sound pressure level. Sound spectra. Octave band analysis. Loudness. Noise: Effects, Ratings and Regulations; Non-auditory effects of noise on people, Auditory Effects of noise, Noise standards and limits in India. Major sources of the noise; Industrial noise sources. Industrial noise control-strategies; Noise control at the source, Noise control along the path, Acoustic barriers, Noise control at the receiver.	02 02	

	02 02	
UNIT-2:	**7**	**20**
Scope of vibration, important terminology and classification, Degrees of freedom, Harmonic motion; vectorial representation, complex number representation, addition. Derivation of equation of motion for one dimensional longitudinal, transverse and torsional vibrations without damping using Newton's second law, D' Alembert's principle and Principle of conservation of energy. Compound pendulum and centre of percussion. Damped vibrations of single degree of freedom systems. Viscous damping; under damped, critically damped and over damped systems, Logarithmic decrement. Vibration characteristics of Coulomb damped and Hysteretic damped systems.	02 02 03	
UNIT-3:	**07**	**20**
Forced vibrations of single degree of freedom systems. Forced vibration with constant harmonic excitation. Steady state and transient parts. Frequency response curves and phase angle plot. Forced vibration due to excitation of support. Vibration Isolation and transmissibility; Force transmissibility, Motion transmissibility. Forced vibration with rotating and reciprocating unbalance. Materials used in vibration isolation.	03 04	

UNIT-4:	**07**	**20**
System with two degrees of freedom; principle mode of vibration, Mode shapes. Undamped forced vibrations of two degrees of freedom system with harmonic excitation. Vibration Absorber; Undamped dynamic vibration absorber and centrifugal pendulum absorber. Many degrees of freedom systems: exact analysis.	02 02 03	
UNIT-5:	**07**	**20**
Many degrees of freedom systems: approximate methods; Rayleigh's, Dunkerley's, Stodola's and Holzer's methods. Vibrations of continuous systems; Transverse vibration of a string, Longitudinal vibration of a bar, Torsional vibration of a shaft.	03 04	
TOTAL	**36**	**100**

Reference:

1. Mechanical Vibrations; G.K.Grover, Nemi Chand & Bros., Roorkee
2. Vibration Theory & Applications; W.T.Thomson
3. Vibration & Noise for Engineers; K.K.Purja, Dhanpat Rai & Sons, Delhi
4. Theory & Problems of Mechanical Vibrations; W.W.Seto, Schaum's Outline Series, McGraw Hill International Editions
5. Mechanical Vibrations, Den Hartog
6. Vibration Problems in Engineering, Timshenko

Course outcomes:

On successful completion of the course, the student will be able to:

1. Study of Scope of vibration, important terminology and classification, Degrees of freedom, Harmonic motion; vectorial representation
2. Detailed study of Forced vibrations of single degree of freedom systems. Forced vibration with constant harmonic excitation.
3. Sound level and subjective response to sound; Frequency dependent human response to sound.

Semester	: V	Core / Elective: PROGRAME ELECTIVE	
Teaching Scheme in Hrs (L:T:P)	: **0:0:3**	Credits	: **2 Credits**
Type of course	: **Lab Experiment**	Total Contact Hours	: **20**
Continuous Internal Evaluation	: **60 Marks**	SEE	: **40 Marks**
Programmes: **B.Tech Mechanical Engineering**			

Pre-requisites:

Mechanical Vibration & Noise Vibration , Mathematics-I & II, DOM-I, Numerical Methods.

Course Objectives:

TO STUDY & PERFORM VARIOUS EXPERIMENTS ON VIBRATING EQUIPMENTS

Course Content:

Topic and Contents	Hours	Marks
LIST OF EXPERIMENTS (ANY 10)	**20**	**100**
1. To verify relation T=2 √L/g for a simple pendulum. 2. To determine radius of gyration of compound pendulum. 3. To determine the radius of gyration of given bar by using bifilar suspension. 4. To determine natural frequency of Spring mass System. 5. Equivalent spring mass system 6. To determine natural frequency of free torsional vibrations of single rotor system (a) Horizontal rotor (b) Vertical rotor. 7. To verify the Dunkerleys rule. 8. Study of free damped torsional vibration to performing the experiment to find out damping co-efficient. 9. To conduct experiment on trifilar suspension 10. Vibration of beams concept of more than one degree of freedom Excrtation using eccentric mass.	Two hours for each experiment	

11. Critical speed of shafts. 12. Study of vibration measuring instruments.		
TOTAL	**20**	**100**

Reference:

1. Mechanical Vibrations; G.K.Grover, Nemi Chand & Bros., Roorkee
2. Vibration Theory & Applications; W.T.Thomson
3. Vibration & Noise for Engineers; K.K.Purja, Dhanpat Rai & Sons, Delhi
4. Theory & Problems of Mechanical Vibrations; W.W.Seto, Schaum's Outline Series, McGraw Hill International Editions
5. Mechanical Vibrations, Den Hartog
6. Vibration Problems in Engineering, Timshenko

Course outcomes:

On successful completion of the course, the student will be able to:

1. To determine, Degrees of freedom, Harmonic motion of various vibrating equipments
2. Able to understand about the natural frequency.
3. Calculate damped undamped vibrations of machinery

Course Title: **EMPLOYABILITY SKILL**		Course Code	: **EM-302**
Semester	: **VI**	Core / Elective	: **Program Core**
Teaching Scheme in Hrs (L:T:P)	: **3:1:0**	Credits	: **4 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	ESE	: **60 Marks**
Programmes: **B.Tech (Mechanical Engineering)**			

S.No.	Topic	Details	Contact Hours
1	Group Discussions & PI	Objective and Managing GD/PI, GD/PI-Technical/Mkt/HR/IT/Gen round, Factual, Argumentative, Opinion, Abstract GDs, Practice, Mock, Recorded PI/GD.	10
2	Industry	Importance of SIP & Networking, Workplace Competency, Value and Ethics, Problem Solving & Decision Making, Resume Writing/	6

		Sample Resumes, , Business Sectoral Information	
3	General Awareness	News paper reading & interpretation, Quiz, Current topics, Small Talks, Discussions, Speak Smart, Current affairs, Current Political Issues/Topics	6
4	Preparation Presentation	Role play Presentation skills & Preparation	3

Course Title: **HEAT AND MASS TRANSFER**		Course Code	: ME 302
Semester	: **VI**	Core / Elective	: **Program Core**
Teaching Scheme in Hrs (L:T:P)	: **3:1:0**	Credits	: **4 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	ESE	: **60 Marks**
Programmes: **B.Tech (Mechanical Engineering)**			

Pre-requisites:

ENGINEERING THERMODYNAMICS, INDUSTRY ORIENTED THERMAL ENGINEERING LABORATORY

Course Objectives:

1. Understand the basic concept of laws of heat transfer
2. Analyze the laws of heat transfer in different heat exchangers of different shapes.
3. Have detailed understanding of natural and forced convection.
4. Have an understanding of thermal radiation.
5. Understand basic principles of mass transfer.

Course Content:

Topic and Contents	Hours	Marks
UNIT-1: CONDUCTION	8	20
Conduction: One dimensional steady state conduction. Simple convection. Overall heat transfer coefficient. Simple cases of Heat Transfer through, homogenous and composite plane walls,cylinders and spheres with constant and variable thermal conductivity. Critical thickness of insulation. Heat transfer from Fins of uniform cross section.		
UNITS-2: CONVECTION	7	20
Heat convection, basic equations, boundary layers- Forced convection, external and internal flows- Natural convective heat transfer-Dimensionless parameters for forced and free convection heat transfer-Correlations for forced and free convection- Approximate solutions to laminar boundary layer equations (momentum and energy) for both internal and external flow- Estimating heat transfer rates in laminar and turbulent flow situations using appropriate correlations for free and forced convection.		
UNITS-3: THERMAL RADIATION	7	20
Thermal Radiation: Plank distribution law, Krichoff's law; radiation properties, diffuse radiations; Lambert's law. Radiation intensity, heat exchange between two black bodies heat exchanger between gray bodies. Shape factor; electrical analogy; reradiating surfaces heat transfer in presence of reradiating surfaces.		
UNIT-4: HEAT EXCHANGERS	07	20
Heat transfer during Change of Phase: Film condensation and Drop wise condensation. Flow regimes. Heat transfer coefficient for Film Condensation. Boiling: Classification. Boiling regimes. Heat transfer correlations in boiling. **Heat exchangers:** Types of Heat exchangers. LMTD and NTU methods		

exchangers Design. Simple calculations.		
UNIT 5: MASS TRANSFER	7	20
Mass Transfer : Mass transfer by molecular diffusion- Fick's law of diffusion- diffusion coefficient Steady state diffusion of gases and liquids through solid- equimolar diffusion, Isothermal evaporation of water through air- simple problems. Convective mass transfer- Evaluation of mass transfer coefficient- empirical relations- simple problems- analogy between heat and mass transfer.		
TOTAL	**36**	**100**

Reference:

1. F.P. Incropera and D.P. Dewitt, Fundamentals of Heat and Mass Transfer, 4e, John Wiley and Sons. 1996.
2. J.P. Holman, Heat Transfer, 8e, McGraw Hill, 1997.
3. M.N. Ozisik, Heat Transfer - A basic approach, McGraw Hill, 1985.
4 Bejan, Convection Heat Transfer, 2e, Interscience, 1994.

Course outcomes:

On successful completion of the course, the student will be able to:

1. Understand the basic concept of laws of heat transfer
2. Analyze the laws of heat transfer in different heat exchangers of different shapes.
3. Have detailed understanding of natural and forced convection.
4. Have an understanding of thermal radiation.
5. Understand basic principles of mass transfer.

Course Title: **AUTOMOBILE ENGINEERING**	Course Code : ME 306
Semester : VI	Core / Elective: PROGRAME CORE
Teaching Scheme in Hrs (L:T:P) : **3:0:0**	Credits : **3 Credits**
Type of course : **Lecture + Assignments**	Total Contact Hours : **36**

Continuous Internal Evaluation : **40 Marks**	ESE : **60 Marks**
Programmes: **B.Tech Mechanical Engineering**	

Pre-requisites:

Kinematics of machines, Internal combustion engines, Material science

Course Objectives:

1. To study about the old and latest mechanisms used in automobiles
2. Describe how the steering and the suspension systems operate.
3. The anatomy of the automobile in general.

Course Content:

Units	Course Contents	Hours
I	**Power Plant**: Selection of power plant for automotive vehicle, requirements of vehicle. Characteristics of various power plants (Petrol engines, Diesel engines, CNG LPG engine, Gas Turbines constructional details of C.I. and S.I. engines, crank shafts, connecting rods, pistons, piston pins, piston rings, valves mechanisms, manifolds, air cleaners, mufflers, radiators and oil filters. **Frame & Body:** Layout of chassis, types of chassis frames and bodies, their constructional features and materials.	7
II	Transmission Systems : Transmission requirements, general arrangement of clutch, gear box and rear axle transmission, general arrangement of rear engines and vehicles with live axles. General arrangement of Dead axle and axle-less transmission, De-Dion drive, arrangement of front engine and front wheel drives, four wheel drive transmission. **Clutches**: Principle of friction clutch, single and multiplate clutches, centrifugal clutch. Friction materials. Bonding materials. Fluid fly wheel clutch.	7
III	Transmission : Description and working of manually operated gearboxes like sliding mesh, constant mesh, synchromesh. Hydraulic torque converter and its construction working and performance. Semi-automatic transmission (Wilson Gear Box). Analysis of differentials, live axles, construction and working. Requirement of overdrive.	7

	Steering System : Steering geometry, Ackermann steering, Center point steering, Power steering.	
IV	**Suspension** : Independent suspension; Perpendicular arm type, Parallel arm type. Dead axle suspension. Live axle suspension, air suspension, shock absorbers. **Wheels, Tyres and Brakes** : Wheel and tyre requirements, tyre dynamics, mechanical and hydraulic brakes, shoe arrangements and analysis, disc brakes, braking effectiveness relationship for 4 wheel drive.	7
V	**Automotive Air Conditioning**: Introduction, Loads, Air conditioning system Components, Refrigerants, Fault Diagnosis. **Automotive Safety**: Safety requirements, Safety Devices, Air bags, belts, radio ranging, NVS (Night Vision System) GPS (Global Positioning System) etc.	7
	Total	**35**

Reference:

1. Automobile Engineering, R.K.Sharma
2. Automobile Engineering, Kirpal Singh, Vol. 1 & 2
3. Automotive Chassis and Body, P.L.Kohli, Vol.1 & 2
4. Vehicle Engine and Technology, Heisler, ELBS
5. Jain &Asthana, "Automobile Engineering", Tata McGraw-Hill, New Delhi, 2002.

Course outcomes:

On successful completion of the course, the student will be able to:

1. Selection of power plant for automotive vehicle, requirements of vehicle. Characteristics of various power plants
2. Transmission requirements, general arrangement of clutch, gear box and rear axle transmission
3. Understanding Principle of friction clutch, single and multiplate clutches, centrifugal clutch. Friction materials
4. Study of various types of Wheels, Tyres and Brakes
5. Identify the different parts of the automobile

Course Title: **Finite Element Analysis**	Course Code : ME 316
Semester : VI	Core / Elective: PROGRAME CORE
Teaching Scheme in Hrs (L:T:P) : **3:0:0**	Credits : **3 Credits**

Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	ESE	: **60 Marks**
Programmes: **B.Tech Mechanical Engineering**			

Pre-requisites:

Mathematics-I & II, DOM-I, Mechanics of solids. KOM, Engineering Drawing, Machine Drawing, Numerical Methods.

Course Objectives:

To introduce the concepts of Mathematical Modeling of Engineering Problems.

To appreciate the use of FEM to a range of Engineering Problems

Course Content:

Units	Course Contents	Hours
I	Stress strain and deformation relations, plane - stress, planes strain, Principles of minimum Potential Energy, principle of virtual work.	7
II	Stiffness method for steady state problems of discrete systems (Bar, trusses, one dimensional heat transfer system) Element stiffness matrix, Assembly of elements, global stiffness matrix and its properties, Node numbering, Displacement and force Boundary conditions, Transformations matrix, Gauss elimination method	7
III	Displacement - Based FEM for solid mechanics;Derivation of finite element equilibrium equations, Langrangian elements (I-D & 2-D elements); CST, rectangle, aspect ratio shape functions, lumping of loads, computability and convergence requirements. Stress calculations Isopohmetric Derivation of Stiffness matrices, bar and plane bilinear elements, Seredipity elements, natural coordinates, numerical integration, Co-continuity p and h refinement	8
IV	Variational Method: Variational Approach for known functional of field problems. Weighted Reidual Methods: Point collection, subdomain collocation, methods of least square, Galerkin. Application of these methods to one dimensional boundary value problems; Structures, fluid mechanics and heat transfer.	7

V	Finite Elements in Dynamics and Vibrations: Introduction, Dynamic Equations, Mass and Damping Matrics, Mass Matrics, Consistent and Diagonal, Damping, Natural frequencies and Mode Shapes.	7
	Total	**36**

Reference:

1. Introduction to Finite Elements in Engineering, Tirupathi R. Chandrapatla and Ashok D. Belagundu, Prentice Hall of India. Ltd.
2. Comcept and Applications of Finite Element Analysis, Robert D. Cook. David S. Malkus. Michaiel E. Palesha, John Wiley & Sons.
3. Finite Element Procedures, Klaus Jurgan Bathe, Prentice Hall of India, New Delhi

Course Title: Project Oriented Heat & Mass Transfer Lab	Course Code : ME 352
Semester : VI	Core / Elective: PROGRAME CORE
Teaching Scheme in Hrs (L:T:P) : **0:0:3**	Credits : **2 Credits**
Type of course : **Lab Experiment**	Total Contact Hours : **20**
Continuous Internal Evaluation : **60 Marks**	ESE : **40 Marks**
Programmes: **B.Tech Mechanical Engineering**	

Pre-requisites:

ENGINEERING THERMODYNAMICS, INDUSTRY ORIENTED THERMAL ENGINEERING LABORATORY

Course Objectives:

TO STUDY & PERFORM VARIOUS EXPERIMENTS ON HEAT AND MASS TRANSFER EQUIPMENTS

Course Content:

Topic and Contents	Hours	Marks

LIST OF EXPERIMENTS (ANY 10)	20	100
1. To find emissivity of a grey body relative to a given block body. 2. Perform parallel flow heat exchanger. 3. Perform counter flow heat exchanger. 4. To find out the Stefan Boltzmen constant. 5. To perform experiment on pin fin test rig in forced convection by neglecting radiation losses & to calculate. Convective heat transfer coefficient. (Experimentally & empirical correlation), Efficiency, Effectiveness, Comparison of experimental & theoretical temperature profile. 6. Repeat the same exercise by considering radiation losses 7. To find convectively heat transfer coefficient of a given cylinder in vertical position by neglecting radiation losses by assuring, constant surface temperature, constant heat flux & compare with experimental heat transfer coefficient by neglecting radiation losses. 8.Perform the experiment No.5 by using cylinder in horizontal position. 9. To find convectively heat transfer coefficient of a given cylinder in vertical position by neglecting radiation losses by assuring, constant surface temperature, constant heat flux & compare with experimental heat transfer coefficient by considering radiation losses. 10. To perform experiment on pin fin test rig in forced convection by considering radiation losses & to calculate. Convective heat transfer coefficient. (Experimentally & empirical correlation), Efficiency, Effectiveness, Comparison of experimental & theoretical temperature profile.	TWO hours for each experiment	
TOTAL	**20**	**100**

Reference:

1. F.P. Incropera and D.P. Dewitt, Fundamentals of Heat and Mass Transfer, 4e, John Wiley and Sons. 1996.
2. J.P. Holman, Heat Transfer, 8e, McGraw Hill, 1997.
3. M.N. Ozisik, Heat Transfer - A basic approach, McGraw Hill, 1985.
4. Bejan, Convection Heat Transfer, 2e, Interscience, 1994.

Course outcomes:

On successful completion of the course, the student will be able to:

1. Understand the basic concept of laws of heat transfer
2. Analyze the laws of heat transfer in different heat exchangers of different shapes.
3. Have detailed understanding of natural and forced convection.
4. Have an understanding of thermal radiation.
5. Understand basic principles of mass transfer.

Course Title: **AUTOMOBILE ENGG. LAB**	Course Code : ME 354
Semester : VI	Core / Elective: PROGRAME CORE
Teaching Scheme in Hrs (L:T:P) : **0:0:2**	Credits : **1 Credits**
Type of course : **Lab Experiment**	Total Contact Hours : **20**
Continuous Internal Evaluation : **60 Marks**	ESE : **40 Marks**
Programmes: **B.Tech Mechanical Engineering**	

Pre-requisites:

IC Engine lab

Course Objectives:

TO STUDY THE PARTS OF AN AUTOMOBILE
To understand function and linkages of each part

Course Content:

Topic and Contents	Hours	Marks
LIST OF EXPERIMENTS (ANY 10)	**20**	**100**
1. Disassembling and assembling of multi-cylinder petrol engines and study of their parts. 2. Disassembling and assembling of multi-cylinder diesel engines and study of their parts 3. To disassemble and assemble a 2-stroke petrol engine. 4. To disassemble and assemble a 4-stroke motor cycle engine and study of various engine parts. 5. Load test on a single cylinder 4-stroke diesel engine using a rope brake dynamometer and calculate volumetric and thermal efficiency and draw a heat balance-sheet.	Two hours for each experiment	

6. Study of carburetors and disassembling and assembling of their parts. 7. Study MPFI system and disassembling and assembling of their parts. 8. To calculate valve timing of a multi-cylinder petrol engine and valve tappets adjustment. 9. Disassemble all the parts of a fuel injection pump and its parts study. 10. To disassemble the governor and study its various parts. 11. To study constant mesh gearbox.		
TOTAL	**20**	**100**

Reference:

1.Automobile Engineering, R.K.Sharma

2.Automobile Engineering, Kirpal Singh, Vol. 1 & 2

3.Automotive Chassis and Body, P.L.Kohli, Vol.1 & 2

4.Vehicle Engine and Technology, Heisler, ELBS

Course outcomes:

On successful completion of the course, the student will be able to:

- Disassembly of various parts.
- Assembly of various automobile parts
- Study of various automobile mechanisms

Course Title: Software Lab (Solidwork/ANSYS)	Course Code : ME 362
Semester : VI	Core / Elective: PROGRAME ELECTIVE
Teaching Scheme in Hrs (L:T:P) : **0:0:3**	Credits : **2 Credits**
Type of course : **Lab Experiment**	Total Contact Hours : **20**
Continuous Internal Evaluation : **60 Marks**	ESE : **40 Marks**
Programmes: **B.Tech Mechanical Engineering**	

Pre-requisites:

Engineering Mechanics, Strength of Materials, KOM, DOM, Numerical Methods.

Course Objectives:

Simulation Technology

Systems & Multi Physics

Electromagnetics

Fluid Dynamics

Structural Mechanics

Workflow Technology

Geometry Interfaces

High-performance Computing

Simulation Process & Data Management

Our courses will make use of ANSYS Fluent, ANSYS HFSS, ANSYS Mechanical and ANSYS RedHawk and other ANSYS products.

Course Content:

Topic and Contents	Hours	Marks
LIST OF EXPERIMENTS (ANY 10)	**20**	**100**
1. STUDY OF BASICS IN ANSYS 2. STRESS ANALYSIS OF A PLATE WITH CIRCULAR HOLE 3. STRESS ANALYSIS OF RECTANGULAR L BRACKET 4. STRESS ANALYSIS OF BEAM 5. MODE FREQUENCY ANALYSIS OF BEAM 6. STRESS ANALYSIS OF AN AXI - SYMMETRIC COMPONENT 7. HARMONOC ANALYSIS OF A 2D COMPONENT 8. THERMAL STRESS ANALYSIS OF A 2D COMPONENT 9. CONDUCTIVE HEAT TRANSFER ANALYSIS OF A 2D COMPONENT 10. CONVECTIVE HEAT TRANSFER ANALYSIS OF A 2D COMPONENT 11. INTRODUCTION TO MAT LAB	Two hours for each experiment	
TOTAL	**20**	**100**

Reference:

1. The Finite Element Method for Mechanics of Solids with ANSYS Applications By Ellis H. Dill
2. Bathe, K.J., "Finite Element Procedures",
3. Crisfield, M.A., "Non-linear Finite Element Analysis of Solids and Structures", Vol. 1, 1991 and Vol. 2, 1997
4. Wriggers, P., "Computational Contact Mechanics, 2nd ed, 2006

Course outcomes:

On successful completion of the course, the student will be able to:

1. You will be know how to simulate and validate the performance of products of all manufacturing sectors including automotive, power electronic products, electronic equipment, electromechanical devices, and electrical systems.
2. You will know how to simulate every structural aspect, including linear static analysis, of a single part of a complex assembly with hundreds of components interacting through contacts or relative motions.
3. You will know how to perform fluid flow analysis to know the impact of fluid flows on your product while manufacturing and when used by customers in real world applications.
4. With your mastery in simulation, you will contribute not only to success of products but also cost management, product integrity, designing smart products, and reduced time-to-market.

Course Title: **GAS DYNAMICS AND PROPULSION**		Course Code	: **ME 308**
Semester	: **VI**	Core / Elective **ELECTIVE**	:**PROGRAM**
Teaching Scheme in Hrs (L:T:P)	: 3**:0:0**	Credits	: **3 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	ESE	: **60 Marks**
Programmes: **B.Tech Mechanical Engg.**			

Pre-requisites:

Basics in aerodynamics ,propulsion system, thermodynamics

Course Objectives:

1. To study the various concepts of of Aerodynamic forces and moments

2. To apply the concepts of blade theory and isentropic flow
3. Measurement and analysis of shock wave relation.
4. Able to understand the different tables related to shock, steam etc.

Course Content:

Topic and Contents	Hours	Marks
UNIT-1: **Revision of fundamentals**	08	20
Thermodynamics of compressible flow – wave motion in compressible medium, Mach number and cone, properties. Steady one-dimensional compressible flow through variable area ducts. Effects of heating and friction in duct flow, Rayleigh and Fanno lines. Flows with normal shocks. Oblique shocks and reflection. Expansion waves. Prandtl- Meyer flow. Flow over bodies. Measurements and applications.		
UNITS-2: **Compressors**	07	20
Centrifugal Compressors: Principal of operation; work done and pressure rise; slip diffuser. Design criterion; compressibility effects; non-dimensional quatities used for plotting compressor characteristics surging, choking and rotating stall gas Turbine **Axial Fow Compressors:** Basic constructional features; turbine v/s compressor blades; elementary theory; degree of reaction; vortex theory, simple design calculations; introduction to blade design; cascade test; compressibility effects; operating characteristics;		
UNITS-3: **Nozzles**	07	20
Application of Nozzles. Types of Nozzles. Converging and converging-diverging nozzles and diffusers.Expansion of steam through a Nozzle. Effect of friction. Critical pressure ratio. Areas at Throat & Exit for maximum discharge conditions. Performance at Off- design conditions.		

UNIT-4: **Jet Propulsion:**	07	20
Aircraft propulsion- types of jet engines-energy flow through jet engines, study of turbojet engine components-diffuser, compressor, combustion chamber, turbine and exhaust systems. performance of turbo jet engines-thrust, thrust power, propulsive and overall efficiencies, thrust augmentation in turbo jet engines, ram jet and pulse jet engines.		
UNIT 5: **Rocket propulsion**	07	20
basics, solid and liquid propelled engines, parametric studies,construction features, single and multi-stage rockets. Thrust chamber and nozzle models. Studies of in-use engines. Environmental aspects**.**		
TOTAL	**36**	**100**

Reference:

1. J.P. Holman; “Heat Transfers” McGraw Hill, USA

2. Mills; “Heat Transfers”, C.B.S Publications.

3. Kearton; “Steam Turbine”, C.B.S Publications

4. Arora DomkundwaR, “A Course in heat & Mass Transfer”,

Course outcomes:

On successful completion of the course, the student will be able to:

1.Study of Aerodynamic forces and moments over the body surface, concept of lift and drag, dimensionless force and moment coefficient, centre of pressure of an airfoil
2.Student will be able to understand blade theory and isentropic flow concepts
3.Measurement and analysis of shock wave relation.
4. Fanno line tables; entropy change; choking due to friction; flow through long ducts; Diabatic flow .
5.Student will be able to understand the different propulsion systems.

Course Title: **Mechatronics**		Course Code	: ME 304
Semester	: **VI**	Core / Elective	:**Program Elective**
Teaching Scheme in Hrs (L:T:P)	: 3**:0:0**	Credits	: **3 Credits**

Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	ESE	: **60 Marks**
Programmes: **B.Tech Mechanical Enginnering**			

Pre-requisites:

Electronics Engineering, Electrical Machines, Control Theory and application.

Course Objectives:

1. Apply the basic mathematical skills needed to solve routine engineering problems.
2. To demonstrate knowledge of electrical circuits and logic design
3. Demonstrate knowledge of statics, dynamics and solid mechanics relevant to Mechatronics.
4. Apply and design mechatronic components and systems field.
5. To select the appropriate mechatronic device for a given application

Course Content:

Topic and Contents	Hours	Marks
MECHATRONICS		
UNIT-1: Introduction about Mechatronics	07	20
Introduction about Mechatronics, scope of Mechatronics, application, process control automation and N/c Machines. **Hydraulic And Pneumatic Actuation Systems:** Overview: Pressure Control Valves, Cylinders, Direction Control Valves, Rotary Actuators, Accumulators, Amplifiers, and Pneumatic Sequencing		
UNITS-2: **Electrical Actuation Systems**	07	20

Electrical Actuation Systems: Switching Devices, Mechanical Switches – SPST, SPDT, DPDT, Debouncing keypads; Relays, Solid State Switches, Diodes, Thyristors, Transistors, Solenoid, Types Devices: Solenoid Operated Hydraulic and Pneumatic Vlaves, Electro-Pneumatic equencing Problems. Control of DC Motors, Permanent Magnet DC Motors, Control of DCMotors, Bush less Permanent Magnet DC Motors, AC Motors, Stepper Motors, Stepper Motor Controls, Servo Motors.		
UNITS-3: **Sensors and transducers and application**	08	20
Sensors and transducers and application: Performance Terminology, Static and Dynamic Characteristics, Displacement, Position and Proximity Sensors, Potentiometer Sensors, Strain Gauge Element, LVDT, Optical Encoders, Pneumatic Sensors, Hall Effect Sensors,Tachogenerators, Strain Gauge Load Cell, Thermostats, Photo Darlington. Interfacing Sensors in Mechantronic System as – Temperature Switch Circuit, Float Systems		
UNIT-4: **Interfacing controllers, Data Acquisition and Control System**	07	20
Interfacing controllers: Interfacing, Buffers, Darlington Pair, I/O Ports, Interface Requirements, Handshaking, Serial and Parallel Port Interfacing, Peripheral Interface, Adapters. **Data Acquisition and Control System -** Introduction, Quantitizing theory, Analog to Digital Conversion, Digital to Analog (D/A) conversation, transfer function, transient response & frequency response & frequency response, stability criteria.		
UNIT 5: **Design of Mechatronic systems**	07	20
Design of Mechatronic systems - Introduction, Automatic front and book and cutting in steel rolling mill, lift control system, CNC lathe, temperature control of a heat treatment furnace, EOT crane control panel, Grey grain separators, electrode arm control in electric arc furnace..		
TOTAL	**36**	**100**

Reference:

1. Mechatronics Engineering, Tomkinson, D. and Horne, J., McGraw Hill, 1996
2. Mechatronics, Bolton, W., Longman, 1995
3. Mechatronics, HMT Hand Book, 1998
4. Understanding Electro-Mechanical Engineering, Kamm, L.J., IEEE Press, New York, 2000
5. Nitaigour Premchand Mahalik, Mechatronics, Tata Mcgraw-Hill
6. J.P. Holman, Mechanical Measurements,McGraw-Hill
7. T.K.Kundra, P.N.Rao And N.K.Tewari,Numerical Control and Computer AidManufacturing,Tata McGraw-Hill,

Course outcomes:

On successful completion of the course, the student will be able to:

1. Mechatronics, scope of Mechatronics, application, process control automation and N/c Machines.
2. Student will be able to know the concept of Hydraulic And Pneumatic Actuation Systems
3. Student will be able to understand Sensors and transducers and application .
4. Design of Mechatronic systems

Course Title: **Engineering Metrology and Measurement**		Course Code	: ME 320
Semester	: **VI**	Core / Elective	:Program Elective
Teaching Scheme in Hrs (L:T:P)	: 3**:0:0**	Credits	: **3 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	ESE	: **60 Marks**
Programmes: **B.TECH (MECHANICAL ENGINEERING)**			

Pre-requisites:

Basics physics and physical instrument.

Course Objectives:

- To provide to the students an understanding and appreciation of the science of Measurement.
- To expose the students to various mechanical and electrical engineering measuring devices, and understand the different degree of accuracy obtained from different types of instruments.

Course Content:

Topic and Contents	Hours	Marks

UNIT-1	8	20
Principles of measurement: Definition of Metrology, difference between precision andaccuracy. Sources of errors: Controllable and Random Errors, Effects of Environment and Temperature, Effects of support, alignment errors, application of Least Square principles, errors in measurement of a quality which is function of other variables. **Length Standards:** Line standards, end standards and wavelength standards, transfer from line standards to end standards. Numerical based on line standards. Slip gauges – its use and care, methods of building different heights using different sets of slip gauges. **Limits, fits and tolerances**: Various definitions, IS919-1963, different types of fits and methods to provide these fits. Numerical to calculate the limits, fits and tolerances as per IS 919- 1963. ISO system of limits and fits; Gauges and its types, limit gauges – plug and ring gauges. Gauge Design – Taylor's Principle, wear allowance on gauges. Different methods of giving tolerances on gauges, Numericals..	2 2 4	
UNITS-2	07	20
Comparators: Mechanical Comparators: Johanson Mikrokator and Signma Mechanical Comparator. Mechanical – optical comparator. Principles of Electrical and electronic comparators. Pneumatic comparators – advantages, systems of Penumatic gauging:- Flow type and back pressure type, Principle of working of back pressure gauges, different type of sensitivities and overall magnification, Solex Penumatic gauges and differential comparators. Numericals based on pneumatic comparators.		

Angular Measurement: Sine Bar – different types of sine bars, use of sine bars in conjuction with slip gauges, precautions and calibration of sine bars. Use of angle gauges, spirit level, errors in use of sine bars. Numericals. Principle and working of Micro-optic autocollimator. Circular Division: dividing head and circular tables, circular division by precision Polygons. Caliper Principle, Calibration of polygons. Numerical based on circular division.	4 3	
UNITS-3	07	20
Straightness and flatness: Definition of Straightness and Flatness error. Numericals based on determination of straightness error of straight edge with the help of spirit level and auto collimator. Numericals based on determination of flatness error of a surface plate with the help of spirit level or auto collimator. **Machine Tool Alignment**: Machine tool tests and alignment tests on lathe. Alignment tests on milling machine. Alignment tests on a radial drilling machine.	4 3	
UNIT-4	7	20
Screw Thread Measurement :Errors in threads, Measurement of elements of screw threads –major dia, minor dia, pitch, flank angle and effective diameter (Two and three wire methods).Effect of errors in pitch and flank angles and its mathematical derivation. Numericals. **Gear Measurement**: Measurement of tooth thickness – Gear tooth vernier caliper, Constant chord method, base tangent method and derivation of mathematical formulae for each method.Test plug method for checking pitch diameter and tooth spacing. Measurement of Gear Pitch,Parkinson Gear Tester, Numericals.	4	

	3	
UNIT 5	07	20
Interferometry: Principle of measurement, Interferometry applied to flatness testing, surface contour tests, opticalflats, testing of parallelism of a surface with the help of optical flat. Quantitative estimate of error in parallelism, Flatness Interferometer NPL-Gauge length interferometer for checking the error in slip gauges. Numericals based on Interferometry. **Surface texture**: Introduction, different types of irregularities, standard measures for assessment and measurement of surface finish	5 2	
TOTAL	**36**	**100**

Reference:

1. J.F.W. Galyer, C.R.Shotbolt, ***Metrology for Engineers***, 5th Edition, ELBS Edition, 1993.
2. I .C. Gupta, ***A Textbook of Engineering Metrology***, 4th Edition, Dhanpat Rai Publications, 1994.
3. Bentley, J.P, ***Principles of Measurement Systems***, 3rd Edition, Longmans Publishing, 1995.

Course outcomes:

On successful completion of the course, the student will be able to:

1. To be familiar with the different instruments that is available for linear, angular, roundness and roughness measurements.
2. To be able to select and use the appropriate measuring instrument according to a specific requirement (in terms of accuracy, etc.)
3. TO determination of straightness error of straight edge with the help of spirit level and auto collimator
4. to understand different types of irregularities, standard measures for assessment and measurement of surface finish.
5. to understand machine tool tests and alignment tests on lathe.

Course Title: **Metrology Lab**		Course Code	: ME 364
Semester	: **III**	Core / Elective	: **Program Core**
Teaching Scheme in Hrs (L:T:P)	: 0**:0:2**	Credits	: **1 Credits**
Type of course	: **Lab Experiment**	Total Contact Hours	: **20**
Continuous Internal Evaluation	: **60 Marks**	SEE	: **40 Marks**
Programmes: **B.Tech (Mechanical Engineering)**			

Course Objectives:

- To provide to the students an understanding and appreciation of the science of Measurement.
- To expose the students to various mechanical and electrical engineering measuring devices, and understand the different degree of accuracy obtained from different types of instruments.

Topic and Contents	Hours	Marks
LIST OF EXPERIMENTS (ANY 10)	**20**	**100**
1. Study the working of simple measuring instruments- Vernier calipers, micrometer. 2. Measurement of effective diameter of a screw thread using 3 wire method. 3. Measurement of angle using sinebar & slip gauges. Study of limit gauges. 4. Study & angular measurement using level protector. 5. Adjustment of spark plug gap using feeler gauges. 6. Study of dial indicator & its constructional details. 7. Use of dial indicator to check a shape run use. 8. Use of dial indicator and V Block to check the circularity and plot the polar Graph. 9. Study and understanding of limits, fits & tolerances. 10. Study of Measurement of surface roughness 11. Measurement of gear elements using profile projector	Two hours for each experiment	

TOTAL	**20**	**100**

Reference:

1. J.F.W. Galyer, C.R.Shotbolt, ***Metrology for Engineers***, 5th Edition, ELBS Edition, 1993.
2. I .C. Gupta, ***A Textbook of Engineering Metrology***, 4th Edition, Dhanpat Rai Publications, 1994.
3. Bentley, J.P, ***Principles of Measurement Systems***, 3rd Edition, Longmans Publishing, 1995.

Course outcomes:

On successful completion of the course, the student will be able to:

1. To be familiar with the different instruments that is available for linear, angular, roundness and roughness measurements.
2. To be able to select and use the appropriate measuring instrument according to a specific requirement (in terms of accuracy, etc.)
3. TO determination of straightness error of straight edge with the help of spirit level and auto collimator
4. to understand different types of irregularities, standard measures for assessment and measurement of surface finish.
5. to understand machine tool tests and alignment tests on lathe.

Course Title: **REFRIGERATION AND AIR - CONDITIONING**		Course Code	: ME 401
Semester	: **VII**	Core / Elective	: Program **Core**
Teaching Scheme in Hrs (L:T:P)	: 3**:1:0**	Credits	: **4 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**

Programmes: **B.Tech Mechanical Enginnering**

Pre-requisites:

Properties of materials.,Basic law's of thermodynamics ,Heat and Mass Transfer

Course Objectives:

1. The students will have a thorough understanding Refrigeration and second law of Thermodynamics, Refrigeration effect and unit of Refrigeration, Heat pump, reversed Carnot cycle.
2. Student will be able to distinguish the properties and parameters Simple Vapour absorption system, Electrolux Refrigerator, Analysis of Ammonia absorption refrigeration system, Lithium Bromide Absorption Refrigeration System
3. Psychometric properties, psychometric relations, psychometric charts, psychometric processes, cooling coils, By-pass factor and air washer.
4. Internal heat gain, system heat gain, RSHF, ERSHF, GSHF, cooling load estimation, heating load estimation, psychometric calculation for cooling, selection of air conditioning, apparatus for cooling and dehumidification, Air conditioning system.

Course Content:

Topic and Contents	Hours	Marks
REFRIGERATION AND AIR - CONDITIONING		
UNIT-1: **Refrigeration System**	08	20
Introduction - Refrigeration and second law of Thermodynamics, Refrigeration effect and unit of Refrigeration, Heat pump, reversed Carnot cycle. **Vapour Compression Refrigeration System -** Analysis of simple vapour compression Refrigeration cycle by p-h and T-S diagram. Effect of operating conditions, liquid vapour heat exchangers, actual refrigeration cycle. **Multiple Evaporator and compressor system -** Application, air compressor system, Individual compressor, compound compression, cascade system. Application, air compressor systems, individual compressor, compound compression, cascade system.		
UNITS-2: **Gas cycle Refrigeration**	07	20

Gas cycle Refrigeration - Limitation of Carnot cycle with gas, reversed Brayton cycle, Brayton cycle with regenerative heat exchanger. **Air cycle for air craft -** Necessity of cooling of air craft, Basic cycle, boot strap, regenerative type air craft refrigeration cycle.		
UNITS-3: **Vapour Absorption System**	07	20
Vapour Absorption System - Simple Vapour absorption system, Electrolux Refrigerator, Analysis of Ammonia absorption refrigeration system, Lithium Bromide Absorption Refrigeration System. **Refrigerants -** Classification, Nomenclature, selection of Refrigerants, global warming potential of CFC Refrigerants. **Refrigeration Equipments -** Compressor, condenser, evaporator, expansion devices – types & working.		
UNIT-4: **Other Refrigeration System**	07	20
Other Refrigeration System: Principle and applications of steam jet refrigeration system, Performance; vortex tube refrigeration, thermoelectric refrigeration systems. **Psychrometry-** Psychrometric properties, psychometric relations, pyschrormetric charts, psychrometric processes, cooling coils, By-pass factor and air washers. **Human Comfort -** Mechanism of body heat losses, factors affecting human comfort, effective temperature, comfort chart.		
UNIT 5: **Cooling load calculations**	07	20
Cooling load calculations - Internal heat gain, system heat gain, RSHF, ERSHF, GSHF, cooling load estimation, heating load estimation, psychometric calculation for cooling, selection of air conditioning, apparatus for cooling and dehumidification, Air conditioning system. **Distribution and Duct systems:** Distribution of air in conditioned space et location, return and exhaust grills. Duct materials and sizing, design of Supply and return air ducts.		
TOTAL	**36**	**100**

Reference:

1. **Re** Refrigeration and Air Conditioning, C.P.Gupta
2. Refrigeration and Air Conditioning, Ballarey
3. Refrigeration and Air Conditioning, C.P.Arora

Modern Air Conditioning-Practice, Narman E.Harris, Tata McGraw Hill

Course outcomes:

On successful completion of the course, the student will be able to:

1. Student will be able to distinguish the properties and parameters Simple Vapour absorption system, Electrolux Refrigerator, Analysis of Ammonia absorption refrigeration system, Lithium Bromide Absorption Refrigeration System

2. Psychometric properties, psychometric relations, psychometric charts, psychometric processes, cooling coils, By-pass factor and air washer.
3. Internal heat gain, system heat gain, RSHF, ERSHF, GSHF, cooling load estimation, heating load estimation, psychometric calculation for cooling, selection of air conditioning, apparatus for cooling and dehumidification, Air conditioning system.

Course Title: **Renewable Energy Technology**		Course Code	: ME 409
Semester	: **VII**	Core / Elective	: Program **Core**
Teaching Scheme in Hrs (L:T:P)	: 3**:0:0**	Credits	: **3 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.Tech Mechanical Enginnering**			

Pre-requisites:

Nil

Course Objectives:

The objective of the course are:

1. The course intends to provide an overview of the principles, basics and application of electronic materials.
2. To provide the basic skills required to understand, develop, and design various engineering applications involving magnetic fields
3. To introduce the concepts and techniques seeking understanding of semiconductor material structures and to measure and characterize materials properties.
4. To help in predicting and evaluating the performance of materials as structural or functional elements including mechanical, electrical, optical, magnetic, thermal, and chemical properties in engineering systems with respect to conductor and superconductors
5. The main objective of this course is to obtain physical and chemical phenomena underlying the electronic properties of solids from macroscopic to nano properties of engineering materials.

Units	Course Contents	Hours
I	**FUNDAMENTALS OF ENERGY** Introduction to Energy-Energy consumption and standard of living-classification of energy resources-consumption trend of primary energy resources-importance of renewable energy sources-energy chain-common forms of energy-advantages and disadvantages of conventional energy sources-salient features of nonconventional energy sources-environmental aspects of energy-energy for sustainable development-energy	7

	density of various fuels-availability of resources and future trends. Energy scenario in India – Overall production and consumption-Availability of primary energy resources: Conventional, Non-Conventional-Estimated potential and achievement-Growth of energy sector and its planning in india – Energy conservation: Meaning and importance.	
II	**SOLAR ENERGY** Introduction – Solar radiation at the earth's surface-Solar Radiation measurements-Estimation of average solar Radiation. Solar energy collectors- Classifications-Flat plate collectors-Concentrating collectors-Comparison. Solar water heaters-Solar industrial heating system – Solar Refrigeration and Air-Conditioning Systems-Solar cookers-Solar furnaces- Solar greenhouse-Solar Distillation-Solar pond Electric power plant-Distributed Collector- Solar thermal Electric power plant. Principles of photovoltaic conversion of solar energy – types of solar cells – solar Photo Voltaic applications.	7
III	**WIND ENERGY** Introduction-Basic principles of wind energy conversion: Nature of the wind, power in the wind, forces on the blades and wind energy conversion-wind data and energy estimation-site selection-classification of wind energy conversion systems-Advantages and Disadvantages-Types of wind machines-Horizontal axis machine-Vertical axis machine-Generating system-Energy Storage– Application of wind energy-Safety and environmental aspects.	7
IV	**BIO – ENERGY** Introduction – photo synthesis – usable forms of bio mass, their composition and fuel properties-Biomass resources – Biomass conversion technologies – Urban waste to energy conversion – Biomass gasification – biomass liquification – biomass to ethanol production – Biogas production from waste Biomass – types of bio gas plants - applications – Bio diesel production – Biomass energy programme in india.	7
V	**OCEAN AND GEOTHERMAL ENERGY** Ocean energy resources – principle's of ocean thermal energy conversion (OTEC) – Methods of Ocean thermal electric power generation – Energy utilisation – basic principle of tidal power – components and operations of tidal power plant – Energy and Power forms of waves – Wave energy conversion devices. Geothermal Energy – Geothermal Sources – Prime movers for Geothermal energy conversion – Advantages and Disadvantages – Applications – Material selection for geothermal power plants – Geo thermal exploration – Operational and Environmental problems – Prospects of geothermal energy in india.	7
	Total	**35**

Text Books:

1. Non Conventional Energy Sources - G.D. Rai – Khanna Publishers, New Delhi,1999.
2. Non Conventional Energy Sources and Utilisation - R.K. Rajput - S.Chand & Company Ltd., 2012.
3. Renewable Energy Sources - Twidell, J.W. and Weir, A. - EFN Spon Ltd., 1986.
4. "Non-Conventional Energy Resources - B.H.Khan - Tata Mc Graw Hill, 2nd Edn, 2009

Course outcomes:

On successful completion of the course:

Students in this program learn how environmental forces such as the wind and sun are used to reduce consumption of fossil fuels and other limited natural resources. Associate's degree programs teach everything from the electrical construction of photovoltaic systems to the mechanical workings of wave-driven turbines.

Students interested in renewable energy technology learn how to perform cost-to-benefit analyses, evaluate potential locations for system installations and repair existing systems.

Course Title: **OPERATION RESEARCH**		Course Code	: ME 405
Semester	: **VII**	Core / Elective	: **Core**
Teaching Scheme in Hrs (L:T:P)	: 3**:1:0**	Credits	: **4 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.TECH (MECHANICAL ENGINEERING)**			

Pre-requisites:

Basics math and understand problem of industry

Course Objectives:

This course aims to introduce students to use quantities methods and techniques for effective decisions–making; model formulation and applications that are used in solving business decision problems.

Course Content:

Topic and Contents	Hours	Marks
UNIT-1	7	20
Linear Programming- Introduction & Scope, Problem formulation, Linear Programming: LP formulation, graphical method, simplex method, duality and Sensitivity analysis.		

UNITS-2	7	20
Transportation Model, Assignment Model, Sequencing problems, Network Flow, constrained optimisation and Lagrange multipliers. **Dynamic Programming-** Multistage decision problems & solution, Principle of optimality		
UNITS-3	7	20
Decision theory-Decision under various conditions. **Game Theory-** Minimax & maximum strategies. Application of linear programming. **Integer Programming-** Cutting Plane method and Branch & Bound method		
UNIT-4	8	20
Deterministic and Stochastic inventory models- Single & multi period models with continuous & discrete demands, Service level & reorder Policy. **Replacement Models:** Capital Equipment replacement with time, group replacement of tems subjected to total failure, Industrial staff problem, replacement problems under warranty condition.		
UNIT 5	7	20
Simulations- Need of simulation, advantages and disadvantages of simulation method of simulation. Generation of Random numbers, Generation of normal Random numbers, Generation of random numbers with any given distribution. Use of random numbers for system simulation, Application of simulation for solving queueing Inventory Maintenance, Scheduling and other industrial problems. Simulation V/S mathematical modeling, Monte Carlo simulation, simulation language ARENA, Example & cases. **Queing models-** Introduction Model types, M.M. 1 & M/M/S system cost consideration.		
TOTAL	**36**	**100**

Reference:

1. Introduction of Operations Research, Hiller F.S. & Liberman G.J.CBS Publishers
2. Operations Research, Taha H.A., McMillan Publishing Company
3. Foundation of Optimization, Heightler, C.S. & Philips D.T. Prentice Hall

Course outcomes:

On successful completion of the course, the student will be able to:

1. Be able to understand the characteristics of different types of decision-making environments and the appropriate decision making approaches and tools to be used in each type.
2. Be able to build and solve Transportation Models and Assignment Models.
3. Be able to design new simple models, like: CPM, PERT to improve decision –making and develop critical thinking and objective analysis of decision problems.
4. Be able to build and solve Queuing Models and simulation.

Course Title: **REFRIGERATION AND AIR CONDITIONING LAB**	Course Code : ME 451
Semester : VII	Core / Elective: PROGRAME CORE
Teaching Scheme in Hrs (L:T:P) : **0:0:3**	Credits : **2 Credits**
Type of course : **Lab Experiment**	Total Contact Hours : **20**
Continuous Internal Evaluation : **60 Marks**	SEE : **40 Marks**
Programmes: **B.Tech Mechanical Engineering**	

Pre-requisites:

Basic thermodynamics law's, Systems' process, Heat transfer modes.

Course Objectives:

TO STUDY & PERFORM VARIOUS EXPERIMENTS ON REFRIGRATION & AIR-CONDITIONING SYSTEM.

Course Content:

Topic and Contents	Hours	Marks
LIST OF EXPERIMENTS (ANY 10)	**20**	**100**
1.Study of a vapour absorbtion refrigeration system. (Electrolux refrigerator). 2.To determine the C.O.P. of vapour compression cycle. 3.To determine actual and the political C.O.P. of heat pump setup. 4.To study various refrigeration accessories. 5.Three Ton air-conditioner performance test. 6.Energy analysis of parallel and counter flow heat exchanger. 7.Study of Vaporization System.	Two hours for each experiment	

8.Study of vortex tube refrigeration system. 9.Study of thermoelectric syst Study of steam jet refrigeration system.		
TOTAL	**20**	**100**

Reference:

1. Refrigeration and Air Conditioning, C.P.Gupta
2. Refrigeration and Air Conditioning, Ballarey
3. Refrigeration and Air Conditioning, C.P.Arora

Modern Air Conditioning-Practice, Narman E.Harris, Tata McGraw Hill

Course outcomes:

On successful completion of the course, the student will be able to:

1. The students will have a thorough understanding Refrigeration and second law of Thermodynamics, Refrigeration effect and unit of Refrigeration, Heat pump, reversed Carnot cycle.
2. Student will be able to distinguish the properties and parameters Simple Vapour absorption system, Electrolux Refrigerator, Analysis of Ammonia absorption refrigeration system, Lithium Bromide Absorption Refrigeration System
3. Psychometric properties, psychometric relations, psychometric charts, psychometric processes, cooling coils, By-pass factor and air washer.
4. Internal heat gain, system heat gain, RSHF, ERSHF, GSHF, cooling load estimation, heating load estimation, psychometric calculation for cooling, selection of air conditioning, apparatus for cooling and dehumidification, Air conditioning system.

Course Title: Programing Software Lab(MATLAB)		Course Code	: ME 459
Semester	: VII	Core / Elective: PROGRAME CORE	
Teaching Scheme in Hrs (L:T:P)	: **0:0:3**	Credits	: **2 Credits**
Type of course	: **Lab Experiment**	Total Contact Hours	: **20**
Continuous Internal Evaluation	: **60 Marks**	SEE	: **40 Marks**
Programmes: **B.Tech Mechanical Engineering**			

List of Experiments:

S. No.	Experiment
1.	Arithmetic Operators and all formats of variables.
2.	Array and Matrix (access and operations).
3.	Creates graphs and plots in 2-Dimensions (2D)
4.	Creates graphs and plots in 3-Dimensions (3D)
5.	Start working with m-file. (Multiple programs for practice).
6.	Multiple programs for practice based on Mechanics/Mechanical branch subjects
7.	Solving programs based on Symbolic Mathematics (like algebra, calculus, etc.)
8.	Solving programs based on Symbolic Mathematics (like differential, integrals etc.)
9.	Simulink tool
10.	Multiple programs for creating block diagrams of a problem, practice based on Mechanics/Mechanical branch subjects

Course Title : **Power Plant Technologies**		Course Code	: ME 403
Semester	: VII	Core / Elective: PROGRAME CORE	
Teaching Scheme in Hrs (L:T:P)	: **3:0:0**	Credits	: **3 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.Tech Mechanical Engineering**			

Pre-requisites:

Fluid Engineering, Turbo Machinery.

Course Objectives:

- To introduce the concepts and phenomenon of different sources of Power Generation.
- To give an idea about the fundamental concepts of electrical power distribution, both AC & DC.
- To familiarize the students with the Tariff methods for electrical energy consumption in the prospect of optimum utilization of electrical energy.
- To impart the knowledge of different turbines used in the generating stations with the analytical methods.

Course Content:

Topic and Contents	Hours	Marks
UNIT-1:	**07**	**20**
Introduction: Introduction to generation of electrical power, Sources of energy, comparative merits, types of power plants. Review of growth of power & development of different types of power plants in India, future possibilities. Review of Steam power plant and gas power plant.	07	
UNIT-2:	**07**	**20**
Diesel Power Plants: General layout; elements of diesel power plants; field of use; systems of diesel power plant; comparison with steam power plants (advantages and disadvantages). combined gas and steam power plants; Advantage of combined cycle, Introduction to integrated coal gasification combined cycle power plants	**07**	
UNIT-3:	**07**	**20**
Nuclear Power Plants: Elementary concept of physics of generation of nuclear energy, Nuclear materials and waste disposal; nuclear fuels, fuel cycles, coolants, moderating and reflecting materials; cladding materials, shielding materials; Disposal of nuclear waste; General components of nuclear reactor, different types of nuclear reactors, Their construction and working; Location of nuclear power plants; Comparison of nuclear plants with thermal plants. Enrichment; safety and control. Fast breeder reactors and power plants	07	
UNIT-4:	**07**	**20**
Hydro-elecrtic power Plant: Classification and applications of Hydro-electric plant; Measurement of stream flow; capacity calculation of hydro-power, The hydro plant and its auxiliaries; automatic and remove control of hydro-systems. MHD geothermal, tidal & wind power plants.	07	
UNIT-5:	**07**	**20**
Power Plant Economics: Load curves; different terms and definitions; cost of electrical energy; Selection of type of generation; Performance and operating characteristics of power plants; load division combined operation of power plants; load division between stations. Different systems of tariff.	07	
TOTAL	**35**	**100**

Reference:

4. 1 Power Plant Technology, M.M.El-Wakil, McGraw Hill Book Company
5. A Course in power Plant Engineering, Arora and Domkunwar Dhanpat Rai and Co.(P) Ltd.
6. Power Plant Engineering, Black and Veatch, CBS publication.

Course outcomes:

On successful completion of the course, the student will be able to:

1. To study about generation of electrical power
2. To study various types of power plant
3. Understand to calculate the power consumption
4. Study various parts of plant

Course Title: **COMPUTATIONAL FLUID DYNAMICS**		Course Code	: ME 413
Semester	: VII	Core / Elective: PROGRAME ELECTIVE	
Teaching Scheme in Hrs (L:T:P)	: **3:0:0**	Credits	: **3 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.Tech Automobile Engineering**			

Pre-requisites:

Fluid Engineering, Design of machine element, CAD. Knowledge of a scientific programming language.

Course Objectives:

To study about basis of fluid, basis of conservation of law & analyize the fluid flow.
To introduce the student to widely used techniques in the numerical solution of fluid equations, issues that arise in the solution of such equations, and modern trends in CFD.
Emphasis will be on 'learning by doing', as students will work on programming projects for assignments.

Course Content:

Topic and Contents	Hours	Marks
UNIT-1:	**6**	**20**

Review of basic fluid mechanics and the governing (Navier-Stokes) equations. Types of partial differential equations- hyperbolic, parabolic and elliptic. Traditional solution methods- method of characteristics, separation of variables, Greens function method.		
UNIT-2:	**07**	**20**
Preliminary computational techniques: Discretisation, converting derivatives to discrete algebraic expressions, spatial derivatives, time derivatives. Approximation of derivatives, Taylor series expansion, general techniques. Accuracy of discretisation process-higher order vs lower order formulae.		
UNIT-3:	**08**	**20**
Finite difference method: conceptual implementation, application to transient heat conduction problem.Convergence, consistency and stability of FD equation.		
UNIT-4:	**07**	**20**
Weighted residual methods: General formulation, Introduction to Finite Volume method. Finite Volume method: Equations with first derivatives and second derivatives. FV method applied to Laplace's equation.		
UNIT-5:	**08**	**20**
Finite Element method: Linear interpolation, quadratic interpolation, two dimensional interpolations. Application to heat transfer problems.		
TOTAL	**36**	**100**

Reference:

1. Computational Fluid Dynamics: The Basics with Applications, John D.Anderson, McGraw Hill, 1995.
2. Computational Flow Moeling for Chemical Reactor Engineering, V. V. Ranade, Process Engineering Science, Volume 5, 2001.
3. Fundamentals of Grid Generation, Patrick Knupp and Stanly Steinberg, CRC Press,1994.
4. Turbulence Modelling for CFD, D.C. Wilcox 1993,

5. Computational Methods for Fluid Dynamics, J.H. Ferziger & M. Peric, 3rd Edition.

6. Computational Techniques for Fluid Dynamics 1, C.A.J. Fletcher, 2nd Edition.

7 Computational techniques for Fluid Dynamics 2, C.A.J. Fletcher, 2nd Edition.

Course outcomes:

On successful completion of the course, the student will be able to:

1. To solve partial differential equations.
2. To converting derivatives to discrete algebraic expressions, spatial derivatives & time derivatives
3. To analyze stability of FD equation.
4. Implementation of FEM to various realistic problems.

Course Title: **Engineering Nano Technology**		Course Code	: ME 417
Semester	: **VII**	Core / Elective	:Program Elective
Teaching Scheme in Hrs (L:T:P)	: 3**:0:0**	Credits	: **3 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.Tech Mechanical engineering**			

Pre-requisition:

It is assumed that you have a background in basic University-level theoretical physics and chemistry .

Course Objectives:

- You will have broad knowledge in your chosen discipline, with deep knowledge in its core concepts.
- You will have knowledge in at least one discipline other than your primary discipline and some understanding of interdisciplinary linkages.
- You will demonstrate well-developed problem solving skills, applying your knowledge and using your ability to think analytically and creatively.
- You will develop a capacity for independent and self-directed work.

Course Content:

Topic and Contents	Hours	Marks
UNIT-1:	8	20

Nanoscale Cutting:- Introduction, Material representation and microstructure, Atomic interaction; Nonomachining:- Introduction, Nanometric machining, Theoretical basis of machining; Meso-micromcahining:- Introduction, size effects in micromachining, mechanism for large plastic flow, origin of the size effect, Mesomachining processes. Product quality in micromachining, Burr formation in micromachining operations.		
UNITS-2:	7	20
Microturning:- Characteristic features and applications, Microturning tools and tooling systems, Machine tools for microturning **Microdrilling:** Characteristic features and applications, Microdrills and tooling systems, Machine tools for microdrilling Micromilling:- Characteristic features and applications, Micromills and tooling systems, Machine tools for micromilling, Micro machining high aspect ratio microstructures, micromolding, micromolding processes, micromolding tools, micromold design, micromolding applications, limitations of micromolding.		
UNITS-3:	7	20

Microgrinding and Ultra-precision Processes: Introduction, Micro and nanogrinding, Nanogrinding apparatus, Nanogrinding procedures, Nanogrinding tools, Preparation of nanogrinding wheels, Bonding systems, Vitrified bonding **Non-Conventional Processes:** Laser Micromachining:- Introduction, Fundamentals of lasers, Stimulated emission, Types of lasers, Laser microfabrication, Nanosecond pulse microfabrication, Shielding gas, Effects of nanosecond pulsed microfabrication, Picosecond pulse microfabrication, Femtosecond pulse microfabrication, Laser nanofabrication.		
UNIT-4:	07	20
Diamond Tools in Micromachining: Introduction, Diamond technology, Hot Filament CVD (HFCVD), Preparation of substrate, Selection of substrate material, Pre-treatment of substrate, Modified HFCVD process. Deposition on complex substrates, Diamond deposition on metallic (molybdenum) wire, Deposition on WC-Co microtools, Diamond deposition on tungsten carbide, (WC-Co) microtool, Performance of diamond-coated microtool		
UNIT 5:	7	20
Evaluation of Subsurface Damage in Nano and Micromachining: Introduction, Destructive evaluation technologies, Cross-sectional microscopy, Preferential etching, Angle lapping/angle polishing, X-ray		

diffraction, Micro-Raman spectroscopy. **Applications of Nano and Micromachining in Industry:** Introduction, Typical machining methods, Diamond turning, Shaper/planner machining, Applications in optical manufacturing, Aspheric lens, Fresnel lens, Microstructured components, Semiconductor wafer production.		
TOTAL	**36**	**100**

Reference:

Cao G., "Nanostructures and Nanomaterials: Synthesis, Properties and Applications", Imperial College Press, 2004.

T.Pradeep, "A Text Book of Nanoscience and Nanotechnology", Tata McGraw Hill, New Delhi, 2012.

Sam Zhang, "Materials Characterization Techniques", CRC Press, 2008.

Course outcomes:

On successful completion of the course, the student will be able to:

1. Describe the basic science behind the properties of materials at the nanometre scale, and the principles behind advanced experimental and computational techniques for studying nanomaterials.
2. Communicate clearly, precisely and effectively using conventional scientific language and mathematical notation.
3. Systematically solve scientific problems related specifically to nanotechnological materials using conventional scientific and mathematical notation

Course Title: **Non Destructive Evaluation & Testing**		Course Code	: ME 419
Semester	: **VII**	Core / Elective	:Program Elective
Teaching Scheme in Hrs (L:T:P)	: 3**:0:0**	Credits	: **3 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.Tech Mechanical engineering**			

Pre-requisites: The student should have basic knowledge of the following. ·

Basic Mathematics. · Basic Physics · Fundamentals of Materials Science and Engineering.

Course Objectives: NDT techniques are used for locating flaws as well as for characterizing material properties. Flaws within the materials can play havocs and may cause planes to crash, reactors to fail, trains to derail, pipelines to burst and alike. However if we d techniques, all these catastrophic failures can be avoided. Use of NDT techniques results in better confidence in the materia lower value of factor of safety. Understanding the basic principles of various NDT techn various applications of NDT techniques, limitations of NDT techniques, codes, standards and specifications related to non techniques etc. would be taught to the students and thus the students would have proper skills and would be equipped with proper competencies to locate a flaw in various materials, products

Course Content:

Topic and Contents	Hours	Marks
UNIT-1:	8	20
Introduction: An Overview, Factors influencing the Reliability of NDE, Defects in materials, Defects in composites. NDT methods used for evaluation of materials and composites. **Visual Inspection:** Basic Principle and Applications. **Liquid Penetrant Testing:** Principle, Procedure and Test Parameters, Materials, Limitations and Applications.		
UNIT-2:	7	20
Radiographic Inspection: Principles of X – ray radiography, equipment, Absorption, Scattering, X-ray film processing, General radiographic procedures, Reading and Interpretation of Radiographs,		

Industrial radiographic practice, Limitations and Applications, Welding defects detection. Gamma ray radiography		
UNIT-3:	7	20
Ultrasonic Testing: Principle of wave propagation, Ultrasonic equipment, Variables affecting an ultrasound test, Basic methods: Pulse Echo and Through Transmission, Types of scanning. **Applications of UT:** Testing of products, Welding Inspection, Tube Inspection, Thickness Measurement, Elastic Constant Determination, Ultrasonic testing of composites.		
UNIT-4:	07	20
Magnetic Particle Inspection: Methods of generating magnetic field, Demagnetization of materials, Magnetic particle test: Principle, Test Equipment and Procedure, Interpretation and evaluation. **Introduction to Accostic Emission Testing and Thermography.**		
UNIT 5:	7	20
Eddy Current Testing: Principle of eddy current, Factors affecting eddy currents, Test system and test arrangement, Standardization and **5** calibration, Application and effectiveness. Comparison and Selection of NDT Methods, Codes and Standards		
TOTAL	**36**	**100**

Reference Books:

1. Nondestructive Testing Techniques, Ravi Prakash, New Age International Publishers,

2012.

2. Practical Non-destructive Testing, Baldev Raj, T. Jayakumar and M. Thavasimuthu Woodhead Publishing, 2002.

3. Non-destructive Evaluation - A tool in Design, Manufacturing and Service by D.E. Bray and R. K. Stanley, Revised Edition CRC Press, 1996.

4. NDT Handbooks Vol 1-17, ASNT Press, OH, USA. 3. Nondestructive Testing, "Warren J. McGonnagle", McGraw-Hill, 1961.

Course outcomes:

On successful completion of the course, the student will be able to:

1. Ability to apply scientific and technical knowledge to the field of non-destructive testing.
2. Ability to use the relevant non-destructive testing methods for various engineering practice. 3. Ability to recognize and achieve high levels of professionalism in their work.
3. Recognition of the need and ability to engage in lifelong learning, thought process and development

Course Title: **Advanced Innovation and New Product Development**		Course Code	:
Semester	: **VII**	Core / Elective	: **Elective**
Teaching Scheme in Hrs (L:T:P)	: 3**:0:0**	Credits	: **3 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	ESE	: **60 Marks**
Programmes: **B.TECH (MECHANICAL ENGINEERING)**			

Pre-requisites:

Design, strength of materials and method of management in earlier semesters.

Course Objectives:

This course aims at introducing the students to the basic concepts of engineering design and product development with focus on the front end processes. At the end of this course the student is expected to demonstrate an understanding of the overview of all the product development processes and knowledge of concept generation and selection tools.

Course Content:

Topic and Contents	Hours	Marks
UNIT-1: **NEW PRODUCT DEVELOPMENT PROCESS**	8	20
Importance of new product for growth of enterprise. Definition of product and new product. Responsibility for new product development. Demands on product development team. Classification of products from new product development. Point of view- Need based/Market pull products, Tech. push, Platform based, Process based and customized products. New product development process and organization. Generic product development process for Market Pull Products. Modification of this process for other types of products.		
UNITS-2: **NEED ANALYSIS**	07	20
Establishing economic existence of need, Need Identification and Analysis, Engineering Statement of Problem, Establishing Target Specification.		
UNITS-3: **CONCEPT GENERATION AND SELECTION**	07	20
Concept generation- a creative process, Creativity, Road Elects to creative thinking- Fear of criticism and Psychological set. Tools of creativity like brain storming, Analogy, Inversion etc., Creative thinking Process. Concept feasibility and Concept Selection, Establishing Engineering Specification of Products.		

UNIT-4: **PRELIMINARY & DETAILED DESIGN**.	7	20
Preliminary design- Identification of subsystems, Subsystem specifications, Compatibility. Detailed design of subsystems, component design, Preparation of assembly drawings. Review of product design from point of view of Manufacturing, Ergonomics and aesthetics		
UNIT 5: **MANAGEMENT OF NEW PRODUCT**	07	20
New Product Management's Challenges – Maintaining focus, Promotion of Right Culture, Management of Creativity, Top Management attention. Design Team Staffing and Organization. Setting key mile stone, Identification of Risk Areas, Project Execution and Evaluation Product Launch Strategies. Project Planning – Project Task matrix, estimation of time & resources, project scheduling.		
TOTAL	**36**	**100**

Reference:

1. Product Design and Manufacturing, Chital AK and Gupta RC,PHI
2. Product Design and Manufacturing, Ulrich Ktand Eppinger SD McGraw Hill
3. Product Design and Manufacturing, Lind beck JR, Prentice Hall.
4. Engineering Design Method, Cross, Nigel, John Wiley & Sons.
5. Design for Strength & Production; C.Ritz and F. Koenigsbenger.

Course outcomes:

On successful completion of the course, the student will be able to:

1. Understand the integration of customer requirements in product design
2. Apply structural approach to concept generation, selection and testing
3. Understand various aspects of design such as industrial design, design for manufacture , economic analysis and product architecture
4. to understand the top management work
5. to understand the customer need
6. to understand identification of risk areas, project execution and evaluation of product

Course Title: INTELLECTUAL PROPERTY RIGHT		Course Code	: HS 402
Semester	: **VIII**	Core / Elective	:**University Core**
Teaching Scheme in Hrs (L:T:P)	: 2**:0:0**	Credits	: **2 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **24**

Continuous Internal Evaluation : **40 Marks**	SEE : **60 Marks**
Programmes: **B.TECH (MECHANICAL ENGINEERING)**	

Pre-requisites:

NONE

Course Objectives:

Basics of Intellectual property right

Course Content:

Topic and Contents	Hours	Marks
UNIT-1	5	20
OVERVIEW OF INTELLECTUAL PROPERTY introduction and the need for intellectual property right (IPR) IPR in India – Genesis and Development IPR in abroad Some important examples of IPR		
UNITS-2	5	20
PATENTS Macro economic impact of the patent system Patent and kind of inventions protected by a patent Patent document How to protect your inventions? Granting of patent Rights of a patent How extensive is patent protection? Why protect inventions by patents?		
UNITS-3	5	20
Searching a patent Drafting of a patent Filing of a patent The different layers of the international patent system (national, regional and international options) Utility models Differences between a utility model and a patent?		
UNIT-4	5	20

COPYRIGHT **What is copyright?** What is covered by copyright? How long does copyright last? Why protect copyright? RELATED RIGHTS What are related rights? Distinction between related rights and copyright? Rights covered by copyright?		
UNIT 5	4	20
TRADEMARKS What is a trademark? Rights of trademark? What kind of signs can be used as trademarks? types of trademark function does a trademark perform How is a trademark protected? How is a trademark registered?		
TOTAL	**24**	**100**

Course outcomes:

On successful completion of the course, the student will be able to:

Basics of IPR policy

Course Title: Computer Aided Mechanical Design		Course Code	: ME 406
Semester	: VIII	Core / Elective: PROGRAME CORE	
Teaching Scheme in Hrs (L:T:P)	: **3:1:0**	Credits	: **4 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**

Continuous Internal Evaluation : **40 Marks**	SEE : **60 Marks**
Programmes: **B.Tech Mechanical Engineering**	

Pre-requisites:

Mathematics-I & II, DOM-I, Numerical Methods.

Course Objectives:

- Train engineers to become professionally certified in the computer-aided mechanical engineering field without formally pursuing a graduate degree.
- provide a set of integrated courses on the fundamentals of finite element analysis and CAD/CAM, and
- enable students completing the certificate program to understand the theoretical foundations of modeling and analysis of various mechanical components and to conduct performance analysis

Course Content:

Units	Course Contents	Hours
I	Overview of Computer Graphics, Picture representation, Coordinate Systems, Output Graphcis Display devices. Raster Scan Graphics : DDA for line generation and Bresenham's algorithm for line and circle generation.	8
II	Wire frame models, Parametric representation of curves, Plane curves : line, circle, ellipse, parabola and hyperbola. Space curves : Cubic spline curve, Bezier Curve and B Spline Curves. Blending of Curves.	7
III	Surface models and entities Parametric representation of Hermite Bicubic surfaces, Bezier surfaces and B-spline surfaces. Solid Models and entities, Solid Representation : B-rep. and CSG.Comparison between three types of models**.**	7
IV	Two and three dimensional transformation of Geometric models: Translation, Scaling Reflection, Rotation and Shearing. Homogeneous Representation,	7

	Combined Transformation. Projection of Geometric models: Parallel and Perspective Projection.	
V	Clipping : Point clipping, Line clipping, Cohen- Sutherland algorithm etc. Viewing Transformation, Hidden Line and surface Removal : Techniques and Algorithms.	7
	Total	**36**

Reference:

1. Mathematical Elements for Computer Graphics, Rogers and Admas.
2. CAD/CAM Theory and Practice, Zied Ibrahim, Tata McGraw Hill.
3. Computer Graphics (Schaum Series), Plastock and Kalley.

Course outcomes:

On successful completion of the course, the student will be able to:

1. They will be able to understand Overview of Computer Graphics, Picture representation, Coordinate Systems, Output Graphcis Display devices. Raster Scan Graphics .
2. They will be able to understand Wire frame models, Parametric representation of curves, Plane curves : line, circle, ellipse, parabola and hyperbola. Space curves : Cubic spline curve, Bezier Curve and B Spline Curves. Blending of Curves.
3. They will be able to understand Two and three dimensional transformation of Geometric models: Translation, Scaling Reflection, Rotation and Shearing. Homogeneous Representation, Combined Transformation. Projection of Geometric models: Parallel and Perspective Projection.

Composition of Educational Components:

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)
1	Remembering and Understanding	35
2	Applying the knowledge acquired from the course	25
3	Analysis and Evaluation	40

Course Title: CNC Machines & Programming	Course Code : ME 404

Semester	: VIII	Core / Elective: PROGRAME CORE	
Teaching Scheme in Hrs (L:T:P)	: **3:1:0**	Credits	: **4 Credits**
Type of course	: **Theory**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.Tech Mechanical Engineering**			

Pre-requisites:

Computer Aided Designing, Mathematics-I, Engineering Mechanics

Course Objectives:

- The main objective is to obtain products at a much lower manufacturing cost, compared to the one resulted from conventional applications.
- CNC applications, by their complexity, allow the obtaining of much more reduced manufacturing times, compared to the conventional ones.

Course Content:

Units	Course Contents	Hours
I	Introduction: Overview of manufacturing processes, types of manufacturing systems, the product cycle, computer's role in manufacturing, sources and types of data used in manufacturing. The Beginning of CAM: Historical Background, Basic components of NC systems, NC Procedure, NC coordinate system and machine motions, applications and economics of NC.	8
II	Part programming- manual and computer assisted such as APT Language. Computer Controls In NC Systems: Problems with conventional NC computer numerical control, Direct numerical control, combined CNC/ DNC systems, adaptive control machining system computer process interfacing, New development and latest trends.	7
III	Computer Aided Process Planning: Traditional Process Planning, Retrieval process planning system, Generative Process Planning, Machinability data system, computer generated time standards. Group Technology: Introduction, part families, part classification and coding, coding system and machining cells.	7

IV	Computer Aided Production Management Systems: Introduction to computer aided PPC, Introduction to computer aided inventory management, manufacturing resource planning (MRPII), computer process monitoring and shop floor control, computer process control. Computer Aided Quality Control: Computer in quality control, contact inspection methods, Non contact inspection methods, optical and non optical computer aided testing. Computer Aided Material Handling: Computer control on material handling, conveying, picking. Ware house control, computerized material handling for automated inspection and assembly.	7
V	Computer Integrated Manufacturing Systems: Introduction, types special manufacturing systems, flexible manufacturing systems (FMS). Collaborative Engineering**:** Introduction, Faster Design throughput, Web based design, Changing design approaches, extended enterprises, concurrent engineering, Agile and lean manufacturing.	7
	Total	**36**

Reference:

1. Automation, Production Systems and Computer Integrated Manufacturing by M.P.Grover, PHI
2. Principal of computer integrated manufacturing by S.Kant Vajpayee.
3. Numerical control and computer aided Manufacturing; Kundra, Rao & Tiwari, TMH.

Course outcomes:

On successful completion of the course, the student will be able to:

1. Understand Overview of manufacturing processes, types of manufacturing systems, the product cycle, computer's role in manufacturing, sources and types of data used in manufacturing. The Beginning of CAM: Historical Background, Basic components of NC systems, NC Procedure, NC coordinate system and machine motions, applications and economics of NC.
2. To understand how Part programming- manual and computer assisted such as APT Language. Computer Controls In NC Systems: Problems with conventional NC computer numerical control.
3. Understanding of special manufacturing systems, flexible manufacturing systems (FMS). Collaborative Engineering: Introduction, Faster Design throughput, Web based design, Changing design approaches, extended enterprise.

Topic and Contents	Hours	Marks
UNIT 1	8	14
Introduction and classification of advanced machining process, consideration in process selection, difference between traditional and non-traditional process, Hybrid process.		
Abrasive finishing processes: AFM, MAF (for Plain and cylindrical surfaces).		

Course Title: Non-Conventional Machining Methods		Course Code	: ME 414
Semester	: IV	Core / Elective: Programe Elective	
Teaching Scheme in Hrs (L:T:P)	: **3:0:0**	Credits	: **3 Credits**
Type of course	: **Theory**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.Tech Mechanical Engineering**			

Course Content:

UNIT-2:	7	20
Mechanical advanced machining process: Introduction, Mechanics of metal removal, process principle, Advantages, disadvantages and applications of AJM,USM,WJC.	7	
UNIT-3:	7	20
Thermo electric advanced machining process: Introduction, Principle, process parameters,advantages, disadvantages and applications about EDM, EDG, LBM, PAM, EBM	7	
UNIT-4:	07	20
Electrochemical and chemical advanced machining process: ECM, ECG, ESD, Chemical machining, Anode shape prediction and tool design for ECM process. Tool (cathode) design for ECM Process.	7	
UNIT 5:	7	20
Intorduction to Micro and nanomachining, Nanoscale Cutting, Diamond Tools in Micromachining, Conventional Processes: Microturning, Microdrilling and Micromilling, Microgrinding, Non-Conventional Processes: Laser Micromachining, Evaluation of Subsurface Damage in Nano and Micromachining, Applications of Nano and Micromachining in Industry.	7	
TOTAL	**36**	**100**

Course Objectives:

- The course aims in identifying the classification of unconventional machining processes.
- To understand the principle, mechanism of metal removal of various unconventional machining processes.

- To study the various process parameters and their effect on the component machined on various unconventional machining processes.
- To understand the applications of different processes.

Course outcomes:

After completion of course, the student shall understand the principle of working, mechanism of metal removal in the various unconventional machining process. The student is able to identify the process parameters, their effect and applications of different processes.

References:

1. Sukhatme S.P. and J.K.Nayak, Solar Energy - Principles of Thermal Collection and Storage, Tata McGraw Hill, New Delhi, 2008.

2. Khan B.H., Non-Conventional Energy Resources,Tata McGraw Hill, New Delhi, 2006.

3. J.A. Duffie and W.A. Beckman, Solar Energy - Thermal Processes, John Wiley, 2001.

Course Title: **Operation Management**		Course Code	: ME 418
Semester	: **VIII**	Core / Elective	: **ELECTIVE**
Teaching Scheme in Hrs (L:T:P)	: 3**:0:0**	Credits	: **3 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.Tech Mechanical engineering**			

Course objectives:

One of the most critical areas for success in any business enterprise is how Production and Operations are managed. In the 'Productions and Operations Management' course an attempt will be made to

integrate the courses studied by the students like statistics, economics, finance, organizational behaviour and strategy into a consolidated production and operation related decisions

Units	Course Contents	Hours
I	**Operations Management:** An Overview - Systems concepts in Operations Management, Objectives in Operations Management, Operations management Decisions, Productivity concepts and measurement, Types of Production Systems. Aggregate planning and master scheduling Objectives of Aggregate planning Methods, Master Scheduling, Objectives, Master Scheduling Methods.	7
II	**Forecasting Demand:** Forecasting Objectives and uses, Qualities & Quantities methods of Forecasting, Opinion and Judgmental Methods Time Series Methods, Exponential Smoothing, Regression and Correlation Methods, Time Series Analysis, Application and Control of Forecasts. Capacity Planning: Capacity Strategy, aspects of Capacity Planning, Determination of Capacity Requirement, Types of capacity, Evaluation of Alternative plant size, Traditional Economic Analysis, Cost-Volume Profit Analysis.	7
III	Materials Management: Scope of Materials Management, Purchase system and procedure, purpose of Inventories, Classification of inventory, factors effecting inventory, inventory models, probabilistic models, inventory systems classification, selective inventory control, stores management, standardization codification and variety reduction. Material and Capacity Requirements Planning Overview, MRP and CRP, MRP Underlying concepts, system parameters, MRP Logic, CRP Activities.	7
IV	Scheduling and controlling Production Activities: Introduction, PAC Objectives and Date Requirements. Scheduling Strategy and Guidelines., Scheduling Methodology, Priority Control, Capacity Control	7
V	Just in Time (JIT) in manufacturing planning & control. Major-elements, Characteristics of Just in Time System pre-requisite for JIT manufacturing, Elements of Manufacturing, Eliminating Waste, Enforced, Problem Solving and Continuous Improvements, Benefits of JIT Purchasing, The Kanban System JIT implementation in Industries. Bottleneck scheduling and theory of constraints. Issues in choosing manufacturing technologies and strategies: product life cycle, standardization, simplification, diversification, value analysis.	7
	Total	**35**

Reference Books:

1. Production and Operations Management, Adam Everett E.& Elbert Ronald J., PHI

2. production & Operation Management; S.N.Charry, TMH
3. Manufacturing planning and control systems; Berry W.L.Whybark D.C. Vollman T.E.galgotia Publication Pvt. Ltd.
4. Operations Management: Theory and Problems Monk J.G. McGraw Hill.

Learning outcomes:

After completing the course the participants shall develop an understanding on how to create a production entity with focus on -

- Production Base.
- Financial (Cost) Performance.
- Technical and Operational capabilities.
- Human Capabilities.

Course Title: **CAM LAB**	Course Code : ME 462
Semester : **VIII**	Core / Elective : **Core**
Teaching Scheme in Hrs (L:T:P) : 0**:0:2**	Credits : **1 Credits**
Type of course : **Lab Experiment**	Total Contact Hours : **20**
Continuous Internal Evaluation : **60 Marks**	SEE : **40 Marks**
Programmes: **B.TECH (MECHANICAL ENGINEERING)**	

Pre-requisites:

CAD and CAM theory

Course Objectives:

To know basics of cad and cam software

Course Content:

Topic and Contents	Hours	Marks
LIST OF EXPERIMENTS	20	100
1. To prepare part programming for plain turning operation. 2. To prepare part programming for turning operation in absolute mode. 3. To prepare part program in inch mode for plain turning operation. 4. To prepare part program for taper turning operation. 5. To prepare part program for turning operations using turning cycle. 6. To prepare part program for threading operation. 7. To prepare part program for slot milling operation. 8. To prepare part program for gear cutting operation. 9. To prepare part program for gear cutting using mill cycle. 10. To prepare part program for drilling operation. 11. To prepare part program for multiple drilling operation in Z-axis. 12. To prepare part program for multiple drilling in X-axis. 13. To prepare part program for multiple drilling in X and Z axis using drilling cycle.	Two hours for each experiment	
TOTAL	**20**	**100**

Reference:

1. Mikell P. Grover, “Automation, Production Systems and Computer-Integrated Manufacturing”, Pearson Education, New Delhi.
2. P. Radhakrishnan and S. Subramanyan “CAD/CAM/CIM” Willey Eastern Limited, New Delhi.
3. Michael Fitzpatrick, “Machining and CNC Technology”, Tata McGraw Hill.
4. Mikell P. Grover and Enory W. Zimmers Jr. “CAD/CAM”, Pearson Education, New Delhi.
5. Steve Krar, Arthar Gill “CNC Technology and Programming”, McGraw Hill Pub. Company, New Delhi.
6. P.N. Rao N.K. Tewari et al “CAM” Tata Mc Graw Hill Pub. New Delhi.
7. David Bedworth, "Computer Integrated Design and Manufacturing", TMH, New Delhi
8. Zeid Ibrahim, “CAD/CAM Theory and Practices”, McGraw Hill International Edition.

Course outcomes:

On successful completion of the course, the student will be able to:

1. Preparation of cad model
2. Preparation of cam model

Course Title: **SOLAR LAB**	Course Code : ME 464
Semester : **VIII**	Core / Elective : **Core**
Teaching Scheme in Hrs (L:T:P) : 0**:0:2**	Credits : **1 Credits**
Type of course : **Lab Experiment**	Total Contact Hours : **20**
Continuous Internal Evaluation : **60 Marks**	SEE : **40 Marks**
Programmes: **B.TECH (MECHANICAL ENGINEERING)**	

-requisites:

Theory of solar energy

Course Objectives:

- To produce an ultimate practical knowledge on various gadgets of solar systems and trying with assorted parameters
- To analyze of analyzing the numerical results from experimentation
- To generate consciousness on routine usages of solar energy gadgets/ industrial utilities

Course Content:

Topic and Contents	Hours	Marks
LIST OF EXPERIMENTS	20	100

1. Solar Radiation Measurements 2. Flat Plate Solar Water Heater 3. Flat Plate Solar Air Heater 4. IV. Flat Plate Collector with Reflector 5. Parabolic Trough Collector 6. Evacuated Tube Collector 7. Solar Cookers 8. Thermal Storage System	Two hours for each experiment	
TOTAL	**20**	**100**

Course outcomes:

On successful completion of the course, the student will be able to:

The student will be able to understand • The working principle behind the existing collector systems practically. • The domestic and industrial purposes and usages of solar gadgets available. • The various radiation measuring instruments and storages related to solar thermal studies.

Course Title: **ROBOTICS ENGINEERING**		Course Code	: ME-402
Semester	: **VIII**	Core / Elective	:Program Elective
Teaching Scheme in Hrs (L:T:P)	: 3**:0:0**	Credits	: **3 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.Tech Mechanical engineering**			

Pre-requisites:

Basics of Electronics Engineering, Electrical Machines, Control Theory and application. Mechatronics System.

Course Objectives:

1. To gain introductory knowledge of systems, and how the functional units connect to each other.
2. Understand importance of robotics in today and future goods production
3. To read drawings related to mechanics, electronics and pneumatics.
4. An ability to understand the Coordinate Frames, Description of Objects in Space, Transformation of Vectors, Inverting a Homogeneous Transform, Fundamental Rotation Matrices.
5. Principles of robot programming and handle with typical robot •
6. working of mobile robots.

Course Content:

Topic and Contents	Hours	Marks
INDUSTRIAL ROBOTICS		
UNIT-1: **Introduction to Robotics**	07	20
Introduction to Robotics – Origin**,** Evolution of Robots and Robotics, Laws of Robotics, What is and What is not a Robot, Progressive Advancement in Robots, Robot Anatomy, Human Arm Characteristics, Design and Control Issues, Manipulation and Control, Sensors and Vision, Programming Robots, Notations.		
UNITS-2: **Artificial Intelligence, Internet of Things, Swarm Robotics**	07	20
Artificial Intelligence-Origin, Alan Turing & his Machines, What is Intelligence, Artificial Intelligence, AI Types &Applications, Machine Learning, Future Prospects. **Internet of Things-** History, Concept, Application& Future Prospects. **Swarm Robotics**-Introduction to Coordination of multiple robots as a system, Social Insect Motivation & Inspiration		
UNITS-3: **Symbolic Modeling of Robots – Direct Kinematic Model**	07	20
Coordinate Frames- Coordinate Frames, Description of Objects in Space, Transformation of Vectors, Inverting a Homogeneous Transform, Fundamental Rotation Matrices **Symbolic Modeling of Robots** -Mechanical Structure and Notations, Description of Links and Joints, Kinematic Modeling of the Manipulator, Denavit – Hartenberg Notation, Kinematic Relationship between Adjacent Links, Manipulator Transformation Matrix.		

Introduction to Inverse Kinematic model		
UNIT-4: **Robotic Sensors and Vision**	07	20
Robotic Sensors and Vision - The Meaning of Sensing, Sensors in Robotics, Kinds of Sensors used in Robotics, Robotic vision, Industrial Applications of Vision-Controlled Robotic Systems, Process of Imaging, Architecture of Robotic Vision Systems, Image Acquisition.		
UNIT 5: **Robot Applications**	08	20
Robot Applications - Industrial Applications, Material Handling, Processing Applications, Assembly Applications, Inspection Application, Principles for Robot Application and Application Planning, Justification of Robots, Robot Safety, Non-Industrial Applications, The Future Prospects.		
TOTAL	**48**	**100**

Reference:

1. Introduction to Robotics by John J. Craig,Pearson Education
2. Robotics by K.S.Fu,R.C.Gonzalez and C.S.G.Lee,McGraw-Hill
3. Robotic Engineering by Richard D.Klafter,Thomas A.Chmielewski and Michel Negin

Course outcomes:

On successful completion of the course, the student will be able to:

1. An ability to understand the fundamental concept robotics.
2. An ability to know the concepts about Evolution of Robots and Robotics, Laws of Robotics, What is and What is not a Robot, Progressive Advancement in Robots.
3. An ability to understand the Coordinate Frames, Description of Objects in Space, Transformation of Vectors, Inverting a Homogeneous Transform, Fundamental Rotation Matrices.

Course Title: Reliability and Maintenance	Course Code : ME 412
Semester : VIII	Core / Elective: PROGRAME ELECTIVE
Teaching Scheme in Hrs (L:T:P) : **3:0:0**	Credits : **3 Credits**
Type of course : **Lecture + Assignments**	Total Contact Hours : **36**

Continuous Internal Evaluation : **40 Marks**	SEE : **60 Marks**
Programmes: **B.Tech Mechanical Engineering**	

Pre-requisites:

Operation Management, Production Management,

Course Objectives:

TO STUDY ABOUT THE PRODUCTION AND MANAGEMENT ENGINEERING

Course Content:

Units	Course Contents	Hours
I	**Introduction:** Maintenance Objectives and Functions; Maintenance Organization and Administration of Maintenance Systems. Need of planned maintenance. Maintenance policies; Breakdown, time based maintenance: Block replacement, age replacement and periodic replacement policy. Corrective and preventive maintenance. Maintenance planning, Scheduled maintenance. Cost of maintenance versus Cost of equipment and production delays.	8
II	**Predictive maintenance.** Equipment wear records, standards. Equipment used in predictive maintenance. Computerized maintenance, Total Productive Maintenance. Methods of condition monitoring, Non-destructive testing, Liquid Penetrate, Magnetic particles, Ultrasonic testing, and Vibration analysis. Oil analysis, Radiographic testing.	7
III	**Reliability**: Definition, failure data analysis, Mean failure rate, mean time to failure (MTTF),mean time between failures (MTBF) , hazard rate, Bathtub curve. **Inspection**: Inspection intervals, Inspection reports, card history system, guarantee period etc.	7
IV	**System reliability**: Series, parallel and mixed configuration; Simple problems. Reliability improvement: Techniques, use of Pareto analysis-Design for reliability, redundancy unit and stand by redundancy, Optimization of reliability.	7
V	**Spare Parts Management:** Spare parts, features and categorization of spares, cost considerations, Techniques of cost reduction; Selective controls used in spare parts	7

	control; ABC analysis, FSN, XYZ, VED and other approaches. Inventory control of spares.	
	Total	**36**

Reference:

1. **Reliability of Machines by D.Reshetov, A.Ivanov, V.Fadeev**
2. **Engineering Diagnostics by I.A.Birger**
3. Production Technology by R.K.Jain
4. Production and operation management by Adam and Evert ,Tata McGraw Hill.

Course outcomes:

On successful completion of the course, the student will be able to:

1. Study of Scope of Production Management, important terminology and classification, Maintenance.
2. Detailed study of Management.

Course Title:	**Design & Manufacturing of Plastic Products**	Course Code	: **ME 422**
Semester	: **VIII**	Core / Elective:	**PROG ELECTIVE**
Teaching Scheme in Hrs (L:T:P)	: 3**:0:0**	Credits	: **3 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.Tech Mechanical Engg.**			

Course Objectives:

1. To provide the students with overall knowledge on the manufacturing of plastic materials, their properties, applications, processing, product design, mold design, testing & quality control, and recycling through theory as well as practical training.
2. To make the students competent to take up the challenging positions in Plastics material manufacturing industries, compounding industries, processing machinery manufacturing industries through offering specialized elective subjects and industry exposure.

Course Content:

Topic and Contents	Hours	Marks
UNIT-1:	08	20

Plastics Materials: An Overview, Classification, Thermoplastics, Thermosets, Crystalline, Amorphous, and Liquid, Crystalline Polymers, Copolymers, Alloys, Elastomers, Additives, Reinforcements, and Fillers, Physical Properties and Terminology. Mechanical Properties, Thermal Properties, Electrical Properties, Environmental Considerations.		
08		
UNITS-2:	07	20
Design Considerations for Injection-Molded Parts: Injection Molding Process, Design Strategy, Efficient and Functional Design, Material Selection, Nominal Wall Thickness, Normal Ranges of Wall Thickness, Structural Requirements of the Nominal Wall, Insulation Characteristics of the Nominal Wall, Impact Response of the Nominal Wall, Draft, Structural Reinforcement, Ribs, Other Geometric Reinforcement, Bosses, Coring, Fillets and Radii, Undercuts		
UNITS-3:	07	20
Polymer processing techniques such as extrusion, compression and transfer moulding. Injection moulding, blow moulding, thermoforming, rotational moulding, calendaring.		
UNIT-4:	07	20
Assembly: General Types of Assembly Systems, Molded-In Assembly Systems, Snap-Fit Assembly, Molded-In Threads, Press-Fits, Chemical Bonding Systems, Solvent Welding, Adhesive Bonding, Thermal Welding Methods. Spin Welding, Radio Frequency (RF) Welding, Electromagnetic or Induction Welding, Assembly with Fasteners, Bolted Assembly, Threaded Metal Inserts, Self-Tapping Screws, Riveted Assembly, Sheet Metal Nuts, Specialty		

Plastic Fasteners		
UNIT 5: Solar Refrigeration	07	20
Machining of Plastics: Drilling and Reaming,Thread Tapping, Sawing, Milling, Turning, Grinding. Finishing and Decorating of Plastics: Painting, Vacuum Metallizing and Sputter Plating, Electroplating, Flame Spraying/Arc Spraying, Hot Stamping		
TOTAL	**36**	**100**

Course Outcomes:

1. This program could provide well trained professionals for the plastics and allied industries to meet the well trained manpower requirements.
2. The program will help the graduates to take up responsibilities in production, testing, design and marketing in the plastics industries and contribute for the growth of industry.
3. The graduates will get hands on experience in various aspects of plastics technology viz. plastic materials manufacturing, properties, applications, processing, product design, mold design, testing & quality control, and recycling.

References:

1. Hand Book of Plastics Materials & Technology - By Rubin, Irwin, J.
2. Text Book of Polymer Science-By Billmeyer, F.W.
3. Plastics Materials Hand Book - By Athalye, A.S