THIRD SEMESTER

Subject Code	**MA1201**	**Total Contact Hour**	**30**
Semester	**3rd**	**Total Credit**	**3**
Subject Name	**Mathematics–III**		
SYLLABUS			
Module-I	Random variables (Discrete and Continuous. Cumulative Distribution Function (CDF). Variance and standard deviation. Moments. Functions of a random variable. Distributions: Binomial, Poisson, normal, Gaussian, uniform (definitions and examples only). Moment generating function.		6 Hrs
Module-II	Pairs of random variables. Joint probability density function. Joint probability mass function. Marginal distribution. Functions of two random variables, PDF and expected values of the sum of two random variables.		6 Hrs
Module-III	Probability Models of n Random Variables. Vector notation. Independence of random variables and random vectors. Functions of random vectors. Expected value vector and correlation matrix.		6 Hrs
Module-IV	Stochastic Processes. Definitions and examples. Types of stochastic processes. Random variables from random processes. The Poisson process.		6 Hrs
Module-V	Markov Chains. Discrete-time Markov chain. Discrete-Time Markov chain dynamics. Limiting state probabilities for a finite Markov chain. State classification.		6 Hrs
Essential Reading	1. Roy D. Yates, Rutgers and David J. Goodman, Stochastic Processes, 2d Edition, John Wiley and Sons, INC. 2. Gregory F Lawler, Introduction to Stochastic Processe, Chapman & Hall/ CRC Press (Taylor Francis Group).		
Course Outcomes	The objective of this course is to familiarize the prospective engineers with techniques in Probability and Statistics. It aims to equip the students to deal with advanced level of Statistics that would be essential for Engineering disciplines. CO1. To apply different distributions in real life problems of industries. CO2. To deal with problems that contains multivariable probability distribution. CO3.To enrich knowledge Probability Models of multi-Random Variables. CO4. To learn use of stochastic processes in daily life. CO5. Application of eigen values in solving matrices.		

Subject Code	**ME1201**	**Total Contact Hour**	**30**
Semester	**3rd**	**Total Credit**	**3**
Subject Name	**Mechanics Of Deformable Solids**		
Pre-requisites	Students should have a foundational understanding of engineering mechanics as a prerequisite for this course. Additionally, they should also have proficiency in physics and mathematics, including algebra, calculus, and trigonometry.		
Course Objective	1. To provide students with a solid understanding of the fundamental concepts of stress, strain, and their relationship, enabling them to analyze mechanical behavior and properties of materials. 2. To enable students to analyze complex stress systems and determine principal stresses, strains, and planes using Mohr's circle. 3. To develop students' ability to analyze torsional loading on solid and hollow circular shafts, calculate torsional deformation and strain energy, and assess shaft strength under various loading conditions. 4. To enable students to construct shear force and bending moment diagrams for statically determinate beams, analyze stress distributions, and determine beam deflections using integration and area moment methods. 5. To provide students with the knowledge and skills to understand column buckling phenomena, apply Euler's theory, assess column stability under different loading conditions, and analyze the behavior of columns with initial curvature.		
SYLLABUS			
Module-I	**Stress and strain**: Stress and strain types, stress strain relationship, Poisson's ratio, modulus of rigidity, stress strain diagram of ductile & brittle materials, mechanical properties, hardness and impact strength, Temperature stress in composite rods statically indeterministic problem.		8Hrs
Module-II	**Two-Dimensional State of Stress and Strain:** Oblique stress, Two-dimensional stress system, Principal stresses, Principal strains, Principal planes and principal axes. Mohr's circle for principal stresses and principal planes (Two dimensional), Thin cylinder and its wire winding.		6Hrs
Module-III	**Shear Force and Bending Moment Diagram:** Shear force and bending moment diagram of a beam (only for statically determinate beams), Relation between shear force and bending moment. Distribution of normal & shear stress for initially straight beam, beams of two materials, Deflection of beams by integration method and area moment method.		8Hrs
Module-IV	**Torsion:** Torsion of solid and hollow circular shafts, strain energy, Strength of solid and hollow circular shafts, Strength of shafts in combined bending & twisting.		4Hrs
Module-V	**Buckling of columns:** Euler's theory of initially straight columns with various end conditions, Eccentric loading of columns. Columns with initial curvature.		4Hrs
Essential Reading	1. Strength of materials, G. H. Ryder, Publisher: McMillan India Ltd. 2. Elements of Strength of Materials, S. P. Timoshenko, D. H. Young, Publisher: East West Press Pvt. Ltd.		
Supplementary Reading	1. Introduction to Solid Mechanics, H. Shames, Publisher: Prentice Hall India, New Delhi 2. Engineering Mechanics of Solids, E. P. Popov, Publisher: Prentice Hall India, New,Delhi 3. Engineering Physical Metallurgy, Y. Lakhtin, Publisher:MIR pub, Moscow.		

Course Outcomes	CO1 Mastery of stress and strain fundamentals, including types, relationships, and their practical implications in material behavior and mechanical properties evaluation. CO2 Proficiency in analyzing complex stress systems, such as oblique stress, and determining principal stresses, strains, and planes using Mohr's circle. CO3 Competence in torsional analysis, including calculating torsional deformation, strain energy, and evaluating the strength of solid and hollow circular shafts under various loading conditions. CO4 Ability to construct shear force and bending moment diagrams for statically determined beams, analyze stress distributions, and determine beam deflections using integration and area moment methods. CO5 Understanding of column buckling phenomena, including Euler's theory application, assessing stability under different loading conditions, and analyzing the behavior of columns with initial curvature.

Subject Code	**ME1202**	**Total Contact Hour**	**30**
Semester	**3rd**	**Total Credit**	**3**
Subject Name	**Basics Thermodynamics**		
Pre-requisites	Students should have a basic understanding of Physics, Chemistry and mathematics including algebra, calculus, and differential equations.		
Course Objective	1. To learn different terminologies used in thermodynamics. 2. To acquire knowledge about the fundamentals of thermodynamic laws, concepts and principles. 3. To gauge quality of energy. 4. To understand the principles of various cycles and to apply the thermodynamic concepts in various applications like IC engines and Air-conditioning systems. 5. To prepare them to carry out experimental investigation and analysis at later stages of graduation.		
Module-I	Basic Concepts: Thermodynamic systems, Properties of a system, State and Equilibrium, processes and cycles. Temperature and the Zeroth Law of Thermodynamics, Pressure. Properties of a pure substance: Pure substance and its phase change process, property diagram and property tables, Ideal gas equation of state, P-V-T behavior of low and moderate density gases.		6Hrs
Module-II	Work and Heat: Definition of work, Moving boundary work for simple compressible system, Definition of heat and modes of heat transfer, Comparison of heat and work. First Law of Thermodynamics: First law for a closed system undergoing a cycle and undergoing a change of state. Internal energy as system properties, Enthalpy as a thermodynamic property, Internal energy, enthalpy, and specific heats of ideal gases. Application of first law to different thermodynamic processes. PMM1, First law of thermodynamics for a control volume and its application to steady and unsteady flow processes.		8Hrs
Module-III	Second Law of Thermodynamics: Introduction to Second law of thermodynamics, Thermal Energy Reservoirs, Heat Engine, Refrigerators and Heat Pumps, Equivalence of Kelvin-Plank and Clausius statement, PMM2, Reversible and Irreversible processes. Carnot cycle and its proposition. Thermodynamic temperature scale. Entropy: Inequality of Clausius, Entropy: a property of a system, Entropy change of a control mass in reversible and irreversible processes, Entropy change for solid, liquid and ideal gases. Entropy generation and principle of increase of entropy.		6Hrs
Module-IV	Available energy, Reversible work and Irreversibility, second law efficiency, Exergy change of a system, The decrease of Exergy principle, Exergy balance: Closed Systems and Control Volumes Thermodynamic property relations: Maxwell relations, The Clapeyron equation.		4Hrs
Module-V	Analysis of Thermodynamic Cycles to Energy Conversions: Basic considerations in power cycle analysis. Air standard assumptions. Otto, Diesel and Simple Brayton cycles.		4Hrs
Essential Reading	1. Thermodynamics, P K Nag, Publisher: TMH 2. Thermodynamics: An Engineering Approach: Yunus A. Cengel, Michael A. Boles, Publisher: Mc Graw Hill.		

Supplementary Reading	1. Fundamentals of Thermodynamics: Sonntag, R.E., Borgnakke, C., and Van Wylen, Publisher: John Wiley.
Course Outcomes	CO1: Explain fundamental concepts relevant to thermodynamics. CO2: Apply the first law of thermodynamics for a closed system and control volume. CO3: Explain the second law of thermodynamics, including why it is necessary, how it is defined (Kelvin-Planck and Clausius statements), the nature of irreversibility, and the Carnot cycle. CO4: Determine how much of useful energy can be produced from a given thermal source. CO5: To apply the first and the second laws of thermodynamics to the analysis and optimization of the power generation, refrigeration, air-conditioning, combustion, and gas flow processes.

Subject Code	**ME1203**	**Total Contact Hour**	**30**
Semester	**3rd**	**Total Credit**	**3**
Subject Name	**Engineering Materials & Metallurgy**		
Pre-requisites	Students should have the fundamental knowledge of Mathematics, Physics and Chemistry.		
Course Objective	• To understand the crystal structure and classification of materials. • To understand the classification of ferrous and non-ferrous alloys and study their applications. • To interpret the phase diagrams of materials. • To understand heat treatment and surface hardening processes affecting mechanical properties of metals and alloys. • To understand the effect of alloying elements.		
SYLLABUS			
Module-I	Crystal geometry: Space Lattices, Unit cells, Crystal Structure, Crystal directions and planes Mechanism of Crystallization, Defects in crystalline materials, plastic deformation by slip and twining. Effects of cold working on properties, Review of strengthening methods.		5Hrs
Module-II	Classification of engineering materials: Classification of Ferrous and Non-ferrous Alloys, Ferrous Alloys: Basic differences between Steel and cast iron, Non-ferrous Alloys: Various thermosetting and thermoplastic polymer, Ceramics, Classification of Composites.		4Hrs
Module-III	Constitutions of Alloys: Pure metal, intermediate alloy phase, solid solution: Substitutional and interstitial. Hume Rothary's rules for solid solution. Gibb's Phase rules, Cooling curve (CCR), Phase Diagram: Binary phase diagram, iron-carbon equilibrium diagram, and phase transformation in iron-carbon system.		8Hrs
Module-IV	Heat Treatment of Steels: Introductory ideas on structure and properties of materials, Annealing: different types of annealing, Normalizing, Hardening: Time Temperature Transformation (TTT) diagram, different cooling curves and transformation on continuous cooling, Tempering, Jominy end quench test, sub-zero treatment of steel, Defects due to heat treatment. Surface Hardening of Steels: Induction hardening, Flame hardening, Case hardening: Carburizing, Nitriding, Cyaniding, Carbonitriding, Diffusion coating.		9Hrs
Module-V	Introductory Ideas on Ferrous Alloys: Effect of alloying elements on the properties of steels, general Classification of steel, Cast Iron: types of Cast Iron.		4Hrs
Essential Reading	1. Engineering Materials and Metallurgy by R.K. Rajput, Publisher: S. Chand. 2. Material Science and Engineering by V. Raghavan, Publisher: PHI Learning 3. Introduction to Physical Metallurgy by Sidney H. Avner, Publisher: Tata Mc Graw Hill.		
Supplementary Reading	1. Engineering Physical Metallurgy by Y. Lakhtin, Publisher: Mir Publishers, CBS publishers India. 2. Callister's Material Science and Engineering, R. Balasubramaniam, Wiley.		

Course Outcomes	CO1: Understand the crystal structure and classification of materials. CO2: Understand the classification of ferrous and non-ferrous alloys and study their applications. CO3: Interpret the phase diagrams of materials. CO4: Understand heat treatment and surface hardening processes affecting mechanical properties of metals and alloys. CO5: Understand the effect of alloying elements.

Subject Code	**CS1205**	**Total Contact Hour**	**30**
Semester	**3rd**	**Total Credit**	**2**
Subject Name	**Programming in Python**		
Course Objective	1: Introduction to Python Language and its features. 2: To understand the concept of Python Program using sequence data and Control statements. 3: To be able to understand and create User Defined Function. 4: To understand the concept of OOPs and its implementation. 5: To understand the concept of strings and file handling		
SYLLABUS			
Module-I	**Beginning Python Basics:** Introduction to Python Features of Python, Application of Python Data Types, Keywords, Identifiers, Literals, Constants. Python Indentation. Operators and expressions. Naming Conventions with examples, Managing Input and Output, Concept of Indentation. Conditional statement, Looping statements, break and continue, pass & return statements, Nesting of loops.		6 Hrs
Module-II	**Modules:** Built-in Modules, Import statement, Packages, Date and Time Modules. Array and its operations, Handling Strings and Characters, List: slicing, bound, cloning, nested list, list and methods, Adding Element: append, extend, count, index and insert). Mutability: Sort, reverse, remove, clear and pop. Map, Filter.		8 Hrs
Module-III	Tuple and methods, Sets and methods, Dictionary: Basic operation, iterator and methods. **Function:** Introduction to Functions, passing arguments, Anonymous functions (Lambda Function), Recursive Functions.		6 Hrs
Module-IV	**Object Oriented Programming:** Classes and Objects, Class methods. Encapsulation, Data Abstraction, Constructor, Destructor and Inheritance. **Exception Handling:** Handling Exceptions: try-except, try-finally		6 Hrs
Module-V	**Strings and Regular Expressions:** Methods of String Objects, Escape Sequence, Iterating Strings, String Module, String Formatting, Regular Expressions: Re-Module. **File Handling:** Introduction to File Handling, File Operations, Directories.		4 Hrs
Essential Reading	1. Python Programming for Beginners by Adam Stewart 2. Python Cookbook by David Beazley and Brian K. Jones		

Supplementary Reading	1. Introduction to Python Programming By Gowrishankar S. Veena A. 2. Python Programming: Using Problem Solving Approach, Oxford University Press by ReemaThareja. 3. Python Programming University Press by ChSatyanarayan, M Radhika, B N Jagadesh.
Course Outcomes	CO1: Understand the Python Language and its features. CO2: Apply sequence data and control statements to solve problem. CO3: Able to create user defined functions to solve problems. CO4: Analyze the concept of OOPs and its implementation. CO5: Create the python program using strings and files.

Subject Code	**HS1202**	**Total Contact Hour**	**30**
Semester	**3rd**	**Total Credit**	**2**
Subject Name	**Organizational Behaviour**		
Course Objective	1: To understand the relevance of organizational behavior concepts and theories in real-life organizational settings & to develop skills in critical thinking, decision–making, problem-solving in applying organizational behavior concepts to practical situations. 2: To provide an understanding of individual behavior in the workplace, including personality, motivation, perception, learning, and attitudes. 3: To understand the impact of team composition, diversity, and communication on team performance & to understand the role of motivation and leadership in managing organization. 4: To explore how organizational culture affects behavior, communication and decision making by enhancing creativity and innovation and give an episteme how to cope with change and stress. 5: To Develop intercultural competence, including awareness, knowledge, and skills for effective communication, negotiation, and collaboration across culture		
SYLLABUS			
Module-I	**Fundamentals of OB & Understanding the Basic Framework of OB:** Evolution of OB through Quality Management movement, Definitions, Scope & Importance of OB,Challenges (Diversity, Globalization& Ethical Perspective) and opportunities for OB, models of OB, applying OB to solving problems.		6 Hrs
Module-II	**Understanding the Determinants of Individual Behavior:** **Personality:** Determinants of personality, Theories of Personality (Type &Psychoanalytic theory), MBTI, Big five personality traits and other major traits influence workplace behavior. **Perception:** Meaning, Perceptual Process, Application of Perception at Workplace. **Motivation:** Motivation Framework, Content theory (Maslow's need hierarchy & Hertzberg's two factors theory), Process theory (Adam's Equity & Vroom's Expectancy theory), Job Design and motivation, Importance of motivation at Workplace. **Learning:** Theories of learning (Classical Conditioning, Operant Conditioning, & Cognitive Theory), Principles of Learning. Bhavioral modification through learning.		6 Hrs

Module-III	**Understanding Group and Team Behavior at Workplace:** **Group & Team:** Defining and classifying groups, the five-stage model of group development Group properties: Roles, norms, status, size and cohesiveness, Group decision making. **Leadership:** Meaning, Definition & types of leadership, Traditional theories of leadership: Trait theories, Behavioral theories, Contingency theories, Contemporary approaches to leadership, importance of leader in organizations.	6 Hrs
Module-IV	**Understanding the Organizations & the Process** **Organizational Culture:** Meaning, Definition, Cultural dimensions, effect of Organizational culture **Organizational Change & Development:** Nature, Levels & types of Change, Change Agents: Resistance to Change, Force field theory of Change, Managing the Change.	6 Hrs
Module-V	**Conflict & International Organizational Behavior:** **Managing Conflict and Negotiations:** Meaning, views, & levels of Conflict, Process of conflict, Conflict resolution techniques. **Transactional Analysis:** Meaning, Importance of TA, Life position, Ego states and their encounters. **IOB:** Internationalization of Business, Cultural differences and similarities, Understanding Interpersonal behavior across culture through Hofstede's Cultural Dimensions.	6 Hrs
Essential Reading	1. "Organizational Behavior: Text, Cases, & Games" by K. Aswathappa. Publisher: Himalaya Publishing House 2. "Essentials of Organizational Behavior" by Stephen P. Robbins and Timothy A. Judge. Publisher: Pearson Education.	
Supplementary Reading	1. "Organizational Behavior: Improving Performance and Commitment in the Workplace" by Jason A. Colquitt, Jeffery A. LePine, and Michael J. Wesson. Publisher: McGraw-Hill Education. 2. "Organizational Behavior: Human Behavior at Work" by John W. Newstrom and Keith Davis. Publisher: McGraw-Hill Education. 3. "Organizational Behavior: An Evidence-Based Approach" by Fred Luthans. Publisher: McGraw-Hill Education. 4. "Organizational Behavior: Emerging Knowledge, Global Reality" by Steven L. McShane and Mary Ann VonGlinow. Publisher: McGraw-Hill Education. 5. "Organizational Behavior and Management" by Ivancevich, Konopaske, and Matteson. Publisher: McGraw-Hill Education. 6. "Organizational Behavior: Theory, Research, and Practice" by John R. Schermerhorn Jr., James G. Hunt, and Richard N. Osborn. Publisher: Wiley	

Course Outcomes	CO1. Explain the importance of organizational behavior in improving individual and organizational effectiveness with Ethical practices. CO2. Evaluate the effectiveness of different leadership styles and their application in different situations. CO3.Develop critical thinking, Creativity& Innovation, problem-solving, and communication skills necessary for success in organizational settings. CO4. Develop strategies for managing organizational change effectively and maintaining sustainability. CO5. Apply organizational behavior concepts and theories to practical organizational situations.

SESSIONALS

Subject Code	**ME1281**	**Total Contact Hour**	**20**
Semester	**3rd**	**Total Credit**	**1.5**
Subject Name	**Thermal Engineering Material Testing and Foundry Laboratory**		
Pre-requisites	Students should have a foundational understanding of Chemistry, Basic Thermodynamics and Workshop Practice-I as a pre-requisite for this course. Additionally, they should also have proficiency in physics and mathematics.		
Course Objective	1. To develop the knowledge to express the working principle of Internal Combustion engine and knowledge of load test on engines like twin cylinder diesel engine with hydraulic dynamometer to obtain the requisites. 2. To be able to express the knowledge in Cochran Boiler and demonstrate the performance test of a two-stage reciprocating air compressor. 3. To be able to evaluate grain fineness number, permeability number and compressive strength of a given moulding sand. Evaluate the clay content and moisture content of a given sand mould. 4. To analyze and interpret the mechanical properties of materials like mild steel, brass, aluminum, and copper by conducting tensile and hardness tests on the Universal Testing Machine (UTM) which includes determination of critical material properties such as Young's Modulus and hardness values. 5. Develop proficiency in assessing the ductility and impact strength of materials such as steel, copper, and aluminum using appropriate testing methods. This includes performing ductility tests and conducting impact strength tests using the Izod impact test machine, allowing them to evaluate material behavior under different conditions.		
List of Experiments			
Part A	A. Thermal engineering:(8 Hrs) 1. Study of I.C engine (cut-section model). 2. Study of Cochran Boiler. 3. Load test on Twin cylinder Kirloskar make 4-stroke Diesel Engine. 4. Performance test on two-stage reciprocating Air-Compressor.		
Part B	B. Material Testing: (8 Hrs) 1.To study the stress -strain characteristics of Mild Steel by conducting Tensile test on Universal Testing Machine and determination of Young's Modulus. 2. Hardness test of Brass, Aluminum and Copper specimens. 3. Ductility test of Steel, Copper, and Aluminum specimens. 4. Impact strength test of Mild steel and Aluminum specimens using		

	Izod impact test machine.
Part C	C. Foundry: (4 Hrs) 1. Determination of Grain Fineness Number (GFN) of a given moulding sand. 2. Determination of permeability number and compressive strength of a given moulding sand. 3. Determination of clay content of given moulding sand. 4. Determination of moisture content of given moulding sand.
Essential Reading	1. Internal Combustion Engines, V. Ganeshan, MC Graw Hill. 2. Principles of Foundry Technology, P.L. Jain, MC Graw Hill. 3. Introduction to Physical Metallurgy, Sidney H. Avner, MC Graw Hill.
Supplementary Reading	1. Internal Combustion Engine Fundamentals, John B.Heywood, MC Graw Hill. 2. Callister's Material ScienceandEngineering,R.Balasubramaniam,Wiley. 3. Manufacturing Technology, Foundry, Forming and Welding, Vol I, II & III, P. N. Rao. 4.Foundy, Moulding Materials and Production, G.L. Datta, New Age International Publishers.
Course Outcomes	CO1 Demonstrate the knowledge to express the working principle of Internal Combustion engine and knowledge of load test on engines like twin cylinder diesel engine with hydraulic dynamometer to obtain the requisites. CO2 Express the knowledge in Cochran Boiler and demonstrate the performance test of a two-stage reciprocating air compressor. CO3 Evaluate grain fineness number, permeability number and compressive strength of a given moulding sand. Evaluate the clay content and moisture content of a given sand mould. CO4 Analyze and interpret the mechanical properties of materials like mild steel, brass, aluminum, and copper by conducting tensile and hardness tests on the Universal Testing Machine (UTM) which includes determination of critical material properties such as Young's Modulus and hardness values. CO5. Develop proficiency in assessing the ductility and impact strength of materials such as steel, copper, and aluminum using appropriate testing methods. This includes performing ductility tests and conducting impact strength tests using the Izod impact test machine, allowing them to evaluate material behaviour under different conditions.

Subject Code	**ME1282**	**Total Contact Hour**	**20**
Semester	**3rd**	**Total Credit**	**1.5**
Subject Name	**Machine Drawing**		
Pre-requisites	Students should have a foundational understanding of Workshop Practice-I as a pre-requisite for this course. Additionally, they should also have proficiency in mathematics, especially geometry, trigonometry and algebra.		
Course Objective	1. To understand how to represent the machine parts used by machine drawing. 2. To be able to draw the machine elements including different types of screw threads, single start and multi-start threads, screw fastenings, different types of nuts and bolts and their sectional views. 3. To be able to draw joints of machine parts and their sectional views such as: riveted joints, cotter joints, knuckle joints and flanged couplings. 4. To learn to construct the assembly drawing using part drawings of machine components or engine parts. 5. To be able to apply computer graphics, computer aided drawing to real problems.		
List of Experiments			
Course Content 1. Screw threads 2. Screwed fastening 3. Keys, Cotter joints 4. Knuckle joints 5. Rivetted joints 6. Flange coupling 7. Engine parts 8. Introduction to computer graphics Computer aided drawing			
Essential Reading	1. Machine Drawing by N.D. Bhatt, Charotar Publishing House, 2003. 2. Machine Drawing by N. Sidheswar, P. Kannaiah and V.V.S. Sastry, Tata McGraw Hill Book Company, New Delhi, 2000.		
Supplementary Reading	1. Kannaih, P., Production Drawing, New Age International, 2009 2. Machine Drawing by S.C. Sharma, Standard Publishers Distributers.		
Course Outcomes	CO1 Understand how to represent the machine parts used by machine drawing. CO2 Draw the machine elements including different types of screw threads, single start and multi-start threads, screw fastenings, different types of nuts and bolts and their sectional views. CO3 Drawing of joints of machine parts and their sectional views such as:		

	riveted joints, cotter joints, knuckle joints and flanged couplings. CO4 Construct the assembly drawing using part drawings of machine components or engine parts. CO5 Introduction to computer graphics, computer aided drawing.

Subject Code	**ME1283**	**Total Contact Hour**	**20**
Semester	**3rd**	**Total Credit**	**1.5**
Subject Name	**Workshop Practice- II**		
Pre-requisites	Students should have a foundational understanding of Workshop Practice-I as a pre-requisite for this course. Additionally, they should also have proficiency in physics and mathematics.		
Course Objective	1. Acquire knowledge on different types of hand tools, measuring tools, and machine tools that are used in foundry and welding shop. 2. Know the selection of materials, types of patterns and allowances used in casting processes and analyze the components of moulds. 3. Acquire knowledge on design of core, core print and gating system, and melting & pouring of molten metal casting processes. 4. Understand different types of arc, gas, solid state and resistance welding processes and acquire knowledge on different types joints carried out in welding. 5. Understand the importance of safety precautions in foundry shop and welding shop.		
List of Experiments			
Part A	A. Foundry shop: Study of different hand tools, equipments, Cupola & oil-fired furnace, different types of patterns and green sand used in Foundry and casting work with safety precautions. Preparation of Job: Sand moulding and Casting with core and without core. Includes the operations: (i) Preparation of moulding sand using moisture, binder and additives. (ii) Preparation of green sand mould by using single piece pattern, cope and drag pattern, split pattern etc. (iii) Melting of Aluminium and its alloys using Oil fired furnace. (iv) Pouring and casting of Aluminium. (v)Fettling of cast product.		
Part B	B. Welding shop: Study of different hand tools, equipments, different methods of arc-welding, oxy-acetylene gas welding, plasma cutting, tungsten inert gas welding (TIG), metal inert gas welding (MIG) and spot welding with safety precautions. Preparation of Job: Study Table/Shoe Stand/ Tea table/Kitchen Stools (any one) Includes the operations: (i) Measuring and Marking, Cutting, Grinding, Setting, Tacking, Welding, Chipping, Finishing, Brazing & soldering. (ii) Oxy-acetylene Gas welding & Arc welding by AC/DC power source. (iii) Study of MIG, TIG & Spot welding		

Essential Reading	1. Elements of Workshop Technology, S. K. Hajra Choudhury, Nirjhar Roy, Publisher: Media Promoters & Publishers Pvt Ltd. Vol I & II. 2. A Course in Workshop Technology, Vol I, II & III,B.S.Raghuwanshi, Publisher: Dhanpat Rai & Co. 3. Principles of Foundry Technology,P.L.Jain,MCGraw Hill. 4. Complete Casting handbook: Metal Casting Processes, Metallurgy, Techniques and Design, John Campbell, Elsevier. 5. Principles of Metal Casting, R.W. Heine, C.R. Loper, P.C. Rosenthal, MC Graw Hill.
Supplementary Reading	1. ManufacturingTechnology,Foundry, Forming and Welding,VolI, II & III,P.N.Rao. 2. Workshop Technology,Vol I, II & III W.A.J.Chapman,Routledge publishers. 3. Foundy,Moulding Materials and Production, G.L.Datta, New Age International Publishers.
Course Outcomes	CO1 Acquire knowledge on different types of hand tools, measuring tools, and machine tools that are used in foundry and welding shop. CO2 Know the selection of materials, types of patterns and allowances used in casting processes and analyze the components of moulds. CO3 Acquire knowledge on design of core, core print and gating system, and melting & pouring of molten metal casting processes. CO4 Understand different types of arc, gas, solid state and resistance welding processes and acquire knowledge on different types joints carried out in welding. CO5 Understand the importance of safety precaution in foundry shop and welding shop.

Subject Code	**CS1285**	**Total Contact Hour**	**20**
Semester	**3rd**	**Total Credit**	**1.5**
Subject Name	**Machine Learning Using Python Laboratory**		
Course Objectives	1: Introduction to Python Language and its features. 2: To understand the concept of Python Program using sequence data and Control statements. 3: To be able to understand and create User Defined Function. 4: To understand the concept of OOPs and its implementation. 5: To understand the concept of strings and file handling.		
List of Experiments			
1	Program on basics of python Programming Language.		
2	Program on basic Data Structures in Python.		
3	Program on Conversion from on data type to another.		
4	Program on Functions in Python.		
5	Program using Object Oriented Programming in Python.		
6	Program using Inheritance in Python.		
7	Program using String in Python.		
8	Program using Regular expression in Python.		
9	Program using File Handling in Python.		
10	Program using basics of Pandas and Matplotlib module in Python.		
Course Outcomes	CO1: Understand the Python Language and its features. CO2: Apply sequence data and control statements to solve problem. CO3: Able to create user defined functions to solve problems. CO4: Analyze the concept of OOPs and its implementation. CO5: Create the python program using strings and files.		

FOURTH SEMESTER

Subject Code	**MA1203**	**Total Contact Hour**	**30**
Semester	**4th**	**Total Credit**	**3**
Subject Name	**Numerical Methods in Engineering**		
SYLLABUS			
Module-I	Logic: Proposition and logical operation, conditional statement, methods of proof, mathematical induction. Counting principle: permutation and combination, principle of inclusion and exclusion, pigeonhole principle		6 Hrs
Module-II	Relations: Properties of relations, equivalence relations, closure properties of relations, transitive closure by Warshall's algorithm.		6 Hrs
Module-III	Recursive definition and structural induction, recurrence relations, solution to recurrence relations, generating functions, partially ordered sets, Hass diagram, lattice, finite Boolean algebra.		6 Hrs
Module-IV	Graph Theory: Introduction to graph theory, Graph terminology, Representation of graphs, Isomorphism, Euler and Hamiltonian paths, Planar graph, Graph coloring, Introduction to trees, Application of trees.		6 Hrs
Module-V	Semi groups, monoids, groups, subgroups, cosets, Lagrange theorem, permuation groups, isomorphism, homomorphisms, normal subgroups, definitions and examples only for (Rings, integral domain and fields).		6 Hrs
Essential Reading	1.Kenneth H Rosen, "Discrete mathematics and its applications", McGraw hill international. 2. C.L Liu, "Elements of Discrete mathematics" McGraw hill international 3. B. Kolman, R C Bosby,. S Ross, " Discrete mathematical structure", PHI		
Course Outcomes	The objective of this course is to familiarize the prospective engineers with techniques in Discrete Mathematics. It aims to equip the students to deal with advanced level of Discrete Mathematics that would be essential for Engineering disciplines, especially for Computer Science, IT, Electronics, Electrical Engineering. **The Students will Learn:** CO1. To enrich knowledge of inference and logic CO2. To deal with problems that involves Warshall's algorithm. CO3. To apply Boolean algebra in engineering fields. CO4.To learn applications of graph theory in daily life CO5.To be familiar with groups, rings and fields in industry.		

Subject Code	**ME1204**	**Total Contact Hour**	**30**
Semester	**4th**	**Total Credit**	**3**
Subject Name	**Fluid Mechanics**		
Pre-requisites	Students should have basic understanding of Physics, Mathematics including algebra, calculus, differential equations and Engineering Mechanics.		
Course Objective	1. To understand the properties and classification of fluids. 2. To be able to evaluate the forces on floating and submerged bodies under static condition and analyze their stability. 3. To understand the generalized Integral and differential equation governing fluid motion for application in inviscid flow problems. 4. To understand Bernoulli's equation and its application for various devices. 5. To be able to evaluate various losses in pipes and understand the working principles of various flow measuring devices.		
SYLLABUS			
Module-I	Introduction and Fundamental Concepts: Definition of a fluid, Scope of fluid mechanics, Basic equations and methods of analysis, Fluid as a continuum, Physical properties of fluids: Viscosity, Newtonian and Non-Newtonian Fluids, Surface Tension, Vapour pressure, Velocity field: One, two and three-dimensional Flows, Path lines, streamline and streak line, Stress field, Classification of fluid motion: Viscous and Inviscid flows, Laminar and Turbulent Flows, Compressible and incompressible flows.		6Hrs
Module-II	Fluid Statics: Basic equation of fluid statics, Manometers, Hydrostatic force on plane and curved submerged surface, Centre of pressure, Buoyancy, Stability of immersed and floating bodies, Fluid masses subjected to uniform acceleration, Free and Forced vortex. Basic equations in Integral form for a Control Volume: Relation of system derivatives to the control volume formulation (Reynolds Transport equation), Conservation of mass, and momentum equation for inertial and non-inertial control volume, the angular momentum principle and its application.		6Hrs
Module-III	Differential Analysis to Fluid Motion: Conservation of mass, Motion of a fluid element (Kinematics): Stream function for two-dimensional incompressible flow and concept of flow net, Fluid Translation, Fluid Rotation and fluid deformation, Vorticity vector: Concept of rotational and irrotational flow.		6Hrs

Module-IV	Incompressible Inviscid flow: Euler's equations of motion, Bernoulli equation: Integration of Euler equation along a streamline, Derivation using rectangular co-ordinates, Static, dynamic and stagnation pressure, Limitation of Bernoulli's equation, kinetic energy correction factor, Relation between the first law of Thermodynamics and the Bernoulli's equation.	6Hrs
Module-V	Flow through pipes (Incompressible Flow): Laminar and turbulent flow in pipes- Hydraulic mean radius, Concept of friction loss, Darcy-Weisbach equation, Moody's diagram, Flows in sudden expansion and contraction, Minor losses in fittings, Branched pipes in parallel and series, Transmission of power, Water hammer in pipes, Sudden closure condition. Measurements: Pitot tube, Venturi meter, Orifice meter, Notches and Weir, Hook Gauge.	6Hrs
Essential Reading	1. Introduction to Fluid Mechanics and Fluid Machines; Authors: S. K. Som, G. Biswas and S. Chakraborty, Publisher: McGraw-Hill.	
Supplementary Reading	1. Introduction to Fluid Mechanics, Fox & Mc Donald, Publisher: Wiley. 2. Fluid Mechanics, F.M White, Publisher: McGraw-Hill.	
Course Outcomes	CO1: Understand the fluid as a state of matter by knowing its properties and its classification. CO2: Evaluate forces on floating and submerged bodies under static condition and to analyse their stability. CO3: Understand the generalized Integral and differential equation governing fluid motion for application in inviscid flow problems. CO4: Able to understand Bernoulli's equation and application for various devices. CO5: Evaluate various losses in pipes and understand the working principles of various flow measuring devices.	

Subject Code	**ME1205**	**Total Contact Hour**	**30**
Semester	**4th**	**Total Credit**	**3**
Subject Name	**Machine Element & System Design**		
Pre-requisites	Students should have a solid understanding of Engineering Mechanics, Mechanics of Solids, Material Science and Mathematics		
Course Objective	1: To enable the students to analyze the stress and strain on mechanical components; and understand the failure modes for mechanical parts. 2: To acquire knowledge on basic machine elements used in machine design that withstand the loads and deformations for a given application, while considering additional specifications. 3: To enable students to design machine elements successfully. 4: To develop students' ability to design various types of springs and present their designs. 5: To enable the students to identify the characteristics of machine element designs that has safety, societal, or environmental impact.		
SYLLABUS			
Module-I	Introduction to machine design: Stages in design, standardization interchangeability, Mechanical properties of engineering materials (strength, and rigidity). Types of engineering materials (ferrous, non-ferrous), BIS and International (ASTM, DIN, SAE) standard of designation for ferrous materials (Cast Iron and Steel), allowable stress, factor of safety.		6Hrs
Module-II	Design of joints: Riveted, welded, and bolted joints based on different types of loading, illustrative problems with solutions. Design of eccentrically loaded riveted, welded, and bolted joints.		6Hrs
Module-III	Design of shaft : Solid and hollow shaft design based on strength and rigidity. Design of keys, and couplings- protective type of rigid flange coupling.		6Hrs
Module-IV	Design of spring: Helical Spring, Terminology of Helical Springs, Stress and Deflection Equations, Design of helical spring, Spring Design: Trial-and-Error Method, Multi-leaf springs, Nipping of Leaf Springs, and its design.		6Hrs
Module-V	Design of belt (Flat belt, and V-belt), rope, Illustrative problems with solutions.		6Hrs

Essential Reading	1. Design of Machine Elements, V.B. Bhandari, Publisher: Mc Graw Hill. 2. Machine Design, P. C. Sharma, D. K. Agrawal, Publisher: Kataria and Sons. 3. Mechanical Engineering Design, J. E. Shigley, I. C. Mitchelle, Publisher: Mc Graw Hill. 4.Any design data book
Supplementary Reading	1. Elements of machine design, N.C. Pandya & C.S. Shah, Publisher: Charotar publication.
Course Outcomes	CO1: 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: Approaches a design problem successfully, taking decisions when there is not a unique answer and proficient in the use of software for analysis and design. CO4: To work in teams to analyze and design various types of springs and present their designs orally and in writing. CO5: To identify the characteristics of machine element designs that has safety, societal, or environmental impact.

Subject Code	**ME1206**	**Total Contact Hour**	**30**
Semester	**4th**	**Total Credit**	**3**
Subject Name	**Kinematics and Dynamics of Machines**		
Pre-requisites	Students should have basic understanding of Physics, Mathematics including algebra, calculus, and differential equations and Engineering Mechanics.		
Course Objective	• To apply the fundamentals of mechanics to machines which include engines, linkages etc. • To understand the kinematic pairs and constrained motions and different types of inversions. • To know the inertia forces of reciprocating mass. • To know about the power transmission system using belt drive. • To give insight into gear trains.		
SYLLABUS			
Module-I	Mechanisms: Basic kinematic concepts & definitions, mechanisms, link, kinematic pair, degrees of freedom, kinematic chain, degrees of freedom for plane mechanism, Gruebler's equation, inversion of mechanism, four bar chain & their inversions, single slider crank chain, double slider crank chain & their inversion.		6Hrs
Module-II	Kinematics analysis: Determination of velocity using graphical and analytical techniques, instantaneous centre method, relative velocity method, Kennedy theorem, velocity in four bar mechanism, slider crank mechanism, acceleration diagram for a slider crank mechanism, Kleins construction method, rubbing velocity at pin joint, Coriolis component of acceleration and its applications.		6Hrs
Module-III	Inertia force in reciprocating parts: Velocity and acceleration of connecting rod by analytical method, piston effort, force acting along connecting rod, crank effort, turning moment on crank shaft, dynamically equivalent system, compound pendulum, correction couple, friction, pivot & collar friction, friction circle, friction axis.		6Hrs
Module-IV	Belt drive, Open and cross belt drive, initial tension, Effect of centrifugal tension on power transmission, maximum power transmission.		6Hrs
Module-V	Gear trains: Introduction, types of gears: Simple, Compound, Reverted and Epicyclic gear trains, Train value, Methods of finding train value/velocity ratio: Tabular method and analytical method for Epicyclic gear trains.		6Hrs
Essential Reading	1. A text book of theory of machine, R. K. Bansal, J. S. Brar, Laxmi Publications Pvt. Ltd.		

Supplementary Reading	1. Theory of machines, S. S. Ratan, TMH publications. 2. Theory of machines, Thomas Bevan, TMH publications.
Course Outcomes	CO1: Understand the basic kinematic concepts &definitions,mechanisms, link, kinematic pair and their inversions. CO2: Calculate the velocity and acceleration using graphical and analytical techniques. CO3: Calculate the inertia force of different parts like crank and connecting rod. CO4: Understand belt transmission system and their practical applications. CO5: Understand gear train transmission system.

Subject Code:	**CS1209**	**Total Contact Hour**	**30**
Semester:	**4th**	**Total Credit**	**2**
Subject Name:	**Artificial Intelligence and Machine Learning**		
Course Objectives:	1.To familiarize students with the fundamental concepts, theories, and applications of Artificial intelligence& Machine learning. Students will gain insight into the various subfields of AI& ML. 2.Students will have a clear understanding of the fundamental concepts and terminology of Artificial intelligence& Machine learning, enabling them to discuss and comprehend AI-related topics. 3. Students will have a clear understanding about neural networks, Fuzzy logic. 4. Students will have a clear understanding about Clustering and related techniques. 5. Students will have a clear understanding about Classification and related techniques.		
SYLLABUS			
Module I	Introduction to Artificial Intelligence, Applications of AI, State-space problem, Problem solving by Intelligent search: BFE, DFS, Iterative Deepening Search, Hill climbing, Heuristic search: A*, AO*, MIN_MAX Algorithm, Alpha-beta cutoff		**8 Hrs**
Module II	Knowledge representation and reasoning: Formalized symbolic logic, propositional logic, First-order predicate logic, wff conversion to clausal form, inference rules, resolution principle.		**5 Hrs**
Module III	Unsupervised Learning: K-means, K-Medoids, Hierarchical clustering, Density based clustering, Validation Method: LOO, K-fold cross validation.		**5 Hrs**
Module IV	Supervised Learning: Decision Tree, Naïve Bayes classifier, K-NN, Introduction to regression. Performance matrix: Confusion matrix, Precision, Recall, Sensitivity, Specificity, MAE, MSE		**6 Hrs**
Module V	Neural Network Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks, Training of ANN, Back propagation, RBFNN.		**6 Hrs**
Essential Reading	1.E.Rich and K. Knight, Artificial Intelligence-TMH 2.Neuro Fuzzy and Soft Computing, J. S. R. JANG,C.T. Sun, E. Mitzutani, PHI		
Supplementary Reading	1.Artificial Intelligence, Dan W Patterson, Prentice Hall of India 2.Computational Intelligence Principles, Techniques and Applications, Amit Konar, Springer publication. 3. M. Gopal, Applied Machine Learning, McGraw Hill Education, 2018		
Course Outcomes:	CO1:Understand the basics of Search techniques, Knowledge representation and reasoning in Artificial Intelligence. CO2:Understand the Supervised machine learning and Unsupervised machine learning. CO3:Analyzevarious machine learning models. CO4:Implement various Supervised machine learning techniques and analyze them. CO5:Implement various Unsupervised machine learning techniques and analyze them.		

Subject Code	**HS1201**	**Total Contact Hour**	**30**
Semester	**4th**	**Total Credit**	**2**
Subject Name	**Engineering Economics**		
SYLLABUS			
Module-I	**Basic Principles of Economics:** Definition, Nature, Scope and significance of economics for Engineers. Demand & Supply and their Determinants, Elasticity-Government policies and application. Basic Macroeconomics concept: National income accounting (GDP/GNP/NI/Disposable Income etc.) and identities for both closed and open economies.		6 Hrs
Module-II	**Utility Analysis:** Cardinal and ordinal measurability of utility, Assumptions of cardinal utility analysis, law of diminishing marginal utility, Consumer's equilibrium: Principle of equi-marginal utility; Indifference curve-Concepts, properties, Budget line, Equilibrium of the consumer, Revealed preference hypothesis, Individual choice under Risk and Uncertainty: St. Petersburg paradox and Bernoulli's hypothesis, Neumann-Morgenstern method of constructing utility index, Friedman-Savage hypothesis		6 Hrs
Module-III	**Production, Cost and Market Structure:** Production function: short run production function and law of variable proportion; Long run production function: Isoquants, isocost line, returns to scale, Optimum factor combinations, Cost Analysis: Concepts, Classification- Short run and Long run cost curves, Analytical and accounting cost concepts; Market structure: Market classifications, Perfect competition: Characteristics, price and output determination in Short run and long run, Monopoly market: Price and output determination, price discrimination Modern theories of firms: Baumol's theory of sales revenue maximisation, Bain's limit pricing model.		6 Hrs
Module-IV	**Money and Banking:** Money-Function of Money, Demand for Money Theory. Quantity theory of money; Banking: Commercial Banks and their Functions, Central bank's Functions. Role of the Banks in Economic Development, Monetary and Fiscal Policy Tools and their impact on the economy.		6 Hrs
Module-V	**Capital Budgeting and Investment Analysis:** Time value of money: use of cash flow diagram, Annual economic worth, present worth, future worth, Internal Rate of Return (IRR), Net Present Value (NPV), Payback period method, Analysis of public projects: Cost-Benefit analysis, Cost effectiveness.		6 Hrs

Essential Reading	1. Koutsoyiannis, A. (1979). Modern Microeconomics. The Macmillan Press Ltd., London 2. Pindyck, R. S., D. N. Rubinfeld and P. L. Meheta (2009). Microeconomics, Pearson India, New Delhi. 3. Panneerselvam, R. (2007). Engineering Economics, Prentice-Hall of India, New Delhi. 4. Mankiw Gregory N. (2002). Principles of Economics, Thomson Asia.
Course Outcomes	CO1- Utilise economics principles in consumption process CO2- Describe the utility measurement and measure the utility associated with risk CO3- Efficient use of resources in production and take decision regarding optimum output CO4- Describe market mechanism and analyse product market to take proper decisions CO5- Implement economic principles in company related decision making

SESSIONALS

Subject Code	**ME1284**	**Total Contact Hour**	24
Semester	**4th**	**Total Credit**	**1.5**
Subject Name	**Dynamics And Metrology Laboratory**		
Pre-requisites	Students should have basic understanding of Physics, Mathematics including algebra, calculus, and differential equations and Engineering Mechanics.		
Course Objective	1. To apply the fundamentals of mechanics to machines which include engines, linkages etc. 2. To understand the kinematic pairs and constrained motions and different types of inversions. 3. To know the inertia forces of reciprocating mass. 4. To know about the power transmission system using belt drive. 5. To give insight into gear trains.		
List of Experiments			
Part A	A. Dynamics Lab (12 Hrs) 1. Determination of rigidity modulus of a given wire. 2. Determination of Moment of Inertia of a fly wheel. 3. Determination of mechanical advantage & velocity ratio of various lifting machines. 4. Determination of Torque & Brake Power using brake dynamometer. 5. Determination of Performance characteristics of spring-loaded Governor. 6. Determination of Performance characteristics of universal loaded Governor 7. Determination of Natural frequency of torsional vibration.		
Part B	B. Metrology Lab (12 Hrs) 1. Measurement of the diameter of holes and the distance between their centres 2. Measurement of thread parameters using Tool maker's Microscope. 3. Measurement of accuracy of slip gauge using optical flat. 4. Measurement of thread parameters using Profile Projector.		
Essential Reading	1.A text book of theory of machine, R. K. Bansal, J. S. Brar, Laxmi Publications Pvt. Ltd.		
Supplementary Reading	1. Theory of machines, S. S. Ratan, TMH publications. 2. Theory of machines, Thomas Bevan, TMH publications.		

Course Outcomes	CO1 Understand the performance characteristics of different dynamically loaded machine components. CO2 Demonstrate the applications of governor, dynamometer and flywheel in different mechanical devices. CO3 Determine the torsional vibration characteristics and various system properties. CO4 Understand precision and accuracy in measurement of different parameters related to various machine elements. CO5 Demonstrate the application of tool maker microscope and profile projector in measuring thread parameters.

Subject Code	**ME1285**	**Total Contact Hour**	**20**
Semester	**4th**	**Total Credit**	**1.5**
Subject Name	**Machine Design Laboratory-I**		
Pre-requisites	Students should have basic understanding of Physics, Mathematics including algebra, calculus, and differential equations and Engineering Mechanics.		
Course Objective	1. To be able to analyze the stress and strain on mechanical components; and understand, identify and quantify failure modes for mechanical parts 2.Undertanding of the stress and strain on mechanical components; and understand, identify and quantify failure modes for mechanical parts 3. To be able to approach a design problem successfully, take decisions when there is not a unique answer and be proficient in the use of software for analysis and design. 4. Toto able to work in teams to analyze and design various types of brakes and clutches and present their designs orally and in writing. 5. To identify the characteristics of their designs that have safety, societal, or environmental impact.		
List of Experiments			
Course content Design and drawing of: 1. Design of riveted joint 2. Design of Bolted joint. 3. Design of Welded joint. 4. Design of Cotter joint. 5. Design of Knuckle joint. 6. Design of Flexible coupling. 7. Design of Screw jack.			
Essential Reading	1. Bhandari, V B., Design of Machine Elements, 3/e, Tata McGraw Hill Book Company, New Delhi, 2009. 2. Kannaiah, P., Machine Design, 2/e, SciTech Publication Pvt. Ltd., 2009.		
Supplementary Reading	1. Norton, R. L., Machine Design: An Integrated Approach, 3/e, Pearson, 2004. 2. Shigley, J.E and Mischke,C. R. Mechanical Engineering Design, 6/e, Tata McGraw Hill, 2005. 3. Paul H Black and O. E. Adams, P., Machine Design, 3/e, McGraw Hill Book Company, Inc., New York, USA., 2007.		

Course Outcomes	Course Outcomes CO1 Analyze the stress and strain on mechanical components; and understand, identify and quantify failure modes for mechanical parts CO2 Analyze the stress and strain on mechanical components; and understand, identify and quantify failure modes for mechanical parts CO3 Approach a design problem successfully, take decisions when there is not a unique answer and be proficient in the use of software for analysis and design. CO4 To work in teams to analyze and design various types of brakes and clutches and present their designs orally and in writing. CO5 To identify the characteristics of their designs that have safety, societal, or environmental impact.

Subject Code	**ME1286**	**Total Contact Hour**	**20**
Semester	**4th**	**Total Credit**	**1.5**
Subject Name	**Workshop Practice-III**		
Pre-requisites	Students should have a foundational understanding of Chemistry, Basic Thermodynamics and Workshop Practice-I as a pre-requisite for this course. Additionally, they should also have proficiency in physics and mathematics.		
Course Objective	1. Acquire knowledge on different types of hand tools, measuring tools, machine tools and mechanisms of machine tools (Crank & Slotted link, open & cross belt drive Quick return Mechanism) used in Turning and machine shop. 2.Acquire knowledge on manufacturing of gears i.e. spur, helical gears etc. and different types of machining operations e.g. planning, slotting, keyway cutting, drilling etc. in machine shop. 3. Acquire knowledge on different parts of lathe machine, accessories, attachments, and their functions. 4. Understand different types machining operations e.g. facing, plain turning, step turning, threading, taper turning and knurling in lathe machine. 5.Understand the importance of safety precautions in both machine shop and turning shop		
List of Experiments			
Part A	A. Turning shop: (10 Hrs) Study of different types of Lathe machines, mechanisms, methods of taper turning, accessories, attachments, hand tools and precision measuring instruments with safety precautions. Preparation of Job: Machining of a cylindrical mild steel work piece as per the given job diagram using different types of single point cutting tools. Includes the operations: (i) Use of different precision measuring instruments like Vernier Calliper, Micrometre, Vernier Depth Gauge etc. (ii) Use of different marking instruments. (iii) Centring, Facing, Drilling, Plain Turning, Grooving, Step Turning, Taper Turning, Thread cutting, Knurling and Chamfering.		

Part B	B. Machine shop: (10 Hrs) Study of different machines such as Milling, Shaper, Planner, Slotter, Surface Grinder, Radial Drilling & Gear Hobbing. different mechanisms of machine tools, different types single and multipoint cutting tools, different types of milling cutters, work and cutting tool holding devices with safety precautions. Preparation of Job: (i) Machining of Spur gear/Helical gear using Universal column and knee type Milling machine. (ii) Machining of rectangular slot of the given dimension on a rectangular cast iron work piece using a Universal horizontal push type Shaper machine. Includes the operations: a. Flat surface machining, machining of slots, machining of grooves, keyways etc b. Machining of gears using index head attachment.
Essential Reading	1. Elements of Workshop Technology, S.K. Hajra Choudhury, Nirjhar Roy, Publisher: Media Promoters & Publishers Pvt Ltd. Vol I & II. 2. A Course in Workshop Technology, Vol I, II & III, B.S. Raghuwanshi, Publisher: Dhanpat Rai & Co. 3. Principles of Foundry Technology, P.L. Jain, MC Graw Hill. 4. Complete Casting handbook: Metal Casting Processes, Metallurgy, Techniques and Design, John Campbell, Elsevier. 5. Principles of Metal Casting, R.W. Heine, C.R. Loper, P.C. Rosenthal, MC Graw Hill.
Supplementary Reading	1. Manufacturing Technology, Foundry, Forming and Welding, Vol I, II & III, P. N. Rao. 2. Workshop Technology, Vol I, II & III W. A. J. Chapman, Routledge publishers. 3. Foundy, Moulding Materials and Production, G.L. Datta, NewAge International Publishers.
Course Outcomes	CO1Acquire knowledge on different types of hand tools, measuring tools, machine tools and mechanisms of machine tools (Crank & Slotted link, open & cross belt drive Quick return Mechanism) used in Turning and machine shop. CO2Acquire knowledge on manufacturing of gears i.e. spur, helical gears etc. and different types of machining operations e.g. planning, slotting, keyway cutting, drilling etc. in machine shop. CO3 Acquire knowledge on different parts of lathe machine, accessories, attachments and their functions. CO4 Understand different types machining operations e.g. facing, plain turning, step turning, threading, taper turning and knurling in lathe machine. CO5 Understand the importance of safety precaution in both machine shop and turning shop.

Subject Code	**ME1287**	**Total Contact Hour**	**20**
Semester	4th	**Total Credit**	**1.5**
Subject Name	**Fluid Mechanics Laboratory**		
Pre-requisites	Students should have a foundational understanding of Chemistry, Basic Thermodynamics as a pre-requisite for this course. Additionally, they should also have proficiency in physics and mathematics.		
Course Objective	1. To know the practical applications of buoyancy force and meta centre effect. 2. Apply Bernoulli's principle in determining the coefficient of discharge of various flow meters. 3. Compute the friction factor for fluid flow through set of pipes. 4. Discuss the effect of change in pressure head, flow rate and the coefficient of discharge for flow meters. 5. To be able to exhibit ethical principles in engineering practices.		
List of Experiments			
1.To determine the Metacentric height of a Ship model. 2. Verification of Bernoulli's Theorem. 3. Determination of Value of Co-efficient of discharge in a Venturi-meter fitted in a pipe. 4.To determine Darcy-Weisbach Co-efficient for discharge through different pipe sizes and study of friction factor Vs Reynold's number relation. 5.To determine Chezy's C and Manning's N coefficient for flow through a rectangular channel. 6. Determine Co-efficient of discharge for flow through the given Orifice meter. 7.To determine Reynold's number experimentally.			
Essential Reading	1. Introduction to Fluid Mechanics and Fluid Machines; Authors: S. K. Som, G. Biswas and S. Chakraborty, Publisher: McGraw-Hill		
Supplementary Reading	1. Introduction to Fluid Mechanics, Fox & Mc Donald, Publisher: Wiley. 2. Fluid Mechanics, F.M White, Publisher: McGraw-Hill.		
Course Outcomes	CO1 To know the practical applications of buoyancy force and meta centre effect. CO2 Apply Bernoulli's principle in determining the coefficient of discharge of various flow meters. CO3 Compute the friction factor for fluid flow through set of pipes. CO4 Discuss the effect of change in pressure head, flow rate and the coefficient of discharge for flow meters. CO5 Exhibit ethical principles in engineering practices.		