Study Scheme and Syllabus of

B. Tech. (3rd and 4th Semester)

Mechanical Engineering

B.Tech. ME- 3rd Sem

Category	Course Code	Course Title	Subject Type	Hours per week			Maximum Marks			Credits
				L	T	P	Int	Ext	Total	
Professional Core Course	25C1MEU-301	Solid Mechanics	T	3	1	0	40	60	100	4
Professional Core Course	25C1MEU-302	Kinematics and Dynamics of Machines	T	3	1	0	40	60	100	4
Professional Core Course	25C1MEU-303	Basic Thermodynamics	T	3	1	0	40	60	100	4
Professional Core Course	25C1MEU-304	Machine Drawing	T	1	0	2	40	60	100	2
Professional Elective	25C1MEU-CE1-XX	Core Elective- I (Swayam / NPTEL/ MOOCs/Any other Platform/Department Elective Pool)	T	3	0	0	40	60	100	3
NCC	25C1NCU-301	Constitution of India	T	2	0	0	0	0	0	Satisf actory/ Unsatis factory
Professional Core Course	25C1MEU-311	Solid Mechanics Lab	P	0	0	2	30	20	50	1
Professional Core Course	25C1MEU-312	Kinematics and Dynamics of Machines Lab	P	0	0	2	30	20	50	1
Professional Core Course	25C1MEU-313	Computer Aided Drafting Lab	P	0	0	2	30	20	50	1
Skill Enhancement	25C1SEU-311	Future Skills Lab-I	P	0	0	2	30	20	50	1
Skill Enhancement	25C1SEU-301	Career Planning and Placement - I	P	0	0	2	50	0	50	1
Training	25C1MEU-314	Summer Internship - I	P	0	0	0	60	40	100	2
Total				**15**	**3**	**12**	**430**	**420**	**850**	**24**

B.Tech. ME 4th Sem

Category	Course Code	Course Title	Subject Type	Hours per week			Maximum Marks			Credits
				L	T	P	Int	Ext	Total	
Professional Core Course	25C1MEU- 401	Fluid Mechanics	T	3	1	0	40	60	100	4
Professional Core Course	25C1MEU- 402	Applied Thermodynamics	T	3	1	0	40	60	100	4
Professional Core Course	25C1MEU- 403	Materials Engineering	T	3	0	0	40	60	100	3
Professional Core Course	25C1MEU- 404	Modern Manufacturing Processes	T	3	0	0	40	60	100	3
Open Elective	25C1XXU- XXX	Open Elective-I (Swayam / NPTEL/ MOOCs/Any other Platform/Department Elective Pool)	T	3	0	0	40	60	100	3
Humanities & Social Sciences	25C1HSU-401	Universal Human Values	T	3	0	0	40	60	100	3
Professional Core Course	25C1MEU- 411	Applied Thermodynamics Lab	P	0	0	2	30	20	50	1
Professional Core Course	25C1MEU- 412	Fluid Mechanics Lab	P	0	0	2	30	20	50	1
Professional Core Course	25C1MEU- 413	Material Engineering Lab	P	0	0	2	30	20	50	1
Skill Enhancement	25C1SEU- 411	Future Skills Lab-II	P	0	0	2	30	20	50	1
Professional Core Course	25C1MEU- 414	Modern Manufacturing Processes Lab	P	0	0	2	30	20	50	1
Skill Enhancement	25C1SEU-401	Career Planning and Placement - II	P	0	0	2	50	0	50	1
Total				**18**	**2**	**12**	**440**	**460**	**900**	**26**

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1MEU- 301	Solid Mechanics	PCC	4	3	1	0	40	60	100

Pre-requisite: Basic knowledge of mechanical properties and forces etc.

Course Outcomes

At the end of the course, the student will be able to:	
CO1	Analyze stresses, strains and failure of materials under different loading conditions
CO2	Evaluate shear force, bending moment, shear and bending stresses, slope, and deflection in beams
CO3	Apply torsion and bending equation to determine the stresses and deflections in shafts and springs
CO4	Determine stresses and dimensional changes in pressure vessels
CO5	Develop columns and rotating discs based on stress considerations.

Detailed Syllabus

Unit 1: Mechanics of solids: Stress, strain and their types, temperature stress and strain. Principal stresses and strains, Mohr's circle of stress. Castigliano's and Maxwell's theorem of reciprocal deflection. Maximum principal stress theory, maximum shear stress theory, maximum principal strain theory, total strain energy theory, shear strain energy theory. Method of calculating Stress, strain using simulation tools. **(12 Hrs.)**

Unit 2: Mechanics of beams: S.F and B.M diagrams, Relation between loads, shear force and bending moment, moment, slope and deflection, method of calculating deflection and slope for different types of Beams using Simulation tools. Derivation of bending equation, bending and shear stress distribution to beams of various sections. Combined direct and bending stresses. Shear centre and its importance. Calculation of stresses in unsymmetrical Sections. **(12 Hrs.)**

Unit 3: Mechanics of shafts and springs: Derivation of torsion equation for hollow and solid circular shafts. Torsional rigidity, combined torsion and bending of circular shafts, principal stress and maximum shear stresses. Open and closed coiled helical springs under the action of axial load and/or couple. Leaf spring deflection and bending stresses. Visualization of failure of shafts and springs using Virtual Labs. **(8 Hrs.)**

Unit 4: Thin and thick pressure vessels: Derivation of Lame's equations, Calculation of Hoop stress, radial stress, longitudinal stress and strains due to internal pressure in cylindrical and spherical shells, effects of joints. Compound cylinders, hub shrunk on solid shafts, shrinkage allowance and shrinkage stress demonstration using Virtual Lab/simulation tools. **(6 Hrs.)**

Unit 5: Columns, struts and rotational discs: Introduction, failure of columns, Euler's formula, Rankine-Gordon's formula, Johnson's empirical formula for axially loaded columns and their applications. Stresses in rotating discs and rims of uniform thickness using virtual lab simulations for stress analysis. **(8 Hrs.)**

Text Books

S No.	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Strength of Materials	S. S. Rattan	Tata McGraw Hill, New Delhi	2nd (2022)
2	Strength of Materials	Sadhu Singh	Khanna Publishers, Delhi	11th (2024)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Mechanics of Materials	Timoshenko and Gere	CBS Publishers and Distributors, New Delhi.	9th (2023)
2	Strength of Materials	G. H. Ryder	Macmillan Education India Pvt. Ltd., New Delhi.	3rd (2022)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1MEU-302	Kinematics and Dynamics of Machines	PCC	4	3	1	0	40	60	100

Pre-requisite: Knowledge of simple machines and mechanisms

Course Outcomes

At the end of the course, the student will be able to:	
CO1	Apply principles of power transmission using belts, ropes, chains, gears and gear trains in mechanical systems.
CO2	Analyze cam mechanisms through displacement, velocity and acceleration diagrams, and cam profile design.
CO3	Evaluate the effectiveness of flywheels and governors in maintaining speed regulation using turning moment diagrams and numerical analysis.
CO4	Determine balancing conditions in rotating and reciprocating machines to reduce vibrations.
CO5	Predict gyroscopic effects on stability and motion of vehicles, ships and aircraft.

Detailed Syllabus

Unit 1: Power Transmission Systems: Flat belts – basics of belt length, power transmission and tension ratio considering creep and slip. Effect of centrifugal tension and initial tension in belt drives. Fundamentals of V-belts, rope drives and chain drives. Toothed gears terminology, path and arc of contact, conditions for correct gearing, involute tooth profile and interference. Gear trains – simple, compound and epicyclic gear trains and estimation of velocity ratio. Visualization of gear trains using Simulation tools and Virtual Labs. **(12 Hrs.)**

Unit 2: Cams: Types of cams and followers through experiential learning, Terminology related to cams. Displacement, velocity, and acceleration diagrams for followers. Analytical and graphical cam profile design for various follower motions—Simple Harmonic Motion (SHM), Uniform Velocity, Uniform Acceleration and Retardation, and Cycloidal Motion **(8 Hrs.)**

Unit 3: Flywheels and Governors: Flywheels: Turning-moment and crank-effort diagrams for reciprocating machines, Fluctuations of speed, coefficient of fluctuation of speed and energy, Determination of mass and dimensions of flywheels for engines. Governors: Function, types and characteristics of governors. Watt, Porter, Proell governors, Hartnell and Wilson–Hartnell spring-loaded governors. Visualization of Flywheels and governors using Simulation tools and Virtual Labs. **(8 Hrs.)**

Unit 4: Balancing: Need for balancing, Static and dynamic balancing, Balancing of single and multiple rotating masses, Partial unbalanced primary force in engines, Balancing of reciprocating masses, Conditions for balance in multi-cylinder in-line and V-engines. Concept of direct and reverse crank. Balancing of machines, rotors and reversible rotors. **(10 Hrs.)**

Unit 5: Gyroscopic Motion and Couples: Gyroscopic effects on supporting and holding structures of machines. Stabilization of ships and aircraft. Gyroscopic effect on two-wheeler and four-wheeler vehicles. Animated visualization of gyroscopic motion through Simulation tools and Virtual Labs. **(8 Hrs.)**

Text Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Theory of Machines	S.S. Rattan	McGraw-Hill Education	7th (2021)
2	Theory of Machines	R.S. Khurmi & J.K. Gupta	S. Chand Publishing	2nd (2024)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Kinematics and Dynamics of Machinery	Charles E. Wilson and J. P. Sadler	Pearson Education	3rd (2022)
2	Theory of Machines and Mechanisms	John J. Uicker Jr., Gordon R. Pennock, and Joseph E. Shigley	Oxford University Press	5th (2021)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1MEU - 303	Basic Thermodynamics	PCC	4	3	1	0	40	60	100

Pre-requisite: Fundamental knowledge of thermodynamics

Course Outcomes

At the end of the course, the student will be able to:	
CO1	Explain fundamental thermodynamic concepts including systems, properties, processes, laws of thermodynamics, and ideal gas behavior.
CO2	Apply the First Law of Thermodynamics to analyze energy interactions in non-flow and steady-flow processes.
CO3	Interpret the Second Law of Thermodynamics using entropy principles and evaluate the performance of heat engines, refrigerators, and heat pumps.
CO4	Analyze gas power cycles (Otto, Diesel, and Dual) and evaluate the performance parameters of internal combustion engines.
CO5	Evaluate steam formation processes and analyze the performance of Rankine cycle and gas turbine systems.

Detailed Syllabus

Unit 1: Basic Concepts: Thermodynamics: System, surroundings, boundary and their types. Property, state, path, process and cycle, Point and path functions through experiential learning, Reversible, quasi-static and irreversible processes. Energy and its forms, Energy transfer across system boundaries. Heat and work, concept of temperature. Analysis of thermodynamic properties. Zeroth law of thermodynamics, Thermal equilibrium and principles of thermometry. Ideal gas and characteristic gas equation. **(10 Hrs.)**

Unit 2: First Law of Thermodynamics: Concept of First law of thermodynamics, essence and its corollaries through Simulation tools. Internal energy and enthalpy, analysis of ideal gas for various processes. Changes in various properties work done and heat exchange during these processes. Free expansion and throttling process. Steady Flow Energy Equation and its application. **(8 Hrs.)**

Unit 3: Second Law of Thermodynamics: Limitations of First law of thermodynamics, concept of Kelvin Plank and Clausius statements. Efficiency and philosophy of Carnot cycle and its consequences, Carnot Engine and Carnot theorem, Carnot refrigerator, Heat Pump and Heat Engines. Clausius theorem, Clausius inequality, concept of entropy, principle of increase in entropy, representation of various processes on T-S coordinates and change in entropy through Simulation tools and virtual Labs. **(10 Hrs.)**

Unit 4: Gas Power Cycles and Internal Combustion Engines: Air-standard efficiency, Nomenclature of Piston-Cylinder arrangement *w.r.t.* swept volume, clearance volume, compression ratio and mean effective pressure, Analysis and philosophy of Air-Standard Cycles, Comparison between the three Cycles. Classifications and applications of I.C. Engines, Construction and working details of two-stroke and four-stroke cycle engines through Simulation tools and animations. **(8 Hrs.)**

Unit 5: Steam Formation and its applications: Pure Substance, steam formation at constant pressure and the properties of steam, simple Rankine cycle. Construction, working, classification

and applications of gas turbines, comparison of gas turbines with steam turbines and IC engines. **(6 Hrs.)**

Text Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Applied Thermodynamics	R. Yadav	Central Publishing House	6th (2022)
2	Engineering Thermodynamics	R.K. Rajput	Laxmi Publications	7th (2024)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Thermodynamics: An Engineering Approach	Yunus A Cengel, Michael A. Boles	McGraw-Hill Education (India)	10th (2025)
2	Engineering Thermodynamics	P.K. Nag	McGraw-Hill Education (India)	4th (2021)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1MEU-304	Machine Drawing	PCC	2	1	0	2	40	60	100

Pre-requisite: Basic knowledge of engineering graphics

Course Outcomes

At the end of the course, the student will be able to:	
CO1	Apply the principles of drawings to draw and interpret the machine drawings.
CO2	Construct different types of temporary and permanent fasteners and the joints formed using them.
CO3	Explore various types of Couplings, Joints and pipe fittings.
CO4	Develop orthographic drawings of assembled and disassembled IC engine parts, boiler mountings, and machine parts.
CO5	Utilize CAD software to create different types of machine drawings.

Detailed Syllabus

Unit 1: Basic of Machine Drawing: Classification of drawings, Principles of Machine drawing, Requirements of machine drawing, sectional views and conventional representation of machine elements, introduction and familiarization of code SP 46:2003 by Bureau of Indian Standards. **(6 Hrs.)**

Unit 2: Limits, fits and tolerances: Concept of limits, fits, tolerances. Interchangeability. Important Terms Used in Limit System. Basis of Limit System. Indian Standard System of Limits and Fits. Calculation of Fundamental Deviation for Shafts. Calculation of Fundamental Deviation for Holes. Surface Roughness and its representation. **(6 Hrs.)**

Unit 3: Fasteners: Types of fasteners. Temporary and Permanent fasteners: Screw threads, nuts, bolts and screw fasteners. Permanent fasteners: welded and riveted joints. Welded joints. Riveted joints: methods of riveting, material of rivets, types of rivet heads, types of riveted joints, lap joint, butt joint, important terms used in riveted joints, caulking and fullering. **(15 Hrs.)**

Unit 4: Couplings and Joints: Couplings: Rigid and flexible couplings, protected and unprotected type flange coupling, pin type flexible, muff coupling. Joints: Knuckle joint, cotter joints, Universal Joint. **(6 Hrs.)**

Unit 5: Pipe joints: Flanged joints, spigot and socket joint, union joint, hydraulic and expansion joint. **(6 Hrs.)**

Text Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Machine Drawing	P.S. Gill	S.K. Kataria And Sons	13th (2024)
2	Machine Drawing	R.K. Dhawan	S.Chand Publication	8th (2022)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Machine Drawing	N Sidheswar, P Kannaiah and V V S Sastry.	Tata McGraw-Hill	7th (2022)
2	Machine Drawing	N.D.Bhatt	Charotar publications	49th (2022)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1NCU-301	Constitution of India	Mandatory Course	2	2	0	0	0	0	S/NS

Pre-requisite: Basic knowledge of civics

Course Outcomes

At the end of the course, the student will be able to:	
CO1	Summarize the emergence, evolution, structure, and composition of the Indian Constitution.
CO2	Analyze the concept and functioning of federalism in the India as provided in the Constitution.
CO3	Classify the Panchayati Raj institutions as instruments of decentralization and the roles of the three organs of the state in the contemporary scenario.
CO4	Explain the Indian political scenario in the context of emerging challenges.
CO5	Elaborate Indian foreign relations under the cold war and post-cold war era.

Detailed Syllabus

Unit 1: Introduction to Indian Constitution: Historical Background of the Constituent Assembly, Government of India Act of 1935 and Indian Independence Act of 1947, Composition of the Constituent Assembly, Functions of the Constituent Assembly, Various Committees of the Constituent Assembly, Enforcement of the Constitution, Indian Constitution and its Salient Features. **(8 Hrs.)**

Unit 2: The role of B R Ambedkar in the making of the Indian Constitution, The Preamble of the Constitution, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Gandhian Principles, Liberal Principles, Socialistic Principles. **(8 Hrs.)**

Unit 3: Indian Federalism: Meaning and Definition of Federalism, Structure and Features of Indian Federalism, Difference between Indian and Federation of other states, Difference between federal and unitary features, Critical Evaluation of the Indian Federal System, Decentralization of Powers, Centre-State Relations, 73rd Amendment, Panchayat Raj Institutions. **(8 Hrs.)**

Unit 4: Union Government: Powers of Indian Parliament, Functions of Rajya Sabha, Functions of Lok Sabha, Powers and Functions of the President, Comparison of powers of Indian President with the United States, Powers and Functions of the Prime Minister. **(8 Hrs.)**

Unit 5: India's External Relations - Cold War and Post-Cold War era: What is Foreign Policy? Basic Determinants of Foreign Policy, Indian and its Neighbours, India's Extended Neighbourhood in West Asia and South-East Asia, India's relations with the United States and Russia, India and the World Organizations, India in the 21st century. **(8 Hrs.)**

Text Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Constitution of India	The Constitution of India, 1950 (Bare Act)	Government Publication.	-
2	Working of a Democratic Constitution of India.	Granville Austin	Oxford University Press, New Delhi	1st (2003)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Contemporary India: Economy, Society, Politics	N. Chandhoke & Priyadarshini	Pearson Education India	1st (2009)
2	Understanding Contemporary India: Critical Perspectives	A. Vanaik & R. Bhargava	Orient Blackswan	1st (2010)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1MEU - 311	Solid Mechanics Lab	PCC	1	0	0	2	30	20	50

Pre-requisite: Basic knowledge of mechanical properties and forces etc.

Course Outcomes

At the end of the course, the student will be able to:	
CO1	Apply tensile and compression tests to obtain stress–strain curves and determine mechanical properties of ductile and brittle materials.
CO2	Make use of shear testing and hardness testing to evaluate shear strength and surface hardness of materials.
CO3	Examine impact and torsion tests to determine impact strength and torsional properties of materials.
CO4	Analyze fatigue and bending tests to determine fatigue behaviour, Young's modulus, and modulus of rupture.
CO5	Determine buckling loads of columns and evaluate stiffness and modulus of rigidity of helical coil springs.

Detailed Syllabus

List of Practicals

1.	To perform tensile test on ductile material to draw stress-strain curve and to determine various mechanical properties.
2.	To perform compression test on brittle material to draw stress-strain curve and to determine various mechanical properties.
3.	To perform shear test on ductile material to calculate the shear strength.
4.	To perform Rockwell, Brinell and Vicker's hardness tests.
5.	To perform impact test to determine impact strength.
6.	To perform torsion test to determine the torsional properties of a material.
7.	To perform Fatigue test on circular test piece.
8.	To perform bending test on beam and to determine the Young's modulus and modulus of rupture.
9.	Determination of Bucking loads of long columns with different end conditions.
10.	To evaluate the stiffness and modulus of rigidity of helical coil spring.

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1MEU - 312	Kinematics and Dynamics of Machines Lab	PCC	1	0	0	2	30	20	50

Pre-requisite: Knowledge of simple machines and mechanisms

Course Outcomes

At the end of the course, the student will be able to:	
CO1	Apply graphical methods to analyze kinematic chains and cam mechanisms.
CO2	Demonstrate the working and performance characteristics of governors and determine gyroscopic effects.
CO3	Analyze the balancing conditions of rotating masses and determine the moment of inertia of flywheels.
CO4	Examine gears and gear trains and calculate the gear-train ratios of compound and epicyclic gear systems.
CO5	Evaluate bearing pressure distribution and friction characteristics of belt–pulley systems.

Detailed Syllabus

List of Practicals

1.	To study the various inversions of kinematic chains
2.	Conduct experiments on various types of governors and draw graphs between height and equilibrium speed of a governor
3.	Determination of gyroscopic couple (graphical method).
4.	Balancing of rotating masses (graphical method).
5.	Cam profile analysis (graphical method)
6.	To study the different types of gears and gear trains.
7.	Determination of gear- train value of compound gear trains and epicyclic gear trains.
8.	To draw circumferential and axial pressure profile in a full journal bearing.
9.	To determine coefficient of friction for a belt-pulley material combination.
10.	Determination of moment of inertia of flywheel.

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1MEU - 313	Computer Aided Drafting Lab	PCC	1	0	0	2	60	40	100

Pre-requisite: Basic knowledge of engineering graphics

Course Outcomes

At the end of the course, the student will be able to:	
CO1	Utilize CAD software to prepare orthographic drawings of basic machine components.
CO2	Demonstrate the construction of sectional and detailed views of mechanical elements using standard conventions.
CO3	Interpret constructional features of bearings, valves, joints, and lifting devices for accurate technical representation.
CO4	Construct dimensioned drawings of machine components in accordance with BIS/ISO standards.
CO5	Utilize CAD software to prepare accurate and complete engineering drawings.

Detailed Syllabus

List of Practicals (following drawings will be practiced using drafting/designing software)

1.	To draw orthographic and sectional views of a Plummer Block
2.	To draw orthographic and sectional views of a footstep bearing.
3.	To draw orthographic and sectional views of a swivel bearing.
4.	To draw orthographic and sectional views of a steam stop valve.
5.	To draw orthographic and sectional views of a blow off cock.
6.	To draw orthographic and sectional views of a feed check valve.
7.	To draw orthographic and sectional views of a spring loaded safety valve.
8.	To draw orthographic and sectional views of a screw jack.
9.	To draw orthographic and sectional views of a tail Stock.
10.	To draw orthographic and sectional views of a crane hook.
11.	To draw orthographic and sectional views of a piston.
12.	To draw orthographic and sectional views of a connecting rod.

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1ECU-314	Future Skills Lab-I	Skill Enhancement	1	0	0	2	30	20	50

Course Outcomes

At the end of the course; the student will be able to	
CO1	Apply CAD modelling; and additive manufacturing techniques to design and fabricate simple components.
CO2	Analyze fabricate; and assemble basic electronic circuits including schematic development; PCB layout; and PCB prototyping.
CO3	Make use of electronic test and measurement instruments to analyze electrical parameters and signal characteristics.
CO4	Recall fundamental concepts of number systems, basic PLC hardware components and ladder logic symbols.
CO5	Explain the working principles of PLC systems, including iQ-F/iQR series configuration, ladder logic programming and HMI interfacing using GX Works3.

Part- A List of Activities for Future Skills Lab

S. No.	Activity Title
1	Design and fabricate a flat component on acrylic/wood using laser cutting machine
2	Design and fabricate a two-dimensional profile using a vinyl cutting plotter.
3	Draw schematic and PCB layout of a electronic circuit.
4	Fabricate a single-layer printed circuit board using PCB milling/prototyping equipment.
5	Perform electronic component assembly using a soldering station and verify circuit continuity.
6	Generate standard waveforms using a signal/function generator and observe them using a digital storage oscilloscope.
7	Interpret the fundamental concepts of number systems by examining different types and convert numbers between these systems for usage in digital systems.
8	Apply knowledge of hardware modules and components of the iQR series PLC and connection procedures to establish a functional PLC setup for basic control applications.
9	Recall and list the fundamental symbols and instructions used in basic ladder logic programming to represent simple control operations in a PLC.
10	Analyze the process of programming and interfacing the iQ-F PLC with HMI using GX Works for real-time monitoring and control.
11	Evaluate the performance of an induction motor by controlling its speed and direction using an inverter kit.
12	Apply PLC pulse train output to control a servo system for achieving precise position and motion control.

Part-B: Lab Projects

Every individual student is required design and build one Lab Project under the supervision of course teacher. Topic of the project may be any from the theory contents and not limited to following list:

1. USB Powered LED Night Lamp
2. Continuity Tester Device
3. Mobile Phone Charger Indicator Board
4. Mini Audio Amplifier Board
5. DC Motor Speed Indicator
6. Smart traffic control using PLC

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1SEU-301	Career and Placement Planning -1	HSS	1	0	0	2	50	0	50

Pre-requisite: Basic knowledge of arithmetic operations, elementary mathematics and fundamental logical reasoning skills required for problem solving and analytical thinking.

Course Outcomes

At the end of the course, the student will be able to:	
CO1	Demonstrate mental calculation techniques and mathematical shortcuts to simplify and solve numerical expressions efficiently.
CO2	Analyze coded information and spatial relationships to interpret patterns and determine accurate logical conclusions.
CO3	Apply numerical properties and mathematical methods to solve problems involving factors, multiples, divisibility rules, and HCF–LCM relationships.
CO4	Illustrate quantitative relationships to solve problems involving averages, proportional reasoning, and real-life numerical situations.
CO5	Evaluate patterns and logical sequences to identify inconsistencies and determine the correct classification.

Detailed Syllabus

Unit 1: Vedic Mathematics & Simplification: - Simplification & Approximation, Fractions, Decimals and Percentages.
Number System: - Types of Numbers, Divisibility Rules, Factors and Multiples, Remainders, Unit Digit Problems.
Arithmetic Applications: - Profit, Loss and Discount, Simple Interest and Compound Interest, Partnership, Time and Work, Time, Speed and Distance, Boats and Streams.
Algebra & Advanced Quant: - Quadratic Equations, Sequence and Series, Permutation and Combination, Probability. **(8 Hrs.)**

Unit 2: Coding Decoding : - Introduction to Coding Decoding, Types of Coding Decoding (Letter, Number, Symbol, Mix), Coding Decoding Techniques (Pattern Recognition, Substitution, Logical Reasoning based), Advanced Coding & Decoding Patterns.
Directions: - Introduction to the concept of directions, Types of Directions, Cardinal Directions (N,S,E,W), Intermediate Directions (NE,NW,SE,SW), Movement- Clockwise, Anticlockwise, Shortest Distance & Direction. **(7 Hrs.)**

Unit 3: HCF-LCM: Introduction to the concept of HCF-LCM, Finding LCM-HCF (Prime Factorization, Division Method). HCF-LCM of Fractions, Relation between HCF-LCM and Problems, Co-Primes. **(4 Hrs.)**

Unit 4: Averages: - Introduction to the concept of Averages, Finding Averages (Formula & Approximation Techniques), Problems on Averages.
Ages:- Introduction to the Ages Problems, Types of Problems (Simple, Age Ratio, Age Difference), Techniques for solving.
Ratio and Proportion:- Introduction to Ratio & Proportion, Combining of Ratios, Comparison of Ratio, Duplicate, Sub Duplicate, Triplicate, Sub Triplicate Ratio, Problems on Ratio & Proportions, Mean Proportional. **(8 Hrs.)**

Unit 5: **Odd Man Out: -** Introduction to odd man out, Types of patterns & Techniques (Letter Series, Number Series), Identifying Patterns. **(3 Hrs.)**

Text Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Quantitative Aptitude for Competitive Examinations by R.S. Aggarwal	R.S. Aggarwal	S Chand and Company Ltd	Revised Edition 2025
2	A Modern Approach to Verbal & Non-Verbal Reasoning by R.S. Aggarwal	R.S. Aggarwal	S. Chand	2nd (2018)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Quantitative Aptitude & Logical Reasoning	TPP Department	TPP	6th Edition
2	Fast Track Objective Arithmetic **by** Rajesh Verma (Arihant)	Rajesh Verma	Arihant Publications (India) Ltd	Latest Edition-2025-2026

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1MEU-401	Fluid Mechanics	PCC	4	3	1	0	40	60	100

Pre-requisite: Basic knowledge of bulk matter

Course Outcomes

At the end of the course, the student will be able to:	
CO1	Describe basic fluid properties and apply concepts of fluid statics, buoyancy, and pressure measurement in various engineering applications.
CO2	Analyze fluid motion using kinematics concepts and implement the continuity equation for one-dimensional flow.
CO3	Use Bernoulli's equation and impulse–momentum principles to evaluate fluid flow systems and flow measuring devices.
CO4	Utilize dimensional analysis and similarity concepts to determine model–prototype relationships.
CO5	Explain laminar and turbulent internal flows to determine friction losses and pipe flow characteristics.

Detailed Syllabus

Unit 1: Fluid Statics and Buoyancy: Fluid Properties, concept of static fluid pressure, Pascal's law and its industrial applications, hydrostatic paradox, action of fluid pressure on a plane submerged surface, resultant force and center of pressure, force on a curved surface. Buoyancy: buoyancy and floatation, stability of floating and submerged bodies, metacentric height and its determination, visualization of using Virtual Lab. **(10 Hrs.)**

Unit 2: Fluid Kinematics: Description of Fluid Motion, classification of fluid flows, Lagrangian and Euler flow descriptions, velocity and acceleration of fluid particle, local and convective acceleration, normal and tangential acceleration, path line, streak line, streamline and timelines, rotational flows: rotation, vorticity and circulation, stream function and velocity potential function, and relationship between them, flow net one dimensional continuity equation, visualization using Virtual Lab. **(8 Hrs.)**

Unit 3: Fluid Dynamics: Introduction: Equations of Motion, Derivation of Euler's Equation and Bernoulli's equation using principle of conservation of energy and equation of motion, Limitations and its Applications, Venturi meter, Orifice Meter, Pitot Tube, visualization using virtual Lab. Representation of energy changes in fluid system (hydraulic and energy gradient lines), Impulse Momentum Equation, Flow Along a Curved Streamline, Free and Forced Vortex Motions. **(8 Hrs.)**

Unit 4: Dimensional Analysis and Similitude: Dimensional Analysis: need of dimensional analysis, dimensions and dimensional homogeneity, Rayleigh's and Buckingham's π - method, dimensionless numbers (Reynolds, Froude, Euler, Mach, and Weber) and their significance, need of similitude, geometric, kinematic and dynamic similarity, model and prototype studies, similarity model laws. **(8 Hrs.)**

Unit 5: Internal Flows: Internal Flows: laminar and turbulent flows: Reynolds number, visualization using Virtual Lab, critical velocity, critical Reynolds number, hydraulic diameter, flow regimes,

Hagen – Poiseuille equation, Darcy equation, head losses in pipes and pipe fittings, flow through pipes in series and parallel, concept of equivalent pipe, roughness in pipes, rotameters. **(6 Hrs.)**

Text Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	A Text Book of Fluid Mechanics and Hydraulic Machines	R.K. Bansal	Laxmi Publications (P) Ltd., New Delhi	8th (2022)
2	Fluid Mechanics and Fluid Power Engineering	D.S. Kumar	S.K. Kataria & Sons Publishers	4th(2021)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Fluid Mechanics - Fundamentals and Applications	Y.A. Cengel and J.M. Cimbala	Tata McGraw Hill Publications	5th (2025)
2	Fluid Mechanics	Frank M. White	Tata Mc Graw Hill Publications	9th (2024)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1MEU - 402	Applied Thermodynamics	PCC	4	3	1	0	40	60	100

Pre-requisite: Knowledge of basic thermodynamics

Course Outcomes

At the end of the course, the student will be able to:	
CO1	Apply the principles of operation and performance evaluation of reciprocating air compressors.
CO2	Explain the properties of steam and the significance of Mollier charts in analyzing steam cycles and process problems.
CO3	Examine the working and efficiency of vapor power cycles under reheating and regenerative conditions.
CO4	Describe the working principles and types of steam nozzles and condensers.
CO5	Evaluate the performance of steam turbines by analyzing velocity triangles and their performance characteristics.

Detailed Syllabus

Unit 1: Reciprocating Air Compressors: Single stage single acting reciprocating and multi stage compressor explanation through simulation tool and virtual lab: construction, operation, work input and best value of index of compression, heat rejected to cooling medium, isothermal, overall thermal, isentropic, polytropic and mechanical efficiency, Clearance volumetric efficiency, Overall volumetric efficiency, effect of various parameters on volumetric efficiency, free air delivery, Performance curves. **(10 Hrs.)**

Unit 2: Steam: Study of properties of steam including superheated steam, sensible heat, latent heat, total enthalpy, dryness fraction and degree of superheat. Entropy and internal energy of steam and the use of steam tables for property evaluation. Analysis of various thermodynamic processes with steam. Representation of these processes on T–S and H–S diagrams and understanding the significance and application of Mollier charts through simulation tools. **(8 Hrs.)**

Unit 3: Vapour Power Cycle: Study of the Rankine steam power cycle including representation of heat addition, heat rejection and work. Analysis of the effect of different parameters on Rankine cycle efficiency. Methods to improve efficiency such as reheat cycle, regenerative cycle and feed-water heating (bleeding). Introduction to combined heat-regenerative cycles, ideal working fluids and binary vapour cycles and its explanation through experiential learning. **(8 Hrs.)**

Unit 4: Steam Nozzles and Condensers: Study of steam nozzles including definition, types, steam flow through nozzles, critical pressure ratio, condition for maximum discharge, nozzle dimensions and supersaturated flow. Introduction to steam condensers, their functions and components. Types of condensers and the effect and prevention of air leakage. Description of air pumps, cooling towers and cooling ponds used in condensing systems. Simulation of Nozzles and condensers explanation through virtual labs. **(8 Hrs.)**

Unit 5: Steam Turbines: Introduction to steam turbines through animation and simulation tools, their classification and comparison of impulse and reaction turbines. Analysis of single impulse and reaction turbines including pressure and velocity variations and velocity diagrams. Study of various

compound impulse turbines and its parameters. Effects of blade friction and speed ratio, condition for axial discharge and overall efficiencies. Concepts of reheating, reheat factor, condition curve, turbine losses, backpressure and extraction turbines. **(8 Hrs.)**

Text Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Applied Thermodynamics	P.L. Ballaney,	Khanna Publishers	25th (2022)
2	Engineering Thermodynamics	R.K. Rajput	Laxmi Publications	7th (2024)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Applied Thermodynamics	R. Yadav	Central Publishing House	6th (2022)
2	Engineering Thermodynamics	P.K. Nag	McGraw-Hill Education (India)	4th (2021)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1MEU - 403	Materials Engineering	PCC	3	3	0	0	40	60	100

Pre-requisite: Knowledge of materials and their properties.

Course Outcomes

At the end of the course, the student will be able to:	
CO1	Classify engineering materials and analyze their structural features, including crystal systems, defects, and mechanical behavior, to relate microstructure with properties.
CO2	Evaluate diffusion mechanisms and deformation processes in solids and apply diffusion laws to predict material behaviour under various conditions.
CO3	Interpret phase diagrams and transformation kinetics to predict the phases, microstructures, and resulting mechanical properties of alloy systems.
CO4	Select appropriate heat-treatment processes for steels by analyzing transformation behavior, hardenability, and common heat-treatment defects.
CO5	Examine the role of alloying elements in steels and correlate their composition with resulting microstructures and mechanical properties.

Detailed Syllabus

Unit 1: Engineering Materials & Crystallography: Classification of engineering materials, Overview of properties of engineering materials, review of mechanical properties and creep through experiential learning. Polymorphism and allotropy, Imperfections in Solids, point defects, line defects and dislocations, interfacial defects, bulk or volume defects. **(7 Hrs.)**

Unit 2: Diffusion in solids: Importance of Diffusion, Types of diffusion, Diffusion mechanisms through simulation tools, Laws of Diffusion and Diffusion Coefficients, Kirkendall Effect, factors affecting diffusion. Theories of plastic deformation, recovery, re-crystallization. **(5 Hrs.)**

Unit 3: Phase Transformation: General principles of phase transformation in alloys, phase rule and equilibrium diagrams, Equilibrium diagrams of Binary systems. Iron carbon equilibrium diagram and various phase transformations. Time temperature transformation curves (TTT curves): fundamentals, construction and applications through animation and virtual labs. **(11 Hrs.)**

Unit 4: Heat Treatment: Principles and applications. Processes viz. annealing, normalizing, hardening, tempering. Surface hardening of steels through animation and virtual Simulation tools: Principles of induction and oxyacetylene flame hardening. Procedure for carburizing, nitriding and cyaniding. Harden-ability: determination of harden-ability. Jominy end-quench test. Defects due to heat treatment and their remedies. **(8 Hrs.)**

Unit 5: Ferrous Metals and Their Alloys: Effects produced by alloying elements. Composition of alloy steels: Introduction, classification, composition of alloys, effect of alloying elements (Si, Mn, Ni, Cr, Mo, W, Al) on the structures and properties of steel. **(5 Hrs.)**

Text Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Materials Science and Engineering: A First Course	V. Raghavan	Prentice-Hall of India Pvt. Ltd., New Delhi	6th (2022)
2	Material Science and Metallurgy	O.P. Khanna	Dhanpat Rai Publications, New Delhi	2006

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Materials Science and Engineering	W.D. Callister	John Wiley & Sons	10th (2018)
2	Introduction to Physical Metallurgy	S.H. Avner	McGraw-Hill International Editions,	26th (2009)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1MEU - 404	Modern Manufacturing Processes	PCC	3	3	0	0	40	60	100

Pre-requisite: Basic Knowledge of Manufacturing Processes

Course Outcomes

At the end of the course, the student will be able to:	
CO1	Explain fundamentals of manufacturing and analyze casting, forming and powder metallurgy processes.
CO2	Analyze machining processes, cutting tools, tool life, and basic machine tool operations including CNC
CO3	Explain and differentiate various welding and joining processes and their industrial applications.
CO4	Select suitable advanced machining processes employed for making different products.
CO5	Describe additive manufacturing techniques and basic tooling such as jigs, fixtures, moulds, and dies.

Detailed Syllabus

Unit 1: Material Shaping Processes: Metal Casting: Sand casting, pattern, gating system, molding sand. Cores. Special casting processes: shell moulding, investment casting, pressure die-casting, and centrifugal casting. Defects in casting process, remedies.
Metal Forming: Bulk forming (forging, rolling, extrusion, drawing) and sheet metal forming Sheet metal forming (shearing, deep drawing, bending). Powder Metallurgy, latest material shaping techniques, Industrial applications of all processes, and their visualization using Virtual Lab. **(10 Hrs.)**

Unit 2: Machining Processes: Introduction: elements of machining process, machinability. Cutting tool: single and multi-point cutting, cutting tool materials, geometry of single cutting point-cutting tool, tool wear and tool life. Chip formation, cutting fluids and types. Introduction to various machines tools and CNC machining through Virtual Lab. **(8 Hrs.)**

Unit 3: Welding and Allied Processes: Introduction, Types of Welding Processes: oxy acetylene gas welding, electric arc welding: gas tungsten arc welding, gas metal arc welding, submerged arc welding. Electric resistance welding. Solid state welding processes. Special welding processes: electron beam welding, laser beam welding, plasma arc welding, atomic hydrogen welding, thermit welding, brazing, soldering, industrial applications and their visualization using Virtual Lab**.** **(10 Hrs.)**

Unit 4: Advanced Machining Processes: Advanced Machining Processes: Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining. Electrical Discharge Machining, Wire EDM, Electro-chemical machining, Chemical Machining, etchant &maskant, process parameters, MRR and surface finish. Laser Beam Machining, Plasma Arc Machining, Electron Beam Machining and industrial applications. **(6 Hrs.)**

Unit 5: Additive Manufacturing and Tooling: Introduction, Need of Additive Manufacturing,

key steps in the additive manufacturing process, types of additive manufacturing: stereo lithography, selective laser sintering, fused deposition modeling, electron beam melting, laminated object manufacturing, 3D printing, direct metal laser sintering and visualization using Virtual Lab. Rapid tooling. holding tools: jigs and fixtures, types of jigs and fixtures, principles, and their industrial applications. **(6 Hrs.)**

Text Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Manufacturing Technology, Foundry, Forming & Welding	PN Rao	Tata McGraw – Hill	8th (2022)
2	A course in Workshop technology Vol-II	B.S Raghuwanshi	Dhanpat Rai & Co.	10th (2013)
3	Modern Machining processes	H.S Shan P.C Pandey	Tata McGraw – Hill	5th (2017)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Manufacturing Engineering and Technology	PN Rao	Tata McGraw-Hill	5th (2022)
2	Principles of manufacturing materials and processes	J S Campbell	Tata McGraw-Hill	2nd (2021)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1HSU-401	Universal Human Values	HSS	3	3	0	0	40	60	100

Course Outcomes

At the end of the course, the student will be able to:	
CO1	Explain the need and process of value education in understanding basic human aspirations for happiness and harmony.
CO2	Apply the understanding of harmony between the self ('I') and body to promote health and prosperity.
CO3	Make use of human values such as trust, respect and justice to build harmony in family and society.
CO4	Differentiate the interconnectedness and mutual harmony among different orders of nature to understand co-existence in the whole existence.
CO5	Justify the role of human values and holistic understanding in promoting professional ethics and socially responsible practices.

Detailed Syllabus

Unit 1: Course Introduction – Need, Basic Guidelines, Content and Process for Value Education: Self-Exploration–what is it? 'Natural Acceptance' and Experiential Validation- as the process for self-exploration; Happiness and Prosperity- A look at basic Human Aspirations; Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority; Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario; Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co- existence) rather than as arbitrariness in choice based on liking-disliking. **(6Hrs.)**

Unit 2: Understanding Harmony in the Human Being - Harmony in Myself!: Understanding human being as a co-existence of the sentient 'I' and the material 'Body'; Understanding the needs of Self ('I') and 'Body' - happiness and physical facility; Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer); Understanding the characteristics and activities of 'I' and harmony in 'I' ; Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail; Programs to ensure Sanyam and Health. Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease. **(5Hrs.)**

Unit 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship**:** Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship; Understanding the meaning of Trust; Difference between intention and competence; Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship; Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals; Visualizing a universal harmonious order

in society- Undivided Society, Universal Order- from family to world family. Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives. **(5Hrs.)**

Unit 4: Understanding Harmony in the Nature and Existence -Whole existence as Coexistence: Understanding the harmony in the Nature; Interconnectedness and mutual fulfilment among the four orders of nature - recyclability and self-regulation in nature; Understanding Existence as Co-existence of mutually interacting units in all- pervasive space; Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc. **(4Hrs.)**

Unit 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics: Natural acceptance of human values; Definitiveness of Ethical Human Conduct; Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order ; Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco -friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems; Case studies of typical holistic technologies, management models and production systems. the level; Strategy for transition from the present state to Universal Human Order: a. At of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations; Sum up. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions e.g. to discuss the conduct as an engineer or scientist etc. **(7Hrs.)**

Text Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1.	A foundation course in Human Values and Professional Ethics	R. R. Gaur, R. Asthana, G. P. Bagaria	UHV Publications	3rd Revised Edition (2023)
2.	Human Values	A.N. Tripathi	New Age Intl. Publishers, New Delhi	3rd Edition (2023)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1.	Professional Ethics and Human Values (JNTU-Kakinada, Anantpur)	B.S. Raghavan	Scitech Publications	2nd Edition(2021)
2.	Indian Ethos and Modern Management	B L Bajpai	New Royal Book Co., Lucknow	3rd Edition(2004)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1MEU-411	Applied Thermodynamics Lab	PCC	1	0	0	2	30	20	50

Pre-requisite: Knowledge of basic thermodynamics

Course Outcomes

At the end of the course, the student will be able to:	
CO1	Explain the construction, components, and operating principles of 2-stroke and 4-stroke petrol and diesel engines using cut-sectional working models.
CO2	Analyse valve-timing diagrams and evaluate their influence on the performance characteristics of internal combustion engines.
CO3	Perform performance tests on petrol and diesel engines to determine brake power, indicated power, friction power, mechanical efficiency, specific fuel consumption, and exhaust emissions.
CO4	Compute the dryness fraction and assess the thermal efficiency of the Rankine cycle using experimental observations.
CO5	Demonstrate the construction and working of boilers, steam condensers, and cooling towers through laboratory models and practical installations.

Detailed Syllabus

List of Practicals

1.	To examine the construction and operation of 2-stroke and 4-stroke petrol engines using cut-sectional working models.
2.	To examine the construction and operation of 2-stroke and 4-stroke diesel engines using cut-sectional working engine.
3.	To plot actual valve timing diagram of a 4-stroke diesel engine and study its impact on its performance.
4.	Determine the brake horse power, indicated horse power, friction power and mechanical efficiency of a multi cylinder petrol engine running at constant speed (Morse Test).
5.	Performance testing of a single cylinder Petrol engine from no load to full load (at constant speed) in terms of brake horse power, indicated horse power, mechanical efficiency and specific fuel consumption and to measure the exhaust emission. Draw/obtain power consumption and exhaust emission curves. Also, make the heat balance sheet.
6.	Performance testing of a single cylinder Diesel engine from no load to full load (at constant speed) in terms of brake horse power, indicated horse power, mechanical efficiency and specific fuel consumption and to measure the exhaust emission. Draw/obtain power consumption and exhaust emission curves. Also, make the heat balance sheet.
7.	To study the construction, mountings and accessories of various types of boilers through models and actual water tube boiler installed in the laboratory.
8.	To determine the dryness fraction of steam and estimation of Rankine efficiency.
9.	Examine the construction and operation of various types of steam condensers using models.
10.	Examine the construction and operation of various types of cooling towers using models.

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1MEU - 412	Fluid Mechanics Lab	PCC	1	0	0	2	30	20	50

Pre-requisite: Basic knowledge of bulk matter

Course Outcomes

At the end of the course, the student will be able to:	
CO1	Evaluate metacentric height and verify Bernoulli's equation experimentally.
CO2	Determine discharge coefficients of flow for an obstruction flow meter and notches.
CO3	Analyze flow regime transition and hydraulic coefficients of orifice flow.
CO4	Calculate the friction factor and head losses in pipe flow.
CO5	Examine velocity distribution for pipeline flow and evaluate free and forced vortex flow characteristics.

Detailed Syllabus

List of Practicals

1.	To determine the metacentric height of a floating vessel under loaded and unloaded conditions.
2.	To study the flow through a variable area duct and verify Bernoulli's energy equation.
3.	To determine the coefficient of discharge for an obstruction flow meter (venturi meter/ orifice meter.
4.	To determine the discharge coefficient for a V- notch or rectangular notch.
5.	To study the transition from laminar to turbulent flow and to ascertain the lower critical Reynolds number.
6.	To determine the hydraulic coefficients for flow through an orifice.
7.	To determine the friction coefficients for pipes of different diameters.
8.	To determine the head loss in a pipe line due to sudden expansion/ sudden contraction/ bend.
9.	To determine the velocity distribution for pipeline flow with a pitot static probe.
10.	Experimental evaluation of free and forced vortex flow

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1MEU - 413	Material Engineering Lab	PCC	1	0	0	2	30	20	50

Pre-requisite: Basic knowledge of materials and their properties

Course Outcomes

At the end of the course, the student will be able to:	
CO1	Explain atomic and crystal structures of metals.
CO2	Analyze the effect of heat treatment processes on steel hardness.
CO3	Develop metallographic specimens using standard techniques.
CO4	Examine microstructures and identify phases in ferrous and non-ferrous metals.
CO5	Evaluate hardenability of steel using the Jominy end quench test.

Detailed Syllabus

List of Practicals

1.	Preparation of models/charts related to atomic/crystal structure of metals.
2.	Annealing the steel specimen and study the effect of annealing time and temperature on hardness of steel.
3.	Hardening the steel specimen and study the effect of quenching medium on hardness of steel.
4.	Practice of specimen preparation (cutting, mounting, polishing, and etching) of mild steel, aluminum and hardened steel specimens.
5.	Study of the microstructure of prepared specimens of Mild Steel, Aluminium and hardened steel.
6.	Identification of ferrite and pearlite constituents in given specimen of mild steel.
7.	Determination of hardenability of steel by Jominy End Quench Test.

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1MEU - 414	Modern Manufacturing Processes Lab	PCC	1	0	0	2	30	20	50

Pre-requisite: Basic knowledge of manufacturing processes

Course Outcomes

At the end of the course, the student will be able to:	
CO1	Examine the properties and strength characteristics of moulding sand through testing.
CO2	Demonstrate the use of machine tools like lathe, shaper, and milling machines.
CO3	Analyze cutting forces in turning, drilling, and milling operations.
CO4	Develop welded joints using oxy-acetylene and arc welding processes.
CO5	Utilize MIG, TIG, and spot welding equipment to prepare weld joints.

Detailed Syllabus

List of Practicals

1.	To determine clay content, moisture content, hardness and shatter index of a moulding sand sample.
2.	To test tensile, compressive, transverse strength of moulding sand in green condition.
3.	To determine permeability and grain fineness number of a moulding sand sample.
4.	To grind single point and multipoint cutting tools.
5.	To prepare job on Lathe involving specified tolerances, cutting of V- threads and square threads.
6.	To prepare job on shaper involving plane surface.
7.	Use of milling machines for generation of plane surfaces, spur gears and helical gears, use of end mill cutters.
8.	To determine cutting forces with dynamometer for turning, drilling and milling operations.
9.	To make lap joint, butt joint and T- joints with oxy- acetylene gas welding and manual arc welding processes
10.	To study MIG, TIG and Spot-welding equipment and make weld joints by these processes.
11.	Prepare and set up a 3D printer to fabricate a specified component.
12.	To prepare a job on CNC lathe machine

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1SEU-401	Career Planning Placement-2	HSS	1	0	0	2	50	0	50

Pre-requisite: Basic English communication, grammar, vocabulary, and teamwork skills needed for professional communication and placement preparation.

Course Outcomes

At the end of the course, the student will be able to:	
CO1	Demonstrate improved group communication and workplace interaction skills.
CO2	Apply verbal ability concepts in grammar, vocabulary, and reading tasks relevant to employability.
CO3	Participate effectively in group discussions, case-based conversations, and structured speaking tasks.
CO4	Develop foundational professional documents and workplace communication habits.
CO5	Analyze communication situations and respond with clarity, logic, and confidence.

Detailed Syllabus

Unit 1: Professional Communication in Group Contexts: Transition from academic to professional communication, speaking with purpose, body language in professional settings, listening in teams, collaboration skills, discussion etiquette, communication in formal vs informal contexts. **Activity:** Icebreaker with role-based speaking, body language observation task. **(6 Hrs.)**

Unit 2: Verbal Ability for Employability: Advanced sentence correction, error detection, commonly confused words, sentence completion, para jumbles basics, contextual vocabulary, reading comprehension with inference and tone-based questions. **Activity:** Timed verbal drills, RC strategy practice, sentence completion tasks. **(6 Hrs.)**

Unit 3: Group Discussion & Analytical Communication: Introduction to group discussion, types of GDs, initiating and concluding a GD, agreeing and disagreeing politely, idea structuring, speaking with relevance, handling interruptions, current-affairs-based discussion approach. **Activity:** Mock GDs, topic analysis sheet, role rotation in GD. **(6 Hrs.)**

Unit 4: Case Study & Problem-Solving Communication: Introduction to case study approach, identifying problem statement, brainstorming techniques, solution framing, presenting practical recommendations, collaborative problem solving, structured speaking under pressure. **Activity:** Short case analysis, group solution presentation, business scenario discussion. **(6 Hrs.)**

Unit 5: Resume Basics, Digital Communication & Professional Presence: Introduction to resume writing, components of an effective resume, academic achievements and projects presentation, introduction to LinkedIn awareness, email etiquette basics, digital professionalism, and online communication manners. **Activity:** Drafting first resume, email writing practice, profile headline exercise. **(6 Hrs.)**

Text Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Verbal Ability book	TPP Dept.	TPP	6th Edition
2	Interviews and Group Discussions	T. S. Jain & Gupta	Upkar Publications	2nd (2008)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Word Power Made Easy	Norman Lewis	Goyal Publishers	4th (2012)
2	Communication Skills for Engineers	Sunita Mishra & C.Muralikrishna	Pearson Education	1st (2011)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1ECU-414	Future Skills Lab-II	Skill Enhancement	1	0	0	2	30	20	50

Course Outcomes

At the end of the course; the student will be able to	
CO1	Implement digital fabrication tools such as laser cutting machines; CNC routers; and vinyl cutting plotters to manufacture two-dimensional and three-dimensional profiles.
CO2	Design and Integrate mechanical; electronic; and digital fabrication skills to develop a functional prototype or mini-project.
CO3	Apply PLC timer instructions to develop and test a blinking LED circuit and design SCADA screens for controlling simple industrial processes.
CO4	Implement SCADA-based monitoring and control systems using MC Works64 and demonstrate basic robotic operations
CO5	Analyze the performance and safety of collaborative robot operations and PID-controlled systems by evaluating process responses

Part- A List of Activities for Future Skills Lab

S. No.	Activity Title
1	Perform 3D scanning of a physical object; modify the digital model; and prepare it for additive manufacturing.
2	Design a three-dimensional CAD model of a simple component and fabricate it using additive manufacturing techniques.
3	Analyze time-domain and frequency-domain characteristics of signals using a mixed signal oscilloscope.
4	Inspect PCB tracks; solder joints; and electronic components using a digital microscope.
5	Carry out mechanical assembly of a quadcopter platform using a standard assembly kit.
6	Design and fabricate a functional prototype using equipment available in the laboratory.
7	Evaluate the performance of a blinking LED circuit by testing timer instructions in a PLC program to ensure accurate timing and reliable operation.
8	Design a SCADA screen to monitor and display the ON/OFF status of a lamp by organizing appropriate indicators and control elements.
9	Implement a SCADA-based monitoring and control system for industrial processes using MC Works64.
10	Demonstrate basic robotic operations using a robot learning setup by simulating pick-and-place applications.
11	Identify and recognize the basic operations and safety features of a collaborative robot (cobot) for safe human–machine interaction.

12	Apply a PID controller by setting proportional, integral, and derivative parameters to regulate and control a process variable in a basic control system.

Part-B: Lab Projects

Every individual student is required design and build one Lab Project under the supervision of course teacher. Topic of the project may be any from the theory contents and not limited to following list:

1. USB Powered LED Night Lamp
2. Continuity Tester Device
3. Mobile Phone Charger Indicator Board
4. Mini Audio Amplifier Board
5. DC Motor Speed Indicator
6.PLC based auto door control system

Course Code	Course Title	Category	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
HSMC-101	Design Thinking	HSS	3	2	1	0	50	100	150

Course Outcomes:

At the end of the course the student will be able to	
CO1	Articulate the fundamentals of the Design Thinking Framework for problem solving.
CO2	Understand the needs and challenges of different stakeholders in the given problem domain.
CO3	Apply design thinking framework and strategies to develop innovative solutions for complex business problems.
CO4	Evaluate the financial viability of the proposed solution (product/service).
CO5	Work in a team to develop, validate and test the solution.

Detailed Syllabus

Unit 1: Design Thinking: Introduction of Design Thinking; Framework: 5 Phase Design i.e. Empathize, Define, Ideate, Prototype, and Test; Case Study, Design Thinking in the organization. **(6 Hrs.)**

Unit 2: Empathize Phase: Discover design problems; Overview of the empathize phase; Define project stakeholders; Methods within empathize phase. Define Phase: Frame the design problems, Overview of the define phase, Methods within Define phase. **(8 Hrs.)**

Unit 3: Ideate Phase: Come up with multiple solutions, Overview of the Ideate phase, Methods within the Ideate phase. **(5 Hrs.)**

Unit 4: Project Proposal: Project Identification - Developing Business Idea, Preparing Feasibility Report; Project Formulation - Feasibility Analysis Techno - Economic Analysis, Financial Analysis, Profitability Analysis; Significance of a business plan, components of a business plan. **(8 Hrs.)**

Unit 5: Prototype phase: Design the solutions, Overview of the Prototype phase, Methods within Prototype phase. Test phase: Validate the solutions, overview of the Test phase, methods within test phase. **(8 Hrs.)**

Text Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Designing for growth: A design thinking tool kit for managers	Jeanne Liedtka and Tim Ogilvie	Columbia University Press	1st (2011)
2	The design thinking playbook: Mindful digital transformation of teams, products, services, businesses and ecosystems	Michael Lewrick, Patrick Link, Larry Leifer	Wiley	1st (2018)