LORDS INSTITUTE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution)
DEPARTMENT OF MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS & EXAMINATIONS [LR-24]
(w.e.f. Academic Year 2024-25)
B.E. III-Semester

S. No.	Course Code	Category	Course Title	Scheme of Instruction				Scheme of Examination			Credits
				L	T	P/D	Contact Hours/ Week	Maximum Marks		Duration in Hours	
								CIE	SEE		
Theory Course											
1	U24MA302	BSC	Mathematics-III (PDE & PS)	3	1	-	4	40	60	3	4
2	U24EE305	ESC	Fundamentals of Electrical Engineering	3	-	-	3	40	60	3	3
3	U24ME301	PCC	Metallurgy and Material Science	3	-	-	3	40	60	3	3
4	U24ME302	PCC	Mechanics of Solids	3	-	-	3	40	60	3	3
5	U24ME303	PCC	Thermodynamics	3	-	-	3	40	60	3	3
Practical / Laboratory Course											
6	U24ME3L1	PCC	Metallurgy and Material Testing Lab	-	-	4	4	25	50	3	2
7	U24ME3L2	PCC	Machine Drawing and Modelling Lab	-	-	3	3	25	50	3	1.5
8	U24EE3L4	ESC	Fundamentals of Electrical Engineering Lab	-	-	3	3	25	50	3	1.5
9	U24DT3L1	HSMC	Design Thinking Lab	-	-	2	2	25	50	3	1
Total				**15**	**1**	**12**	**28**	**300**	**500**	**27**	**22**
For Lateral Entry Students Only											
Bridge Course											
10	U24CS3L2	ESC	C Programming Lab	-	-	2	2	50	-	-	-
11	U24EN3L2	HMSC	Effective Communication Skills Lab	-	-	2	2	50	-	-	-
Mandatory Course											
12	U24EN102	MC	Indian Constitution	2	-	-	2	40	60	3	-
Total				**17**	**1**	**16**	**34**	**440**	**560**	**30**	**22**

L: Lecture (Hrs/Wk/Sem) **T**: Tutorial (Hrs/Wk/Sem) **P**: Practical **D**: Drawing (Hrs/Wk/Sem)

CIE: Continuous Internal Evaluation
BSC: Basic Science Course
MA: Mathematics
PCC: Professional Core Courses
CS: Computer Science
HSMC: Humanities & Social Sciences Including Management Courses
SEE: Semester End Examination
ESC: Engineering Science Course
EN: English
ME: Mechanical Engineering

Note:

1. Each contact hour is a Clock Hour.
2. The duration of the practical class is three hours, however it can be extended wherever necessary, to enable the student to complete the experiment.

Course Code	Course Title						Core / Elective
U24MA302	**MAHEMATICS – III (PDE & PS) (Branch - CIVIL,MECH)**						**Core**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
--	3	1	-	-	40	60	4

Course Objectives :

The objective of the course is to:

- Introduce PDE and solution of first order PDE.
- Introduce the solution methodologies for second order Partial Differential Equations with applications in engineering
- Provide an overview of probability and statistics to engineers
- Obtain the concepts of curve fitting, correlation and test of significance.
- Acquire the knowledge of Test of Hypothesis pertaining to mean and variance, chi-square for goodness of fit.

Course Outcomes :

After completing the course, the student will be able to:

1. Solve field problems in engineering involving first order PDEs.
2. Solve field problems in engineering involving higher order PDEs.
3. Apply the concepts of probability, distributions and it moments, kurtosis and skewness
4. Determine the coefficient of correlation, regression and obtain the knowledge of sampling theory with context to test of hypothesis.
5. Analyze and check the validity of statement using testing of hypothesis for various parameters and goodness of fit.

UNIT-I

Formation of Partial Differential Equations, First order partial differential equations, solutions of first order linear Partial Differentiation Equations, Lagrange's equation, Non-linear First Order equations, Charpit's method.

UNIT-II

Second-order linear equations and their classification, Method of separation of variables, vibration of stretched string wave equation, one dimensional heat equation, two dimensional heat equation, solution of Laplace's equation.

UNIT-III

Probability distributions: Poisson, Uniform and Normal distributions, Mean, variance, Moment generating function and evaluation of statistical parameters for these distributions, Moments, Skewness and Kurtosis.

UNIT-IV

Curve fitting by the method of least squares: Fitting of straight lines, second degree Parabolas and more general curves, Correlation, regression and Rank correlation. Test of Significance: Large sample test for single proportion, difference of proportions, single mean, Difference of means and difference of standard deviations.

UNIT-V

Test for single mean, difference of means and correlation coefficients, test for ratio of Variances, Chi-square test for goodness of fit and independence of attributes.

Suggested Reading:

1. R.K.Jain & Iyengar, "Advanced Engineering Mathematics", Narosa Publications.
2. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2000.
3. P.Sivaramakrishna Das & C.Vijaya Kumar, "Engineering Mathematics" , Pearson India Education Services Pvt. Ltd.
4. N.P. Bali & M. Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications,2010.
5. S.C.Gupta & V.K.Kapoor, "Fundamentals of Mathematical Statistics" , S.Chand Pub.
6. P. G. Hoel, S. C. Port & C. J. Stone, "Introduction to Probability Theory", Universal Book Stall, 2003.
7. W. Feller, "An Introduction to Probability Theory and its Applications", Vol. 1, Wiley, 1968.

Course code	Course title						Core/Elective
U24EE308	**Fundamentals of Electrical Engineering**						**Core**
Pre-requisites	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
--	3	-	-	-	40	60	3

Course Objectives:

1. To understand the behavior of different circuit elements R, L & C, and the basic concepts of electrical circuit analysis.
2. To know the concepts of AC circuits, RMS value, Average value, Phasor analysis etc.
3. To understand the basic principle of operation of Transformer and DC machines.
4. To understand the basic principle of operation of AC machines.
5. To know about different types of electrical wires and cables, Batteries, domestic and industrial wiring.

Course Outcomes:

On completion of this course, students are able to

1. Analyze DC electrical circuits and measure the parameters of electrical energy.
2. Analyze AC electrical circuits and measure the parameters of electrical energy.
3. Comprehend the working principles of Electrical DC Machines and Transformers.
4. Comprehend the working principles of Electrical AC machines.
5. Identify various electrical switchgear components and installations.

UNIT-I

DC Circuits: Basics definitions, Classification of energy sources, Passive elements, KVL, KCL, Network reduction techniques. Superposition Theorem, Thevinen's and Norton's Theorems, Maximum Power Transfer Theorem.

UNIT-II

AC Circuits: Representation of sinusoidal waveforms, Peak and RMS values, Phasor representation. Analysis of 1Φ AC circuits with R, L, C and series combinations. 3Φ circuits, Voltage and current relations in star and delta connections.

UNIT-III

DC Machines: Basic Laws of Electromagnetic Induction, Construction and working principle of DC generator, EMF equation, Types and its applications, OCC characteristics. Working principle of DC motor, Back EMF, Types and its applications.

Transformers: Working Principle, Construction, EMF equation, Ideal and practical transformer, OC and SC tests, Losses and efficiency.

UNIT-IV

AC Machines

Asynchronous Machines: Working principle of a three-phase induction motor, Concept of slip, Construction, Types and its Applications. 1Φ induction motors: Working Principle, Construction, Types and its Applications. Synchronous Generators: Construction, Working Principle, Types, Applications, OC and SC Characteristics.

UNIT-V

Electrical Installations: Components of LT Switchgear: Switch Fuse Unit, MCB, ELCB, MCCB, Types of Wires and Cables, Earthing, Power factor improvement using capacitors, Types of Batteries, Characteristics for Batteries and Battery backup. Elementary calculations for energy consumption.

Textbooks:

1. J.B.Gupta, “Fundamentals of Electrical Engineering and Electronics” S.K.Kataria & Sons Publications, 2002.
2. J.B.Gupta, “Utilization of Electric Power and Electric Traction” S.K.Kataria& Sons Publications, 2010
3. Abhijit Chakrabarti, SudiptaNath, Chandan Kumar Chanda, “ Basic Elactrical Engineering”Tata McGraw Hill, Publications, 2009.
4. Hughes, "Electrical Technology", VII Edition, International Student -on, Addison WelseyLongman Inc., 1995.
5. D.P. Kothari and I.J. Nagrath, “Electrical Machines”, 3rd Edition, Tata McGraw Hill, Publications.

Course Code	Course Title						Core/Elective
U24ME301	Metallurgy and Material science						Core
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
--	3	-	-	-	40	60	3

Course Objectives

The objective of the course is to:

- Enable to understand structure property relations, analyse the failures of metals and their prevention.
- Broad understanding of phase diagrams.
- Acquire basic knowledge in various heat treatment operations, their purpose and applications.
- Expose to various methods of extractive metallurgy techniques.
- Understand various mo
- des of failure and suggest mechanisms for preventions of failures.
- Understand applications of conventional metals and alloys.

Course Outcomes

After completing this course, the student will be able to

1. Apply the fundamentals of materials engineering to classify materials, analyze bonding in solids, interpret crystal structures, and evaluate mechanical properties like elasticity and toughness.
2. Apply concepts of crystal structures, dislocations, and mechanical properties to explain material behaviour during processes like cold working and strain hardening.
3. Analyze the impact of fatigue, fracture, and creep on materials, examining factors like crack propagation and deformation mechanisms.
4. Evaluate the properties and applications of various alloys and the effects of alloying elements on material performance.
5. Evaluate heat treatment processes and select appropriate hardening techniques based on T.T.T. diagrams and material requirements.

UNIT-I

Introduction: Introduction to Materials engineering, scope of metallurgy, classification of materials- metals and alloys, ceramics, polymers and composites, Bonds in solids, Space lattice, unit cell, crystal structure, crystal directions and planes, crystal imperfections- point defects, line defects, surface defects, volume defects. Types of dislocations, Hall-Petch equation, Orange peel effect, cold and hot working, strain hardening and Bauchinger effect Recovery, Recrystallisation,. Mechanical properties of materials- Tensile properties, stress-strain diagrams ,elasticity, plasticity, ductility, toughness, modulus of elasticity, resolved shear stress, tensile and compression test, hardness and its measurement, Bonds in solids.

UNIT-II

Fracture: Ductile and Brittle fracture, Fatigue: S-N curve, Structure of fatigue fracture specimen, Fatigue crack propagation, modes of fracture, ductile to brittle transition, crack initiation and propagation , Effect of metallurgical variables on fatigue of metal, Experimental determination of fatigue strength (RR-Moore Test).Creep: Creep strength, Creep curve, Creep deformation mechanisms, Creep Test, Differences between creep curve and stress rupture curve.

UNIT-III

Structure of Alloys: Types of solid solution, Substitution solids, Hume Rothary's rules for solid solution, TTT diagram, Construction and interpretation of Binary equilibrium diagram, Isomorphous, Eutectic and Peritectic diagrams, Intermediate phases and phase rule, Iron-Iron Carbide equilibrium diagram, Intermediate phases and phase rule, Iron-

Iron Carbide equilibrium diagram construction and interpretation, Types of Plain Carbon Steels,. Cast Iron and their properties and Characteristics.

UNIT-IV

Alloy Steels: Effects of alloying elements like Nickel, Chromium, Manganese, Silicon and Tungsten, Titanium., Study about Stainless steels, HSS, Maraging steels, Brass, Bronze, Muntz Metal, Invar, Duralumin and Ti Alloy (Ti-6Al-4V) – their composition and Properties. Introduction to Electrometallurgy

UNIT-V

Heat Treatment: Annealing, Normalizing, Hardening, Tempering, Construction and interpretation of T.T.T Curve, Austempering and Martempering. Case Hardening: Carburising, Nitriding, Carbo-nitriding, Flame Hardening,Induction Hardening. Brief introduction of Age Hardening,Non-ferrous metals and alloys: Properties and applications of –Cu and its alloys, Al and its alloys, Age hardening, Ti and its alloys, Ni- based alloys, Ceramics, Polymers and Composites: Ceramics, crystalline ceramics, glasses, properties and applications of ceramics, polymers-polymerization, thermoplastics and thermosetting plastics, properties and applications of polymers, Composites: concept of composites, matrix and reinforcement, rule of mixtures

Suggested Readings:

1. V.Raghavan, Material Science and Engineering, Prentice Hall of India Ltd., 4th Edition, 1994
2. S.H. Avner, Introduction to Physical Metallurgy, Tata McGraw Hill, 2nd Edn.1997.
3. S.P. Nayak, Engineering Metallurgy and Material Science, Charotar Publishing House, 6th Edition, 1995.
4. E. Dieter, Mechanical Metallurgy, Metric Editions, Tata McGraw Hill, 3rd Edn,1997.
5. Robert M Jones, Mechanics of Composite Materials, Taylor and Francis

Course-Code	Course Title					Core/ Elective
U24ME302	Mechanics of Solids					Core
Prerequisites	Contact Hour per Week			CIE	SEE	Credit
	L	T	P			
	3	-	-	40	60	3

Course Objectives:

The objective of the course is to:

- Understand the basic concept of stress and strains for different materials.
- Apply Mechanism of the development of shear force and bending moment in beams
- Know the theory of simple bending, direct & bending stress and distribution of shear stress.
- Calculate normal and shear stresses, and also the behavior of thin cylinders under pressure.
- Analyse and understand shear stress, torsional stress, Columns and Struts and their applications.

Course Outcomes:

After completing this course, the student will be able to

1. Explain the basic concepts of stresses and strain their relations for different sections and identify the behavior of the solid bodies, composite bars, and thermal stresses and strain energy, subjected to various types of loading.
2. Apply the concepts of S.F and B.M for drawings of S.F and B.M diagrams for different beams with different loads and locate the maximum B.M and point of contra flexure, and deflection of beams.
3. Analyze Bending stresses and shear stress distribution in different sections of beams.
4. Determine Longitudinal and circumferential stresses of thin cylinder and spheres.
5. Analyze the torsional stresses developed in the shafts and also the behavior of the Columns and Struts under different loading.

UNIT – I

Simple Stresses & Strains: Elasticity and plasticity – Types of stresses & strains–Hooke's law– stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic moduli & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT – II

Shear Force and Bending Moment: Definition of beam – Types of beams – Concept of shear force and bending moment- Construction of S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads and combination of these loads, Point of contra flexure and Relation between S.F & B.M.

UNIT- III

Bending stresses in Beams: Assumptions made in pure bending, Derivation of bending moment equation, Moment of resistance, Determination of bending stresses. Section modulus of rectangular and circular sections (Solid and Hollow), I, T,

Distribution of shear stress: Equation of shear stress, Distribution across rectangular section, circular, triangular cross sections.

UNIT – IV

Compound Stresses: Stresses on oblique planes, Principal stresses and Principal planes. Mohr's circle and ellipse of stresses & strains

Thin Cylinders: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in dia, and volume of thin cylinders– Thin spherical shells.

UNIT - V

Torsion of Circular Shafts: Theory of pure torsion, Assumptions made, Derivation of basic torsion equation, Torsional moment of resistance, Polar section modulus, Power transmitted by shafts, combined bending and torsion.
Columns and Struts: Introduction to columns and struts, Buckling and Stability, types of supports, critical load, Euler's formulae and Rankine formulae, Equivalent length of the column, eccentric axial loads

Suggested Reading:

1. RK Bansal, - Strength of Materials", Laxmi Publications, Delhi,2018
2. S. Ramamrutham, ―Strength of Materials", Dhanpat Rai & Sons, 1993.B.C
3. EgorP.Popov, ―Engineering Mechanics of Solids", Prentice Hall of India, NewDelhi,. Punmia, Strength of Materials and Theory of Structures, Laxmi Publishers, Delhi, 2000.
4. R.K. Rajput, ―Strength of Materials", S. Chand & Co., 2003.
5. Ferdinand P. Beer et.al., ―Mechanics of Materials", Tata McGraw-Hill Publishing Co. Ltd., New Delhi,2005

Course-Code	Course Title					Core/ Elective
U24ME303	**Thermodynamics**					Core Course
Prerequisites	Contact Hour per Week			CIE	SEE	Credit
	L	T	P			
	3	**-**	**-**	**40**	**60**	**3**

Course Objectives :

The objective of the course is to:

- Basic definitions of thermodynamics and significance of Zeroth law of thermodynamics.
- The importance and application of first law of thermodynamics.
- The various laws associated with second law of thermodynamics.
- Properties of pure substances and use of Mollier diagram.
- Various air standard cycles, their importance and their comparison.
- Calculation procedures of the air-fuel ratio.

Course Outcomes:

After completing this course, the student will be able to:

1. Explain fundamental thermodynamics concepts, including system types, properties, processes, energy interactions, and temperature measurement principles.
2. Apply the First Law of Thermodynamics to analyze energy interactions, calculate work and heat transfer in closed and open systems.
3. Illustrate the Second Law of Thermodynamics, analyze entropy changes, and evaluate energy availability in various thermodynamic processes.
4. Analyze thermodynamic properties of fluids, interpret phase changes, and utilize steam tables and diagrams for solving thermodynamic problems.
5. Analyze and compare the performance of various power cycles.

UNIT-I

Introduction: Definition and Concept of Thermodynamics, Microscopic and Macroscopic approach of thermodynamics, System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems,, intensive and extensive properties, Thermodynamic Equilibrium, State, Property, Process, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition, Types, Displacement & Other forms of Work, Heat, Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry – Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale

UNIT-II

First law of Thermodynamics: Statement of First Law, Heat and work interactions, Thermodynamics work and Internal energy, Energy as property of system, First Law applicable to Closed system, Thermodynamic processes and calculation of work, Heat transfer, and internal energy, Heat as Path Function, first law analysis of flow processes and limitation, Calculation of work done during flow processes.

UNIT-III

Second Law of Thermodynamics: Physical description of second law, Kelvin– Planck and Clausius statement of Second Law of thermodynamics, Equivalence of Kelvin– Planck and Clausius statement, Reversible and irreversible processes, Carnot Theorem, Clausius Inequality, Calculation of entropy change during various thermodynamic processes, principle of Entropy increase, T– S diagram, Available and Unavailable energies in steady flow, Second Law Analysis of Control Volume, Helmholtz and Gibb's functions, Available function for flow and non– flow processes and applications.

UNIT-IV

Thermodynamic properties of Fluids: Properties of pure substances, Concept of phase change, Graphical representation of pressure, Volume and Temperature, (PVT)– T and H diagrams, Properties of steam, Use of steam Tables and Mollier diagram, Thermodynamic relations involving entropy, Enthalpy, Internal Energy, Maxwell relations and Clapeyron equation.

UNIT-V

Power Cycles: Carnot cycle, Otto, Diesel, Dual Combustion cycles, Joule/ Brayton cycle, Sterling Cycle, Atkinson Cycle, Ericsson Cycle, Lenoir Cycle – Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles.

Suggested Readings:

1. P.K. Nag, Basic & Applied Thermodynamics, Tata McGraw Hill, 2nd Edn., 2008.
2. Yunus A Cengel & Michael A Boles, Thermodynamics- An Engineering Approach, Tata McGraw Hill, 7th Edition in SI Units (Special Indian Edition),2011
3. Y.V.C.Rao, An Introduction to Thermodynamics, Universities Press, 2nd Edn., 2010.
4. P.L Ballaney, Thermal Engineering, Khanna Publishers 2004.
5. E. Rathakrishnan, Fundamentals of Engineering Thermodynamics, PHI Learning Pvt. Ltd, 2005.

Course Code	Course Title					Core/Elective
U24ME3L1	Metallurgy and Material Testing Lab					Core
Prerequisite	Contact Hours Per Week			CIE	SEE	Credits
--	L	T	P/D			
	-	-	4	25	50	2

Course Objectives :

The objective of the course is to:

- Acquire basic knowledge by understanding iron-carbide diagram and its application in engineering.
- Expose to Metallographic study and analysis of various metals.
- Acquire knowledge in determining the hardness of metals before and after various Heat treatment operations.
- Understand differences between different heat treatment methods.
- Expose to T-T-T curve and its application in engineering metallurgy.
- Understand the relation between micro structure and properties.

Course Outcomes:

After completing this course, the student will be able to:

1. Recall the working principles of metallurgical microscopes and common material testing equipment
2. Explain the microstructures of various ferrous and non-ferrous metals and alloys based on metallographic analysis.
3. Perform mechanical tests such as tensile, compression, and hardness tests to determine material properties.
4. Analyze the effects of heat treatment and alloy composition on the microstructure and mechanical behaviour of metals.
5. Develop a comprehensive report that integrates metallographic and mechanical test data to evaluate material suitability for engineering applications.

List of Experiments:

A: Metallurgy Experiments:

1. Study of: Metallurgical Microscope, Iron-Iron Carbide diagram, Procedure for specimen preparation.
2. Metallographic Study of Pure Iron& Low carbon steel.
3. Metallographic Study of Medium carbon steel, Eutectoid steel & Hyper Eutectoid steel.
4. Metallographic Study of, White cast-iron, Malleable cast iron, Nodular cast iron & grey cast-iron
5. Metallographic Study of Aluminum, Brass & Bronze
6. Jominy Quench test or Study of microstructure after heat treatment

B: Materials testing Lab

1. Uni-axial tension test, to draw stress- strain diagram, and estimate modulus of elasticity, % of elongation and toughness.
2. Compression test on bricks and Impact test.
3. Hardness test: Brinell & Rockwell.
4. Shear force & bending moment tests.
5. Bending test on cantilever, simply supported and fixed beam.
6. Spring test and torsion test.

Note: At least ten experiments should be conducted

Course Code	Course Title					Core/Elective
U24ME3L2	**Machine Drawing and Modelling Lab**					**Core**
Prerequisite	Contact Hours per Week			CIE	SEE	Credits
	L	T	P/D			
-	**-**	**-**	3	25	50	**1.5**

Course Objectives :

The objective of the course is to:

- Understand format of drawing sheet.
- Understand angle of projections.
- Understand isometric projections and practice on simple machine elements
- Practice free hand sketching of machine elements
- Understand Modeling of assembly drawings of typical machine parts.

Course Outcomes:

After completing this course, the student will be able to:

1. Create and format drawing sheets with appropriate title blocks in AutoCAD, following standard conventions for professional and technical drawings.
2. Apply the fundamental conventions for drawing lines, dimensioning, and sectional views according to industrial standards in AutoCAD.
3. Create accurate drawings of simple machine elements, such as shafts, gears, and pulleys, using the correct dimensional standards and sectional views in AutoCAD.
4. Design and present detailed assembly drawings of components such as connecting rods and eccentrics, ensuring proper alignment and interaction between parts in SOLIDWORKS.
5. Demonstrate proficiency in designing mechanical systems by creating assembly models of components like pedestal bearings (Plummer blocks) and screw jacks, integrating them with accurate material properties and movement simulations.

List of Experiments:

I. Machine Drawing (Auto CAD):

1. Format of drawing sheet & title block,
2. Conventions of drawing lines and dimensions,
3. Convention for sectional views.
4. Simple machine elements.
5. Riveted and screwed fastenings.
6. Joints and coupling.

II. Assembly drawing (SOLIDWORKS):

7. Connecting rod.
8. Eccentric.
9. Cross head.
10. Stuffing box.
11. Lathe Tool Post.
12. Revolving centre.
13. Pedestal bearing (Plummer block).
14. Screw Jack.

Note: The test is for the ability of the student to read and interpret drawing. The drawing should include part list in standard format.

Suggested Reading:

1. N.D. Bhatt, Machine Drawing, Charotar Publishing house, Anand, New Delhi, 28th edition, 1994.
2. K.L. Narayana, P. Kannaiah, K. Venkat Reddy, Machine Drawing, New Age International (P) Ltd.,2nd edition.

Course code	Course title						Core/Elective
U24EE3L4	**Fundamentals of Electrical Engineering Lab**						**Core**
Pre-requisites	Contact Hours Per Week				CIE	SEE	Credits
....	L	T	D	P			
	-	-	-	3	25	50	1.5

Course Objectives:

1. To impart the practical knowledge on analysis of Kirchhoff's Laws and various theorems in DC Circuits.
2. To provide hands on experience on working of single phase and three phase transformers.
3. To impart the practical knowledge on working of DC Motors and characteristics of DC generators

Course Outcomes:

1. Get an exposure to common electrical components and their ratings.
2. Comprehend the usage of common electrical measuring instruments.
3. Analyze the Laws and theorems in DC circuits
4. Analyze the voltage and currents in RL, RC and RLC Circuits.
5. Test the basic characteristics of transformers and electrical machines.
6. Analyze the performance of DC Motors and DC Generators.

Demonstration - 1: Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors

1. Verification of Ohm's Law, KVL and KCL.
2. Verification of Superposition theorem (with DC excitation).
3. Verification of Thevinen's and Norton's theorems (with DC Excitation)
4. Verification of Maximum Power transfer Theorem (with DC Excitation)
5. Sinusoidal steady state response of R-L, and R-C circuits

Demonstration – 2: Demonstration of cut-out sections of Machines: DC Machine (Commutator-brush arrangement), Transformers, Induction Machine (Squirrel cage rotor), Synchronous Machine (Field winging - slip ring arrangement) and Single-Phase Induction Machine.

6. Measurement of phase voltage/current, line voltage/current and power in a balanced three-phase circuit connected in star and delta
7. OCC characteristics of DC Generator
8. Transformers: Observation of the no-load current waveform on an oscilloscope (Non sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics).
9. O.C test and S.C test on single phase Transformer.
10. Measurement of primary and secondary voltages, currents and power of a single phase Transformer:
11. Open circuit and Short circuit characteristics of an Alternator
12. Power factor improvement of Induction Motor using static capacitorNote: Minimum eight experiments should be conducted in the semester

Text books:

1. J.B.Gupta, “Fundamentals of Electrical Engineering and Electronics” S.K.Kataria& Sons Publications, 2002.
2. J.B.Gupta, “Utilization of Electric Power and Electric Traction” S.K.Kataria& Sons Publications,2010
3. AbhijitChakrabarti, SudiptaNath, Chandan Kumar Chanda, “ Basic Elactrical Engineering” Tata McGraw Hill, Publications,2009
4. Hughes, "Electrical Technology", VII Edition, International Student -on, Addison Welsey Longman Inc., 1995.
5. D.P. Kothari and I.J. Nagrath, “Electrical Machines”, 3rd Edition, Tata McGraw Hill, Publications.

LORDS INSTITUTE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution)
DEPARTMENT OF MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS & EXAMINATIONS [LR-24]
(w.e.f. Academic Year 2025-26)
B.E. IV-Semester

S. No.	Course Code	Category	Course Title	Scheme of Instruction				Scheme of Examination			Credits
				L	T	P/D	Contact Hours/Week	Maximum Marks		Duration in Hours	
								CIE	SEE		
Theory Course											
1	U24MB401	HSMC	Business Economics and Financial Analysis	3	-	-	3	40	60	3	3
2	U24EN401	HSMC	English for Technical Communication	2	-	-	2	40	60	3	2
3	U24ME401	PCC	Manufacturing Processes	3	-	-	3	40	60	3	3
4	U24ME402	PCC	Applied Thermodynamics	3	-	-	3	40	60	3	3
5	U24ME403	PCC	Kinematics of Machines	3	-	-	3	40	60	3	3
6	U24ME404	PCC	Operations Research	3	-	-	3	40	60	3	3
Practical / Laboratory Course											
7	U24EN4L1	HSMC	Soft Skills and Employability Skills Lab	-	-	3	3	25	50	3	1.5
8	U24ME4L1	PCC	Manufacturing Processes Lab	-	-	3	3	25	50	3	1.5
9	U24ME4L2	PCC	Thermal Engineering Lab	-	-	3	3	25	50	3	1.5
Total				**17**	**-**	**9**	**26**	**315**	**510**	**27**	**21.5**
For Lateral Entry Students Only											
Mandatory Course*											
11	U24CH202	MC	Environmental Science	2	-	-	2	40	60	3	-
12	U24EN203	MC	Essence of Indian Traditional Knowledge	2	-	-	2	40	60	3	-
Total				**21**	**0**	**9**	**30**	**395**	**630**	**33**	**21.5**

L: Lecture (Hrs/Wk/Sem) **T**: Tutorial (Hrs/Wk/Sem) **P**: Practical **D**: Drawing (Hrs/Wk/Sem)

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination
ESC: Engineering Science Courses **PCC:** Professional Core Courses
EN: English **ME**: Mechanical Engineering
HSMC: Humanities & Social Sciences Including Management Courses
CS: Computer Science **MB:** Management Studies

Note:

1. Each contact hour is a Clock Hour.
2. The duration of the practical class is three hours, however it can be extended wherever necessary, to enable the student to complete the experiment.
3. At the end of IV semester students should undergo summer Industrial Internship of two-week duration- Credits for Summer Internship will be awarded in V semester.

Course-Code	Course Title					Core/ Elective
U24MB401	BUSINESS ECONOMICS AND FINANCIAL ANALYSIS					-
Prerequisites	Contact Hour per Week			CIE	SEE	Credit
	L	T	P			
	3	-	-	40	60	3

Course Objectives:

The objective of the course is to:

- Understand the concepts of managerial economics and the market dynamics namely demand elasticity of demand and pricing in different market structures.
- Gain the knowledge on the production theories and cost analysis while dealing with the production and the concept of breakeven analysis.
- Examine the price-output decisions under different types of marketing structures and the significance of different forms of business organizations existing in the modern business.
- Describe the significance of the project management, capital budgeting, estimation of the projects through capital budgeting methods for choosing the best and optimal projects.
- Provide the optimal decisions for acquiring the knowledge on financial accounting, management accounting and ratio analysis.

Course Outcomes:

After completing this course, the student will be able to

1. Understand the elasticity of the demand of the product, different types, and measurement of elasticity of demand and factors influencing on elasticity of demand.
2. Recognize the Production function, features of Iso-Quants and Iso-Costs, different types of internal economies, external economies and law of returns with appropriate examples.
3. Illustrate the features, merits and demerits of different forms of business organizations existing in the modern business.
4. Enumerate the concept of capital budgeting and allocations of the resources through capital budgeting methods and compute simple problems for project management.

UNIT – I

Introduction to Business and Economics: Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance. Economics: Significance of Economics, Micro and Macro Economic Concepts, Inflation, Money Supply in Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics,

UNIT – II

Demand and Supply Analysis: Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Demand Forecasting: Supply Analysis: Determinants of Supply, Supply Function & Law of Supply.

UNIT- III

Production, Cost, and Market Structures & Pricing: Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Cost analysis: Types of Costs, Short run and Long run Cost Functions. Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, and Monopolistic Competition. Pricing: Types of Pricing, Break Even Analysis, & Cost Volume Profit Analysis.

UNIT – IV

Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, and Preparation of Final Accounts.

UNIT - V

Financial Analysis through Ratios: Concept of Ratio Analysis, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems), Introduction to Fund Flow and Cash Flow Analysis (simple problems).

Suggested Readings:

1. A.R. Aryasri, "Managerial Economics and Financial Analysis", TMH Publications, 3nd Edition, 2007.
2. D.N. Dwivedi, "Managerial Economics", Vikas Publication House Pvt. Ltd, 2nd Edition, 2012.
3. S.N. Maheshwari & S.K.Maheshwari, "Financial Accounting", Vikas Publication House Pvt.Ltd, 4th Edition, 2012.
4. R. Narayana Swamy, "Financial Accounting- A managerial Perspective", Pearson publications, 1st Indian Reprint Edition, 2012.
5. J.V. Prabhakar Rao & P.V. Rao, "Managerial Economics & Financial Analysis", Maruthi Publishers, 1st Revised Edition, 2011.
6. M.Kasi Reddy & Saraswathi, "Managerial Economics and Financial Analysis", PHI Publications, New Delhi, 10th Revised Edition, 2012.
7. Varshney & Maheswari, "Managerial Economics", Sulthan Chand Publishers, 1st Revised Edition, 2009.

Course code	Course Title						Core/Elective
U24EN401	**English for Technical Communication**						-
Pre-requisites	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
	2	-	-	-	40	60	2

Course Objectives:

The objective of the course is to:

- Understand the significance of Technical Writing.
- Various aspects of professional communication
- Different types of business correspondence
- Various styles of technical report writing
- Designing, creating and developing technical manual
- Familiarize with the technical features of information transfer

Course Outcomes:

After completing the course, the student will be able to:

1. Acquire and apply technical communication professionally
2. Correspond technically through various methods and style of technical writing
3. Apply different types of business correspondence in various situations
4. Gain and apply different technical writing skills of report writing
5. Obtain efficient skills in creating and designing technical manuals

UNIT-I

Definition and Features of Technical communication: Definition, Types and Process of Communication, Definition and features of technical communication (precision, relevance, format, style, use of visual aids), Difference between general writing and technical writing, Types of technical communication.

UNIT-II

Technical Writing-I (Official correspondence): Emails, Business letters (all types), Business proposals.

UNIT-III

Technical writing-II (Reports): Definition, Importance, Types of Report - Memo, Letter & Manuscript, Feasibility report, Project report, Progress report,Evaluation report.

UNIT-IV

Technical writing- III (Manuals): Types of manuals, User manual, Product manual,Operations manual

UNIT-V

Information Transfer and Presentations: Non-verbal (bar diagram, flow chart, pie chart,tree diagram) to verbal (writing), Verbal (written) to non-verbal, Important aspects of oraland visual presentations.

Suggested Reading:

1. Raman, Meenakshi & Sharma, Sangeeta. (2015). *Technical Communication:Principles and Practice* (3rd ed.). New Delhi.
2. Rizvi, Ashraf, M. (2017).*Effective Technical Communication* (2nd ed.).Tata McGrawHill Education. New Delhi.
3. Sharma, R. C., & Mohan, Krishna. (2017). *Business Correspondence and Report Writing: A Practical Approach to Business & Technical Communication* (4th ed.). TataMcGraw Hill Education. New Delhi.
4. Tyagi, Kavita & Misra, Padma. (2011). *Advanced Technical Communication*. NewDelhi, PHI Learning.

5. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hill 2009
6. Handbook for Technical Communication by David A. McMurrey & Joanne Buckley. 2012. Cengage Learning

Course Code	Course Title						Core/Elective
U24ME401	**Manufacturing Process**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**40**	**60**	**3**

Course Objectives

The objective of the course is to:

- Make the students aware of different manufacturing processes like casting, metal forming, forging methods, joining processes.
- Know the advantages and limitations of each process.
- Select the optimal process to produce a product.
- Know the basic principle of advanced forming processes.

Course Outcomes

After completing this course, the student will be able to:

1. Describe the concepts of Foundry Technologies consisting of producing casting by pattern making, mould making, Riser, Gating designing.
2. Discuss the importance of special casting processes, categorize various casting defects and describe the processing of plastics and powder metallurgy concepts.
3. Classify and differentiate various Arc welding, Gas welding discusses their advantages, applications and limitations & understand the arc, gas welding processes.
4. Differentiate &understands the various solid state and resistance welding processes. Discuss their applications, and identify various welding defects.
5. Describe various forming processes, sheet metal operations and discuss the importance of forming processes.

UNIT-I

Casting: Steps involved in making a casting – Advantage of casting and its applications, Casting terms Patterns, Types, Materials used for patterns, pattern allowances, core, Moulding sands, Properties of moulding sands. Types of moulding machines, Directional solidification, use of chaplets, chills, Riser – Function, Design of gating systems

UNIT-II

Special Casting Processes: Shell moulding, CO_2 moulding, die casting, centrifugal casting, investment or lost wax process; Casting defects, causes and remedies, Inspection and testing of castings. Processing of plastics - extrusion, injection moulding, blow moulding and thermo forming. Introduction to Powder Metallurgy- Process, Production of powders, blending, mixing, compaction techniques and finishing operations employed in powder metallurgy processes

UNIT-III

Welding processes: Introduction, Classification of welding processes, gas welding equipment and techniques, types of flames. arc welding.- SMAW, SAW, GMAW, GTAW, PAW, Atomic hydrogen welding, principle of Electro slag welding, Gas cutting, Brazing and Soldering..

UNIT-IV

Solid State Welding Process: Forge Welding, Friction Welding, Friction Stir Welding, and Explosive Welding. Resistance welding processes - Spot welding, Seam welding, Projection welding, weldability, welding defects – causes and remedies;

UNIT-V

Forming Processes: Hot extrusion and cold extrusion - Forward extrusion and backward extrusion –description of Forging, Rolling, Drawing operations. Sheet Metal Operations: Blanking, Piercing, Bending, Deep drawing, Spinning. Advance Forming Processes- High energy rate forming processes such as Explosive forming, Electro- magnetic forming and Electro-hydraulic forming; Rubber pad forming.

Suggested Readings:

1. P.N. Rao, ―*Manufacturing Technology*‖ Vol. 1, Tata McGraw Hill Publ., 3nd Ed., 2011.
2. Amitabh Ghosh & Mallick, ―*Manufacturing Science*‖, Assoc. East west Press Pvt. Ltd. 4th Ed., 2011.
3. Hajra Choudhary; Workshop Technology:, Vol I.
4. Serope Kalpakjian, ―*Manufacturing Engineering and Technology*‖, Pearson Education, 2018.
5. George. E. Dieter, *"Mechanical Metallurgy*", SI Metric Edition McGraw-Hill Book Company.
6. J.P.Kaushish, *"Manufacturing Processes*", PHI Learning Pvt. Ltd., 2nd, 2010.

Course-Code	Course Title					Core/ Elective
U24ME402	**Applied Thermodynamics**					**Core Course**
Prerequisites	Contact Hour per Week			CIE	SEE	Credit
	L	T	P			
	3	**-**	**-**	**40**	**60**	**3**

Course Objectives:

The objective of the course is to:

- Study the application of thermal science in mechanical engineering, consisting of the fundamental laws and processes for energy conversion.
- Understand thermal design aspects of reciprocating machinery-reciprocating compressors and IC Engines.
- Analyse Rankine cycle applied to thermal power plants and its improvements.
- Gain the knowledge on the power plant thermal Devices-Boilers, Condensers, Pumps¬ &Nozzle

Course Outcomes:

After completing this course, the student will be able to

1. Analyze reciprocating air compressors, including P-V diagrams, efficiency, and the effects of clearance, inter-cooling, and multi-stage compression."
2. Explain the working, classification, performance, and supporting systems of I.C. engines, including S.I. and C.I. engine components and fuel systems.
3. Analyze combustion phenomena in S.I. and C.I. engines, including stages, knocking, fuel ratings, and combustion chamber design.
4. Explain the classification, working principles, and components of steam boilers, condensers, and draught systems, including high-pressure and supercritical boilers.
5. Analyze steam power plant cycles and nozzle flow characteristics, including Rankine cycle modifications, steam flow through nozzles, and related performance parameters.

UNIT-I

Reciprocating Air Compressors: Classification and applications. Ideal and actual P-V diagrams, work input and efficiency relations for single and multi-stage compressors. Effect of clearance volume on work input and efficiency. Inter cooling and after cooling concepts.

UNIT-II

Internal Combustion Engines: Classification and applications, Working principles of four stroke and two stroke engines, Spark Ignition and Compression ignition engines, Deviation of actual cycles from Air Standard cycles. Performance parameters of I.C. Engines, Heat balance sheet of I. C. Engine. Overview of Engine supporting systems- Cooling Systems, Lubrication systems- Wet sump, Dry sump and Mist Systems. Working principles of S.I. Engine fuel systems- Carburetors, Battery and Magneto Ignition systems. Working principles of C.I. Engine fuel systems- Fuel pump and Fuel injector.

UNIT-III

I.C. Engine Combustion phenomena: Stages of combustion in S.I. Engines- Ignition delay, Flame front propagation and After burning. Abnormal combustion- Pre-ignition and Knocking. Factors affecting Knocking. Stages of combustion in C.I. Engines, Delay period, Period of Uncontrolled Combustion, Period of Controlled Combustion and after burning. Abnormal Combustion-Knocking. Factors affecting Knocking. Octane and Cetane rating of fuels. Design considerations for combustion chamber and cylinder head. Type of combustion chambers of S.I. engines and C.I. engines.

UNIT-IV

Steam Boilers: Classification and Working Principles. Water tube boilers- Babcok & Wilcox and Stirling boilers. Fire tube boilers- Cornish, Cochran, Locomotive and Lancashire boilers. High Pressure boilers / Supercritical boilers: Lamont, Benson boiler, Loeffler boiler and Velox boiler. Boiler Mountings and Accessories: Boiler Draught, Calculation of Chimney height, Steam Condensers: Jet and Surface condensers, Principle of Operation and Applications.

UNIT-V

Steam Power Plant Cycles : Carnot and Rankine cycles of operation and their efficiencies, Analysis of Rankine cycle with superheating, reheating and regeneration (Direct and Indirect types). Steam Nozzles: Flow of steam through convergent - divergent nozzles, velocity of steam flowing through the nozzle, mass of steam discharge through the nozzle, condition for maximum discharge, critical pressure ratio and nozzle efficiency. Super saturated expansion of steam through nozzles.General relationship between area, velocity and pressure in Nozzle flow.

Suggested Reading:

1. R.K. Rajput, " Thermal Engineering", Laxmi Publications, 9th Edn., 2013
2. V. Ganesan, "Internal Combustion Engines", Tata McGraw Hill Publishing, 2007
3. P.L. Ballaney, "Thermal Engineering", Khanna Publishers, 19th Edn., 1993.
4. Richard Stone, "Introduction to I.C. Engines", Mac Millan, 2nd Edn., 1997

Course Code	Course Title					Core
U24ME403	**Kinematics of Machines**					**Core**
Engineering Mechanics	Contact Hours per Week			CIE	SEE	Credits
	L	T	P/D			
-	**3**	**-**	-	40	60	3

Course Objectives

The objective of the course is to:

- Differentiate the Link, kinematics chain and mechanisms.
- Analyze the different mechanisms by graphical methods.
- Construct the different straight Line mechanisms.
- Draw displacement diagram for followers with various types of motions.
- Estimate the velocity and acceleration of different type of gear and gear trains.

Course Outcomes

At the end of the course, the student will be able to

1. Demonstrate the basic components and layout of linkages in the assembly of a system / machine & mobility of planar mechanism for finding D.O.F of mechanism & know the applications of mechanisms.
2. Perform synthesis of different mechanism by graphical methods.
3. Develop the steering gearing mechanism & Hooke's joint & can be able to determine correct steering angle, and can be able to analyze the shafts velocities in Hooke's joint.
4. Draw the displacement diagram and cam profile diagram for follower executing different types of motions and various configurations of followers
5. Draw the displacement diagram and cam profile diagram for follower executing different types of motions and various configurations of followers.

UNIT-I

Fundamentals of kinematics and Mechanisms: Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematics pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully and incompletely constrained.

Mechanism and Machines – Mobility of Mechanisms: Kutzbach criterion , Grubler's criterion, classification of machines – kinematics chain – inversions of mechanism – inversions of quadric cycle chain, single and double slider crank chains, Mechanical Advantage

UNIT-II

Velocity and acceleration analysis: Relative velocity acceleration methods, Corioli's component of acceleration, instantaneous center of Rotation method, Kennedy theorem of three center in line, body and space centrode, Klein's construction, Position analysis of links with vector and complex algebra methods, Loop closure equation, Velocity and acceleration analysis of mechanisms using vector and complex algebra methods.

UNIT-III

Straight-line motion mechanisms: Exact and approximate copied and generated types – Peaucellier - Hart - Scott Russel – Grasshopper – Watt -Tchebicheff's and Robert Mechanism – Pantographs, Geneva mechanism.

Steering gear: Conditions for correct steering – Davis steering gear Ackerman's steering gear.

Hook's joint: Single and double Hooke's joint –velocity ratio – application.

UNIT-IV

CAMS & FOLLOWERS: Types of cams and followers, types of follower motion, Displacement, velocity and acceleration diagrams, profile of cam cams with specified contours. Analysis of uniform motion, parabolic motion,

simple harmonic motion and epicycloidal motion, Design of cam profiles: Cams with knife edge, roller and flat face followers.

UNIT-V

Gears and Gear trains: Classification, Terminology, Law of Gearing, Interferences, methods of avoiding interferences, path of contact, arc of contact. Simple gear train, compound gear train, reverted gear train, planetary/epicyclic gear train, Sun and planet gear

Suggested Readings :

1. S.S. Rattan, ―Theory of Machines", Tata McGraw-Hill, 3rd Edition,2009.
2. J. E. Shigley, ―Theory of Machines and Mechanisms", McGraw-Hill Publications,2005.
3. Thomas Bevan, ―Theory of Machines", Pearson Education
4. Norton RL, ―Kinematics and Dynamics of Machinery", McGraw-Hill Publications.
5. Amitabha Ghosh and Ashok Kumar Mallik, ―Theory of Mechanisms and Machines", East West Press Pvt. Ltd,2008

Course Code	Course Title						Core/Elective
U24ME404	**OPERATIONS RESEARCH (Common to CSD, IT & Mech)**						**---**
Prerequisite	**Hours Per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
-	**3**	**-**	**-**	**-**	**40**	**60**	**3**

Course Objectives:

Develop ability to

1. Explain with examples, the basic terminology of functions, relations, and sets.
2. Perform the operations associated with sets, functions, and relations.
3. Relate practical examples to the appropriate set, function, or relation model, and interpret the associated operations and terminology in context.
4. Describe the importance and limitations of predicate logic.
5. Use Graph Theory for solving problems.

Course Outcomes:

At the end of the course, student would be able to

1. Understand the ideas of mathematical induction to recursion and recursively defined structures.
2. Prepare the students to have the knowledge of Linear Programming Problem in Operations
3. Research at the end students would be able to understand the concept and develop the models for different applications.
4. Make students understand the concept Replacement models at the end students would able to explain various features and applications of replacement models in real time scenario.
5. Prepare the students to understand theory of Game in operations research at the end students would able to explain application of Game theory in decision making for a conflict

UNIT – I

Introduction: Definition and Scope of Operations Research.

Linear Programming: Introduction, Formulation of linear programming problems, graphical method of solving LP problem, simplex method, maximization methods and minimization, Degeneracy in LPP, Unbounded and, Infeasible solutions.

UNIT – II

Transportation Models: Finding an initial feasible solution - North West corner method, least cost method, Vogel‘s Approximation method, Finding the optimal solution, optimal solution by stepping stone and MODI methods, Special cases in Transportation problems - Unbalanced Transportation problem.

Assignment Problems: Hungarian method of Assignment problem, Maximization in Assignment Problem, unbalanced problem, problems with restrictions, travelling salesman problems.

UNIT – III

Network Fundamentals- scheduling the activities -Fulkerson’s Rule –CPM- earliest and latest times -determination of ES and EF in the Forward Pass - LS and LF in backward pass determination of Critical Path, Crashing, time cost trade off. PERT-Beta Distribution, probabilistic models, Calculation of CP, resource analysis and allocation.

UNIT – IV

Replacement Models: Introduction, replacement of items that deteriorate ignoring change in money value, replacement of items that deteriorate considering change in money value with time, replacement of items that fail

suddenly - Individual replacement policy, Group replacement policy.

Game Theory: Introduction, 2 person zero sum games, Maximin - Minimax principle, Principle of Dominance, Solution for mixed strategy problems, Graphical method for 2 x n and m x 2 games.

UNIT – V

Sequencing Models: Introduction, General assumptions, processing n jobs through 2 machines, processing n jobs through m machines, Processing 2 jobs through m machines

Queuing Theory: Introduction, single channel - Poisson arrivals - exponential service times with infinite population & finite population, Multi-channel - poison arrivals - Exponential service times with infinite population.

Introduction to Optimization Techniques: Single objective & Multi objective optimization Techniques like G.A, NSGA, P.Q.O & MPSO Techniques.

Suggested Readings:

1. Hamdy, A. Taha, ‒Operations Research-An Introduction‖, Sixth Edition, Prentice Hall of India Pvt. Ltd.,1997
2. S.D. Sharma, Operations Research, Kedarnath, Ramnath & Co., Meerut,2009
3. Dr. Mohammed Asif Kattimani, Mr. Shaik Mohammed Ali, Dr. P R Venkatesh, Introduction to Operations Research & Application of Python, Infotech Standards India Pvt. Ltd, 2025.
4. J.B. Gupta, ―Utilization of Electric Power and Electric Traction‖ S.K. Kataria & Sons Publications, 2010.
5. Hrvey M. Wagner, Principles of Operations Research, Second Edition,Prentice Hall of India Ltd., 1980.
6. V.K. Kapoor, Operations Research, S. Chand Publishers, New Delhi,2004
7. R. Paneer Selvam, Operations Research, Second Edition, PHI Learning Pvt. Ltd., New Delhi,2008.

Course code	Course title						Core/Elective
U24EN4L1	**Soft Skills and Employability Skills Lab**						**-**
Pre-requisites	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	25	50	1

Course Objectives:

The objective of the course is to:

- Improve the students' fluency in English, through Interpersonal Communication skills.
- Read the given text at normal speed and analyze and evaluate critically.
- Exhibit their ability and skills relevantly and coherently through resume writing and cover letter writing.
- Develop oral presentation skills to meet the global competition.
- Boost confidence through the dynamics of Group Discussion.
- Prepare all the students for their placements through Mock Interviews.

Course Outcomes:

After completing this course, the student will be able to:

1. Organize ideas relevantly and coherently in their communication
2. Analyze and Comprehend the text inferentially
3. Write Resume/CV and Cover letter effectively
4. Practice oral presentation confidently
5. Participate in group discussions dynamically
6. Face interviews optimistically

List of Activities:

1. **Activities on Fundamentals of Inter-personal Communication:** Starting a conversation, responding appropriately and relevantly – using the right body language and Role Play in different situations.

2. Activities on Reading Comprehension: General Vs. Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading.

3. **Activities on Writing Skills:** Structure and presentation of different types of Resume/CV writing, Cover letter writing, improving one's writing of Resume and Cover letter.

4. **Activities on Presentation Skills**: Oral presentations through JAM, Extempore, Seminars and Poster Presentations.

5. Activities on Group Discussion and Interview Skills: a).Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation. b). Concept and Process, Pre-interview planning, opening strategies, answering strategies, interview (Types) and Mock Interviews.

Suggested Readings:

1. Professional Communication by Aruna Koneru, McGraw Hill Education (India) Pvt. Ltd, 2016.
2. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
3. Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi
4. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
5. Job Hunting by Colm Downes, Cambridge University Press 2008.

Course Code	Course Title						Core/Elective
U24ME4L1	**Manufacturing Processes Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**3**	**25**	**50**	**1.5**

Course Objectives

The objective of the course is to:

- Gain knowledge and skill in various manufacturing processes such as casting, welding and forming.
- Learn the basic operation of various manufacturing processes
- Understand and perform operations like pattern making, sand testing and casting.
- Understand how to join metal pieces by various welding techniques and gain hands on experience.
- Understand the working principle and produce some components by various metal forming techniques

Course Outcomes

After completing this course, the student will be able to:

1. Explain the properties of moulding sands and pattern making.
2. Understand fabrication of joints using gas welding and arc welding & evaluate the quality of welded joints.
3. Identify the basic idea of press working tools and performs moulding studies on plastics.
4. Demonstrate the understanding of the theoretical concepts of above technologies while working in small groups.
5. Identity the defects / imperfections and discuss their causes and suggest remedies to eliminate them.

I. Foundry:

1. Producing different types of patterns considering draft , shrinkage and machining allowances.
2. Green sand mould making processes with complete gating and risering systems.
3. Testing of moulding sand properties.
4. Melting and pouring of lead to produce casting.

II. Welding:

I. Evaluation of strength and hardness of
   1. Butt joint prepared by gas welding using different types of flame.
   2. Lap joint by resistance welding process.
   3. V-joint by Arc welding process.

II. Exercises using TIG welding processes.
III. Performing Brazing and Soldering operations.

III. Forming:

1. Performing drawing operation on Aluminum.
2. Performing blanking and piercing operations on Hydraulic Press.

IV. Processing Of Plastics:

1. Manufacturing of a simple component using Plastic Injection moulding machine.
2. Manufacturing of a simple component using Plastic Blow Moulding.

Note: At least ten experiments should be completed in the semester .

SUGGESTED READINGS:

1. Dictionary of Mechanical Engineering – G.H.F. Nayler, Jaico Publishing House

Course-Code	Course Title					Core/ Elective
U24ME4L2	**Thermal Engineering Lab**					**Core Course**
Prerequisites	Contact Hour per Week			CIE	SEE	Credit
	L	T	P			
	-	**-**	**3**	**25**	**50**	**1.5**

Course Objectives

The objective of the course is to:

- Understand applications of thermal engineering concepts through experimentation.
- Provide knowledge in testing of properties of fuels and lubricating oils.
- Demonstrate and conduct experiments, Interpret and analyze data and report results of IC engine testing.
- Understand the working principal of Compressors.
- Understand the Economical Speed of Engines.

Course Outcomes

After completing this course, the student will be able to:

1. Perform experiments to find the efficiency of Petrol and Diesel engines.
2. Find the properties of unknown fuels/lubricants.
3. Perform experiments on Reciprocating Air Compressor
4. Perform the Experiments on Heat Balance.
5. Understand the method of finding the indicated power of individual cylinders of an engine by using morse test.

List of Experiments:

1. To determine volumetric efficiency and Mechanical efficiency of a single stage reciprocating air compressor.
2. To determine Valve timing diagram of a Diesel engine.
3. To determine Port timing diagram of a Petrol engine.
4. To conduct performance test on single cylinder Diesel engine.
5. To conduct Heat balance test on a Diesel engine.
6. To conduct Performance test on a two-stroke Petrol engine.
7. To determine Economical speed Test on a SI engine
8. To conduct Performance test on multi cylinder Petrol engine.
9. To conduct Morse test on multi cylinder Petrol engine. .
10. To conduct Performance Test on Variable Compression Ratio Diesel engine.
11. Dis-assembly / Assembly of Engines
12. Determination of viscosity of lubricating oil.
13. Determination of flash and fire points of a fuel
14. Study of Boiler Models

Note: Atleast 10 experiments should be conducted in the Semester