

B.Tech

DEPARTMENT OF MECHANICAL ENGINEERING

Sem	Course Code								Lecture	L	T	P	Contact Hour	Credits
	Course Name								Course				Per Week	
I														
II														
III	AHL-211 Mathematics-III (310)4	MEL 205 Engineering Mechanics (312)5	MEL 207 Strength of Materials (312)5	MEL 209 Machine Drawing (103)3	MEL 211 Engineering Thermodynamics (310)4	MSL 503 Managerial Economics (40 0) 4	AHP 201 Professional Comm. III (1 0 2)0		7	18	4	9	31	25
IV	MEL 202 Fluid Mechanics (312)5	MEL 204 Machine Design-I (320)5	MEL 206 Kinematics of Machine (312)5	MEL 208 Material Science (302)4	AHL 208 Numerical Methods (312)5	MSL 212 Principles of Management (3 0 0) 3	MEV 202 VAC-I (0 0 2)0		7	18	5	10	33	27
V	MEL 301 Dynamics of Machines (312)5	MEL 303 Machine Design - II (310)4	MEL 305 Measurement and Instrumentation (302)4	MEL 307 Fluid Machines (312) 5	MEL 309 Manufacturing Technology (312) 5	MEL 311 Industrial Engineering (300) 3	MET 325 Practical Training – I (000) 0	MEV 301 VAC-II (002)0	8	20	4	8	30	26
VI	MEL 302 Internal combustion Engine (312)5	MEL 304 Manufacturing Technology-II (312)5	MEL 306 Heat Transfer (312)5	MEL 308 Steam Power Generation (312)5	MEL 310 Metrology & Control (310)4	MEL 312 CNC Machine and Automation (300)3	MEV 302 VAC-III (002)0		7	19	4	8	30	27
VII	MEL 401 Refrigeration and Airconditioning (312)5	MEL 403 Mechanical Vibrations (312)5	MED 419 Minor Project (Including Seminar)* (004)2	MET 425 Practical Training - II** (002)1	*2 Elective (310)4	*3 Elective (310)4	AHL 400 Prof. Comm. V (2 0 0)0		7	12	4	10	26	21
VIII	MEL 402 Operation Research (310)4	MEL 404 Computer Aided Design (312)5	MED 420 Major Project (Including Seminar)* (0012)6	MEC 422 Independent Seminar** (002)1	*4 Elective (310)4	*5 Elective (310)4	MEV 402 VAC-III (002)0		7	12	4	16	32	24
Total													177	147

*2	Elective-I					*3	Elective-II					
	MEL 405	Nano Technology					MEL 409	Financial Management				
	MEL 407	Non-Conventional Energy Systems					MEL 411	Automobile Emissions & Control				
	MEL 413	Robotics					CSL 401	Cryptography and Network Security				
	BEL 401	Biomedical Engineering					CSL 403	Data Mining and Data Warehousing				
	ECL 401	Optical Communication					CSL 405	Digital Image Processing				
	ECL 403	Intelligent Instrumentation for Engineers					CSL 407	Software Testing				
*4	Elective-III					*5	Elective-IV					
	FML 406	Engineering Economics					MEL 412	Finite Element Methods				
	MEL 408	Power Plant Engineering					MEL 414	Flexiible Manufacturing System				
	MEL 410	Management Information Systems					MEL 416	Integrated supply chain management				

MVN University, Palwal
Scheme of Studies, Syllabus & Examinations
B.Tech 2nd Year
Semester - III

S.No	Course Title	Course Code	Teaching Schedule			Total Hours	Credit
			L	T	P		
1	Mathematics-III	AHL-211	3	1	0	4	4
2	Engineering Mechanics	MEL 205	3	1	2	6	5
3	Strength of Materials	MEL 207	3	1	2	6	5
4	Machine Drawing	MEL 209	1	0	3	4	3
5	Engineering Thermodynamics	MEL 211	3	1	0	4	4
6	Managerial Economics	MSL 503	3	0	0	3	3
7	Professional Communication - III	AHP 201	1	0	2	3	0
Total			17	4	9	30	24

AHL-211	MATHEMATICS -III	L	T	P	Cr
		3	1	0	4

SECTION-A

UNIT-I

Fourier Series: Euler's formulae, conditions for a Fourier expansion, change of interval, Fourier expansion of odd and even functions, Fourier expansion of square wave, rectangular wave, saw-toothed wave, half and full rectified wave, half range sine and cosine series.

UNIT-II

Complex Analysis: Functions of Complex Variable, Definition, Exponential function, Trigonometric and Hyperbolic functions, Logarithmic functions. Limit and Continuity of a function, Differentiability and analyticity Cauchy-Riemann equations, necessary and sufficient conditions for a function to be analytic (without proof), polar form of the Cauchy-Riemann equations. Harmonic functions, Integration of complex functions. Cauchy-Integral theorem and formula.

UNIT-III

Power Series and Contour Integration: Power series, radius and circle of convergence, Taylor's Malaren's and Laurent's series. Zeroes and Singularities of complex functions, Residues. Evaluation of real integrals using residues (around unit and semi circle only).

SECTION-B

UNIT-IV

Linear Programming Problems: Formulation, Solving linear programming problems using (i) Graphical method (ii) Simplex method (iii) Big -M method (iv) Dual simplex method (v) Two phase method.

UNIT-V

Transportation Problem: Formulation, Basic feasible solutions, optimum solution by u-v method, unbalanced and degenerate problems.

UNIT-VI

Assignment Problem: Formulation, Solution by Hungarian method, unbalanced problem, case of maximization, travelling salesman and crew assignment problems.

Text Books:

1. Engineering Mathematics by N.P. Bali, Laxmi Publications.
2. Operation Research by S.D.Sharma.

Reference Books:

1. Higher Engineering Mathematics by B.S. Grewal
2. Operation Research by P.K.Gupta&KantiSwaroop.
3. Advanced Engineering Mathematics by R.K.Jain&S.R.K.Iyengar.Narosa

MEL 205	ENGINEERING MECHANICS	L	T	P	Cr
		3	1	2	5

SECTION-A

UNIT-I

Introduction: Force system, dimensions and units in mechanics, laws of mechanics, vector algebra, addition and subtraction of forces, cross and dot products of vectors, moment of a force about a point and axis, couple and couple moment, transfer of a force to a parallel position, resultant of a force system using vector method, Problems involving vector application.

Friction: Laws of Coulomb Friction, Equilibrium of Bodies involving Dry-friction, Belt friction, Applications

UNIT-II

Truss and Frames: Truss, classification of truss, assumptions in truss analysis, perfect truss, analysis of perfect plane truss using method of joints and method of sections, Problems.

UNIT-III

Moment of Inertia: Area moment of inertia, mass moment of inertia, parallel axis and perpendicular axis theorems, radius of gyration, polar moment of inertia, product of inertia, principle axis, problem based on composite figures and solid objects.

SECTION-B

UNIT-IV

Particle Dynamics: Energy methods and momentum methods, Newton's laws, work energy equation for a system of particles, linear and angular momentum equations, projectile motion, problem.

UNIT-V

Centroid: Centre of mass and Centre of gravity, Determination of centroid, centre of mass and centre of gravity by integration method of regular and composite figures and solid objects, Problems.

UNIT-VI

Kinematics: Concept of rigid body, velocity and acceleration, relative velocity, translation and rotation of rigid bodies, equations of motion for translation and rotation- problems Force, Mass and Acceleration, Work and Energy, Impulse and Momentum, D'Alembert's Principles and Dynamic Equilibrium

Text Books:-

1. Engineering Mechanics – U.C.Jindal, Galgotia Publication
2. Engineering Mechanics – A.K.Tayal, Umesh Publication

Reference Books:

1. Engineering Mechanics – Irving H. Shames, PHI Publication

ENGINEERING MECHANICS LAB

List of Experiments:

1. Verification of reciprocal theorem of deflection using a simply supported beam.
2. Verification of moment area theorem for slopes and deflections of the beam.
3. Deflections of a truss-horizontal deflections & vertical deflections of various joints of a pin-jointed truss
4. Elastic displacements (vertical & horizontal) of curved members.
5. Experimental and analytical study of 3 hinged arch and influence line for horizontal thrust.
- 6 Experimental and analytical study of behavior of struts with various end conditions.
- 7 To determine elastic properties of a beam.
- 8 Experiment on a two-hinged arch for horizontal thrust & influence line for horizontal thrust.
- 9 Experimental and analytical study of a 3 bar pin jointed Truss.
- 10 Experimental and analytical study of deflections for unsymmetrical bending of acantilever beam.

MEL 207	STRENGTH OF MATERIALS	L	T	P	Cr
		3	1	2	5

SECTION-A

UNIT-I

SIMPLE STRESSES & STRAINS: Concept & types of Stresses and Strains, Poisson's Ratio, Stresses and Strain in Simple and Compound bars under Axial Loading, Stress -Strain diagrams, Hooks law, Temperature Stress & Strain in Simple & Compound bars under Axial Loading, Numerical.

COMPOUND STRESSES & STRAINS: Concept of Surface & Volumetric Strains, Principle Stresses , Strains & Principle Planes, Mohr, Circle of Stresses

UNIT-II

SHEAR FORCE & BENDING MOMENTS: Definitions, SF & BM diagrams for Cantilevers & Simply Supported Beams with or without Over-hang and Calculation of Maximum BM & SF and the Point of Contraflexure under (i) Concentrated loads, (ii) Uniformly Distributed Loads over whole span or a part of it, (iii) Combination of Concentrated Loads ,Uniformly Distributed Loads & Moments Numerical.

UNIT-III

TORSION OF CIRCULAR MEMBERS: Torsion Equation of Circular Tube, Solid and Hollow circular shafts, Stepped shaft & Composite Circular Shafts, Combined Bending and Torsion, Equivalent Torque, Numerical..

SECTION-B

UNIT-IV

BENDING & SHEAR STRESSES IN BEAMS: Bending Stresses in Beams with derivation & application to Beams of Circular, Rectangular, I,T and Channel Sections, Composite Beams, Shear Stresses in Beams with Combined Bending, Torsion & Axial Loading of Beams. Numerical..

UNIT-V

DEFLECTION OF BEAMS: Relation between Deflection, Slope, Bending Moment & Shear Force. Derivation of deflection & slope of Simply Supported Beam carrying point load at centre & uniform distributed load over whole span (BY DOUBLE INTEGRATION METHOD & MOHR,S THEOREM), Derivation of deflection & Slope of Simply Supported Beam carrying Eccentric point load(BY MACAULAY,S METHOD) Derivation of deflection\$ Slope of Cantilever Beam with point & uniform distributed load. Numerical.

UNIT-VI

COLUMNS & STRUTS: Column under Axial Load, Concept of Instability and Buckling, Slenderness Ratio, Derivation of Euler's formulae for the Elastic Buckling Load, Eulers, Rankine, Gordon's formulae Johnson's empirical formula for Axial Loading Columns and their applications, Eccentric Compression of a Short Strut of Rectangular & Circular Sections, Numerical.

Text Books:

1. Strength of materials by S Ramamurtham, Published by Dhanpatrai & Company Ltd., New Delhi
2. Strength of Material By R S Khurmi & Gupta, Published By S Chand & Company Ltd, New Delhi

Reference Books:

1. Strength of materials by Dr. Sadhu Singh, Published By Khanna & Company

2. Strength of materials by Dr. R K Bansal Published by Laxmi Publication.

STRENGTH OF MATERIAL-LAB

List of Experiments:

1. To study the Brinell hardness testing machine & perform the Brinell Hardness Test.
2. To study the Rockwell Hardness Testing Machine & perform the Rockwell Hardness Test
3. To study the Vickers Hardness Testing Machine & perform the Vickers Hardness Test.
4. To study the Erichsen sheet metal Testing Machine & perform the Erichsen sheet metal test.
5. To study the Impact Testing Machine and perform the Impact Tests (Izod&Charpy).
6. To study the Universal Testing Machine and perform the Tensile Test.
7. To perform Compression & Bending tests on UTM.
8. To study the Torsion Testing Machine and perform the Torsion Test.
9. To draw Shear Force, Bending Moment diagrams for a Simply Supported Beam under Point and Distributed Loads.
10. To find Moment of Inertia of a Flywheel.

MEL 209	MACHINE DRAWING	L	T	P	Cr
		1	0	3	3

SECTION A

UNIT I

Limits, Fits and Tolerances: Limits, Deviation, Allowance, Basic size and Design size. Fundamental tolerances, Fundamental deviation and Method of placing limit dimensions. Clearance fit, Transition fit, Interference fit, Hole basis system, Shaft basis system, Tolerance grades. Calculation for values of clearance/interference, Hole tolerance, Shaft tolerance with given basic size for common assemblies like H7/g6, H7/m6, H8/u7.

Surface Roughness: Surface roughness number, Use of machining symbols in Production drawings, Indication of surface roughness, Indication of special surface roughness characteristics, Indication of machining allowance, Indication of surface roughness symbols on drawings, Method of indicating surface roughness on given components.

UNIT II

Gears: Gear terminology, I.S. convention of machining components and representation of assembly of spur gears, helical gears, bevel gears, worm and worm wheel.

UNIT III

Orthographic Projections: Conversion of Orthographic views from Isometric View of machine parts / components.

SECTION B

UNIT IV

Need of Sectioning: Types of Sections, Sectional views of Coupling (Flexible, Oldham's and Universal), Cotter Joint, Knuckle joint and Riveted Joints.

UNIT V

Free hand sketching: Need for free hand sketching of Standard parts like Pulley, Piston and Connecting rod.

UNIT VI

Assembly Drawing: Assembly drawing with sectioning and bill of materials from given detailed drawing of assemblies like Lathe Tail stock, Machine vice, Pedestal bearing. Foot step bearing, Stuffing Box.

Text Books:

1. Machine Drawing by P.S. Gill; S.K. Kataria and Sons, Delhi.
2. Machine Drawing by R.K. Dhawan; S. Chand and Company, Delhi.

Reference Books:

1. Machine Drawing by R.B. Gupta; SatyaParkashan, New Delhi.
2. Machine Drawing by N.D. Bhatt; Charotar Publishing House.

MEL 211	ENGINEERING THERMODYNAMICS	L	T	P	Cr
		3	1	0	4

SECTION A

UNIT-I

Fundamental Concepts and Definitions: Introduction and Definition of Thermodynamics, Dimensions and Units, Microscopic and Macroscopic Approaches, Systems (Open Closed And Isolated system), Surroundings and Universe, Control System Boundary, Control Volume and Control Surface, Properties and State, Thermodynamic Properties, Intensive and Extensive Properties Thermodynamic Path, Process and Cycle, Thermodynamic Equilibrium, Reversibility and Irreversibility, Quasi Static Process, Energy and its Forms, Work and Heat, Problem.

Zereth Law of Thermodynamics:

Zereth Law of Thermodynamics, Temperature and it's Measurement, Temperature, Scales and Problem.

UNIT-II

First Law Of Thermodynamics: Thermodynamic Definition of Work and Heat Thermodynamic Processes, Calculation of Work in Various Processes and Sign Convention, Non-flow Work and Flow work, Joules' Experiment, First law of thermodynamics, Internal Energy and Enthalpy, First Law of Thermodynamics Applied to Open systems, Steady Flow Systems and Their Analysis, Steady Flow Energy Equation, and Its Application. First Law Analysis for Closed System (Non Flow Processes), Analysis of Unsteady Processes Such as Filling and Evacuation of Vessels with and Without Heat Transfer, Limitations of First Law of Thermodynamics and PMM-I, Problem.

UNIT-III

Second Law of Thermodynamics: Devices Converting Heat to Work, Thermal Reservoir, Heat Engines, Efficiency, Devices Converting Work to Heat, Heat pump, Refrigerator, Coefficient of Performance, Reversed Heat Engine, Kelvin Planck Statement of Second Law of Thermodynamics, Clausius Statement of Second Law of Thermodynamics, Equivalence of two Statements of Second Law of Thermodynamics, Reversible and Irreversible Processes, Carnot Cycle and Carnot Engine, Carnot Theorem and it's Corollaries, PMM-II Problems.

Entropy: Introduction, Clausius Inequality, Principle of Entropy Increase, Temperature Entropy Plot, Entropy Change in Different Processes, Introduction to Third Law of Thermodynamics, Problems.

SECTION B

UNIT-IV

Availability and Irreversibility: High and Low Grade Energy, Available and Unavailable Energy, Loss of Available Energy due to Heat Transfer through a Finite Temperature Difference, Helmholtz and Gibb's Functions, Availability of a Closed System, Availability of a Steady Flow System, Dead State of a System, Effectiveness and Irreversibility, Second law efficiencies of Processes & Cycles, Problems.

UNIT-V

Pure Substances and Their Properties: Pure Substance and its Properties, Phase and Phase Transformation, Saturated and Superheat Steam, Triple point, T-V, P-V and P-T Plots During Steam Formation, Properties of Dry, Wet and Superheated Steam, Property Changes During Steam Processes, Temperature – Entropy (T-S) and Enthalpy – Entropy (H-S) Diagrams, Throttling and Measurement of Dryness Fraction of Steam, Problems.

Introduction to Working of I.C. Engines: Compression Ignition engines, Spark Ignition engines, 2 stroke and 4 stroke engines, Performance parameters of IC engine, Heat balance sheet Problems.

UNIT-VI

Ideal and Real Gases: Concept of an Ideal Gas, Basic Gas Laws, Characteristic Gas Equation, Avogadro's law and Universal Gas Constant, P-V-T Surface of an Ideal Gas Vander Waal's Equation of State, Reduced Co-ordinates, Compressibility Factor and Law of Corresponding States; Mixture of Gases, Mass, Mole and Volume Fraction, Gibson Dalton's law, Gas Constant and Specific Heats, Entropy for a Mixture of Non-Reactive gases, Problems.

Thermodynamics Relations: Maxwell Relations, Relations for changes in Enthalpy and Internal Energy & Entropy, Specific Heat Capacity Relations, Clapeyron Equation, Joule Thomson coefficient & Inversion Curve, Problems.

Text Books:

1. Engineering Thermodynamics – P K Nag, Tata McGraw Hill.
2. Thermodynamics: An Engineering Approach - Cengel and Boles, McGraw Hill Company.

Reference Books:

1. Fundamentals of Engineering Thermodynamics – E. Radhakrishnan, PHI, New Delhi.
2. Engineering Thermodynamics – Jones and Dugan, PHI, New Delhi.
3. Theory and Problems of Thermodynamics – Y. V.C. Rao, Wiley Eastern Ltd., New Delhi.
4. Engineering Thermodynamics – C P Arora, Tata McGraw Hill.

MSL 503	MANAGERIAL ECONOMICS	L	T	P	Cr
		3	00		3

SECTION A

UNIT I

Introduction: Definition of Economics, Nature and scope of Economics, Production Possibility Curve, Relationship between Science, Engg, Technology and Economics.

UNIT II

Principles: opportunity cost principle, Concept of Utility, Law of Diminishing Marginal Utility, Equi-marginal principle.

UNIT III

Demand and Supply Analysis: Demand, Law of demand, determinants, elasticity of demand – meaning, importance, measurement of elasticity of demand, Demand Schedule, Income Elasticity, Cross Elasticity, Supply, Law of Supply, Role of Demand and Supply in determination of Price.

SECTION B

UNIT IV

Production and Cost Analysis – Production Function: Meaning and Factors, Law of Return to factor and Law of Return to Scale, Cost function and their nature, Types of Cost, short run cost curves.

UNIT V

Theory and Behavior of firm – Different market structure and their characteristics: Perfect competition, Monopolistic competition, Monopoly and Oligopoly.

UNIT VI

Indian Economy: Nature of Indian Economy, Privation : meaning, Merits and Demerits of Globalization : meaning, Merits and Demerits.

Text Books:

1. Dwivedi, D.N, Managerial Economics, Vikas publishing house pvt.ltd, New Delhi, Ed 2006
2. Jain T.R., V.K. Ohri Economics For Engineers, V. K. Publication

Reference Books:

1. Hirschey, Mark, Managerial Economics, Thomson Learning, Bangalore
2. Monroe, Kent B., Pricing-Making Profitable Decisions, MacGraw-Hill, New York
3. Keat, Paul B., and Philip K.Y. Young, Managerial Economics – Economic Tools for Today's Decision Makers, Pearson Education, Delhi
4. Salvatore, Dominick, Managerial Economics in a Global Economy, Thomson Learning, Hyderabad

AHP 201	PROFESSIONAL COMMUNICATION-III	L	T	P	Credits
		1	0	2	0

(Common for B. Tech, Integrated M. Tech, Dual Degree M. Tech, Integrated MBA, Dual Degree MBA)

UNIT-I: Phonetics

- i. Recapitulation of Consonant and Vowel Sounds
- ii. Concept of Phonemes and Allophones
- iii. Concept of Minimal Pairs
- iv. Differences in pronunciation between words with
 - /f/ and /P/ sounds
 - /z/ and /dʒ/ sounds
 - /S/ and /ʃ/ sounds
 - /v/ and /w/ sounds
 - /tʃ/ and /ʃ/ sounds
- v. Words commonly mispronounced

UNIT-II: Reading Practice

- i. Reading newspaper articles
- ii. Reading magazine articles

UNIT-III: Oral Practice

- i. Self-Introduction
- ii. Introducing others
- iii. Speeches with prior preparation
- iv. Extempore Speeches
- v. Free Speeches

UNIT-IV: Study Skills

- i. Looking up a dictionary
- ii. Learning pronunciation from a dictionary
- iii. Filling up of examination forms
- iv. Spell check

SEMESTER – IV

S. No	Course Title	Course Code	Teaching Schedule			Total Hours	Credit
			L	T	P		
1	Fluid Mechanics	MEL 202	3	1	2	6	5
2	Machine Design-I	MEL 204	3	2	0	5	5
3	Kinematics of Machine	MEL 206	3	1	2	6	5
4	Material Science	MEL 208	3	0	2	5	4
5	Numerical Methods	AHL 208	3	1	2	6	5
6	Management Concept & Application	MSL 500	3	0	0	3	3
7	VAC-I	MEV 202	0	0	2	2	0
Total			18	5	10	33	27

Note: Training period after fourth semester shall be of 4-6 weeks duration. However, viva-voce shall be conducted in the fifth semester.

MEL 202	FLUID MECHANICS	L	T	P	Cr
		3	1	2	5

SECTION-A

UNIT-I

Introduction: Fluids and Continuum, Physical Properties of Fluids i.e. Mass, Mass Density, Specific Weight, Specific Gravity, Compressibility, Surface Tension, Capillarity, Vapor Pressure, Viscosity, Cavitations, Problems.

UNIT-II

Fluid Statics: Pascal's law, Hydrostatic Law, Measurement of Pressure by Manometers and Mechanical Gauges, Pressure on Plane and Curved Surfaces, Stability of Floating and Submerged Bodies, Classification of Fluid Problems.

Fluid Kinematics: Classification of Fluid Flows, : Lagrangian and Eulerian approaches, Path, Stream and Streak lines, Flow rate and Continuity Equation, Differential Equation of Continuity in Cylindrical and Polar Coordinates, Rotation, Vortices and Circulation, Stream and Potential Functions, Flow net, Problems.

UNIT-III

Fluid Dynamics-I : Concept of Control Volume and Control Surface, Introduction to Navier-Stokes Equations, Euler's Equation of Motion along a Streamline and its Integration, Bernoulli's Equation and its Applications, Venturimeter, Orifice, Orifice meter, Mouth Piece, Pitot Tube, Impulse Momentum Relationship and its Applications, Problems

Fluid Dynamics-II: Impulse-Momentum Principle; Moment of Momentum Equation, Momentum Equation application to Stationary and Moving Vanes, Pipe Bends, Determination of Coefficients of Discharge, Velocity and Contraction and Energy Loss. Problems

Compressible Flow: Introduction, Continuity Momentum and Energy Equation, Sonic Velocity, Propagation of Elastic Waves due to Compression of Fluid, Propagation of Elastic Waves due to Disturbance in Fluid, Stagnation Properties, Problems

SECTION-B

UNIT-IV

Laminar And Turbulent Flow: Laminar and Turbulent Flow, Viscous Flow, Flow Regimes, Reynolds's Number, Shear Stress, Pressure Gradient, Reynolds Experiments, Unidirectional Flow between Stationary and Moving Parallel Plates, Movement of a Piston in a Dashpot, Power absorbed in Bearings, Turbulence Equation for Turbulent flow, Reynolds Stresses, Mixing length Concept and Velocity Distribution in Turbulent flow, Working Principle of Hot-wire anemometer and Laser Doppler Anemometer, Problems.

UNIT-V

Boundary Layer Flow: Boundary layer Concept, Displacement, Momentum and Energy thickness, Von-Karman Momentum Integral Equation, Laminar and Turbulent boundary layer Flows, Drag on a Flat Plate; Boundary layer Separation and Control. Streamlined and Bluff Bodies, Lift and Drag on a Cylinder and an Airfoil. Local and Average Friction Coefficients, Problems.

UNIT-VI

Flow Through Pipes: Major and Minor Head Losses; Resistance Coefficient and its Variation; Hydraulic Gradient and total Energy Lines, Poiseuille Law, Series and Parallel Connection of Pipes, Branched Pipes, Equivalent Pipe, Power Transmission Through Pipes, Problems

Text Books:

1. Fluid Mechanics – R K Bansal, Laxmi Publication
2. Mechanics of Fluids – I H Shames, McGraw Hill
3. Fluid Mechanics – Streeter V L and Wylie E B, McGraw Hill

Reference Books

1. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas, TMH
2. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar, S.K. Kataria and Sons
3. Fluid Mechanics and Machinery – S.K. Agarwal, TMH, New Delhi

FLUID MECHANICS LAB**List of Practical:**

1. To Determine the Coefficient of Impact for Vanes.
2. To Determine the Coefficient of Discharge of an Orifice meter.
3. To Determine the Coefficient of Discharge of Notch (V and Rectangular type).
4. To Determine Friction Factor for the Pipes.
5. To Determine the Coefficient of Discharge of Venturimeter.
6. To Determine the Coefficient of Discharge, Contraction, and Velocity of an Orifice.
7. To Verify the Bernoulli's Theorem.
8. To Find Critical Reynolds Number for a Pipe Flow.
9. To Determine the Meta-Centric Height of a Floating Body.
10. To Determine the Minor Losses due to sudden Enlargement, Contraction, and Bends.
11. To Show the Velocity and Pressure Variation with Radius in a Forced Vortex Flow. To Verify the
12. To Verify the Momentum Equation.

MEL 204	MACHINE DESIGN-I	L	T	P	Cr
		3	2	0	5

SECTION-A

UNIT-I

Design Philosophy: General procedure for machine design, Design requirement of machine elements, Ergonomics consideration in machine design, Selection of materials, Selection of fits & tolerances, Types of fits. Social & environmental feasibility.

Design against Statics Load: Modes of Failure, Factor of Safety, Principal Stresses, Stresses due to Bending and Torsion, Theory of Failure. Selection of Materials for Static and Fatigue Loads. Numericals.

UNIT-II

Mechanical Joints: Design of Lap & Butt Riveted Joints & Various types of Welding Joints in different load conditions., Design of Power Screws and Jacks. Numericals.

UNIT-III

Cotter And Knuckle Joints: Types of Cotter Joint, Design of Cotters joint, Knuckle Joint. Numericals..

SECTION-B

UNIT-IV

Keys, Coupling And Fly Wheel: Design of Keys- Flat, Woodruff Keys, Splines, Couplings Design-Rigid & Flexible Coupling, Turning Moment Diagram of Flywheel, Coefficient of Fluctuation of Energy and Speed, Design of Flywheel-solid disk & rimmed Flywheels, Numericals.

UNIT-V

Clutch: Various type of Clutches in Use, design of Friction Clutches-Disc, Multidisc, Cone and Centrifugal Torque Transmitting Capacity, Numericals.

Brakes: Various Types of Brakes, Design of Shoe Brakes- Internal & External Expanding, Band Brakes. Numericals

UNIT-VI

Mechanical Springs: Types, Material for Helical Spring End Connections for Compression and Tension Helical springs. Stresses and Deflection of Helical Spring of Circular Wire, Design of Helical Springs Subjected to Static and Fatigue Loading. Numericals

Text Book:

1. Mechanical Engg. Design - First Metric Editions: Joseph Edward Shigley-MGH, New York.
2. Design of Machine Elements – V.B. Bhandari – Tata McGraw Hill, New Delhi.
3. PSG Design Data Book
4. Design of machine elements-C S Sharma, KamleshPurohit, PHI

Reference Book:

1. Engineering Design – George Dieter, MGH, New York.
2. Product Design and Manufacturing ,A.K.Chitale and R.C.Gupta, PHI.
3. Machine Design An Integrated Approach: Robert L.Norton, Addison Wesley.
4. Machine Design : S.G. Kulkarini - Tata MacGraw Hill

MEL 206	KINEMATICS OF MACHINE	L	T	P	Cr
		3	1	2	5

SECTION-A

UNIT I

Introduction: Mechanism and Machines, Kinematic links, Kinematics pairs, Kinematic chains, Degree of freedom, Grubler's rule, Kinematic inversion, Four link Planar Mechanisms, Straight line mechanisms, Pantograph, Numerical problems.

UNIT II

Kinematics Analysis of Plane Mechanisms: Displacement analysis, Velocity diagram, Velocity determination by relative velocity method, Instantaneous centre, Kennedy's theorem, Graphical methods of velocity and acceleration analysis (Four bar and Slider crank mechanism), Numerical problems.

UNIT III

Belts and pulleys: Open and cross belt drive, velocity ratio, slip, material for belts, crowning of pulleys, law of belting, types of pulleys, length of belts, ratio of tension, centrifugal tension, power transmitted by belts and ropes, initial tension, creep, chain drives, chain length, classification of chains.

SECTION-B

UNIT IV

Gears: Gear terminology, Fundamental law of gearing, Classification of gears, Interference and Undercutting, Center distance variation, Path of Contact, Arc of Contact, Non- Standard gear teeth, Helical, Spiral, Bevel and Worm gears, Efficiency of helical gears, Numerical problems.

UNIT V

Gear Trains: Synthesis of Simple, Compound and Reverted gear trains, Analysis of Epicyclic gear trains, Differential of a vehicle as application, Numerical problems.

UNIT VI

Cams: Cam terminology, Classification of cams and followers, Disc and Tangent cam nomenclature, Construction of displacement, velocity and acceleration diagrams for different types of follower motions, Analysis of follower motions, Determination of basic dimension, Synthesis of cam profile by graphical methods, Cams with specified contours, Numerical problems

TextBooks:

1. Theory and Machines: S.S. Rattan, Tata McGraw Hill.
2. Theory and Machines: Khurmi & Gupta, S. Chand & Company.

Reference Books:

1. Theory of Machines and Mechanisms: Joseph Edward Shigley and John Joseph Uicker, Jr. Second Edition, MGH, New York.
2. Theory of Mechanisms and Machines: Amitabha Ghosh and Ashok Kumar Malik, Third Edition Affiliated East-West Press.
3. Mechanism and Machine Theory: J.S. Rao and R.V. Dukkipati Second Edition New age International.

KINEMATICS OF MACHINES LAB

List of Practical:

1. To study various types of Kinematic links, Kinematic pairs, Kinematic chain and Mechanisms.
2. To study inversions of Four bar Mechanisms, Single and double slider crank mechanisms.
3. To plot slider displacement, velocity and acceleration against crank rotation for single slider crank mechanism.
4. To find coefficient of friction between belt and pulley.
5. To study various type of cam and follower arrangements.
6. To generate spur gear involute tooth profile using simulated Gear shaping process.
7. To study various types of gears – Spur, Helical, Bevel, Spiral, Worm and worm gearing.
8. To study various types of gear trains – Simple, Compound, Reverted and Epicyclic.
9. To study the working of Screw Jack and determine its efficiency.
10. To study the working of Single and Double Universal joint.

MEL 208	MATERIAL SCIENCE	L	T	P	Cr
		3	0	2	4

SECTION: A

UNIT I

Crystallography: Review of Crystal Structure, Space Lattice, Crystal Planes and Directions, Co-ordination Number, Number of Atoms per Unit Cell, Atomic Packing Factor; Xray crystallography techniques, Imperfections, Defects and Dislocations in solids. Numerical Problems Related to Crystallography.

UNIT II

Mechanical properties and Testing: Stress strain diagram, Ductile & brittle material, Stress vs strength. Toughness, Hardness, Fracture, Fatigue and Creep. Testings such as Strength testings, Hardness testing, Impact testings, Fatigue testing Creep testing, Non-destructive testing (NDT).

Microstructural Exam: Microscope principle and methods. Preparation of samples and Microstructure exam and grain size determination. Comparative study of microstructure of various metals & alloys such as Mild steel, CI, Brass.

UNIT III

Deformation of Metal: Elastic and Plastic Deformation, Mechanism of Plastic Deformation, Twinning, Conventional and True Stress Strain Curves for Polycrystalline Materials, Yield Point Phenomena, Strain Ageing, Work Hardening, Bauschinger Effect, Recovery, Re-Crystallization and Grain Growth.

Failures of Metals: Fracture, Types of Fracture, Mechanism of Fracture, Fatigue, Characteristics of Fatigue, Fatigue Limit, Mechanism of Fatigue, Factors affecting Fatigue. Creep, Creep Curve, Mechanism of Creep and Impact of Time and Temperature on Creep.

SECTION: B

UNIT IV

Solid Solutions and Phase Diagram: Types of Solid Solutions, Solubility Limit, Phases, Microstructure, Phase Equilibria, Unary Phase Diagrams, Gibbs' Phase Rule, Binary Phase Diagrams, Importance and Objectives of Phase Diagram, Binary Isomorphous Systems, Binary Eutectic Systems, Tie Line Rule, Lever Rule, Eutectic and Eutectoid Reactions, Peritectic and Peritectoid Reactions. **Iron-Carbon System:** The Iron-Iron Carbide (Fe-Fe₃C) Phase Diagram, Development of Microstructure in Iron-Carbon Alloys, Allotropic Transformation in Iron and Steel, Influence of other Alloying Elements.

UNIT V

Heat Treatment: Properties of austenite, ferrite, pearlite, martensite. TTT and CCT Diagrams, Principles, Purpose & Classification of Heat Treatment Processes: Annealing, Normalizing, Hardening, Surface Hardening, Carburizing, Nitriding, Cyaniding, Flame And Induction Hardening, Tempering.

UNIT VI

Engineering Materials: Ferrous; Carbon and Alloy Steels, Effect of Alloying Elements in Steels, Cast Irons, Nonferrous Metals and Alloys, Polymers and their Properties, Composites, Types of Composites and their Properties, Processing of Composites, Ceramic Materials: Types of Ceramics, Properties of Ceramic, Processing of Ceramics, Introduction to Nano-Materials & Smart Materials.

Text Books:

1. Material Science and Engineering-An Introduction: Callister, W.D., John Wiley & Sons, Delhi.
2. Elements of Material Science and Engineering: VanVlack, Wesley Pub. Comp.
3. Introduction to Engineering Materials: B. Agarwal, McGraw Hill Publication

Reference Books:

1. Material Science & Engineering –V. Raghvan, Prentice Hall of India Pvt. Ltd, New Delhi
2. Engineering Materials: Kenneth G. Budinski, Prentice Hall of India, New Delhi
3. Material Science - Narula, Narula and Gupta. New Age Publishers

MATERIAL SCIENCE LAB**List of Experiments:**

1. To study crystal structures of a given specimen.
2. To study crystal imperfections in a given specimen.
3. To study microstructures of metals/ alloys.
4. To prepare solidification curve for a given specimen.
5. To study heat treatment processes (hardening and tempering) of steel specimen.
6. To study microstructure of heat-treated steel.
7. To study thermo-setting of plastics.
8. To study the creep behavior of a given specimen.
9. To study the mechanism of chemical corrosion and its protection.
10. To study the properties of various types of plastics.
11. To study Bravais lattices with the help of models.
12. To study crystal structures and crystals imperfections using ball models.

AHL 208	NUMERICAL METHODS	L	T	P	Cr
		3	1	2	5

SECTION-A

UNIT-I

Errors In Numerical Calculations: Errors and their analysis, general error formula.

Interpolation And Curve Fitting: Taylor series and calculation of functions, Introduction to Interpolation, Lagrange interpolation, Newton interpolation, Chebyshev interpolation. Least square Line, curve fitting, interpolation by Spline functions.

UNIT-II

Solution of Non Linear Equations: Fixed –Point Method, Bisection Method, Secant Method, Newton- Raphson Method, and Muller’s Method.

UNIT-III

System Of Linear Equations: Direct Method, Gaussian Elimination Method and pivoting, Matrix inversion, UV factorization and Iterative methods for linear system.

SECTION-B

UNIT-IV

Numerical Differentiation And Integration: Numerical Differentiation using Newton’s interpolation Formula and Cubic Spline Method. Numerical integration using Newton-cote’s interpolation formula, Trapezoidal rule, Simpson’s rule 1/3 and 3/8 Rules, Weddle’s Rule, Gauss- Hermite and Gauss-Legendre Formula.

UNIT-V

Numerical Solution Of Ordinary Differential Equations: Introduction to differential equation, Initial value problems. Euler’s Method, Heun’s Method, Runge-Kutta Method, Taylor’s series Method, System of differential equations, boundary value problems and Finite difference Method.

UNIT-VI

Numerical Solution of Partial Differential Equation, Eigen Values and Eigen vector: Solution of hyperbolic, parabolic, and elliptic equations. The Eigen value problem .The power method, Jacobi’s method, Given Method and House Holder Method for Eigen value problems. Rutishauser method for general matrices.

Text Books:

1. Numerical Methods for Scientific and engineering computation by M.K.Jain, S.R.K.Iyengar and R.K.Jain (New Age International Publishers).
2. Introductory Methods of Numerical Analysis by S.S. Sastry (PHI Learning Pvt.Ltd.).

Reference Books:

1. Numerical Methods in Science and Engineering by B.S.Grewal.
2. Numerical Method by E.Balagurusamy.(TMH).
3. Numerical Methods for Mathematics, Science and Engineering by John H. Mathews(PHI).

MSL-500	MANAGEMENT CONCEPTS AND APPLICATIONS	L	T	P	Credit
		4	0	0	4

SECTION A

UNIT-I

Fundamentals of Management: Concept, Nature, Importance; Management: As an Art and Science, Management as a Profession, Management vs. Administration, Management Skills, Levels of Management, Characteristics of Quality Managers. Evolution of Management: Early contributions, Taylor and Scientific Management, Fayol's Administrative Management, Bureaucracy.

UNIT-II

Human Relations: Hawthorne Experiments and Human Relations, Social System Approach, Decision Theory Approach. Business Ethics and Social Responsibility, Professionalization of management in India

UNIT-III

Management Functions: Introduction to Functions of Management, Planning: Nature, Scope, Objectives, Significance, Types, Process, Barriers to Effective Planning, Planning Premises and Forecasting, Key to Planning, Decision Making.

SECTION B

UNIT-IV

Organizing: Concept, Forms of Organizational Structure; Departmentation, Span of Control, Delegation of Authority, Authority and Responsibility, Organizational Design.

UNIT-V

Decision making and Motivation: Concept, Basics of Motivation: Concept, Motivation and Performance, Theories of Motivation, Approaches for Improving Motivation, Pay and Job Performance, Quality of Work Life, Decision making ;Rationality in decision making ,models ,creativity in Decision making and Group Decision making. Manpower Planning, Job Design

UNIT-VI

Leadership: The Core of Leadership: Influence, Functions of Leaders, Leadership Style, And Leadership Development.

Controlling: Concept, Types of Control, ,Process ,Techniques, An Integrated Control System

Text Books:

- 1.C.B.Gupta ,Management Concepts and applications ,Sultan Chand
2. Robbins S.P. &Decenzo David A., Fundamentals of Management: Essential Concepts and Applications, Pearson Education.

Reference Books:

1. Hellreigel, Management, Thomson Learning, Bombay
2. Koontz, H and Wechrich, H; Management, Tata McGraw Hill
3. Stoner, J et. al, Management, New Delhi, PHI, New Delhi

Semester - V

S.No	Course Code	Course Title	Teaching Schedule			Total Hours	Credit
			L	T	P		
1	MEL 301	Dynamics of Machines	3	1	2	6	5
2	MEL 303	Machine Design – II	3	1	0	4	4
3	MEL 305	Measurement and Instrumentation	3	0	2	5	4
4	MEL 307	Fluid Machines	3	1	2	6	5
5	MEL 309	Manufacturing Technology	3	1	2	6	5
6	MEL 311	Industrial Engineering	3	0	0	3	3
7	MET 325	Practical Training – I	0	0	0	0	0
8	MEV 301	VAC-II	2	0	0	2	0
Total			20	4	8	32	26

MEL 301	DYNAMICS OF MACHINES	L T P 3 1 2
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SECTION-A

Unit-I

Static and Dynamic Force Analysis: Static force analysis of planer mechanisms, dynamic force analysis including inertia and frictional forces of planer mechanisms.

Dynamics of Reciprocating Engines: Engine types, Indicator diagrams, gas forces, equivalent masses, inertia forces, bearing loads in a single cylinder engine, crankshaft torque, engine shaking forces.

Unit-II

Balancing of Rotating Components: Static balance, dynamic balance, balancing of rotating masses, two plane balancing, graphical and analytical methods, balancing of rotors, balancing machines.

Unit-III

Balancing of Reciprocating Parts: Balancing of single cylinder engine, balancing of multi-cylinder inline engines, firing order.

SECTION-B

Unit-IV

Governors: Introduction, types of governors, characteristics of centrifugal governors, gravity controlled and spring controlled centrifugal governors, hunting of centrifugal governors, inertia governors.

Unit-V

Dynamometers: Types of dynamometers, Prony brake, rope brake and band brake dynamometers, belt transmission dynamometer, torsion dynamometer, hydraulic dynamometer.

Unit-VI

Gyroscope: Gyroscopes, gyroscopic forces and couples, gyroscopic stabilization, ship stabilization, stability of four wheel and two wheel vehicles moving on curved paths.

Text Books:

1. Theory of Machine: S.S. Rattan, McGraw Hill Education (India) Pvt Ltd.
2. Theory of machines: R.S.Khurmi & J.K.Gupta, Eurasia Publishing House

Reference Books:

1. Mechanism and Machine Theory: J.S. Rao and R.V. Dukupati, New age International.
2. Theory of Machines and Mechanisms: Joseph Edward Shigley and John Joseph Uicker, Jr. Mc. Graw Hill.
3. Theory of Mechanisms and Machines: Amitabha Ghosh and Ashok kumar Mallik, Third Edition Affiliated East-West Press.

MEL 303	MECHANICAL MACHINE DESIGN -II	L T P	Cr
		3 2 0	5

Section I

UNIT I

Variable stresses in machine parts fluctuating stresses, repeated and alternating stresses, endurance limit, stress concentration factor, Goodman and Soderberg's Criterion, Fatigue design using Miner's equation, Problems.

Unit II

Flywheel: turning Moment diagram, coefficient of fluctuation of energy and speed, design of flywheel – solid disk & rimmed flywheels.

UNIT III

Rolling Contact Bearing: Different types of anti friction bearings, load life relationship, static & dynamic load carrying capacity and its design.

Section II

UNIT IV

Sliding Contact Bearing: Types of sliding contact bearings, bearing characteristics number, bearing modulus for journal bearings, sommerfield number and Design.

UNIT V

Spur Gears: Tooth forms, System of gear teeth, contact ratio, Standard proportions of gear systems, Interference in involutes gears, Backlash, Selection of gear materials, Gear manufacturing methods, Design considerations, Beam strength of gear tooth, Dynamic tooth load, Wear strength of gear tooth, Failure of gear tooth, Design of spur gears, AGMA and Indian standards.

UNIT VI

Helical Gears: Terminology, Proportions for helical gears, Beam strength and wear strength of helical gears, herringbone gears, crossed helical gears, Design of helical gears.

Text Books:

1. Mechanical Engg. Design- R.S Khurmi S. Chand
2. Design of Machine Elements – V.B. Bhandari – Tata McGraw Hill, New Delhi.

Reference Books :

1. Mechanical Engg.: Design- Joseph Edward Shigley-Mc Graw Hill Book Co.
2. Mechanical Engg.: Design- Sadhu Singh.
3. Machine Design: S.G. Kulkarni, TMH , New Delhi.

The paper setter will be required to mention in the note of the question paper that the use of following Design Data book is permitted:

- (i) Design Data Handbook (In SI and Metric Units) for Mechanical Engineers by Mahadevan
- (ii) Design Data Book- PSG College of Technology,Coimbatore.

MEL-305	MEASUREMENT AND INSTRUMENTATION	L	T	P	Cr
		3	0	0	3

Objective: The objective of the course is to introduce the fundamentals of Instrumentation and Measurements, Providing an in-depth understanding of Measurement Errors, Pressure and flow measurements, motion, force and torque measurements, Indicating and Recording Elements.

THEORY:

Note: Question No 1 is compulsory and will be of short answer type from entire syllabus. Two questions are to be attempted out of three questions from each Section A & B.

SECTION – A

UNIT 1: Instrument and Measurement Errors:

Introduction, General block diagram of An Instrumentation system, Classification of Instruments, Static and Dynamic characteristics of Instruments: Accuracy, Precision, Resolution, Threshold, Sensitivity, Linearity, Hysteresis, Dead Band, Backlash, Drift.

Measurement Errors: Gross error, Systematic error, absolute error and relative error, limiting errors.

UNIT 2: Mathematical analysis of systems:

Formulation of Differential Equations for Dynamic Performance- Zero Order, First Order and second order systems, mathematical derivation of the response of First and Second Order Systems to Step, Ramp, Impulse and Harmonic Functions.

UNIT 3: Sensors & Transducer Elements:

Introduction of sensors, types of sensors & transducer, Electromechanical; Potentiometric, Inductive Self Generating and Non-Self Generating Types, Electromagnetic, Electrodynamics, Eddy Current, Magnetostrictive, Variable Inductance, LVDT, Variable Capacitance, PIEZO-Electric Transducer, Strain Gauge transducer & Bridge circuits, Temperature Compensation, Balancing and Calibration, Ionizations Transducers, Opto-Electrical Transducers, Photo Conductive Transducers, Photo Voltaic Transducers, Digital Transducers, Frequency Domain Transducer, Vibrating String Transducer, Binary codes, Digital Encoders.

SECTION – B

UNIT 4: Motion, Force and Torque Measurements:

Introduction, Relative motion Measuring Devices, Electromechanical, Optical, Photo Electric, Moire-Fringe, Pneumatic, Absolute Motion Devices, Seismic Devices, Spring Mass & Force Balance Type, Calibration, Hydraulic Load Cell, Pneumatic Load Cell, Elastic Force Devices, Separation of Force Components, Torque Transducer, and Toque Meter. Intermediate.

UNIT 5: Pressure and Flow Measurements:

Introduction to Pressure & Flow Measurement, Moderate Pressure Measurement, Monometers, Elastic Transducer, Dynamic Effects of Connecting Tubing, High Pressure Transducer, Low Pressure Measurement, Calibration and Testing, Quantity Meters, Positive Displacement Meters, Flow Rate Meters, Variable Head Meters, Variable Area Meters, Rotameters, Pitot-Static Tube Meter, Drag Force Flow Meter, Turbine Flow Meter, Electronic Flow Meter, Electro Magnetic Flow meter. Hot-Wire Anemometer.

UNIT 6: Temperature Measurements and Indicating and Recording Elements:

Temperature Measurement: Non Electrical Methods; Solid Rod Thermometer, Bimetallic Thermometer, Liquid-in-Glass thermometer, Pressure Thermometer. Electrical Methods; Electrical Resistance Thermometers, Semiconductor Resistance Sensors (Thermistors), Thermo-Electric Transducer (Thermocouple), Radiation Methods (Pyrometry), Total Radiation Pyrometer, Selective Radiation Pyrometer.

Indicating and Recording Elements: Introduction Amplifiers, Mechanical, Hydraulic, Pneumatic, Optical, Electrical Amplifying elements, Compensators. Differentiating and Integrating Elements

Text Books:

1. Measurement and Instrumentation in Engineering, Francis S. Tse and Ivan E. Morse, Marcel Dekker
2. Measurement System Application and Design. Ernest O. Doebelin, Tata McGraw Hill Edition (Fourth Edition) 2002.
3. A course in Electrical & Electronics Measurements & Instrumentation: A.K. Sawhney; Dhanpat Rai & Sons.

Reference Books:

1. Principles of Measurement Instrumentation: Alan S. Morris Prentice Hall of India.
2. Mechanical Measurements: T. G. Beckwith, W.L. Buck and R.D Marangoni Addison Wesley.
3. Instrumentation, measurement and analysis – B.C Nakra and K.K. Chaudhary, TMH.
4. Mechanical Measurements by D. S. Kumar, Kataria & Sons

MEL 307	FLUID MACHINERY	L T P 3 1 2
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SECTION-A

UNIT-I

Introduction:

Classification of Fluid Machines & Devices, Application of momentum and momentum equation to flow through hydraulic machinery, Euler's fundamental equation. 4

Impact of jet:

Introduction to hydrodynamic thrust of jet on a fixed and moving surface (flat & curve), Effect of inclination of jet with the surface. 3

UNIT-II

Hydraulic Turbines:

Classification of turbines, Impulse turbines, Constructional details, Velocity triangles, Power and efficiency calculations, Governing of Pelton wheel. 4

UNIT-III

Reaction Turbines:

Francis and Kaplan turbines, Constructional details, Velocity triangles, Power and efficiency calculations, Degree of reaction, Draft tube, Cavitation in turbines, Principles of similarity, Unit and specific speed, Performance characteristics, Selection of water turbines. 8

SECTION-B

UNIT-IV

Centrifugal Pumps:

Classifications of centrifugal pumps, Vector diagram, Work done by impellor, Efficiencies of centrifugal pumps, Specific speed, Model testing, Cavitation & separation and their control, Performance characteristics. 7

UNIT-V

Positive Displacement Pumps:

Reciprocating pump theory, Slip and coefficient of discharges, Indicator diagram, Effect and acceleration, Work saved by fitting air vessels, Comparison of centrifugal and reciprocating pumps, Positive rotary pumps, Gear and Vane pumps, Performance characteristics. 6

UNIT-VI

Other Machines:

Hydraulic accumulator, Special duty pumps, Intensifier, Hydraulic press, Lift and cranes, Theory of hydraulic coupling and torque converters, Performance characteristics. 5

Water Lifting Devices :

Hydraulic ram, Jet pumps, Air lift pumps. 3

BOOKS:

1. Hydraulic Machines by Jagdish Lal, Metropolitan book co. pvt ltd.
2. Hydraulic Machines: Theory & Design, V.P.Vasandhani, Khanna Pub.
3. Applied Hydraulics by Addison
4. Hydraulic Machines by R K Rajput, S.Chand & co Ltd.
5. Hydraulic Machines by D S Kumar

MEL-309	MANUFACTURING TECHNOLOGY	L	T	P	Cr
		3	1	0	4

SECTION-A

UNIT-I

Introduction to metal casting: Types of patterns, their materials and allowances. Moulding materials: Moulding sand compositions and moulding sand properties, types of moulds, cores core sands, types of cores, core Making, elements of gating system, Cupola and its operation charge calculations; types of furnaces.

UNIT-II

Casting processes: sand casting, shell mould casting, investment casting, permanent mould casting, full mould casting, and vacuum casting; Die casting; Centrifugal casting, continuous casting. Casting defects, their causes and remedies. Metallurgical considerations in casting, Solidification of metals and alloys, directional solidification, segregation, nucleation and grain growth, critical size of nucleus, Cleaning and finishing of castings, Testing and Inspecting of castings.

UNIT-III

Welding: Introduction and classification of welding processes, welding terminology, general principles, welding positions, filler metals. Gas welding and gas cutting, principle, oxyacetylene welding equipment . Electric arc welding. Principle, equipment, types- MIG, TIG submerged arc and others. Welding electrodes, classification and selection of electrodes, welding arc and its characteristics, arc stability, arc blow. Heat affected zone grain size and its control. Resistance welding- principle and their types i.e. spot, seam, projection Welding defects, their cases and remedies. Brazing, braze welding and soldering.

SECTION-B

UNIT-IV

Metal Forming Introduction: Classification of forming processes, Rolling: Classification of rolling processes, rolling mills, products of rolling and main variables, rolling defects, Drawing: Drawing of rods, wires and tubes, Draw benches, main variables in drawing operations. Forging : Open and closed die forging, forging operations, hammer forging, press forging and drop forging, forging defects, their causes and remedies. Extrusion: Classification of extrusion processes, extrusion equipment, variables in extrusion process.

UNIT-V

Sheet metal forming operations: Spinning, deep drawing, bending. Introduction to press working. Types of presses, press working operation, Press working tools. Introduction to powder metallurgy, methods of producing powders, briquetting and sintering, sizing and finishing operations.

UNIT-VI

Metal Cutting And Machine Tools: Cutting tool materials, high carbon steels, alloy carbon steels, high speed steel, cast alloys, cemented carbides, ceramics and diamonds, CBN etc. Geometry of single point cutting tools, Twist Drill and milling cutter, cutting speeds and feeds Coolants: Classification, purpose, its effect on speed and feed Lubricants: Function and properties Lathe: Machine and its accessories, Lathe operations, Turning, Taper Turning and Thread cutting, shaping and planing Machine, Drive Mechanisms, slotting machine, cutting speeds and feeds Milling machine and its classification, up milling and down milling . Drilling Operation Boring Operation and boring machines; Grinding: Cylindrical, surface and centreless grinding. Introduction to broaching machine

RECOMMENDED BOOKS:

1. Manufacturing Technology by Rao; Tata McGraw Hill Publishers, New Delhi.
2. Workshop Technology Vol. I, II, III by Chapman; Standard Publishers Distributors, New Delhi.
3. Production Technology by HMT; Tata McGraw Publishers, New Delhi.
4. Production Engineering and Science by Pandey and Singh; Standard Publishers Distributors, New Delhi.
5. Modern Machining Processes by Pandey; Tata McGraw Publishers, New Delhi.
6. A Text Book of Production Engineering by P.C. Sharma; S. Chand and Company Ltd., New Delhi.
7. Workshop Technology Vol-III, by R.P. Dhiman, Ishan Publications Jalandhar
8. Workshop Technology Vol-I, II, by B.S.Raghuwanshi.

MEL 311	INDUSTRIAL ENGINEERING	L	T	P	Cr
		3	0	0	3

SECTION-A

UNIT I

Basic Concepts of Industrial Engineering: Definition, Objectives, Method study, Principle of motion economy, Techniques of method study - Various charts, THERBLIGS, Work measurement - various methods, Time Study - PMTS, determining time, Work sampling, problems.

Unit II

Productivity, Workforce & Information Management: Productivity - Definition, Various methods of measurement, Factors effecting productivity, Strategies for improving productivity, Various methods of Job evaluation & merit rating, Various incentive payment schemes, Behavioral aspects, Financial incentives. Importance of MIS and role of MIS in decision making.

UNIT III

Manufacturing Cost Analysis: Fixed & variable costs, Direct, indirect & overhead costs, & Job costing, Recovery of overheads, Standard costing, Cost control, Break even Analysis, Marginal Costing & contribution Numerical Problems.

SECTION-B

UNIT IV

Materials Management : Strategic importance of materials in manufacturing industries, Relevant costs, Inventory control models - Economic order quantity (EOQ), Economic batch quantity (EBQ) with & without shortage, Purchase discounts, Sensitivity analysis, Inventory control systems - P,Q,Ss Systems, Service level, Stock out risk, determination of order point & safety stock, Selective inventory control - ABC, FSN, SDE, VED and three dimensional, Numerical.

UNIT V

Sales Forecasting: Importance, Objectives, Forecasting and Prediction, Types, Classification of Forecasting Methods, Forecast Errors, Costs and Accuracy of Forecasts, Numerical

UNIT VI

Production Planning & Control (PPC) : Objectives & variables of PPC, Aggregate planning - Basic Concept, its relations with other decision areas, Decision options - Basic & mixed strategies, Master production schedule (MPS), Scheduling Operations Various methods for line & intermittent production systems, Gantt chart, Sequencing - Johnson algorithm for n-Jobs-2 machines, n- Jobs-3 machines, 2 Jobs n-machines, n-Jobs m-machines Various means of measuring effectiveness of PPC, Introduction to JIT, Numerical Problems.

Text Books:

1. Industrial Engineering- O.P Khanna
2. Management Information Systems - Sadagopan, PHI New Delhi.

Reference Books:

1. Modern Production Management – S.S. Buffa, Pub.- John Wiley.
2. Operations Management - Schroeder, McGraw Hill ISE.
3. Operation Management - Monks, McGraw Hill ISE.
4. Production & Operations Management - Martinich, John Wiely SE.
5. Industrial & Systems Engineering - Turner, MIZE,CHASE, Prentice Hall Pub.
6. Industrial Engineering & Operations Management – SK Sharma, Pub-S. K. Kataria
7. Industrial Engineering – Ravi Shankar, Golgotha Pub.

MEL 307	FLUID MACHINES LAB	L	T	P	Cr
		0	0	2	1

Minimum 8 experiments from following:

1. Impact of Jet experiment.
2. Turbine experiment on Pelton wheel.
3. Turbine experiment on Francis turbine.
4. Turbine experiment on Kaplan turbine.
5. Experiment on Reciprocating pump.
6. Experiment on centrifugal pump.
7. Experiment on Hydraulic Jack/Press
8. Experiment on Hydraulic Brake
9. Experiment on Hydraulic Ram
10. Study through detailed visit of any water pumping station/plant
11. Any other suitable experiment/test rig such as comparison & performance of different types of pumps and turbines.
12. Experiment on Compressor
13. Experiment for measurement of drag and lift on aerofoil in wind tunnel.

MEP 301	DYNAMICS OF MACHINES LAB	L	T	P	Cr
		0	0	2	1

Note: Eight experiments out of the following are to be conducted:

1. Study of simple linkage models/mechanisms
2. Study of inversions of four bar linkage
3. Study of inversions of single/double slider crank mechanisms
4. Experiment on Gears tooth profile, interference etc.
5. Experiment on Gear trains
6. Experiment on longitudinal vibration
7. Experiment on transverse vibration
8. Experiments on dead weight type governor
9. Experiment on spring controlled governor
10. Experiment on critical speed of shaft
11. Experiment on gyroscope
12. Experiment on static/dynamic balancing
13. Experiment on Brake
14. Experiment on clutch

MEL-305	MEASUREMENT AND INSTRUMENTATION LAB	L	T	P	Cr
		0	0	2	1

Note: At least ten experiments are to be performed during the semester. At least eight experiments should be performed from the list of experiments. Two experiments may either be performed from the given list of experiments or may be designed by the concerned faculty in consultation with H.O.D as per the scope of syllabus.

List of Experiments:

1. To Study various Temperature Measuring Instruments and to Estimate their Response times.
 - (a) Mercury – in glass thermometer
 - (b) Thermocouple
 - (c) Electrical resistance thermometer
 - (d) Bio-metallic strip
2. To study the working of Bourdon Pressure Gauge and to check the calibration of the gauge in a dead-weight pressure gauge calibration set up.
3. To study a Linear Variable Differential Transformer (LVDT) and use it in a simple experimental set up to measure a small displacement.
4. To study the characteristics of a pneumatic displacement gauge.
5. To measure load (tensile/compressive) using load cell on a tutor.
6. To measure torque of a rotating shaft using torsion meter/strain gauge torque transducer.
7. To measure the speed of a motor shaft with the help of non-contact type pick-ups(magnetic or photoelectric).
8. To measure the stress & strain using strain gauges mounted on simply supported beam/cantilever beam.
9. To measure static/dynamic pressure of fluid in pipe/tube using pressure transducer/pressure cell.
10. To test experimental data for Normal Distribution using Chi Square test.
11. To learn the methodology of pictorial representation of experimental data and subsequent Calculations for obtaining various measures of true value and the precision of measurement using Data acquisition system / calculator.
12. Vibration measurement by Dual Trace Digital storage Oscilloscope.
13. To find out transmission losses by a given transmission line by applying capacitive /inductive load.
14. Process Simulator.

MEL-309	MANUFACTURING TECHNOLOGY-LAB	L	T	P	Cr
		0	0	2	1

Foundry Lab

1. Making a green sand mould
 - a) One mould using split pattern
 - b) At least two for different type of components with core and without core to be made
2. Study of simple destructive & non-destructive testing procedures used for castings
3. Visit to foundry – study of automation processes, Layout, Material handling equipment & other processes with preparation of report

Welding Lab

4. Preparation of specimen & welding using Arc Welding the following:
 - a) Angle joint / T joint
 - b) Lap joint / Butt joint
5. Study the influence of welding parameters in Arc welding.
6. To perform horizontal & vertical welding using Arc welding.

Forging & Sheet Metal Lab

7. Basic experiment on forging – preparation of at least two models in smithy shop
8. Experiment on sheet metal development: (any two of following)
Tray, funnel, truncated cone, pyramid
9. Study/Visit of the extrusion and drawing process industry

Machining Lab

10. Study of divided head and generation of gear profile on milling machine.
11. Perform thread cutting operation.
12. To perform taper turning by different method on lathe machine.
13. Perform boring & facing operations.
14. To perform cylindrical & surface grinding operation.

Note: Perform at least 10 experiments

Semester - VI (Mechanical Engineering)

S.No	Course Code	Course Title	Teaching Schedule			Total Hours	Credit
			L	T	P		
1	MEL 302	Internal Combustion Engine	3	0	2	5	4
2	MEL 304	Manufacturing Technology-II	3	0	2	5	4
3	MEL 306	Heat Transfer	3	1	2	6	5
4	MEL 308	Steam Power Generation	3	1	2	6	5
5	MEL 310	Metrology & Control	3	1	0	4	4
6	MEL 312	CNC Machine and Automation	3	1	0	4	4
7	MEV 302	VAC -III	0	0	2	2	0
Total			18	4	10	32	26

MEL 302	INTERNAL COMBUSTION ENGINE	L T P 3 0 2
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Unit-I

Introduction to I.C Engines: Engine classification, Air standard cycles, Otto cycle, Diesel cycle, Dual cycle, Comparison of Otto, Diesel and Dual cycles, Stirling cycle, Ericsson cycles, Actual cycle analysis, Two and four stroke engines, SI and CI engines, Valve timing diagram, Rotary engines, stratified charge engine. 7

Unit- II

Fuels: Fuels for SI and CI engine , Important qualities of SI and CI engine fuels, Rating of SI engine and CI engine fuels, Dopes, Additives, Gaseous fuels, LPG, CNG, Biogas, Producer gas, Alternative fuels for IC engines. 2

Unit-III

Testing and Performance: Performance parameters, Basic measurements, Blow by measurement, Testing of SI and CI engines. 2

SI Engines:

Combustion in SI engine, Flame speed, Ignition delay, Abnormal combustion and it's control, combustion chamber design for SI engines. 2

Carburetion, Mixture requirements, Carburetor types, Theory of carburetor, MPFI. 2

Ignition system requirements, Magneto and battery ignition systems, ignition timing and spark plug, Electronic ignition. 2

Unit-IV

CI Engine:

Combustion in CI engines, Ignition delay, Knock and it's control, Combustion chamber design of CI engines. 2

Fuel injection in CI engines, Requirements, Types of injection systems, Fuel pumps, Fuel injectors, Injection timings. 2

Scavenging in 2 Stroke engines, pollution and it's control. 2

Unit-V

Engine Cooling: Different cooling systems, Radiators and cooling fans. 3

Lubrication: Engine friction, Lubrication principle, Type of lubrication, Lubrication oils, Crankcase ventilation. 3

Unit-VI

Supercharging: Effect of altitude on power output, Types of supercharging 2

Compressors:

Classification, Reciprocating compressors, Single and Multi stage compressors, Intercooling, Volumetric efficiency. 2

Rotary compressors, Classification, Centrifugal compressor , Axial compressors, Surging and stalling, Roots blower, Vaned compressor. 4

BOOKS:

1. I.C Engine, by Ganeshan, Tata Mc Graw Hill Publishers.
2. I.C Engine, by R. Yadav, Central Publishing House, Allahabad
3. A Course in International Combustion Engines, by Mathur & Sharma, Dhanpat Rai & Sons.
4. Fundamentals of Internal Combustion Engine by Gill, Smith,Ziurs, Oxford & IBH Publishing CO.

MEL 304	MANUFACTURING TECHNOLOGY-II	L T P 3 1 2
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Unit-I

Metal Cutting and Machine Tools

Metal Cutting-

Mechanics of metal cutting. Geometry of tool and nomenclature .ASA system Orthogonal vs. oblique cutting. Mechanics of chip formation, types of chips. Shear angle relationship. Merchant's force circle diagram. Cutting forces, power required. Cutting fluids/lubricants. Tool materials. Tool wear and tool life. Machinability. Dynamometer. Brief introduction to machine tool vibration and surface finish. Economics of metal cutting. 7

Unit-II

Machine Tools

- (i) Lathe : Principle, construction, types, operations, Turret/capstan, semi/Automatic, Tool layout. 2
- (ii) Shaper, slotter, planer : Construction, operations & drives. 1
- (iii) Milling : Construction, Milling cutters, up & down milling. Dividing head & indexing. Max chip thickness & power required. 2
- (iv) Drilling and boring : Drilling, boring, reaming tools. Geometry of twist drills. 2

Unit-III

Grinding & Super finishing

- (v) Grinding : Grinding wheels, abrasive & bonds, cutting action. Grinding wheel specification. Grinding wheel wear - attritions wear, fracture wear. Dressing and Truing. Max chip thickness and Guest criteria. Surface and Cylindrical grinding. Centerless grinding. 5
- (vi) Super finishing : Honing, lapping, polishing. 2

Unit-IV

Standardization & Interchangeability, Limits, Fits & Tolerance and Surfaceroughness:

Introduction to Standardization & Interchangeability Limits, Fits, Tolerances and IS standards, Limit-gauges, and surface-roughness. 5

Unit-V

Metal Joining (Welding)

Survey of welding and allied processes. Gas welding and cutting, process and equipment. Arc welding : Power sources and consumables. TIG & MIG processes and their parameters. Resistance welding - spot, seam projection etc. Other welding processes such as atomic hydrogen, submerged arc, electroslag, friction welding. Soldering & Brazing . 6

Thermodynamic and Metallurgical aspects in welding and weld,. Shrinkage/residual stress in welds. Distortions & Defects in welds and remedies. Weld decay in HAZ. 2

Unit-VI

Introduction to Un-conventional Machining and Welding

Need & benefits, application and working principle of EDM, ECM, LBM, EBM, USM. AJM, WJM. Similarly, non-conventional welding applications such as LBW, USW, EBW, Plasma-arc welding, Diffusion welding, Explosive welding/cladding. 6

Books

1. Manufacturing science by Ghosh and Mallik
2. Production Technology by R.K. Jain
3. Production Engineering Science by P.C. Pandey
4. Fundamentals of Metal Cutting and Machine tools by Boothroyd
5. Production Technology - H.M.T.
6. Modern Machining Processes by P.C. Pandey & H.S. Shan

MEL 306	HEAT TRANSFER	L T P 3 1 2
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UNIT-I

Introduction to Heat Transfer:

Concepts of the mechanisms of heat flows; Conduction, convection and radiation; Effect of temperature on thermal conductivity of materials; Introduction to combined heat transfer mechanism.

2

Conduction :

One-dimensional general differential heat conduction equation in the rectangular, cylindrical and spherical coordinate systems; Initial and boundary conditions.

3

Steady State one-dimensional Heat conduction :

Composite Systems in rectangular, cylindrical and spherical coordinates with and without energy generation; Thermal resistance concept; Analogy between heat and electricity flow; Thermal contact resistance; Critical thickness of insulation.

3

UNIT-II

Fins:

Heat transfer from extended surfaces, Fins of uniform cross-sectional area; Errors of measurement of temperature in thermometer wells.

3

Transient Conduction:

Transient heat conduction; Lumped capacitance method; Time constant; Unsteady state heat conduction in one dimension only, Heisler charts.

4

UNIT-III

Forced Convection:

Basic concepts; Hydrodynamic boundary layer; Thermal boundary layer; Approximate integral boundary layer analysis; Analogy between momentum and heat transfer in turbulent flow over a flat surface; Mixed boundary layer; Flow over a flat plate; Flow across a single cylinder and a sphere; Flow inside ducts; Empirical heat transfer relations; Relation between fluid friction and heat transfer; Liquid metal heat transfer.

4

Natural Convection :

Physical mechanism of natural convection; Buoyant force; Empirical heat transfer relations for natural convection over vertical planes and cylinders, horizontal plates and cylinders, and sphere ; Combined free and forced convection.

3

UNIT-IV

Thermal Radiation :

Basic radiation concepts; Radiation properties of surfaces; Black body radiation Planck's law, Wein's displacement law, Stefan Boltzmann law, Kirchoff's law; ; Gray body; Shape factor; Black-body radiation; Radiation exchange between diffuse non black bodies in an enclosure; Radiation shields; Radiation combined with conduction and convection; Absorption and emission in gaseous medium; Solar radiation; Green house effect.

8

Unit-V

Heat Exchanger :

Types of heat exchangers; Fouling factors; Overall heat transfer coefficient; Logarithmic mean temperature difference (LMTD) method; Effectiveness-NTU method; Compact heat exchangers.

3

Unit-VI

Condensation And Boiling :

Introduction to condensation phenomena; Heat transfer relations for laminar film condensation on vertical surfaces and on outside & inside of a horizontal tube; Effect of non-condensable gases;

Dropwise condensation; Heat pipes; Boiling modes, pool boiling; Hysteresis in boiling curve; Forced convective boiling. 3

Introduction To Mass Transfer :

Introduction; Fick's law of diffusion; Steady state equimolar counter diffusion; Steady state diffusion through a stagnant gas film. 2

Books:

1. Heat and Mass Transfer by Dr. D S Kumar Kataria and sons.
2. Heat Transfer By J.P. Holman, McGraw-Hill International edition.
3. Heat and Mass Transfer by R C Sachdeva
4. Heat and Mass Transfer by R K Rajput
5. Heat Transfer, by Vijay Gupta, New Age International (P) Ltd. Publishers
6. Heat Transfer, by Y.V.C. Rao, University Press.
7. Heat Transfer, by R. Yadav, Central Publishing House, Allahabad.

MEL 308	STEAM POWER GENERATION	L T P 3 1 2
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Unit-I

Thermodynamic relations: Mathematical conditions for exact differentials. Maxwell Relations, Clapeyron Equation, Joule-Thompson coefficient and Inversion curve. Coefficient of volume expansion, Adiabatic & Isothermal compressibility. 3

Fuels and Combustion: Combustion analysis, Heating Values, Air requirement, Air/Fuel ratio, Standard heat of Reaction and effect of temperature on standard heat of reaction, heat of formation, Adiabatic flame temperature. 4

Unit-II

Boilers: Steam generators-classifications. Working of fire-tube and water-tube boilers, boiler mountings & accessories, Draught & its calculations, air pre heater, feed water heater, super heater. Boiler efficiency, Equivalent evaporation. Boiler trial and heat balance. 6

Unit-III

Condenser: Classification of condenser, Air leakage, Condenser performance parameters 2

Steam Engines: Rankine and modified Rankine cycles, Working of steam engine, Classification of steam engines, Indicator diagram, Saturation curve, Missing quantity, Heat balance. 3

Unit-IV

Steam & Gas Nozzles: Flow through nozzle, Variation of velocity, Area and specific volume, Choked flow, Throat area, Nozzle efficiency, Off design operation of nozzle, Effect of friction on nozzle, Super saturated flow. 4

Vapour Power cycles: Carnot vapour power cycle, Effect of pressure & temperature on Rankine cycle, Reheat cycle, Regenerative cycle, Feed water heaters, Binary vapour cycle, Combined cycles, Cogeneration. 3

Unit-V

Steam Turbines : Classification of steam turbine, Impulse and reaction turbines, Staging, Stage and overall efficiency, Reheat factor, Bleeding, Velocity diagram of simple & compound multistage impulse & reaction turbines & related calculations work done efficiencies of reaction, Impulse reaction Turbines, state point locus, Comparison with steam engines, Losses in steam turbines, Governing of turbines. 4

Unit-VI

Gas Turbine: Gas turbine classification Brayton cycle, Principles of gas turbine, Gas turbine cycles with intercooling, reheat and regeneration and their combinations, Stage efficiency, Polytropic efficiency. Deviation of actual cycles from ideal cycles. 4

Jet Propulsion: Introduction to the principles of jet propulsion, Turbojet and turboprop engines & their processes, Principle of rocket propulsion, Introduction to Rocket Engine. 3

Books:

1. Basic and Applied Thermodynamics by P.K. Nag, Tata Mc Graw Hill Pub.
2. Applied thermodynamics by Onkar Singh, New Age International (P) Publishers Ltd.
3. Applied thermodynamics by Dr D S Kumar, Kataria and Sons
4. Thermal Engg. By P.L. Ballaney, Khanna Publisher
5. Theory of Steam Turbine by W.J. Kearton
6. Steam & Gas Turbine by R.Yadav, CPH Allahabad
7. Thermal Engg. By R.K. Rajput, Laxmi Publication

MEL 310	METROLOGY & CONTROL	L T P 3 1 0
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Unit-I:

Metrology

Metrology and Inspection :

Standards of linear measurement, line and end standards. Limit fits and tolerances. Interchangeability and standardisation. 2

Linear and angular measurements devices and systems Comparators: Sigma, Johansson's Microkrator. 2

Limit gauges classification, Taylor's Principle of Gauge Design. 1

Unit-II

Measurement of geometric forms like straightness, flatness, roundness. 2

Tool makers microscope, profile project autocollimator. 1

Interferometry: principle and use of interferometry, optical flat. 2

Measurement of screw threads and gears. 1

Surface texture: quantitative evaluation of surface roughness and its measurement. 1

UNIT III:

Measurement and Inspection: Dimensional inspection – Tolerance, Limit gauging, comparators, Surface roughness, Feature inspection. 2

Modeling of Mechanical System: linear mechanical elements, force-voltage and force current analogy, electrical analog of simple mechanical systems; concept of transfer function & its determination for simple systems. 4

UNIT IV:

Control System: Open loop & closed loop controls, servo mechanisms; concept of various types of system. 2

Signals: Unit step, unit ramp, unit impulse and periodic signals with their mathematical representation and characteristics. 1

Time Response Analysis: Time response of a standard second order system and response specifications, steady state errors and error constants. 2

UNIT V

Stability: Concept and types of stability, Routh Hurwitz Criterion and its application for determination of stability, limitations; Polar plot, Nyquist stability Criterion and assessment of stability. 6

UNIT VI:

Root Locus Techniques: Concept of root locus, construction of root loci.

Frequency Response Analysis: Correlation between time and frequency responses of a second order system; Bode plot, gain margin and phase margin and their determination from Bode and Polar plots. 4

1

Text Book:

1. Control System Engineering, by I.J.Nagrath & M. Gopal, New Age International Publisher
2. Jain, R.K., "Engineering Metrology" Khanna Publishers
3. Kumar D.S., "Mechanical Measurements and Control", Metropolitan, N. Delhi.
4. Hume K.J., "Engineering Metrology", MacDonald and Co. 1963
5. Gupta, I.C., "Engineering Metrology", Dhanpat Rai & Sons, New Delhi, 1994
6. Sirohi, "Mechanical Measurement" New Age Publishers
7. K. Ogata, "Modern Control Engineering" Prentice Hall of India.
8. B.C. Kuo, "Automatic Control systems." Wiley India Ltd.

MEL 312	CNC MACHINE AND AUTOMATION	L T P 3 1 0
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UNIT-I

Automation

Introduction to CAM; Automated Manufacturing system; Need of automation, Basic elements of automation, Levels of automation, Automation Principles & Strategies, Advantages & disadvantages of automation. Introduction to manufacturing system, component & classification. **4**

Features of NC Machines-

Fundamental of Numerical Control, elements of NC machine tools, classification of NC machine tools, Advantages, suitability and limitations of NC machine tools, Application of NC system. **3**

UNIT-II

NC Part Programming-

(a) Manual (word address format) programming. Examples Drilling, Turning and Milling; Canned cycles, Subroutine, and Macro. **5**

(b) APT programming. Geometry, Motion and Additional statements, Macro- statement. **4**

UNIT-III

System Devices

Introduction to DC motors, stepping motors, feedback devices such as encoder, counting devices, digital to analog converter and vice versa. **3**

Interpolators

Interpolator- Linear, Circular & Parabolic **4**

UNIT- IV

Control of NC Systems

Open and closed loops. Control of point to point systems- Incremental open loop control, Incremental close loop, Absolute close loop; Control loop in contouring systems; Adaptive control. **3**

UNIT-V

Computer Integrated Manufacturing system

Group Technology, Flexible Manufacturing System, CIM, CAD/CAM, Computer aided process planning-Retrieval and Generative, Computer aided Inspection. **6**

UNIT-VI

Robotics

Types and generations of Robots, Structure and operation of Robot, Robot applications. Economics, Robot programming methods. VAL and AML with examples. **6**

Intelligent Manufacturing

Introduction to Artificial Intelligence for Intelligent manufacturing. **2**

Books/References-

1. Automation, Production Systems and Computer Integrated Manufacturing by Mikell P. Groover
2. Computer Aided Manufacturing by Kundra and Rao
3. Computer control of Manufacturing systems by Koren
4. NC Machine Tools by S.J. Martin.
5. NC Machines by Koren
6. CAD/CAM by Groover

MEV 302	VAC –III	L T P 0 0 2
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Unit-I

Two experiments on Thermal Engineering

Unit-II

Two Experiments on Manufacturing Science and Material Science.

Unit-III

Two Experiment on Machine design and SOM

Unit-IV

Two Experiments on KOM and DOM

Unit-V

Project on above experiment.

Unit-VI

Project writing and presentation on allotted project by experienced faculty member.

MEL 302	INTERNAL COMBUSTION ENGINE LAB	L T P
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1. Performance Analysis of Four stroke S.I. Engine- Determination of indicated and brake thermal efficiency, specific fuel consumption at different loads, Energy Balance.
2. Determination of Indicated H.P. of I.C. Engine by Morse Test.
3. Performance Analysis of Four stroke C.I. Engine- Determination of indicated and brake thermal efficiency, specific fuel consumption at different loads, Energy Balance.
4. Study & experiment on Valve mechanism.
5. Study & experiment on Gear Box.
6. Study & experiment on Differential Gear Mechanism of Rear Axle.
7. Study & experiment on Steering Mechanism.
8. Study & experiment on Automobile Braking System.
9. Study & experiment on Chassis and Suspension System.
10. Study & experiment on Ignition system of I.C. Engine.
11. Study & experiment on Fuel Supply System of S.I. Engines- Carburetor, Fuel Injection Pump and MPFI.
12. Study & experiment on Fuel Supply System of C.I. Engines- Injector & Fuel Pump.
13. Study & experiment on Air Conditioning System of an Automobile.
14. Comparative study of technical specifications of common small cars (such as Maruti Swift, Hyundai i20, Cheverlet Aveo, Tata Indica, Ford Fusion etc.
15. Comparative study & technical features of common scooters & motorcycles available in India.
16. Visit of an Automobile factory.
17. Visit to a Modern Automobile Workshop.
18. Experiment on Engine Tuning.
19. Experiment on Exhaust Gas Analysis of an I.C. Engine.

MEL 304	MANUFACTURING SCIENCE LAB	L T P 0 0 2
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1. Shear-angle determination (using formula) with tube cutting (for orthogonal) on lathe machine.
2. Bolt (thread) making on Lathe machine
3. Tool grinding (to provide tool angles) on tool-grinder machine.
4. Gear cutting on Milling machine.
5. Machining a block on shaper machine.
6. Finishing of a surface on surface-grinding machine.
7. Drilling holes on drilling machine and study of twist-drill.
8. Study of different types of tools and its angles & materials.
9. Experiment on tool wear and tool life.
10. Experiment on jigs/Fixtures and its uses
11. Gas welding experiment
12. Arc welding experiment
13. Resistance welding experiment.
14. Soldering & Brazing experiment
15. Experiment on unconventional machining.
16. Experiment on unconventional welding.
17. Experiment on TIG/MIG Welding.
18. Macro and Microstructure of welding joints, HAZ.

MEL 306	HEAT TRANSFER LAB	L T P 0 0 2
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Minimum 10 experiment of the following

1. Conduction - Composite wall experiment
2. Conduction - Composite cylinder experiment
3. Convection - Pool Boiling experiment
4. Convection - Experiment on heat transfer from tube-natural convection.
5. Convection - Heat Pipe experiment.
6. Convection - Heat transfer through fin-natural convection .
7. Convection - Heat transfer through tube/fin-forced convection.
8. Any experiment on Stefan's Law, on radiation determination of emissivity, etc.
9. Any experiment on solar collector, etc.
10. Heat exchanger - Parallel flow experiment
11. Heat exchanger - Counter flow experiment
12. Any other suitable experiment on critical insulation thickness.
13. Conduction - Determination of thermal conductivity of fluids.
14. Conduction - Thermal Contact Resistance Effect.

MEL 308	STEAM POWER GENERATION LAB	L T P 0 0 2
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1. Study of Fire Tube boiler
2. Study of Water Tube boiler
3. Study and working of Two stroke petrol Engine
4. Study and working of Four stroke petrol Engine
5. Determination of Indicated H.P. of I.C. Engine by Morse Test
6. Prepare the heat balance for Diesel Engine test rig
7. Prepare the heat balance sheet for Petrol Engine test rig
8. Study and working of two stroke Diesel Engine
9. Study and working of four stroke Diesel Engine.
10. Study of Velocity compounded steam turbine
11. Study of Pressure compounded steam turbine
12. Study of Impulse & Reaction turbine
13. Study of steam Engine model.
14. Study of Gas Turbine Model
15. Any other suitable experiment on thermodynamics