



**List of Courses Focus on Employability/ Entrepreneurship/
Skill Development**

Department : Mechanical Engineering

Programme Name : B.Tech.

Academic Year : 2016-17

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	ME3TES08	Material Science & Metallurgy
02.	ME3TPC01	Kinematics of Machine
03.	ME3TPC02	Applied Thermodynamics
04.	ME4TPC03	Fluid Mechanics
05.	ME4TPC04	Manufacturing Science-I
06.	ME4TPC06	Machine Drawing
07.	ME-352	Mechanics of Solid-II
08.	ME-354	I.C.Engine
09.	ME-355	Fluid Machinery
10.	ME-361	Dynamics of Machine
11.	ME-362	Machine Design-II
12.	ME-363	Heat & Mass Transfer
13.	ME-364	Manufacturing Science
14.	ME-471	Refrigeration & Air Conditioning
15.	ME - 473	Theory of Vibration
16.	ME - 475 B	Finite Element Method
17.	ME-481	Power Plant Engineering
18.	ME-482	Operation Research
19.	ME-483	Automobile Engineering
20.	ME - 485 C	Machine Tool Design
21.	ME - 485 D	Robotics

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Scheme and Syllabus



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DEPARTMENT OF MECHANICAL ENGINEERING

STUDY & EVALUATION SCHEME

W.E.F. SESSION 2016-2017

Year: B.Tech. II year

SEMESTER-III

S. No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	ME3THS03	Elective from Humanity Science	3	0	0	40	60	100	3
2.	ME3TBS05	Statistical Methods	3	1	0	40	60	100	4
✓	ME3TES07	Mechanics of Solid-I	3	1	0	40	60	100	4
✓	ME3TES08	Material Science & Metallurgy	3	0	0	40	60	100	3
✓	ME3TPC01	Kinematics of Machine	3	0	0	40	60	100	3
✓	ME3TPC02	Applied Thermodynamics	3	0	0	40	60	100	3
Total			18	02	0	240	360	600	20
PRACTICALS									
1.	ME3LPC01	Kinematics of Machine Lab	-	-	03	45	30	75	2
2.	ME3LES07	Mechanics of Solid-I Lab	-	-	03	45	30	75	2
Total					06	90	60	150	04

Total Credits: 24

Total Contact Hour: 26

Total Marks: 750

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W.E.F. SESSION 2016-2017

Year: B.Tech. II year

SEMESTER-IV

S. No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	ME4TPE01	Professional Elective	3	0	0	40	60	100	3
✓	ME4TPC03	Fluid Mechanics	3	0	0	40	60	100	3
✓	ME4TPC04	Manufacturing Science-I	3	0	0	40	60	100	3
4	ME4TPC05	Electrical Machine	3	1	0	40	60	100	4
✓	ME4TPC06	Machine Drawing	3	0	0	40	60	100	3
6	ME4TBS06	Numerical Analysis & Computer Programming	3	1	0	40	60	100	4
Total			18	02		240	360	600	20
PRACTICALS									
7.	ME4LPC03	Fluid Mechanics	-	-	03	45	30	75	2
8.	ME4LPC05	Electrical Machine	-	-	03	45	30	75	2
Total					06	90	60	150	04

Total Credits: 24

Total Contact Hour: 26

Total Marks: 750

*INTERNAL ASSESSMENT- One Class Test of 10 Marks, Mid Semester Examination of 20 Marks, Teacher Assessment(Attendance/Assignment)of 10 Marks L-LECTURE, T-TUTORIAL, P-PRACTICAL,CT-CLASS TEST, E.S.E -END SEMESTER EXAMINATION.

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W.E.F. SESSION 2015-2016

Year: B.Tech. III year

SEMESTER-V

S. No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1. ✓	ME-351	Machine Design-I	3	1	-	40	60	100	4
2. ✓	ME-352	Mechanics of Solid-II	3	1	-	40	60	100	4
3.	ME-353	Industrial Engineering	3	1	-	40	60	100	4
4. ✓	ME-354	I.C.Engine	3	1	-	40	60	100	4
5. ✓	ME-355	Fluid Machinery	3	1	-	40	60	100	4
Total			15	05		200	300	500	20
PRACTICALS									
6.	ME-356	Fluid Mechanics	-	-	3	30	20	50	2
7.	ME-357	I.C.Engine	-	-	3	30	20	50	2
8.	MIE-358	Seminar	-	-	3	50	-	50	2
Total					9	110	40	150	6

Total Credits: 26

Total Contact Hour: 29 Total Marks: 650

*INTERNAL ASSESSMENT-(MSE- Mid Semester Examination of 20 Marks, Two Class Test/Assignment/Quizzes/Group Discussion etc.)

L-LECTURE, T-TUTORIAL, P-PRACTICAL, CT-CLASS TEST, E.S.E -END SEMESTER EXAMINATION.

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W.E.F. SESSION 2015-2016

Year: B.Tech. III year
SEMESTER-VI

S. No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
✓ 1.	ME-361	Dynamics of Machine	3	1	-	40	60	100	4
✓ 2.	ME-362	Machine Design-II	3	1	-	40	60	100	4
✓ 3.	ME-363	Heat & Mass Transfer	3	1	-	40	60	100	4
✓ 4.	ME-364	Manufacturing Science	4	-	-	40	60	100	4
5.	ME-365	Measurement Metrology & Control	4	-	-	40	60	100	4
Total			17	03		200	300	500	20
PRACTICALS									
6.	ME-366	Dynamics of Machine Lab	-	-	5	45	30	75	3
7.	ME-367	Heat & Mass Transfer Lab	-	-	5	45	30	75	3
Total					10	90	60	150	6

Total Credits: 26

Total Contact Hour: 30

Total Marks: 650

*INTERNAL ASSESSMENT-(MSE- Mid Semester Examination of 20 Marks, Two Class Test/Assignment/Quizzes/Group Discussion etc.)

L-LECTURE, T-TUTORIAL, P-PRACTICAL, CT-CLASS TEST, E.S.E -END SEMESTER EXAMINATION.

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STUDY & EVALUATION SCHEME

W.E.F. SESSION 2015-2016

Year: B.Tech. IV year

SEMESTER- VII

S. No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
✓ 1.	ME-471	Refrigeration & Air Conditioning	3	1	-	40	60	100	4
2.	ME-472	Turbo Machinery	3	1	-	40	60	100	4
✓ 3.	ME - 473	Theory of Vibration	3	1	-	40	60	100	4
4.	ME-474	Computer Aided Design & Manufacturing (CAD/CAM)	4	-	-	40	60	100	4
5.	ME-475	Elective-I*	3	1	-	40	60	100	4
Total			16	04		200	300	500	20
PRACTICALS									
6.	ME-476	Refrigeration & Air Conditioning Lab	-	-	3	30	20	50	2
7.	ME-477	Project	-	-	4	50	-	50	2
8.	ME-478	Seminar on Summer Training (About 30 Days)**	-	-	3	50	-	50	2
Total					10	130	20	150	6

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Year: B.Tech. IV year

SEMESTER- VIII

S. No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
✓ 1.	ME-481	Power Plant Engineering	3	1	-	40	60	100	4
✓ 2.	ME-482	Operation Research	3	1	-	40	60	100	4
✓ 3.	ME-483	Auto Mobile Engineering	4	-	-	40	60	100	4
4.	ME-484	Elective-II*	3	1	-	40	60	100	4
Total			13	03		160	240	400	16
PRACTICALS									
6.	ME-486	Project	-	-	12	120	80	200	8
7.	ME-487	Comprehensive Viva	-	-	-	-	50	50	2
Total						120	130	250	6

Elective - II*	
ME - 485 A	Total Quality Management
ME - 485 B	Enterprise Resource Planning
ME - 485 C	Machine Tool Design
ME - 485 D	Robotics

Total Credits: 26

Total Contact Hour: 28

Total Marks: 650

INTERNAL ASSESSMENT- (MSE- Mid Semester Examination of 20 Marks, Two Class Test/Assignment /Quizzes/Group Discussion etc.)

L-LECTURE, T-TUTORIAL, P-PRACTICAL, CT-CLASS TEST, E.S.E – END SEMESTER EXAMINATION

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✓ ME3TPC01 - KINEMATICS OF MACHINES

✓ UNIT-1 Mechanism and Machines

Links, kinematics pair, classification of kinematics pair, kinematics chain, degree of freedom & constrained motion, mechanism, inversion problem of slider crank mechanism & its inversion, four bar chain etc, equivalent linkage, mechanism with lower pairs, pantograph.

✓ UNIT-2 Velocity and Acceleration in Mechanism

Plane motion, absolute and relative motion, velocity and acceleration of a point velocity and acceleration of a mechanism by relative velocity diagram, klein's construction, and coriolis components.

✓ UNIT-3 Gear and Gear Train

Classification of gears, spur, helical, bevel, worm gears, spur gear, conjugate action, law of gearing, involutes and cycloidal tooth's profiles, interference and under cutting, contact ratio, gear train, simple, compound and epicyclical gear trains.

✓ UNIT-4 Cams and Followers

Classification of cam and followers, types of follower motion uniform simple, harmonic parabolic, cycloid, Cams profile by graphical method.

✓ UNIT - V

Clutch: single plate and multi plate clutch, cone clutch

Brakes: Analysis & simple brakes assuming uniform pressure and uniform wear, band brake, block brake, internal shoe brake.

Text books:

1. Mechanism of machines By Ghosh and Mallick East West Press
2. Theory of machine By S. Ratan TMGH
3. Theory of Machine By Thomas Beven, C.B.S. Publications

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ME4T PE11-BUSINESS COMMUNICATION AND PRESENTATION SKILL (Elective)

Unit I

Business communication covering, Role of communication in information age; concept and meaning of communication; skills necessary for technical communication; Communications in a technical organization; Barriers to the process of communication and so on

Unit II

Style and organization in technical communication covering, Listening, speaking, reading and writing as skills; Objectivity, clarity, precision as defining features of technical communication; Various types of business writing: Letters, reports, notes, memos; Language and format of various types of business letters; Language and style of reports; Report writing strategies; Analysis of a sample report

Unit III

Communication and personality development covering, Psychological aspects of communication, cognition as a part of communication; Emotional Intelligence; Politeness and Etiquette in communication; Cultural factors that influence communication; Mannerisms to be avoided in communication; Language and persuasion; Language and conflict resolution;

Unit IV

Language Laboratory emphasizing Listening and comprehension skills; Reading Skills; Sound Structure of English and intonation patterns;

Unit V

Oral Presentation and professional speaking covering, Basics of English pronunciation; Elements of effective presentation; Body Language and use of voice during presentation; Connecting with the audience during presentation; Projecting a positive image while speaking; Planning and preparing a model presentation; Organizing the presentation to suit the audience and context; Basics of public speaking; Preparing for a speech;

Text books:

1. Fred Luthans, Organizational Behaviour, McGraw Hill
2. Lesikar and petit, Report writing for Business
3. M. Ashraf Rizvi, Effective Technical Communication, McGraw Hill
4. Wallace and masters, Personal Development for Life and Work, Thomson Learning

Reference books :

1. Farhathullah, T. M. Communication skills for Technical Students
2. Michael Muckian, John Woods, The Business letters Handbook
3. Herta A. Murphy, Effective Business Communication
4. MLA Handbook for Writers of Research Papers

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✓ME3TES07-MECHANICS OF SOLIDS-I

✓UNIT-I

State of stress and strain at a point; Engineering stress and strain. Two dimensional and one dimensional state of stress as a particular case of three dimensional stress system, Members under axial compression and tension, temperature stresses in composite members, Principal stresses and Principal planes for Two dimensional stress system, Mohr's stress circle, Hooke's law and stress strain relation, Ductile and Brittle materials, Relationship between elastic constants.

✓UNIT-II

Bending of beams; shear force and bending moment diagram in beams, bending and shear stresses, composite beams, initially curved beams, leaf spring.

✓UNIT-III

Deflection of beams; double integration, area moment method, Macaulay's methods, Conjugate beam, method of superposition.

✓UNIT-IV

Torsion of circular shaft: solid and hollow circular shafts, torsion of thin hollow sections, Torsion beyond elastic limit, closed coil helical spring

✓UNIT-V

Stability of structure; buckling of columns and beams, eccentrically loaded columns/beams and columns with initial curvature, empirical relations of column design. Theories of failure, thin pressure vessels.

Text Books:

1. Mechanics of material by F.P. Beer & E.R. Johnson Jr. Tata McGraw Hill.
2. Engineering Mechanics of solids by Egor P. Popov., PHI
3. Introduction of solid mechanics by I.H.Shames.

Reference books;

1. An Introduction of mechanics of solid by Crandall, Dahl & Lardnee Tata McGraw Hill.
2. Advance Strength of Materials by L.S. Srinath
3. Strength of Materials by Timoshenko

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✓ME3TES08-MATERIAL SCIENCE AND METALLURGY

✓ UNIT-I

Introduction: Classification of engineering Materials, metals, non metals, plastics, ceramics and composites. Crystalline structure of solids: concepts of unit cell and space lattice, miller indices, crystal structure determination by X-ray diffraction. Crystal structure of ferrous and non-ferrous metals, crystal imperfections.

Plastic Deformation: Mechanisms of plastic deformation, role of dislocation, slip and twinning. slip mechanism, strain hardening.

✓ UNIT II

Phase Diagrams, Phases, phase rules, concept of equilibrium, Phase diagram, lever rule, eutectic, eutectoid, peritectic and peritectoid systems, iron-carbon diagram, and simplified IC diagram. Heat Treatment Isothermal Transformation of austenite (TTT diagram), Transformations of austenite upon continuous cooling, annealing, normalizing, hardening, tempering, hardenability of steel, Surface hardening, tempering, case hardening, Jominy test for hardenability, recovery, recrystallization and grain growth, Age hardening.

✓ UNIT III

Corrosion: Principles of corrosion forms of corrosion, factors affecting the rate of corrosion. Corrosive agents and protection against corrosion.

Creep: Introduction to creep mechanism, creep curves, creep resistant materials, introduction to fatigue, cold working of metals and hot working.

✓ UNIT IV

Engineering Materials

Ferrous: Cast irons, carbon and alloy steels and their coding

Non-ferrous: Aluminum, copper, nickel, chromium, zinc, lead, tin, tungsten, etc. and their alloys.

Classification, structure, general properties and applications of polymers, ceramics and composites.

UNIT V

✓ Powder Metallurgy: Characteristics of metal powder, Particle size, shape and size distribution, Characteristics of powder mass such as apparent density, tap density, flow rate, friction conditions. Properties of green compacts and sintered compacts.

Machining, milling, atomization, electro-deposition, reduction from oxide, carbonyl process, production of alloy powders, New development.

Powder rolling, powder forging, powder extrusion and explosive forming technique.

Text Books

- 1 Raghavan. Material Science and Engineering.
2. Swamp. Elements of Metallurgy
3. Vanlack, Elements of Material Science and Engineering.
4. Aagarwal, B.K Introduction to engineering Materials

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✓ **ME3TPC02-APPLIED THERMODYNAMICS**

✓ **UNIT – I First Law of Thermodynamics**

First Law of thermodynamics, Closed system, work done, change in Internal energy, heat transferred during various thermodynamic processes, P-V diagrams. Open system, Thermodynamic analysis of control volume, Conservation of energy principle, The steady flow process applied to (i) Nozzles and Diffuser (ii) Turbines and Compressor, (iii) Throttle valve. Unsteady flow process (Simple system like Charging & Discharging of tanks)

✓ **UNIT-II Second Law of Thermodynamics**

Second law of Thermodynamics Introduction (Law of degradation of Energy) Thermal Energy reservoir, Kelvin-Planck & Clausius Statement, Heat engine, Refrigerator and Heat pump, Reversible and Irreversible processes, Carnot cycle, Thermodynamic temperature scale. Entropy: The Clausius Inequality, Entropy, Principle of increase of entropy, Change in entropy for Closed and steady flow open systems. Second law analysis of engineering system, Availability, reversible work and Irreversibility.

✓ **UNIT-III Vapour power cycles**

Property of steam, P-V chart, T-S chart, H-S chart and application of these chart Carnot and Rankine cycles; Reheating and regenerative feed heating Rankine cycles; Binary vapour cycle; Thermal efficiency and work ratios; Factors affecting efficiency and work output. Condenser, classification, vacuum efficiency, cooling towers, types and application.

✓ **UNIT-IV Air Compressors**

Classification of air compressors, Advantages, Disadvantages of reciprocating compressors, Working of reciprocating compressor, Equation of work (with & without clearance) volumetric efficiency, Multistage compressors, Efficiency of compressor, Effect of atmospheric condition on output of Compressors, Thermodynamic analysis of reciprocating compressor, Intercooler & External cooler.

✓ **UNIT-V**

Thermodynamic (PVT) relations of Working Fluids Equation of state for ideal gas; Behaviour of real gases and compressibility factor; Generalized, empirical and theoretical equations of state for real gases; Law of corresponding states and use of generalized compressibility chart; Helmholtz and Gibbs functions; Maxwell's relations; Enthalpy, entropy, internal energy, and specific heat relations; Clausius-Clapeyron's equation; Applications to ideal and real gases Joule-thomson coefficient.

Text Books:

- Nag, P.K., "Engineering Thermodynamics", Tata McGraw Hill, New Delhi
- Thermal Engg. By C.P. Arora Tata McGraw - Hill, New Delhi
- Engg. Thermodynamic & Approach, Cengel & Boles, TMH
- Engg. Thermodynamic, John Hawkins
- Reyner Joel; Engineering Thermodynamics, 5th Ed; Addison Wesley, 1999

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✓ME4TPC03-FLUID MECHANICS

✓**UNIT-I Properties of Fluid:** Fluid ideal and real fluid, properties of fluid, mass density, weight density, specific volume, specific gravity, viscosity, surface tension, capillarity, vapour pressure, compressibility and bulk modulus, Newtonian and non-Newtonian fluids. Fluid Statics: Pressure, Pascal's law, Hydrostatic law, Pressure measurement, Hydrostatic force on submerged surface and curved surface, law of buoyancy and flotation.

✓**UNIT - II Fluid Kinematics**

Description of fluid motion, Lagrangian and Eulerian approach, types of fluid flow, types of flow lines-path line, streak line, stream line, stream tube acceleration of a fluid particle, rotational flow, rotation and vorticity, circulation, velocity function, stream and potential function, flow net, its characteristics and utilities. Control volume and surface concept.

✓**UNIT - III Fluid Dynamics**

Conservation of Mass: Continuity equation, conservation of momentum, momentum theorem, Euler's equation, Bernoulli's equation and its practical application, Venturimeter, Orifice meter, Nozzle, Pitot tube, Rotameter, notches and weirs.

✓**UNIT - IV Turbulance**

Basics of Turbulance, Reynolds stresses, Prandtl's mixing length hypothesis, friction velocity, laws of walls. Dimensional Analysis and Similitude: methods of dimensional analysis, Rayleigh's method, Buckingham's theorem, dimensional number and their significance, concept and types of physical similarity, dynamic similarity, applications of dynamic similarity.

✓**UNIT - V- Viscous Flow**

Flow through circular pipes, flow between two parallel plates, loss of head due to friction in viscous flow. **Kinetic energy corrections & momentum correction factors.**

Flow Through pipe: major & minor loss in pipe, Hydraulic gradient and total energy line, pipe in series and parallel, equivalent pipe, power transmission through pipe, water hammer in pipes.

Text Books:

1. Modi & Seth; Fluid Mechanics; Standard Book House, Delhi
2. Som and Biswas; Fluid Mechanics and machinery; TMH
3. JNICK DAKE; Essential of EnggHyd; African Network & ScInstt. (ANSTI)
4. Francis JRD; A Text Book of fluid Mech. for Engg. Student
5. R Mohanty; Fluid Mechanics; PHI
6. Gupta; Fluid Mechanics; Pearson.

Reference Books:

1. Streeter & Wylie, Fluid Mechanics
2. Cengel; Fluid Mechanics; TMH
3. V.L. Shames, Fluid Mechanics

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✓ **ME4TPC04-MANUFACTURING SCIENCE - I**

✓ **UNIT - I**

Welding: Classification of welding process, basic **principal & scope of application, Principle of Gas and electric arc welding, soldering, brazing, power sources and consumables. TIG & MIG processes and their parameter selection, electrodes, types & coatings, welding defects and remedies.**

Resistance welding: principle, equipments & types.

✓ **UNIT - II**

Foundry: Moulding method and materials, sand-clay-water system, additives, pattern making and types, pattern allowances and design considerations, types of moulding sand and their properties, testing, cores boxes, core making, moulding machine.

Melting furnaces and practices: Melting cast iron, steel and non ferrous material, cupola, open furnaces, converter and crucible furnaces, electric, direct arc furnace, inductive furnace.

✓ **UNIT - III**

Casting: **Centrifugal and investment casting, shell, plastic and mould methods, melting of cast iron, element of gating system, types and design of riser, solidification of casting, casting defects, clearing of casting, principle of die casting, gravity and pressure die casting, Die casting consideration.**

Plastic processing, injection, compression & blow moulding

✓ **UNIT - IV**

Forming: mechanism of forming process, elastic and plastic deformation.

Rolling: classification, theories of **Hot & Cold rolling, rolling mills & its types, calculation of rolling parameter & rolling defect.**

forging operations and their classification forging design and defects.

Extrusion: types, extrusion equipments & analysis of processes, **drawing of rods, wire tube- analyses of wire drawing, tube drawing, defects in extrusion & drawing.**

✓ **UNIT - V**

Sheet-metal working: Role of sheet Metal Components, cutting mechanism, description of cutting **processes blanking, piercing, description of forming processes like bending cup drawing, coining embossing, basic elements of press, classification, punch and die clearances, elements of die and punches, clearance, compound, combination, progressive and inverted dies and their operations**

Text Books:

1. Manufacturing Technology vol.1, P.N. Rao, T.M.G.H. Publications
2. Manufacturing Science, Ghose and Mallick, East West press
3. Material and process of Manufacturing, A.Lindberg Roy, PHI Publication.

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✓ ME4TPC06-MACHINE DRAWING

✓ Unit- I

Drawing conventions, sectional views and sectioning, representation of machine parts such as external and internal threads, slotted heads, square ends, and fiat radial ribs, slotted shaft, splined shafts, bearings, springs, Convention of gears in mesh, representation of geometrical tolerances on drawings.

Machining symbols, Surface roughness, grades, material symbols.

✓ Unit- II

Rivet heads and riveted joints: Lap and butt joint with single and double straps.

Welding joints and their representation, symbols of different joint.

✓ Unit- III

Screw thread and screw fastening, different types of thread profile and nuts, bolts.

Sectional views: keys, cotter joints, knuckle joints

✓ Unit- IV

Shaft coupling, flanged coupling, different types of shaft coupling.

Shaft bearing, bushed bearing, plumber block, foot step bearing.

Pulleys: fast & loose pulleys, stepped pulley's belt pulley, rope pulley.

✓ Unit-V

Assembly drawing of Engine parts like piston, stuffing box, cross-heads, eccentrics, connecting rod;

Assembly drawing of stop valve, feed check valve, safety valve, blow off cock.

Assembly drawing of lathe tail stock post.

Text Books and References Books:

1. Bhatt.N.D. Machine Drawing
2. Gill.P.C. Machine Drawing
3. Dhawan RK. Machine Drawing

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Department of Mechanical Engineering

✓ME-351 Machine Design-I

✓Unit-I

Steady stresses and variable stresses in machine member-introduction to the design process factors influencing machine design, selection of material based on mechanical properties, direct, bending and torsional stress equation, impact and shock loading, calculation of principle stresses for various load combination, eccentric loading, design of curved beams, crane hook and 'c' frame, factor of safety, theories of failure, stress concentration, fatigue design for variable loading, solderberg, Goodman and Gerber relations.

✓Unit-II

Riveted joints - failure of riveted joint, strength and efficiency of riveted joint. Design of butt and lap joint for a boiler, eccentrically loaded riveted joint. Design of thread joints, bolted joint in tension, torque requirement for bolt tightening, bolted joint under fluctuating load. Eccentrically loaded joint in shear, bolted joint with combined stresses.

✓Unit-III

Design of cotter and knuckle joints, socket and spigot cotter joint, sleeve and cotter joint Gib and cotter joint, design of knuckle joints. Welded joints- stresses in butt and fillet welds, strength of welded joints, eccentrically loaded joint, welding joint subjected to Bending moment.

✓Unit-IV

Design of Keys and coupling, flat and square keys, woodruff keys, splines, muff coupling, compression coupling, flange coupling, flexible coupling.

Unit-V

Design of shafts: subjected to twisting moment, bending moment, combined twisting moment and bending moment, fluctuating loads, design of shaft on the basis of rigidity.

Text Books:

1. Machine Design-Bhandari, TMH
2. Machine Design:Spott, TMH
3. Machine Design: J.Shigley, TMH
4. Machine Design: Khurmi & Gupta, Khanna Pub.

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Department of Mechanical Engineering

✓ **ME-352 MECHANICS OF SOLID-II**

✓ **UNIT-I**

Three dimensional analysis of stress and strain; State of stress at a point, stress matrix, stress invariants and stress transformation, principal stress and principal planes, three dimensional Mohr's stress circle, Equilibrium equations, stresses on octahedral planes. Three dimensional strains at a point, strain matrix, principal strain, strain invariants and associated planes, strain transformation, physical interpretation of normal and shear strain, compatibility equations & their interpretation.

✓ **UNIT-II Flexural Loading**

Unsymmetrical bending, bending of curved bars, shear centre and stress in Thin-Walled open sections.

✓ **UNIT-III Axisymmetric Problems**

Thick cylinders under internal and external pressure, compound cylinders (shrink fit), rotating disc and cylinders of uniform and variable thickness, thin spherical shells.

✓ **UNIT-IV Torsion:**

Torsion of non-circular members, General Prismatic bar, rectangular bars and thin walled sections, membrane analogy, Torsion of hollow sections, plastic yielding of circular shafts. Open coiled helical spring.

✓ **UNIT-V Energy Methods:**

Energy methods: Strain energy expression, strain energy under axial loading, under bending & torsional loading, Maxwell Betti's Reciprocal theorem, Castigliano's theorem and its applications. Displacement methods; force methods, impact loading, open coiled helical spring.

Text Books :

1. Boresi, A.P., and Sidebottom, O.M., "Advance Mechanics of Materials". John Willey and sons, 1985.
2. Srinath, L.S., "Advanced Mechanics of Materials", 1952.
3. Seeley, F.B. and Smith, J.O., "Advanced Mechanics of Materials", 1952.
4. "Mechanics of solid" by Grandall-Dahl, Lardner, TMGH.
5. "Strength of material" by Rattan 2/E McGraw Hill
6. "Mechanics of solid" by popov, PHI.

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Department of Mechanical Engineering

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✓ME-354 INTERNAL COMBUSTION ENGINES

✓ Unit-I

Introduction of internal combustion engines, classification of I.C. engines, engines components, basic engine nomenclature, four stroke S.I. and C.I. engine, two stroke engines, comparison of two stroke and four stroke engines, comparison of S.I. and C.I. engines, application of IC engines.

Air Standard Cycle: Otto cycle, diesel cycle, dual cycle, comparison between otto, diesel and dual cycles, fuel-air cycles and actual-cycles, effect of variable specific heats and dissociation on indicator diagram.

✓ Unit-II

Combustion in S.I. Engines: Flame development and its propagation, ignition lag, effect of engine parameters on ignition delay, preignition, knocking in S.I. engines, variables affecting knock, combustion chambers.

Carburetor: Principle of carburetion, elements of carburetor, parameters affecting carburetion, air-fuel mixtures, expression for air-fuel ratio.

Fuel ignition system: Battery and coil ignition system, magneto ignition system, firing order, spark advancing.

✓ Unit-III Combustion in C.I. Engines

Combustion phenomenon in C.I. engines, $p-\theta$ diagram and their study for various stage of combustion, delay period, detonation in C.I. engines, parameters affecting detonation.

Conventional & Alternative Fuels: CNG, Biodiesel, Hydrogen.

Fuel Injection System Air and solid injection, fuel pump and injectors.

✓ Unit-IV

Engine Friction and Lubrication: total engine friction, blow by losses, pumping losses, factors effecting engine friction, mechanism of lubrication, lubrication system

Cooling system: Piston and cylinder temperature distribution, parameters affecting engine heat transfer, principles and various methods of cooling.

Two Stroke Engine: Constructional details, scavenging parameters, models and performance of scavenging system, advantages and disadvantages of two stroke engines.

✓ Unit-V

Supercharging in I.C. engines Effect of altitude on output, types of supercharger Testing and Performance of Engines: Engine indicator, measure of air and fuel supply, frictional losses, mechanical and thermal efficiencies, engines losses and heat balance.

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Department of Mechanical Engineering

✓ME-354 INTERNAL COMBUSTION ENGINES

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Introduction of internal combustion engines, classification of I.C. engines, engines components, basic engine nomenclature, four stroke S.I. and C.I. engine, two stroke engines, comparison of two stroke and four stroke engines, comparison of S.I. and C.I. engines, application of IC engines.

Air Standard Cycle: Otto cycle, diesel cycle, dual cycle, comparison between otto, diesel and dual cycles, fuel-air cycles and actual-cycles, effect of variable specific heats and dissociation on indicator diagram.

✓ Unit-II

Combustion in S.I. Engines: Flame development and its propagation, ignition lag, effect of engine parameters on ignition delay, preignition, knocking in S.I. engines, variables affecting knock, combustion chambers.

Carburetor: Principle of carburetion, elements of carburetor, parameters affecting carburetion, air-fuel mixtures, expression for air-fuel ratio.

Fuel ignition system: Battery and coil ignition system, magneto ignition system, firing order, spark advancing.

✓ Unit-III Combustion in C.I. Engines

Combustion phenomenon in C.I. engines, $p-\theta$ diagram and their study for various stage of combustion, delay period, detonation in C.I. engines, parameters affecting detonation.

Conventional & Alternative Fuels: CNG, Biodiesel, Hydrogen.

Fuel Injection System Air and solid injection, fuel pump and injectors.

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Engine Friction and Lubrication: total engine friction, blow by losses, pumping losses, factors effecting engine friction, mechanism of lubrication, lubrication system

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Department of Mechanical Engineering

✓ME-355 FLUID MACHINERY

✓Unit-I

Boundary Layer Theory: Boundary layer definition & characteristics, momentum equation, laminar and turbulent boundary layer, total drag, separation and control Flow around submerge bodies: Force exerted by flowing on a body: drag and lift; stream lined and bluff body, drag on sphere and cylinder, circulation and lift on circular cylinder, lift of an air foil.

✓Unit-II

Impact of Free Jets: Impulse momentum principle, force exerted by the jet on stationary flat and curve plate, hinged plate, moving plate and moving curve vanes, jet propulsion of ship. Impulse Turbine: Classification of turbine, impulse turbine, pelton wheel, construction working, work done, head efficiency and design aspects, governing of impulse turbine.

✓Unit-III

Reaction Turbine: Radial flow reaction turbine, Francis turbine: construction, working work done, efficiency, design aspect, advantages and disadvantages over pelton wheel. Axial flow reaction turbine: Propeller and Kaplan turbine, bulb or tubular turbine, draft tube, specific speed, unit quantities, cavitations, degree of reaction, performance characteristics, surge tanks, governing of reaction turbine.

✓Unit-IV

Centrifugal Pumps: Classification of pumps, centrifugal pump, construction, working work done, heads, efficiencies, multistage centrifugal pump, pump in series and parallel, specific speed, characteristic, net positive suction head, cavitation.

✓Unit-V

Reciprocating Pumps: Classification, component and working, single acting and double acting, discharge, work done and power required, coefficient of discharge, indicator diagram, air vessels.

Fluid System: Hydraulic accumulator, Hydraulic intensifier, Hydraulic press, Hydraulic crane, hydraulic lift, Hydraulic ram, Hydraulic coupling, Hydraulic torque converter, air lift pump, jet pump, Positive Displacement, machine gear pump.

Text Books:

1. Mechanics of Fluid-Massey B.S.-English language books society(U.K.)
2. Introduction to fluid mechanics and fluid machines-S.K. Som & G. Biswas-TMGH
3. "Fluid Mechanics & Machinery" by Agrawal, TMGH
4. "Fluid Mechanics & Machinery" by Kothandraman & Rudra Mounthy, New Age Publication

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Department of Mechanical Engineering

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Department of Mechanical Engineering

✓ **ME-361 Dynamics of Machines**

✓ **UNIT - I**

Force Analysis of Mechanism: Dynamically equivalent system, Dynamics of reciprocating engines, turning moment diagrams, Fluctuations of energy and speed, Flywheels.

Gyroscope: Gyroscopic forces and couple (Torque), Angular velocity and acceleration of gyroscope, gyroscopic effect on naval ships, gyroscopic effect on airplane and vehicle moving on curved path.

✓ **UNIT - II**

Inertia force analysis: Effective force and inertia force of a link, D'Alembert's principle and dynamic equilibrium, equivalent offset inertia force, velocity and acceleration of piston, inertia forces in reciprocating engine, engine force analysis, inertia of connecting rod, turning moment diagram for single and multi-cylinder I.C. Engine, Co-efficient of fluctuation of speed, Co-efficient of fluctuation of energy.

✓ **UNIT - III**

Balancing: Static and dynamic balancing, balancing of rotating masses and balancing of reciprocating masses, balancing of locomotives, effect of partial balancing in locomotive balancing of I.C. Engine, balancing of IN-line engine, balancing of V-engine, balancing of radial engine, forward and reverse crank method, balancing of rotors.

✓ **UNIT - IV**

Governors: Types of governor, centrifugal governor, spring controlled governor, Watt, Porter and Proell, Hartnell, Hartung governor, governor effect, Power stability, Inertia effects.

Analysis in plane mechanism: Motion of rigid body subjected to a system of forces, stresses in moving member, dynamic motion analysis, force analysis of four-bar linkage, force analysis of a slider-crank linkage.

✓ **UNIT - V**

Clutch: single plate and multi plate clutch, cone clutch

Brakes: Analysis & simple brakes assuming uniform pressure and uniform wear, band brake, block brake, internal shoe brake.

Text Books:

1. Theory of machine-S.S.Ratan-TMH.
2. Theory of machine-J.E.Shingley-McGraw Hill
3. Theory of mechanisms and machines-A.Ghosh, A.K. Mallik-EWP Press
4. The Theory of machines. -Thomas Bevan-CBS Publisher
5. 'Mechanisms' and machines Theory-J.S.Rao., R.V. Dukkupati-Wiley Eastern Limited

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5. 'Mechanisms' and machines Theory-J.S.Rao., R.V. Dukkupati-Wiley Eastern Limited

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Department of Mechanical Engineering

✓ **ME-362 Machine Design-II**

✓ **UNIT-I Spring**

Spring materials and their mechanical properties, equation for stress and deflection, helical coil springs of circular section for tension, compression and torsion, dynamic loading, fatigue loading, wahl line, leaf spring and laminated spring.

✓ **UNIT-II Gears**

Spur Gears: Gear drives, classification of gears, selection of types of gears, law of gearing, force analysis, gear tooth failures, selection of material, no of teeth, face width, beam strength of gear tooth, effective load on gear tooth, estimation of module based on wear strength, Lewis equation, gear design for maximum power transmitting capacity, gear lubrication.

✓ **UNIT-III Helical Gears**

Helical gears, terminology of helical gears, virtual no of teeth, tooth proportions, force analysis, beam strength of helical gear, effective load on gear tooth, wear strength of helical gear, Bevel Gears: Bevel gears, terminology of bevel gears, force analysis, beam strength of bevel gear, wear strength of bevel gears, effective load on gear tooth.

✓ **UNIT-IV Bearing**

Rolling Contact Bearing: Types of ball and roller bearings, selection of rolling element bearing for radial and axial load, bearing life, mounting and lubrication, soft scales-contact type and clearance type, load life relationship, load factor.

Journal Bearings: Types of lubrication, viscosity, hydrodynamics theory of lubrication, Sommerfield number, heat balance, self-contained bearings, bearing materials.

✓ **UNIT-V Clutches and Brakes**

Friction clutches, friction materials, torque transmitting capacity, single and multiple plate clutches, centrifugal clutches. Band and block brakes.

Belt Drive: Flat and V-belts, belt construction, geometrical relationship for length of the belt, analysis of belt tensions, condition for maximum power, selection of flat and V-belt, adjustment of belt tensions.

Text Books:

1. Design of machine elements from V.B. Bhandari, TMH publications
2. Machine design by Shigley-McGraw Hill Pub.
3. Machine design by Movbnin-MIR publication
4. Machine design by Sharma & Agrawal-Kaston Pub.
5. Principles of mechanical design by R.Phelan- McGraw Hill Pub.
6. Machine design by Suderraj Murthey-Khanna Pub.
7. Machine design, Theory & Practice by Michels Walter J, Wilson Charles E. & Add Macmillan Pub., New York.

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Department of Mechanical Engineering

✓ ME-362 Machine Design-II

✓ UNIT-I Spring

Spring materials and their mechanical properties, equation for stress and deflection, helical coil springs of circular section for tension, compression and torsion, dynamic loading, fatigue loading, wahl line, leaf spring and laminated spring.

✓ UNIT-II Gears

Spur Gears: Gear drives, classification of gears, selection of types of gears, law of gearing, force analysis, gear tooth failures, selection of material, no of teeth, face width, beam strength of gear tooth, effective load on gear tooth, estimation of module based on wear strength, Lewis equation, gear design for maximum power transmitting capacity, gear lubrication.

✓ UNIT-III Helical Gears

Helical gears, terminology of helical gears, virtual no of teeth, tooth proportions, force analysis, beam strength of helical gear, effective load on gear tooth, wear strength of helical gear, Bevel Gears: Bevel gears, terminology of bevel gears, force analysis, beam strength of bevel gear, wear strength of bevel gears, effective load on gear tooth.

✓ UNIT-IV Bearing

Rolling Contact Bearing: Types of ball and roller bearings, selection of rolling element bearing for radial and axial load, bearing life, mounting and lubrication, soft scales-contact type and clearance type, load life relationship, load factor.

Journal Bearings: Types of lubrication, viscosity, hydrodynamics theory of lubrication, Sommerfield number, heat balance, self-contained bearings, bearing materials.

✓ UNIT-V Clutches and Brakes

Friction clutches, friction materials, torque transmitting capacity, single and multiple plate clutches, centrifugal clutches. Band and block brakes.

Belt Drive: Flat and V-belts, belt construction, geometrical relationship for length of the belt, analysis of belt tensions, condition for maximum power, selection of flat and V-belt, adjustment of belt tensions.

Text Books:

1. Design of machine elements from V.B. Bhandari, TMH publications
2. Machine design by Shigley-McGraw Hill Pub.
3. Machine design by Movbnin-MIR publication
4. Machine design by Sharma & Agrawal-Kaston Pub.
5. Principles of mechanical design by R.Phelan- McGraw Hill Pub.
6. Machine design by Suderraj Murthey-Khanna Pub.
7. Machine design, Theory & Practice by Michels Walter J, Wilson Charles E. & Add Macmillan Pub., New York.

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Department of Mechanical Engineering

✓ ME-363 HEAT AND MASS TRANSFER

✓ Unit-I

Introduction: Various modes of heat transfer, Fourier's, Newton's and Stefan Boltzmann's law, combined modes of heat transfer, thermal transfer, thermal diffusivity, overall heat transfer coefficient. Conduction The thermal conductivity of solids, liquids and gases, factors in influencing conductivity measurement. The general differential equation of conduction, one dimensional steady state conduction, linear heat flow through a plane and composite wall, tube and sphere critical thickness of insulation, effect of variable thermal conductivity, conduction with heat generation in flat and cylinders.

✓ Unit-II

Fins: Conduction convection system, extended surfaces rectangular, triangular circumferential and pin fins. general conduction analysis, fins of uniform and non-uniform cross section area. Heat dissipated by a fin. Effectiveness and efficiency of fin. Approximate solution. Design a fins for maximum heat transfer. Solution for different boundary condition. Use of fins analysis for measuring temperature error of thermometer.

Transient/ unsteady state heat conduction Introduction to unsteady state heating and cooling, system with negligible internal resistance, lumped capacity method and its validity. Unsteady state conduction through finite and semi-infinite slab without surface resistance, convection boundary conditions. Solution through Heisler's chart.

✓ Unit-III

Forced Convection Physical mechanics of forced convection. Dimensional analysis for forced convection, velocity and thermal boundary, layer, flow over plates, flow across cylinders and spheres, flow in tubes, Physical mechanism of natural convection, Dimensional analysis of natural convection, empirical relationship for natural convection.

✓ Unit-IV

Boiling and Condensation: Boiling heat transfer, pool boiling, boiling regimes and boiling curve, next transfer, correlations in pool boiling. Condensation heat transfer, film condensation, derivation for the average heat transfer coefficient 'h' for the case of laminar film condensation over vertical.

Heat Exchangers: Different type of heat exchanger. Determination of heat exchanger performance, heat exchanger transfer unit, analysis restricted to parallel and counter flow heat exchanger (LMTD and NTU method).

✓ Unit-V

Thermal Radiation: Introduction, absorption and reflection of radiant energy, emission, radiosity and irradiation, black and non black bodies, Kirchhoff's law; intensity of



Department of Mechanical Engineering

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Fins: Conduction convection system, extended surfaces rectangular, triangular circumferential and pin fins. general conduction analysis, fins of uniform and non-uniform cross section area. Heat dissipated by a fin. Effectiveness and efficiency of fin. Approximate solution. Design a fins for maximum heat transfer. Solution for different boundary condition. Use of fins analysis for measuring temperature error of thermometer.

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✓ Unit-V

Thermal Radiation: Introduction, absorption and reflection of radiant energy, emission, radiosity and irradiation, black and non black bodies, Kirchhoff's law; intensity of



Department of Mechanical Engineering

radiation, radiation exchange between black surface, geometric configuration factors. Grey body relation exchange between surfaces of unit configuration factors.

Introduction to mass Transfer : Mass and mole concentrations, molecular diffusion, eddy diffusion, molecular diffusion from an evaporating fluid surface, introduction to mass transfer in laminar and turbulent convection combined heat and mass transfer.

Recommended Books:

1. Heat transfer-S.P. Sukhatme-TMH
2. Heat & Mass Transfer-Arora and Domkundwar-Dbanpat Rai
3. Heat Transfer-C P Arora, TMH
4. Heat & Mass Transfer-R.C. Sachdeva-New Age
5. Heat Transfer-J.P. Holman-TMH
6. Heat Transfer-A Practical Approach- Yunus A. Cengel-TMH

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Department of Mechanical Engineering

✓ **ME-471 REFRIGERATION & AIR CONDITIONING**

✓ **UNIT - I**

Carnot Refrigerator & Heat pump, air refrigeration systems, bell Coleman air refrigeration cycle. Air craft system & its performance. Vapour compression refrigeration: simple cycle, t-s and p-h charts analysis of vapor compression cycle, factors effecting performance of vapor compression cycle, actual vapour compression cycle, multi stage compression system.

✓ **UNIT - II**

Vapour absorption refrigeration systems: description of system components, aqua ammonia and water lithium bromide systems. Its analysis & advantages over vapour compression system. Refrigeration equipment: constructional details, capacity, control and performance of compressors, condensers, evaporators, expansion devices, thermostatic expansion valve.

✓ **UNIT - III**

Production of low temperature - cascade system, Joule Thomson effect & liquefaction of gases, liquefaction of hydrogen & helium, application of cryogenics. Nonconventional refrigeration system-thermo-electric refrigeration, vortex tube, steam jetrefrigeration system.

Refrigerants: classification, properties & selection of refrigerants.

✓ **UNIT - IV**

Psychometrics: Psychrometry and psychometric properties, psychometric relations, psychometric chart and its use, psychometrics processes, human comfort, factors affecting comfort, comfort chart.

Requirements of comfort air conditioning: thermodynamics of human body, comfort chart, factors governing optimum effective temperature. Cooling load calculations & design of a.c. System- different heat sources, design of air conditioning system, bypass factors, effective sensible heat factor, cooling coils.

✓ **UNIT - V**

Fluid flow, duct design & air distribution system- various losses in fluid flow, different methods of duct design & arrangement system, air distribution system & ventilation system. Automotive air conditioning: system location and layout components, system maintenance. Car, Railway air conditioning & marine air conditioning.

Text Books:

- 1.Refrigeration and Air Conditioning C. P. Arora - TMH.
- 2.Refrigeration and Air Conditioning – Manohar Prasad – New-Age International Pub
3. Refrigeration and Air Conditioning – Arora & Domkundwar – Dhanpat Rai & Sons
4. Refrigeration and Air Conditioning – P.L. Ballaney – Khanna Pub

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Department of Mechanical Engineering

✓ **ME - 473 THEORY OF VIBRATION**

UNIT I

Element of vibration system: - lumped mass, stiffness and damping, simple harmonic motion, vector representation.

Single degree of freedom system: equation of motion by energy method & Newton law of motion, **general solution, free and forced vibration.**

UNIT II

Damped and undamped motion- Equation of motion for single and two degree of freedom equivalent damping, logarithmic decrement. Damping measurement, rotating **and reciprocating unbalance, vibration absorber, Seismic instruments, Transient vibration:** - impulse response, Convolution integral, Fourier analysis.

UNIT III

Multi degree freedom system: - equation of motion, co-ordinate coupling, undamped forced vibration, principal modes, generalized co-ordinates, semi definite system, orthogonality of modes, modal analysis, Lagrange's equation.

UNIT IV

Natural frequency numerical solution: - Rayleigh's method, Dunkerley's method, Holzer method, Transfer matrix, Iteration method.

UNIT V

Continuous system: - Vibration of stretched cord, torsional vibration, longitudinal vibration of slender rod, lateral vibration of beams, Shear deformation and rotary inertia effect, Rayleigh's quotient, Rayleigh's-Ritz method.

Text Books:

1. Tse,S,Morse R Rolland T . Hinkle. Ivan E. "Mechanical vibrations theory and application" Published by Allyn and Bacon ,The
2. Thomson T. Milliam "theory of vibrations with applications" Prentice Hall of India
3. Hartog Den ,J.P. "mechanical vibrations" Tata McGraw Hills, 4th edition 1956)
4. Meirovitch L. "elements of vibration analysis McGraw Hills -1956
5. Anderson R.A. "fundamentals of vibration" Mecmillan press 1967
6. Kbstad ,N.O. "fundamentals of vibration analysis" McGraw Hills -1956
7. Robert K. Vicrck "vibration analysis" Published by Harper & Row
8. Timoshenko ,s.,young ,D.H. & Weavev W.Jr "vibration problem in engineering 4th ed,New York Wilay 1974
9. Mecrovitch,L., "analytical methods in vibration" published by macmillam(1967)
10. Stoker J.J "non linear vibration" Wilay 1950
11. Minorsky ,N. "non linear oscillations" Published by Van Nostrand 1962.

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✓ ME - 475 B FINITE ELEMENT METHOD (Elective)

✓ UNIT-I

Introduction: general, general description of the method, brief explanation of FEA for a stress analysis problem, finite element method vs classical method, FEM vs FDM, a brief history of FEM, need for studying FEM, warning to FEA Package users.

Basic equations in elasticity: stresses in a typical element, equations of equilibrium, strains, strain displacement equations, linear constitutive law.

Matrix displacement formulation: matrix displacement equations, solution of matrix displacement equations, techniques of saving computer memory requirements.

✓ UNIT-II

Element shapes, Nodes, Nodal unknowns and Coordinate systems. Shape functions: polynomial shape functions, convergence requirements of shape functions, derivation of shape functions using polynomials, finding shape functions using Lagrange polynomials, shape functions for serendipity family elements, Hermite polynomials as shape functions, construction of shape functions by degrading technique.

✓ UNIT III

Strain displacement matrix: strain-displacement matrix for bar element, strain displacement matrix for CST element, strain displacement relation for beam element. Assembling stiffness equation-direct approach: element stiffness matrix for CST element **by direct approach, nodal loads by direct approach.**

✓ UNIT IV

Assembling stiffness equation-variational method: general variational method in elasticity problems, potential energy in elastic bodies, principles of minimum potential energy, Rayleigh-Ritz method, variational formulation in finite element analysis. Discretization of a structure: nodes as discontinuities, refining mesh, use of symmetry, finite representation of infinite bodies, element aspect ratio, and higher order element vs mesh **refinement, numbering system to reduce band width.**

✓ UNIT V

Finite element analysis-bars and trusses: Tension bars/columns, two dimensional trusses (plane trusses), three dimensional trusses (space trusses). Finite element analysis-plane stress and plane strain problems: general procedure when CST elements are used, **use of higher order elements.**

Analysis of beams and rigid frames: beams analysis using two noded elements, analysis of rigid plane frame using 2 Nodes beam elements, a three dimensional rigid frame element, Timoshenko beam element.

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Department of Mechanical Engineering

✓ **ME-481 POWER-PLANT ENGINEERING**

✓ **UNIT I-**

Steam Power Plant: Steam power plants selection of working medium, Heat Balance in steam cycles, Heat rates, Fuels and fuel handling System and Ash handling System, Air pre-heater, Feed water pre-heaters, Steam re-heaters, Dearators, Feed water treatment, Pumping and regulation water walls, Modern developments in steam boilers.

✓ **UNIT - II**

Hydro Electric Power Plant: Site selection, Hydrology, Water storage, main elements of hydroelectric power plant and its classification.

Diesel power Plant: Application of Diesel in power field, Suitability of diesel engines for bulk power, Layout of Diesel Power Plant, Advantages and limitations of diesel Power stations, **Performance Characteristics.**

✓ **UNIT - III**

Nuclear Energy: Introduction to Nuclear Engineering, Release of Energy by Nuclear Reaction, chain reaction, moderation, components of nuclear reactor, types of reactor, Pressured water reactor, CANDU reactor, Gas cooled reactor, Liquid metal cooled reactor, breeder reactor, Nuclear Materials.

✓ **UNIT IV**

Solar Thermal System: Power plants, low temperature, medium and high temperature plants, solar refrigeration systems, solar photovoltaic system and its application.

Wind energy: Type of Rotors, horizontal axis and vertical axis systems, system design and site selection blade material. Wind power scenario in India.

✓ **UNIT V-**

Variable load problems: Idealized and realized load curves, Effect of variable load on plant design and operation variable load operation and load dispatch.

Power station Economics: Source of income, Cost of plant and production, Elements of cost, depreciation and replacement theory of rates.

Text Books:

1. Power Plant Engineering, 2nd Edn. – P.K. Nag – Tata McGraw-Hill Pub. Com., New Delhi, 2004
2. Duffie and Beckman, Solar Energy Thermal Processes, John Wiley.
3. A Course in Power Plant Engineering – Arora, Domkundwar – Dhanpat Rai & Co., 2005

Reference Books:

4. Power Plant Technology – M.M. El – Wakil – McGraw Hill, International Edition 1984
5. Power Plant Engineering – G.R.Nagpal – Khanna Publishers.

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Department of Mechanical Engineering

✓ME-482 Operation Research

✓ UNIT I

Introduction to linear programming, graphically solution to linear programming problem, solving linear problem by simplex method, optimization problem, maximization & minimization function with or without constraints, slack surplus & artificial, variable method, degeneracy problem

✓ UNIT II

Mathematical statement of the transportation problem, the transportation model, method for basic feasible solution, Degeneracy & unbalance problem, Mathematical statement of the assignment problem, solution of assignment problem, traveling sales-man problem

✓ UNIT III

Game theory rule of game, Method of solving game, graphically & Arithmetic, saddle point & without saddle point, dominance method, mixed strategies 2 X 2 game, 2 X N game, M X 2 game, 3 X 3 game (Method of matrix's, method of linear programming etc).
Inventory: Introduction, classification, function, level, control techniques, models, various costs associated, EOQ, optimum lot sizing.

✓ UNIT IV

Introduction of queuing theory, elements of queuing system, operating characteristics of a queuing system, Poisson arrivals & exponential service time, waiting time & idle time cost, single channel Simulation, continuous & discrete simulation, Monte Carlo simulation, Generation of random number and its problem.

✓ UNIT V

Network analysis, Introduction of PERT & CPM, computation of PERT, Time estimation, measure of deviation & variation, probability of completing project, Arrow diagram & critical path method, Scheduling, cost analysis & crashing of network.

Text Books:

1. Sharma & S D Kedarnath - Operation Research, Ramnath & Co Meerut
2. Operation Research, Sasien Yaspan
3. Operation Research - N. D. Vohra - TMH Publication
4. Operation Research- Hira & Gupta - S. Chand & Co.
5. Operation Research - H. Gillette - TMH, New Delhi
6. Operations Research - M. Taha - TMH, New Delhi
7. Operations Research - Phillip Ravindran- Wiley Publications

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Department of Mechanical Engineering

✓ ME 483 Automobile Engineering

✓ UNIT - I

Introduction of an automobile, component and basis structure of automobile, classification, difference between automobile and automotive, the chassis construction & classification, defect in frames, frameless construction & specifications. Wheel and tyres: Types of wheel, wheel dimension, desirable tyres properties, types of tyres, tyre material, tyre dimension, factor affecting tyre life.

✓ UNIT-II

Transmission system: Function of transmission types, sliding mesh gear box, constant mesh gear box synchro mesh gear box, cylindrical gear box, torque converter, propeller shaft, universal joint, hooks joint, final drive, differential, performance of gear box.

✓ UNIT - III

Clutches: Requirement, function & type of clutch, dry friction clutch, wet friction clutch, clutch plate, single plate & multiple plate clutch, centrifugal clutch, and fluid fly wheel. Suspension system function and requirement, leaf spring, torsion bar, telescopic shock absorber.

✓ UNIT - IV

Brakes: Function and requirement, brake efficiency, wheel skidding, types of brake, electrical, mechanical and hydraulic & pneumatic brakes, master cylinder, wheel cylinder, self actualizing brakes, brake drum, brake liners, brake shoe, trouble shooting.

✓ UNIT - V

Front axle and suspension wheel alignment purpose, factor of front wheel alignment, steering geometry, correct steering angle, steering mechanism, under steer and over steer, steering gear, power steering, reversibility of steering gears, steering gear ratio, calculation of turning radius.

Engine emission: Emission standard of vehicle in India, Euro norms, emission, testing. Principle of multipoint fuel injection(MPFI), component of MPFI, Different sensors of MPFI system; vehicle air conditioning, Catalytic connectors, engine troubles & repairs.

Text Books:

1. Automobile Engineering Kripal Singh Vol. I, II
2. Automobile Mechanics Joseph Heitner.
3. Automobile Engineering Giri N.K
4. Automobile Engineering by Shrinivasan T.M.G.H.

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✓(Elective) ME- 484 (C) MACHINE TOOL DESIGN

✓UNIT - I

Introduction: Introduction to machine tool design and mechanism, definitions, classification and general; requirement of machine tool, working and auxiliary motions in machine tools, parameters defining working motion of machine tools Regulation of speed and feed rates: objective of speed and feed rate regulation, design of speed box, general recommendation for developing the gearing diagram, determining the number of teeth of gear boxes, mechanical step less regulation of speed and feed rates. Introduction to NC, CNC & DNC machines.

✓UNIT - II

Design of machine tool structures: function of machine tool structures and their requirement, design criteria and material for machine tool structures, static and dynamic stiffness, profile of machine tool structures, basic design procedure of machine tool structures, design of machine tool bed, columns, housing & bases, tables, cross rails arms and saddles. Integrated SAP model, Integrated Data, Master Data, Transactional Data, Integrated processes, Evolution Electronic Data Interchange (EDI), Use of EDI, and Benefits of EDI, Selection of ERP: Introduction Opportunities and problems in ERP selection, Approach to ERP selection of ERP. Origins of SAP, SAP's Markets, SAP architecture and integration, SAP Business structure, Customization of SAP, SAP R/3 material Management, Sales and Distribution, Production, Plant Maintenance, Quality Management, Methodology for ERP implementation, Implementation phases, Implementation of Life cycle

✓UNIT - III

Design of guide ways and power screws: function and types of guide ways, design of slide ways, design criteria and calculation for slide ways, guide ways operating under liquid friction conditions. Design of aerostatic slide ways, design of anti friction guide ways.

✓UNIT - IV

Design of spindles and spindle supports: function of spindle unit and requirements, material of spindles, effects of machine tool compliance on machining accuracy, design calculation of spindles, design of jigs and fixtures: principle of jigs and fixtures design, locating and clamping, jig bushes, drilling jigs.

✓UNIT V

Machine Tool Installation & Testing, Installation- principles related to machine tools installation, design of foundation. Testing- Introduction, idle run test, accuracy test, performance test, Acceptance test for lathe, drilling & milling machine.

Text Books:

1. Machine Tool Design by NK Mehta Tata Mcgraw Publication.
2. Basu, S.K., Design of Machine tool, Allied Publishers, New Delhi.
3. Koenigsberger, F., Design Principles of Metal cutting machine Tools, pergamon Press, Oxford, 1964.

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4. Push, V.E., Design of Machine Tools, Mashinostroenie Publishers, Moscow, 1977.
5. Machine Tool Design, vols. I-IV, Mir Publishers, Moscow, 1968.

✓(ELECTIVE) ME-484(D) ROBOTICS

✓UNIT - I

Introduction to Robotics: Evolution of robots and robotics, progressive advancement in robots, definitions and classifications, laws of robotics, robot anatomy and related attributes, human arm characteristics, robot control system, manipulation and control, **sensors in robotics, robots programming, the future prospects.**

✓UNIT - II

Coordinate Frames, Mapping and Transforms Robot specification and notations, Coordinate frames, description of objects in space, transformation of vectors, inverting a homogeneous transform, fundamental rotation matrices, yaw pitch and roll, yaw pitch and roll transformation, equivalent angle.

✓UNIT - III

Symbolic Modelling of Robots - Direct Kinematic Model Mechanical structure and notations, description of links and joints, kinematic modelling of the manipulator, Denavit - Hartenberg notation, kinematic relationship between adjacent links, manipulator, transformation matrix, introduction to inverse kinematic model, **Artificial Intelligence in robotics.**

✓UNIT - IV

Robotic Sensors and Vision The meaning of sensing, sensors in robotics, kinds of sensors used in robotics, robotic vision, industrial applications of vision-controlled robotic systems, process of imaging, architecture of robotic vision systems, image acquisition, description of other components of vision system, image representation, **image processing.**

✓UNIT - V

Robot Applications Industrial applications, material handling, processing applications, **assembly applications, inspection, application, principles for robot application and application planning.** justification of robots, robot safety, non-industrial applications, robotic application for sustainable development & social issues.

Text Books:

1. Robotics & Control - R.K. Mittal & I.J. Nagrath - TMH Publications
2. Robotics for engineers - Yoram Korean- McGrew Hill Co.
3. Industrial Robotics Technology programming and Applications - M.P.Groover, M.Weiss,
4. Robotics Control Sensing, Vision and Intelligence - K.S.Fu, R.C.Gonzalez, C.S.G.Lee- McGrew Hill Book co.
5. Kinematics and Synthesis of linkages - Hartenberg and Denavit - McGrew Hill Book Co
6. Kinematics and Linkage Design - AS. Hall - Prentice Hall
7. Kinematics and Dynamics of Machinery - J.Hirchhorn - McGrew Hill Book Company

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