Gautam Buddha University, Greater Noida

School of Engineering (Mechanical Engineering)- ME 301

Degree	Course Name	Course Code	Marks:100
Integrated B. Tech. + M. Tech. / M.B.A.	Heat & Mass Transfer	ME 301	SM+MT+ET 25+25+50
Semester	**Credits**	**L-T-P**	**Exam.**
V	4	3-1-0	3 Hours

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; One-dimensional general differential heat conduction equation in the rectangular; Cylindrical and spherical coordinate systems; Initial and boundary conditions. **(08 Hours)**

Unit - II

Conduction: 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; Heat transfer from extended surfaces; Fins of uniform cross-sectional area; Errors of measurement of temperature in thermometer wells; Transient heat conduction; Lumped capacitance method; Time constant; Unsteady state heat conduction in one dimension only; Heisler charts. **(07 Hours)**

Unit - III

Convection: Forced Convection; 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. **(08 Hours)**

Unit - IV

Natural Convections: 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; Introduction to condensation and boiling phenomena. **(08 Hours)**

Unit - V

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. **(07 Hours)**

Unit - VI

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

Introduction to Mass Transfer: Introduction; Fick's law of diffusion; Steady state equimolar counter diffusion; Steady state diffusion though a stagnant gas film. **(07 Hours)**

Recommended Books:

1. Heat Transfer by J.P. Holman; McGraw Hill International Edition.
2. Fundamentals of Heat and Mass Transfer by F. P. Incropera and D. P. De Witt; John Wiley and Sons.
3. Principles of Heat Transfer by Frank Kreith; McGraw-Hill Book Co.
4. Fundamentals of Momentum; Heat and Mass Transfer by James R. Welty; John Wiley & Sons (Pvt). Ltd.
5. Heat and Mass Transfer by Y.A. Cengel; Tata McGraw Hill.

School of Engineering (Mechanical Engineering)- ME 303

Degree	Course Name	Course Code	Marks:100
Integrated B. Tech. + M. Tech. / M.B.A.	Machine Design - I	ME 303	SM+MT+ET 25+25+50
Semester	**Credits**	**L-T-P**	**Exam.**
V	4	3-1-0	3 Hours

Unit - I

Introduction: Introduction to engineering design; Machine design; Design procedure and considerations; Use of standards in design; Preferred numbers; Factor of safety; Free body diagram; Various types of stresses; 2D and 3D stress elements; Static failure theories; Design for rigidity and stiffness. **(09 Hours)**

Unit - II

Material selection: Classification of materials; Ductile and brittle materials; Stress-strain diagrams of some common materials; Various properties of materials; Designation of materials; Criterion for material selection.

(04 Hours)

Unit –III

Design of elements subjected to simple loadings: Levers; Screws including power screws; Screw jack; Bolted joints; Riveted joints and welded joints including eccentrically loaded joints. **(10 Hours)**

Unit –IV

Joints and Couplings: Cotter joint; Knuckle joint; Pipe joints; Keys and couplings. **(10 Hours)**

Unit – V

Design for fatigue loading: Fatigue loads; Stress concentration; Sensitivity; Endurance strength/limit and modifying factors; Surface strength; Soderberg criterion; Goodman criterion; Modified Goodman criterion. **(08 Hours)**

Unit – VI

Shafts and Axles: Shaft and axle design; Procedure of shaft design with static and cyclic loadings. **(04 Hours)**

Recommended Books:

1. Fundamentals of Machine Elements by B. J. Hamrock; B. Jacobson; S. R. Schmid; McGraw Hill.
2. Machine Design by Joseph E. Shigley Tata McGraw Hill.
3. Design of Machine Elements by V.B. Bhandari; Tata McGraw Hill.
4. Machine Design – Fundamentals and Applications; P. C. Gope; PHI learning Pvt. Ltd.
5. Machine Design by P.C. Sharma & D.K. Aggarwal; Katson.
6. Machine Design by Khurmi & Gupta ; S. Chand.
7. Machine Design by Juvinal; Jhon-Wiley Publications
8. Machine Design by Spots; Prentice Hall Publications
9. Machine Design- an integrated approach by R. L. Norton; Pearson Education
10. Machine Design by Pandaya and Shah; Charotar Publications
11. Machine Design by R. K. Jain; Khanna Publications.

School of Engineering (Mechanical Engineering)- ME 305

Degree	Course Name	Course Code	Marks:100
Integrated B. Tech. + M. Tech. / M.B.A.	Mechanics of Materials - II	ME 305	SM+MT+ET 25+25+50
Semester	**Credits**	**L-T-P**	**Exam.**
V	3	2-1-0	3 Hours

Unit – I

Unsymmetrical Bending: Properties of beam cross section; Product of inertia; ellipse of inertia; Slope of the neutral axis; Stresses & deflections; Shear center and the flexural axis; Problems. **(05 Hours)**

Unit - II

Fixed Beams: Deflections, reactions and fixing moments with SF & BM calculations & diagrams for fixed beams under (i) concentrated loads, (ii) uniformly distributed load and (iii) a combination of concentrated loads & uniformly distributed load. Problems. **(05 Hours)**

Unit - III

Thick Cylinders & Spheres: Derivation of Lame's equations; Radial & hoop stresses and strains in thick and compound cylinders and spherical shells subjected to internal fluid pressure only; Wire wound cylinders; Hub shrunk on solid shaft; Problems. **(05 Hours)**

Unit - IV

Rotating Rims & Discs: Stresses in uniform rotating rings & discs; Rotating discs of uniform strength; Stresses in (i) Rotating rims; neglecting the effect of spokes; (ii) Rotating cylinders; Hollow cylinders & solids cylinders; Problems.

(05 Hours)

Unit – V

Bending of Curved Beams: Stresses in curved beams of initial large radius of curvature; Beams of initial small radius of curvature; Stresses in crane hooks; Rings of circular & trapezoidal sections; Deflection of curved beams & rings; Deflection of rings by Castigliano's theorem; Stresses in simple chain link; Deflection of simple chain links; Problems. **(05 Hours)**

Unit – VI

Springs: Stresses in open coiled helical spring subjected to axial loads and twisting couples; Leaf springs; Flat spiral springs; Concentric springs; Problems.

(05 Hours)

Recommended Books:

1. Strength of Materials; G. H. Ryder; Third Edition in SI Units 1969 Macmillan; India.
2. Mechanics of Materials (Metric Edition); Ferdinand P. Beer and E. Russel Johnston; Jr. Second Edition; McGraw Hill.
3. Solid Mechanics; S. M. A. Kazmi; Tata McGraw Hill
4. Strength of Materials; D. S. Bedi; S. Chand & Co. Ltd.
5. Advanced Mechanics of Solids and Structures; N. Krishan Raju and D. R. Gururaje; Narosa Publishing House.
6. Strength of Materials; Andrew Pytel and Fredinand L. Singer Fourth Edition; Int. Student Ed. Addison; Wesley Longman.

School of Engineering (Mechanical Engineering)- ME 307

Degree	Course Name	Course Code	Marks:100
Integrated B. Tech. + M. Tech. / M.B.A.	Fluid Machines	ME 307	SM+MT+ET 25+25+50
Semester	**Credits**	**L-T-P**	**Exam.**
V	4	3-1-0	3 Hours

Unit - I

Introduction: Velocity diagrams; Euler's turbomachinery equation; Similarity laws and specific speed; Aerofoil and cascade theory; impulse and reaction principle; Degree of reaction. **(06 Hours)**

Unit – II

Hydraulic Turbines: Types; Pelton wheel; Francis Turbine; Kaplan and propeller Turbine; Draft Tube; Cavitation and Thoma's cavitation factor; Governing of impulse and reaction turbines. **(06 Hours)**

Unit – III

Rotodynamic Pumps: Classification; centrifugal; Mixed and axial flow pumps; Head; Power and efficiency calculations; System losses; Impeller slip and slip factor. **(07 Hours)**

Unit – IV

Performance Characteristics of Fluid Machines: Head; Capacity and power Measurement; Performance and operating Characteristics; Muschal or constant efficiency curves; Model testing. **(08 Hours)**

Unit – V

Hydrostatic Machines: Principle and working of positive displacement machines; Indicator diagram; volumetric efficiency; Slip; Effect of acceleration and friction; Air vessels; Two and three throw pumps; Constant and variable delivery pumps; Rotary pumps. **(09 Hours)**

Unit – VI

Hydraulic Power Transmission Devices: Fluid coupling and torque converter; Hydraulic jack; Press; Hydraulic crane; Pressure accumulator and intensifier; Rigid column theory; Pressure transients; Water hammer; Surge control.

(09 Hours)

Recommended Books:

1. Fluid Flow Machines; N. S. Rao; Tata McGraw Hill.
2. Turbomachinery: Basic Theory and Applications; E. Logan; CRC Press.
3. Fluid Mechanics and Hydraulic Machines; R.K.Bansal; Laxmi Publication.
4. A Treatise on Turbomachinery; Gopalakrishnan and Prithviraj D.; Scitech Publications.

School of Engineering (Mechanical Engineering)- ME 309

Degree	Course Name	Course Code	Marks:100
Integrated B. Tech. + M. Tech. / M.B.A.	I C Engines & Gas Turbines	ME 309	SM+MT+ET 25+25+50
Semester	**Credits**	**L-T-P**	**Exam.**
V	4	3-1-0	3 Hours

Unit - I

Air Standard Cycles: Internal and external combustion engines; Classification of I.C. Engines; Cycles of operation in four stroke and two stroke I.C. Engines; Wankel Engines; Assumptions made in air standard cycle; Otto cycle; Diesel cycle; Dual combustion cycle; Comparison of Otto; Diesel and dual combustion cycles; Sterling and Ericsson cycles; Air standard efficiency; Specific work output; Specific weight; Work ratio; Mean effective pressure; Deviation of actual engine cycle from ideal cycle; Problems. **(08 Hours)**

Unit - II

Carburetion; fuel Injection and Ignition systems: Mixture requirements for various operating conditions in S.I. Engines; Elementary carburetor; Requirements of a diesel injection system; Types of injection systems; Petrol injection; Requirements of ignition system; Types of ignition systems ignition timing; Spark plugs; Problems. **(07 Hours)**

Unit - III

Combustion in I.C. Engines: S.I. engines; Ignition limits; Stages of combustion in S.I. Engines; Ignition lag; Velocity of flame propagation; Detonation; Effects of engine variables on detonation; Theories of detonation; Octane rating of fuels; Pre-ignition; S.I. engine combustion chambers; Stages of combustion in C.I. Engines; Delay period; Variables affecting delay period; Knock in C.I. engines; Cetane rating; C.I. engine combustion chambers.

(08 Hours)

Unit - IV

Lubrication and Cooling Systems: Functions of a lubricating system; Types of lubrication system; mist; Wet sump and dry sump systems; Properties of lubricating oil; SAE rating of lubricants; Engine performance and lubrication; Necessity of engine cooling; Disadvantages of overcooling; Cooling systems; Air-cooling; Water cooling; Radiators. **(07 Hours)**

Unit - V

Engine Testing; Performance and Air Pollution: Performance parameters: BHP; IHP; Mechanical efficiency; Brake mean effective pressure and indicative mean effective pressure; Torque; Volumetric efficiency; Specific fuel

consumption (BSFC; ISFC); Thermal efficiency; Heat balance; Basic engine measurements; Fuel and air consumption; Brake power; Indicated power and friction power; Heat lost to coolant and exhaust gases; Performance curves; Pollutants from S.I. and C.I. Engines; Methods of emission control; Alternative fuels for I.C. Engines; The blending of fuels; Bio Diesel; Multi point fuel injection system (MPFI); EURO- (1-4) series & BHARAT series; Problems. **(09 Hours)**

Unit - VI

Gas Turbines: Brayton cycle; Components of a gas turbine plant; Open and closed types of gas turbine plants; Optimum pressure ratio; Improvements of the basic gas turbine cycle; Multi stage compression with inter-cooling; Multi stage expansion with reheating between stages; Exhaust gas heat exchanger; Applications of gas turbines; Problems. **(06 Hours)**

Recommended Books:

1. Internal Combustion Engines; V. Ganesan; Publication; Tata McGraw-Hill.
2. Gas Turbines; V. Ganesan; Tata McGraw Hill. Engineering fundamental of the I.C.Engine – Willard W. Pulkrabek Publication: Prentice Hall of India.
3. Internal Combustion Engines; Mathur and Sharma; Dhanpat Rai and Sons
4. Internal Combustion Engines & Air pollution; E. F. Obert; Pub.-Hopper & Row Pub.; New York.
5. Internal Combustion Engines Fundamentals; John B. Heywood; Pub. McGraw Hill; New York.