Bachelor of Technology (Mechanical Engineering)
KURUKSHETRA UNIVERSITY KURUKSHETRA
Scheme of Studies/Examination
Semester III

S. No.	Course No.	Subject	L:T:P	Hours/Week	Examination Schedule (Marks)				Duration of Exam (Hrs)
					Theory	Sessional	Practical	Total	
1	AS-201N/ HS-201N	Mathematics-III/Fundamentals of Management	3:1:0	4	75	25	0	100	3
2	ME-201N	Basic Thermodynamics	3:1:0	4	75	25	0	100	3
3	ME-203N	Mechanics of Solids-I	3:1:0	4	75	25	0	100	3
4	ME-205N	Machine Drawing	2:0:3	5	75	25	0	100	3
5	ME-207N	Kinematic of Machines	3:1:0	4	75	25	0	100	3
6	ME-209N	Material Science	4:0:0	4	75	25	0	100	3
7	ME-211N	Kinematic of Machines Lab	0:0:2	2	0	40	60	100	3
8	ME-213N	Material Science Lab	0:0:2	2	0	40	60	100	3
9	ME-215N	Mechanics of Solids Lab	0:0:2	2	0	40	60	100	3
		Total		**31**	**450**	**270**	**180**	**900**	
10	MPC-201N	Environmental Studies*	3:0:0	3	75	25	0	100	3

*Paper MPC-201 is a mandatory course which will be non-credit subject and student has to get pass marks in order to qualify the semester

Bachelor of Technology (Mechanical Engineering)
KURUKSHETRA UNIVERSITY KURUKSHETRA
Scheme of Studies/Examination
Semester IV

S. No.	Course No.	Subject	L:T:P	Hours/ Week	Examination Schedule (Marks)				Duration of Exam (Hrs)
					Theory	Sessional	Practical	Total	
1	AS-201N/ HS-201N	Mathematics-III/Fundamentals of Management	3:1:0	4	75	25	0	100	3
2	ME-202N	Production Technology-I	4:0:0	4	75	25	0	100	3
3	ME-204N	Steam Generation & Power	3:1:0	4	75	25	0	100	3
4	ME-206N	Mechanics of Solids-II	3:1:0	4	75	25	0	100	3
5	ME-208N	Fluid Mechanics	4:1:0	5	75	25	0	100	3
6	ME-210N	Dynamics of Machines	3:1:0	4	75	25	0	100	3
7	ME-214N	Fluid Mechanics Lab	0:0:2	2	0	40	60	100	3
8	ME-216N	Dynamics of Machines lab	0:0:2	2	0	40	60	100	3
9	ME-218N	Steam Generation & Power Lab	0:0:2	2	0	40	60	100	3
10	ME-220N	Production Technology Lab	0:0:3	3	0	40	60	100	3
		Total		**34**	**450**	**310**	**240**	**1000**	
11	MPC-202N	Energy Studies*	3:0:0	3	75	25		100	3

*Paper MPC-202 is a mandatory course which will be non-credit subject and student has to get pass marks in order to qualify the semester.

NOTE- 6 weeks hands on training to be done after IVth Semester Exams. Marks will be allotted after training report evaluation in 5th Semester.

Course No.	Course Title	Teaching Schedule			Allotment of Marks			Duration of Exam (Hrs.)
		L	T	P	Theory	Sessional	Total	
AS-201N	MATHEMATICS-III	3	1	0	75	25	100	3
Purpose	To acquaint the students with the basic use of PDE, Linear Programming problems, Fourier series and transforms, Complex variables and Probability							
Course Outcomes (CO)								
CO-1	This section is concerned mainly with Fourier series. However, the underlying ideas can also be extended to non-periodic phenomena. This leads to Fourier integrals and transforms which are very much useful in solving the initial and boundary value problems.							
CO-2	Students will learn about the formation and solution the partial differential equations. First order PDE of any degree by using Charpit's method will be discussed in details. In addition, how to solve homogeneous linear PDE with constant coefficients and variable separable method and LPP will be covered under this section.							
CO-3	Complex analysis is concerned with generalization of the familiar real functions of calculus and their detailed knowledge is an absolute necessity in practical work to solve engineering problems.							
CO-4	Probability theory provides models of probability distributions(theoretical models of the observable reality involving chance effects) to be tested by statistical methods which has various engineering applications, for instance, in testing materials, control of production processes, robotics, and automatization in general, production planning and so on.							

UNIT-I

Fourier Analysis

Fourier series: Euler's formulae, Orthogonality conditions for the Sine and Cosine function, Dirichlet's conditions, Fourier expansion of functions having points of discontinuity, Change of interval, Odd and even functions, Half-range series.

Fourier Transforms: Fourier integrals, Fourier transforms, Fourier Cosine and Sine transforms, Properties of Fourier transforms, Convolution theorem, Parseval's identity, Fourier transforms of the derivative of a function, Application of transforms to boundary value problems (Heat conduction and vibrating string).

UNIT-II

Partial Differential Equations and LPP

Formation and Solutions of PDE, Lagrange's Linear PDE, First order non-linear PDE, Charpit's method, Homogeneous linear equations with constant coefficients, Method of separation of variables.

Solution of linear programming problems: using Graphical and Simplex methods.

UNIT-III

Theory of Complex Variables

A review of concept of functions of a complex variable, Limit, continuity, differentiability and analyticity of a function. Basic elementary complex functions (exponential functions, trigonometric & Hyperbolic functions, logarithmic functions) Cauchy-Riemann Equations.

Line integral in complex plane, definition of the complex line integral, basic properties, Cauchy's integral theorem, and Cauchy's integral formula, brief of Taylor's, Laurent's and Residue theorems (without proofs).

UNIT-IV

Probability theory:

A review of concepts of probability and random variables: definitions of probability, addition rule, conditional probability, multiplication rule, Conditional Probability, Mean, median, mode and standard deviation, Bayes' Theorem, Discrete and continuous random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, moments, moment generating function.

Standard Distributions: Binomial, Poisson and Normal distribution.

References Books:

1. E. Kreyszig : Advanced Engineering Mathematics, Wiley India.
2. B. V. Ramana: Engineering Mathematics, Tata McGraw Hill.
3. R.K. Jain, S.R.K. Iyengar: Advanced Engineering Mathematics, Taylor & Francis.
4. Murray R Spiegel: Schaum's Outline of Complex Variables, McGraw Hill Professional.
5. Michael D. Greenberg: Advanced Engineering Mathematics, Pearson Education, Prentice Hall.

Note: *Examiner will set eight questions by selecting two from each unit. Students will be required to attempt five questions selecting at least one question from each unit.*

Course No.	Course Title	Teaching Schedule			Allotment of Marks			Duration of Exam (Hrs.)
		L	T	P	Theory	Sessional	Total	
ME-201N	BASIC THERMODYNAMICS	3	1	0	75	25	100	3
Purpose	The objective of this course is to make the students aware of Energy, Entropy, Equilibrium, various laws of thermodynamics and relations. The course will help the students to build the fundamental concepts in order to solve engineering problems.							
Course Outcomes (CO)								
CO-1	State the thermodynamic system, properties and equilibrium. Describe the ideal and real gas laws.							
CO-2	Analyze and solve the first and second law of thermodynamics problems.							
CO-3	Define entropy and its change for different processes and also solve entropy problems							
CO-4	Describe the Availability and unavailability for steady and unsteady flow processes. Also understand the concept of irreversibility.							
CO 5	Solve the problems related to Steam and plot the processes on H-S and T-S diagram. Understand thermodynamics relations.							

Unit-I

Basic Concepts: Thermodynamics: Macroscopic and Microscopic Approach, Thermodynamic Systems, Surrounding and Boundary, Thermodynamic Property – Intensive and Extensive, Thermodynamic Equilibrium, State, Path, Process and Cycle, Quasi-static, Reversible and Irreversible Processes, Working Substance. Concept of Thermodynamic Work and Heat, Equality of Temperature, Zeroth Law of Thermodynamic and its utility.

Ideal and Real Gases: Concept of an Ideal Gas, Basic Gas Laws, Characteristic Gas Equation, Avagadro'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, Bass, Mole and Volume Fraction, Gibson Dalton's law, Gas Constant and specific Heats, Entropy for a mixture of Gases.

Unit II

First Law of Thermodynamics: Energy and its Forms, Energy and 1st law of Thermodynamics, Internal Energy and Enthalpy, 1st Law Applied to Non-Flow Process, Steady Flow Process and Transient Flow Process, Throttling Process and Free Expansion Process. Numericals

Second Law Of Thermodynamics: Limitations of First Law, Thermal Reservoir Heat Source and Heat Sink, Heat Engine, Refrigerator and Heat Pump, Kelvin- Planck and Clausius Statements and Their Equivalence, Perpetual Motion Machine of Second Kind. Carnot Cycle, Carnot Heat Engine and Carnot Heat Pump, Carnot's Theorem and its Corollaries, Thermodynamic Temperature Scale, Numericals

Unit III

Entropy: Clausius Inequality and Entropy, Principle of Entropy Increase, Temperature-Entropy Plot, Entropy Change in Different Processes, Introduction to Third Law of thermodynamics. Availability, Irreversibility and Equilibrium: High and Low Grade Energy,

Availability and Unavailable Energy, Loss of Available Energy Due to Heat Transfer Through a Finite Temperature Difference, Availability of a Non-Flow or Closed System, Availability of a Steady Flow System, Helmholtz and Gibb's Functions, Effectiveness and Irreversibility. Numericals.

Unit IV

Pure Substance: Pure Substance and its Properties, Phase and Phase Transformation, Vaporization, Evaporation and Boiling , Saturated and Superheat Steam, Solid – Liquid – Vapour Equilibrium, 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. Numericals.

Thermodynamic Relations: T-Ds Relations, Enthalpy and Internal Energy as a Function of Independent Variables, Specific Heat Capacity Relations, Clapeyron Equation, Maxwell Relations.

Text Books:

1. Engineering Thermodynamics – C P Arora, Tata McGraw Hill
2. Engineering Thermodynamics – P K Nag, Tata McGraw Hill

Reference Books:

1. Thermal Science and Engineering – D S Kumar, S K Kataria and Sons
2. Engineering Thermodynamics -Work and Heat transfer – G F C Rogers and Maghew Y R Longman

Note: *Examiner will set eight questions by selecting two from each unit. Students will be required to attempt five questions selecting at least one question from each unit.*

Course No.	Course Title	Teaching Schedule			Allotment of Marks			Duration of Exam (Hrs.)
		L	T	P	Theory	Sessional	Total	
ME-203N	MECHANICS OF SOLIDS-I	3	1	0	75	25	100	3
Purpose	The objective of this course is to make the students aware of Stress, Strain and deformation of solids with the applications to beams, shafts and column and struts. The course will help the students to build the fundamental concepts in order to solve engineering problems							
Course Outcomes (CO)								
CO-1	Apply fundamental principles of mechanics & principles of equilibrium to simple and practical problems of engineering, determine centroid and moment of inertia of a different geometrical shape and able to understand its importance. Explain the basic concepts of stress and strain and solve the problems							
CO-2	Determine and calculate the values of principal stresses. Express the concept of shear force and bending moment of beams. Construct shear force and bending moment diagram for beams.							
CO-3	Express the concept of torsion of circular shaft and able to solve the problems on torsion of circular shaft. Illustrate and the solve the problems on bending and shear stresses on beams							
CO-4	Solve the problems on column and strut and Derive the derivations and solve the problems on slope and deflection.							

Unit-I

Introduction: Force, types of forces, Characteristics of a force, System of forces, Composition and resolution of forces, forces in equilibrium, principle and laws of equilibrium, Free body diagrams, Lami's Theorem, equations of equilibrium, Concept of center of gravity and centroid, centroid of various shapes: Triangle, circle, semicircle and trapezium, theorem of parallel and perpendicular axes, moment of inertia of simple geometrical figures, polar moment of inertia. Numerical Problems

Simple stresses &strains : Concept & types of Stresses and strains, Polson's ratio, stresses and strain in simple and compound bars under axial loading, stress strain diagrams, Hooks law, elastic constants & their relationships, temperature stress & strain in simple & compound bars under axial loading, Numerical problems.

Unit-II

Principle stresses: Two dimensional systems, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stresses, Numerical

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 contraflexture under (i) concentrated loads, (ii) uniformly distributed loads over whole span or a part of it, (iii)combination of concentrated loads and uniformly distributed loads, (iv) uniformly varying loads and (v) application of moments, relation between the rate of loading, the shear force and the bending moments, Numerical Problems.

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Unit-III

Torsion of circular Members: Derivation of equation of torsion, Solid and hollow circular shafts, tapered shaft, stepped shaft & composite circular shafts, Numerical problems.

Flexural and shear stresses – Theory of simple bending, Assumptions, derivation of equation of bending, neutral axis, determination of bending stresses, section modulus of rectangular & circular (solid & hollow), I,T, Angle, channel sections, composite beams, shear stresses in beams with derivation, shear stress distribution across various beam sections like rectangular, circular, triangular, I, T, angle sections. Combined bending and torsion, equivalent torque,. Numerical problems.

Unit-IV

Columns & Struts: Column under axial load, concept of instability and buckling, slenderness ratio, derivation of Euler's formula for crippling load for columns of different ends, concept of equivalent length, eccentric loading, Rankine formulae and other empirical relations, Numerical problems.

Slope &Deflection : Relationship between bending moment, slope & deflection, moment area method, method of integration, Macaulay's method, calculations for slope and deflection of (i) cantilevers and (ii) simply supported beams with or without overhang under concentrated load, Uniformly distributed loads or combination of concentrated and uniformly distributed loads, Numerical problems.

Text Books:

1. Strength of Materials – R.K. Rajput, Dhanpat Rai & Sons.
2. Strength of Materials – Sadhu Singh, Khanna Publications.
3. Strength of Materials – R.K. Bansal, Laxmi Publications.

Reference Books:

1. Strength of Materials – Popov, PHI, New Delhi.
2. Strength of Materials – Robert l. Mott, Pearson, New Delhi
3. Strength of Material – Shaums Outline Series – McGraw Hill
4. Strength of Material – Rider – ELBS

Note: *Examiner will set eight questions by selecting two from each unit. Students will be required to attempt five questions selecting at least one question from each unit.*

Course No.	Course Title	Teaching Schedule			Allotment of Marks			Duration of Exam (Hrs.)
		L	T	P	Theory	Sessional	Total	
ME-205N	MACHINE DRAWING	2	0	3	75	25	100	3
Purpose	To understand how different parts are assembled for an assembly.							
Course Outcomes (CO)								
CO-1	Student gets aware about surface finish of the finished surface and isometric projection.							
CO-2	Student gets aware about the free hand drawings of the different joints.							
CO-3	Student gets aware about how different parts are assembled for an assembly.							

Unit-I

Introduction to BIS Specification SP: 46 – 1988 Code of engineering drawing –Limits, fits and Tolerance (Dimensional and Geometrical tolerance), Surface finish representation, Isometric projections from orthographic views.

Unit-II

Dimensioning, Sectioning.
Coupling: protected unprotected flange coupling, flexible coupling,
Crankshaft: overhung, disc of crank, Built up crank.
Cotter: sleeve and cotter, spigot and socket, Gib and cotter.
Knuckle joint, Connecting rod, Riveted Joint. Welded Joint

Unit-III

Assembly drawing with sectioning, bill of materials,
Assemblies: Lathe Tail stock, machine vice, pedestal bearing, drill jig and milling jig.

Text Books:

1. Machine Drawing by N D Bhat and V M Panchal, Charotar Publishing House
2. A Text Book of Machine Drawing: P S Gill , Pub.: S K Kataria& Sons
3. A Text Book of Machine Drawing: Dr.R.KDhawan, Pub.: S.Chand

Reference Books :

1. A Text Book of Machine Drawing :Laxminarayana and Mathur, Pub. : M/s. Jain Brothers, New Delhi.
2. Machine drawing : N Sidheshwar, P Kannaieh V V S Sastry, Pub.: Tata Mc Graw –Hill Publishing Ltd.
3. Machine drawing : R B Gupta Satya Prakashan

Note: Some of the exercises may be done on AUTOCAD Software.

NOTE:

(1) In the semester examination, the examiner will set two questions from each unit. The students have to attempt three questions taking one from each unit.
(2) The questions from Unit I and Unit II will carry 15 marks each. Question from Unit III will carry 45 marks.

Course No.	Course Title	Teaching Schedule			Allotment of Marks			Duration of Exam (Hrs.)
		L	T	P	Theory	Sessional	Total	
ME-207N	KINEMATIC OF MACHINES	3	1	0	75	25	100	3
Purpose	To understand construction and working of various types of Mechanisms.							
Course Outcomes (CO)								
CO-1	To understand the basic components and layout of linkages in the assembly of a system / machine							
CO-2	To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.							
CO-3	To understand the motion mechanisms with lower pairs and the mechanisms used in automobile.							
CO-4	To understand the motion resulting from a belt and chain drives systems and study cam mechanisms for specified output motions							

UNIT-I

Introduction to Mechanisms and Kinematics:

Introduction, Machines and Mechanisms, Kinematics, Mechanism Terminology, Kinematic Diagrams, Kinematic Inversion, **Mobility:** Gruebler's Equation, Actuators and Drivers, **Commonly Used Links and Joints:** Eccentric Crank, Pin-in-a-Slot Joint, Screw Joint,**Special Cases of the Mobility Equation:** Coincident Joints, Exceptions to the Gruebler's equation, Idle Degrees of Freedom, **The Four-Bar Mechanism:** Grashof 's Criterion , Double Crank, Crank-Rocker, Double Rocker, Change Point Mechanism, Triple Rocker, **Slider-Crank Mechanism, Special Purpose Mechanisms: S**traight-Line Mechanisms, Parallelogram Mechanisms, Quick-Return Mechanisms, Scotch Yoke Mechanism, **Problems**

UNIT-II

Velocity determination: Kennedy's Space and body centroids, Relative velocity methods, Instantaneous center method,

Acceleration determination: Four link Mechanism, Acceleration of Intermediate and Offset points, Slider Crank Mechanism, Coriolis Acceleration components, Crank and slotted lever mechanism, Klein's and other constructions.

Kinematics Synthesis of Mechanisms: Number Synthesis, Frudenstein's equation, Chebyshev spacing of precisions points, Two and three position synthesis of four bar mechanisms and slider crank mechanisms, Overlay method, Bloch method and transmission angle.

UNIT-III

Mechanisms with Lower Pairs: Pantograph, straight-line motion mechanisms: accurate straight line motion mechanisms (Peaucellier, Hart and Scott Russell mechanism), approximate straight-line motion mechanisms (Grasshopper, Watt, Tchebicheff mechanism) Intermittent motion mechanisms, Parallel linkages, Engine pressure Indicators (Simplex Crosby, Thomson)

Automobile steering gear mechanisms: Fundamental equation for correct steering, Davis and Ackerman steering gear, Hooke's joint (universal coupling), Double hooke's joint, **Friction:** Types of friction, Laws of dry friction, Motion along inclined plane Screw threads, Wedge, screw jack, pivots and collars.

UNIT-IV

Cams and Followers: Introduction, Classification of Followers, Classification of Cams, Terms used in Radial cams, Motion of the Follower,

Displacement, Velocity and Acceleration Diagrams when (i) the Follower Moves with Uniform Velocity (ii) the Follower Moves with Simple Harmonic Motion. (iii) the follower Moves with Uniform Acceleration and Retardation, Cycloidal Motion, Construction of Cam Profiles, Cams with Specified Contours, Tangent Cam with Reciprocating Roller Follower, Circular Arc Cam with Flat-faced Follower.

Belt and Chain Drives: Open and crossed belt drives, velocity ratio, slip, material for belts, crowning of pulleys, lawof belting, types of pulleys, length of belts ratio of tensions, centrifugal tension, power transmitted by belts, initial tension, creep, chain drive, chain length, classification of chains

Suggested reading:

1. Theory of machines: S. S. Rattan, Tata McGraw Hill Publications
2. Theory of Machines and Mechanisms.:Uicker, J.J., Pennock G.R and Shigley, J.E.,3rd Edition, Oxford University Press, 2009.
3. Machines and mechanisms, Applied kinematic analysis by David h. Myszka, Prentice hall
4. Theory of Machines, V. P. Singh, Dhanpat Rai & Co. Pvt. Ltd., Delhi.
5. Mechanism synthesis and analysis: A.H. Soni, McGraw Hill Publications.
6. Mechanism: J.S. Beggs.
7. Mechanics of Machines: P.Black, Pergamon Press.
8. Theory of Machines: P.L.Ballaney, Khanna Publisher
9. "Theory of Machines:Thomas Bevan,", 3rd Edition, CBS Publishers and Distributors, 2005.

Note: *Examiner will set eight questions by selecting two from each unit. Students will be required to attempt five questions selecting at least one question from each unit.*

Course No.	Course Title	Teaching Schedule			Allotment of Marks			Duration of Exam (Hrs.)
		L	T	P	Theory	Sessional	Total	
ME-209N	MATERIAL SCIENCE	4	0	0	75	25	100	3
Purpose	To understand internal structure and properties relationship of different types of materials.							
Course Outcomes (CO)								
CO-1	To understand the Crystal structures and deformation mechanism in various materials.							
CO-2	To study various types of phase diagrams, TTT curve and Iron carbon diagram. To learn about different heat treatment processes.							
CO-3	To learn about the structure properties and applications of Ceramics, composites, polymers and some of the advanced materials.							
CO-4	To study various types of characterization techniques and to learn about failure mechanisms like Creep and Fatigue.							

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; Numerical Problems Related to Crystallography.

Imperfection in Metal Crystals: Crystal Imperfections and their Classifications, Point Defects, Line Defects, Edge & Screw Dislocations, Surface Defects, Volume Defects, Effects of Imperfections on Metal Properties.

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..

UNIT-II

Phase Diagrams: Alloy Systems, Solid solutions, Hume Rothery's Rules, Phase Diagrams, Gibbs Phase Rule, TTT curve, The Lever Rule, binary phase diagrams, intermediate phases, intermetallic compounds, Applications of Phase Diagrams, Phase Transformation, Micro constituents of Fe-C system, Allotropic Forms of Iron, iron-iron carbide phase diagram, Modified Iron Carbon Phase Diagrams,

Heat treatment: Heat treatment of steels, Annealing, Normalising, Hardening, Tempering, Case Hardening, Surface Hardening, Ageing, Austempering and Martempering, Mass Effect, Equipment for Heat Treatment, Major Defects in Metals or Alloys due to faulty Heat treatment, recovery, recrystallization and grain growth. Microstructure, properties and applications of ferrous and non-ferrous alloys.

UNIT-III

Ceramics, Polymers and Composites:

Ceramics:

Structure, properties, processing and applications of traditional and advanced ceramics.

Polymers:

Classification, polymerization, structure and properties, additives for polymer products, processing and applications.

Composites: Properties and applications of various composites.

Advanced Materials:
Smart materials exhibiting ferroelectric, piezoelectric, opto-electric, semiconducting behaviour, Aerogels, photoconductivity and superconductivity, nanomaterials, biomaterials, super alloys, shape memory alloys, Liquid crystals, Carbon Nanotubes, Graphene and Fullerenes.

UNIT-IV

MaterialsCharacterization Techniques:
Characterization techniques such as, scanning electronmicroscopy, transmission electron microscopy, atomic force microscopy, scanningtunnelling microscopy, atomic absorption spectroscopy, differential scanning calorimetry.

Failure of Materials:
Fatigue: Fatigue fracture, fatigue failure, Mechanism of Fatigue Failure, Design for Fatigue, Fatigue Life calculations, Fatigue Tests, Rotating Beam Fatigue Test, Wohler Fatigue Test, Theories of Fatigue, Corrosion Fatigue,
Creep: Creep Curve, Creep Curve equations, Types of Creep, Factors affecting Creep, Mechanism of Creep, Creep Resistant Material, Creep Fracture, Creep Test, Stress Rupture test,

Text Books:

1. Material Science by S.L. Kakani, New Age Publishers.
2. The Science and Engineering of Materials, Donald R. Askeland , Chapman & Hall.
3. Fundamentals of Material Science and Engineeringby W. D. Callister, Wiley.
4. Fundamental of Light Microscopy and Electronic Imaging by Douglas B. Murphy, Kindle Edition 2001
5. Materials Science and Engineering, V. Raghvan
6. Phase Transformation in Metals and Alloys, D. A. Porter & K. E. Easterling
7. Material Science by Narula, TMH
8. Physical Methods for Metal Characterization, PejFlewitt, Institute of Physics Pub.
9. Robert Cahn Concise Encyclopedia of Materials Characterization, Second Edition: 2nd Edition (Advances inMaterials Science and Engineering) Elsevier Publication 2005.

Note: *Examiner will set eight questions by selecting two from each unit. Students will be required to attempt five questions selecting at least one question from each unit.*

Course No.	Course Title	Teaching Schedule			Allotment of Marks			Duration of Exam (Hrs.)
		L	T	P	Sessional	Practical	Total	
ME-211N	KINEMATIC OF MACHINES LAB	0	0	2	40	60	100	3
Purpose	To make students understand various kinds of mechanisms working around in industries and routine life.							
Course Outcomes (CO)								
CO-1	To learn about various types of basic mechanisms & their applications.							
CO-2	To learn about complex mechanisms practically used in machines.							
CO-3	To learn about steering mechanism used in automobiles							
CO-4	To learn about the working of various joints like Hooke's joint.							

List of experiments

1. To Study of the inversions of the single slider crank mechanism.
2. To verify the law of moment using Bell- crank lever.
3. To determine velocity & acceleration of slider in slider-crank mechanism and plot the following:
   a. θ v/s x (displacement of slider)
   b. θ v/s velocity and
   c. θ v/s acceleration.

   Compare the values of velocities & acceleration with those obtained theoretically.(Assume ω=I rad/sec.)**.**
4. To determine experimentally the ratio of the cutting time to idle time (cutting stroke to idle stroke) of the crank and slotted lever (QRM)/ Whitworth and compare the result to theoretical values plot the following
   a. θ v/s X (displacement of slider).
   b. θ v/s velocity.
   c. θ v/s Acceleration and to compare the values of velocities

   (Take angles θ =45˚, 90˚, 135˚, 225˚, 270˚ &335˚, ω = 1 rad/s)
5. To determine the displacement, velocities, & accelerations of the driven shaft of a Hooke's joint for a constant speed of the driver shaft.
6. To study various types of steering mechanisms.
7. To determine the value of coefficient of friction between the screw and nut of the jack, while:
   a. Raising the load
   b. Lowering the load
8. To draw experimentally a curve of the follower-displacement v/s cam-angle. Differentiate the above curve to get velocity and acceleration plot and compare the values with those obtained analytically
9. To determine the coefficient of friction between belt and pulley and plot a graph between $\log_{10} T_1/T_2$ v/s, θ.
10. To determine the value of coefficient of friction for a given pair of surfaces using friction apparatus.
11. To find out experimentally the coriolis component of acceleration and compare with theoretical values.

Note: Any 8 experiments from the above list and other 2 from others (developed by institute) are required to be performed by students in the laboratory.

Course No.	Course Title	Teaching Schedule			Allotment of Marks			Duration of Exam (Hrs.)
		L	T	P	Sessional	Practical	Total	
ME-213N	MATERIAL SCIENCE LAB	0	0	2	40	60	100	3
Purpose	To make the students aware of material structure and properties of material using different experiments.							
Course Outcomes (CO)								
CO-1	Ability to design and conduct experiments, acquire data, analyze and interpret data							
CO-2	Ability to determine the grain size and strain hardening phenomenon in different metals by means of experiments.							
CO-3	Ability to learn about stress concentration factor and microstructures of different materials.							
CO-4	To learn about heat treatment processes through experiments.							
CO-5	Ability to perform Fatigue and creep test on different materials.							

List of Experiments:

1. To study crystal structures with the help of models.
2. To study crystal imperfections with the help of models.
3. Determination of grain size for a given specimen
4. To determine the stress concentration factor at a geometricaldiscontinuity
5. To observe and learn about the strain hardening effect inmetals.
6. Comparative study of microstructures of different specimens of different materials (Mild steel, Gray C.I., Brass, Copper, Aluminium etc.)
7. To prepare a small specimen and mount it using hot mounting press.
8. To harden and temper a given steel specimen.
9. To anneal a given hardened steel specimen.
10. To analyse microstructure of quench hardened steel specimen.
11. To perform Fatigue test on fatigue testing machine.
12. To perform Creep test on creep testing machine.

Note: Any 8 experiments from the above list and other 2 from others (developed by institute) are required to be performed by students in the laboratory.

Course No.	Course Title	Teaching Schedule			Allotment of Marks			Duration of Exam (Hrs.)
		L	T	P	Sessional	Practical	Total	
ME-215N	MECHANICS OF SOLIDS LAB	0	0	2	40	60	100	3
Purpose	To make the students aware of different properties of material using different experiments.							
Course Outcomes (CO)								
CO-1	Ability to design and conduct experiments, acquire data, analyze and interpret data							
CO-2	Ability to determine the behavior of ferrous metals subjected to normal and shear stresses by means of experiments							
CO-3	Ability to determine the behavior of structural elements, such as bars subjected to tension, compression, shear, bending, and torsion by means of experiments.							
CO-4	Physical insight into the behavior materials and structural elements, including distribution of stresses and strains, deformations and failure modes.							
CO-5	Write individual and group reports: present objectives, describe test procedures and results, synthesize and discuss the test results.							

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 Erichson sheet metal testing machine & perform the Erichson 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, compression & bending tests.
7. To perform the shear test 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 prepare the composite specimen using hot compression molding machine and test on UTM.
12. To view and measure the principal stress components and directions of principal stresses by the photo elastic method using 12" Diffused Light Research Polariscope.

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Note: Any 8 experiments from the above list and other 2 from others (developed by institute) are required to be performed by students in the laboratory.

Course No.	Course Title	Teaching Schedule			Allotment of Marks			Duration of Exam (Hrs.)
		L	T	P	Theory	Sessional	Total	
MPC-201N	ENVIRONMENTAL STUDIES	3	0	0	75	25	100	3
Purpose	To learn the multidisciplinary nature, scope and importance of Environmental Studies							
Course Outcomes (CO)								
CO-1	Basic concepts of Various kinds of Microscopy and Centrifugation Techniques							
CO-2	To learn the theoretical and practical aspects of Electrophoresis and Chromatography Techniques							
CO-3	To learn the concepts of different kinds of Spectroscopy and Colourimetry							
CO-4	To understand the concept of radioisotope techniques and their applications in research							

UNIT 1

The multidisciplinary nature of environmental studies. Definition, Scope and Importance. Need for public awareness. Natural Resources: Renewable and Non-Renewable Resources: Natural resources and associated problems.

(a) Forest Resources: Use and over-exploitation, deforestation, case studies. Timber eztraction, mining, dams and their effects on forests and tribal people.
(b) Water Resources- Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
(c) Mineral Resources- Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
(d) Food Resources- World Food Problems, changes caused by agriculture and overgazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
(e) Energy Resources- Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
(f) Land Resources- Land as a resource, land, degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources.Equitable use of resources for sustainable lifestyle.

UNIT II

Ecosystem-Concept of an ecosystem.Structure and function of an ecosystem.Producers, consumers and decomposers.Energy flow in the ecosystem.Ecological Succession.Food Chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem-

a. Forest Ecosystem
b. Grassland Ecosystem
c. Desert Ecosystem
d. Aquatic Ecosystems(ponds, streams, lakes, rivers, oceans, estuaries

Field Work. Visit to a local area to document Environment assets-river/forest/grassland/hill/mountain.Visit to a local polluted site- Urban /Rural Industrial/Agricultural. Study of common plants, insects and birds. Study of simple ecosystems-pond, river, hill, slopes etc. (Field work equal to 5 lecture hours).

UNIT III

Biodiversity and its conservation. Introduction, Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity of global, National and local levels. India as a mega-diversity nation Hot spots of Biodiversity. Threats to biodiversity: Habitat loss, poaching of wild life, man-wildlife conflicts. Endangered and endemic species of India.Conservation of Biodiversity- In situ and Ex-Situ conservation of biodiversity.

Environmental Pollution Definition. Cause, effects and control measures of- (a) Air Pollution (b) Water Pollution (c) Soil Pollution (d) Marine Pollution (e) Noise Pollution (f) Thermal Pollution (g) Nuclear Hazards

Solid waste management- cause, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides

UNIT IV

Social Issues and the Environment.From unsustainable to sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people: Its problems and concerns. Case Studies.Environmental ethics-issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.Wasteland ReclamationConsumerism and waste products.Environment Protection Act.Air (Prevention and Control of Pollution) Act.Water (Prevention and Control of Pollution) Act.Wildlife Protection Act.Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public Awareness. Human population and the Environment.Population growth, variation among nations. Population explosion-Family Welfare Programme. Environment and human health.Human rights.Value Education.HIV/AIDS, Women and Child Welfare.Role of Information Technology in Environment and Human Health.Case Studies.

Text Books

1. Environmental Studies- Deswal and Deswal. Dhanpat Rai & Co.
2. Environmental Science & Engineering Anandan, P. and Kumaravelan, R. 2009. Scitech Publications (India) Pvt. Ltd., India
3. Environmental Studies. Daniels Ranjit R. J. and Krishnaswamy. 2013. Wiley India.
4. Environmental Science-Botkin and Keller. 2012. Wiley, India

Note: *Examiner will set eight questions by selecting two from each unit. Students will be required to attempt five questions selecting at least one question from each unit.*

Course No.	Course Title	Teaching Schedule			Allotment of Marks			Duration of Exam (Hrs.)
		L	T	P	Theory	Sessional	Total	
HS-201N	FUNDAMENTALS OF MANAGEMENT	3	0	0	75	25	100	3
Purpose	To understand the concept and techniques of controlling and new trends in management							
Course Outcomes (CO)								
CO-1	An overview about management as a discipline and its evolution							
CO-2	Understand the concept and importance of planning and organizing in an organization							
CO-3	Enabling the students to know about the importance of hiring and guiding the workforce by understanding the concept of leadership and communication in detail							
CO-4	To understand the concept and techniques of controlling and new trends in management							

UNIT-1

1. Introduction to Management: Meaning, Definition, nature, importance & Functions, Management as Art, Science & Profession- Management as social System, Concepts of management-Administration

2. Evolution of Management Thought: Development of Management Thought- Scientific management, Administrative Theory of Management, Bureaucratic Organization, Behavioral approach (Neo Classical Theory): Human Relations Movement; Behavioral Science approach; Modern approach to management – Systems approach and contingency approach.

UNIT-II

3. Planning: nature, purpose and functions, types of plans, planning process, Strategies and Policies: Concept of Corporate Strategy, formulation of strategy, Types of strategies, Management by objectives (MBO), SWOT analysis, Types of policies, principles of formulation of policies

4. Organizing: nature, importance, process, organization structure: Line and Staff organization, Delegation of Authority and responsibility, Centralization and Decentralization, Decision Making Process , Decision Making Models, Departmentalization: Concept and Types (Project and Matrix), formal & informal organizations

UNIT-III

5. Staffing: concept, process, features; manpower planning; Job Analysis: concept and process; Recruitment and selection: concept, process, sources of recruitment; performance appraisal, training and development

6. Directing: Communication- nature, process, formal and informal, barriers to Effective Communication, Theories of motivation-Maslow, Herzberg, McGregor ; Leadership – concept and theories, Managerial Grid, Situational Leadership. Transactional and Transformational Leadership.

UNIT-IV

7. Controlling: concept, process, types, barriers to controlling, controlling Techniques: budgetary control, Return on investment, Management information system-MIS , TQM-Total Quality Management, Network Analysis- PERT and CPM.

8. Recent Trends in Management: -

Social Responsibility of Management–Management of Crisis, Total Quality Management, Stress Management, Concept of Corporate Social Responsibility (CSR) and business ethics.

Functional aspects of business: Conceptual framework of functional areas of management- Finance; Marketing and Human Resources

Text books

1. Management Concepts - Robbins, S.P; Pearson Education India
2. Principles of Management - Koontz &O'Donnel; (McGraw Hill)

Recommended books

1. *Business Organization and Management* – Basu; Tata McGraw Hill
2. Management and OB-- Mullins; Pearson Education
3. Essentials of Management – Koontz, Tata McGraw-Hill
4. Management Theory and Practice – Gupta, C.B; Sultan Chand and Sons, new Delhi
5. Prasad, Lallan and S.S. Gulshan. *Management Principles and Practices.* S. Chand& Co. Ltd., New Delhi.
6. Chhabra, T.N. *Principles and Practice of Management*. DhanpatRai& Co., Delhi.
7. Organizational behaviour – Robins Stephen P; PHI.

Note: *Examiner will set eight questions by selecting two from each unit. Students will be required to attempt five questions selecting at least one question from each unit.*

Course No.	Course Title	Teaching Schedule			Allotment of Marks			Duration of Exam (Hrs.)
		L	T	P	Theory	Sessional	Total	
ME-202N	Production Technology-I	4	0	0	75	25	100	3
Purpose	To make student aware about various metal cutting tools, mechanism involved and machines used for metal cutting.							
Course Outcomes (CO)								
CO-1	Learn about tool geometry and nomenclature, chip classification, metal cutting theories, tool life, geometry, surface finish etc.							
CO-2	Learn about cutting fluids and tool life, economics of metal machining.							
CO-3	Learn about milling and drilling machines.							
CO-4	Learn about specifications of various machine tools, metrology, surface finish and its measurements.							

UNIT-I

Geometry of Cutting Tools:

Introduction, Geometry of single point turning tools: Cutting edges, Rake and Clearance angles, Systems of description of tool geometry, Designation of tool geometry in Machine reference system, ORS system and NRS system

Geometry of Multi point cutting tools: Geometry of Milling cutters, Geometry of Drills

Mechanics of Metal cutting:

Cutting Tool Materials**,** Chip formation, Types of Chips, Chip control and chip breakers, orthogonal and oblique metal cutting, Chip thickness ratio, Velocity relationship in orthogonal cutting, Merchant's Analysis, Stress and Strain on the chip, Forces on single point cutting tool, Torque, heat produced, power and MRR equations, Use of Merchant's circle diagram in force analysis in orthogonal cutting for single point cutting tool.

Popular theories on mechanics of metal cutting: Earnst Merchant Theory, Merchant theory, Stabler Theory, Lee and Shaffer's Theory. Factors affecting temperature in metal cutting,

UNIT-II

Cutting Fluids and Tool life:

Cutting fluids, Purpose, Properties, Types of lubricants, Types of cutting fluids, Tool Failure, Mechanisms of Tool wear, Tool Life, Factors affecting tool life. Taylor's Tool life equation

Economics of metal machining:

Cost Considerations in Manufacturing, Elements of Machining cost, Minimum cost per piece, Maximum Production rate, Optimum cutting speed and optimum tool life for minimum cost of production and maximum production rate, Machinability, Machinability Index, Improving Machinability, Measurement of cutting forces, Tool force Dynamometers, Numerical on Mechanics of Metal cutting and economics.

UNIT-III

Milling Process:

Milling Machine Operations performed on Milling machine, Parts of Milling Machine, Types of Milling machines, fundamentals of Milling process, Milling Cutters, Elements of Plain Milling cutter, Cutter Holing devices, Cutting speed , Feed and depth of cut, Force system in Milling, Dividing head or Indexing Head, Methods of Indexing

Drilling Machine:

Types of Drills, Drilling machine Types, Drilling machine operations,, Size of Drilling machine, Main parts of drilling machine, Force system in Drilling, Cutting speed, Feed and Depth of cut in drilling, MRR in drilling, Numerical Problems on Drilling.

UNIT-IV

Specification of Machine Tools:

Introduction, purpose of machine tool specifications, Methods of specification of conventional machine tools: specification of lathes, specification of drilling and boring machines, specification of shaper, planer and slotter machines, specification of milling machine, specification of gear teeth generating machines, specification of grinding machines.

Metrology

Measurements, Linear Measurement, Callipers, Vernier Calliper, Micrometer, Angular Measurement, Comparators-mechanical, electrical and optical,sine bar, auto-collimator,

Surface finish and its measurement, Surface Roughness Measurement methods, Factors affecting surface finish in machining, micro and macro deviation, specifying surface finish.

Suggested reading:

1. Machining and Machine Tools by A.B. Chattopadhyay, Wiley India.
2. Manufacturing Processes by J.P. Kaushish, PHI
3. Metrology & Measurement By Bewoor, McGraw Hill.
4. A Textbook of Production Technology by P.C.Sharma, S.Chand pub.
5. Workshop Technology: B.S.Raghuwanshi, DhanpatRai Publications.
6. Production Technology: R.K.Jain, Khanna Publishers.
7. Machine Tools: R.Kesavan & B.Vijaya Ramnath, Laxmi Publications.
8. Machining and Machine Tools: A.B.Chattopadhyay, WILEY INDIA.

Note: *Examiner will set eight questions by selecting two from each unit. Students will be required to attempt five questions selecting at least one question from each unit.*

Course No.	Course Title	Teaching Schedule			Allotment of Marks			Duration of Exam (Hrs.)
		L	T	P	Theory	Sessional	Total	
ME-204N	STEAM GENERATION & POWER	3	1	0	75	25	100	3
Purpose	To make student learn about basics of Thermal engineering, steam generation and applications.							
Course Outcomes (CO)								
CO-1	Learn about boilers, types of boilers and accessories and mounting used on boilers.							
CO-2	Learn about simple and modified Rankine cycle and working of steam engine.							
CO-3	Learn about design and analysis of steam flow through steam nozzles. To learn about the working of different types of condensers.							
CO-4	Learn about working of Steam turbines and about design and analysis of the steam turbine.							

UNIT I

Introduction; classification of boilers; comparison of fire tube and water tube boiler; their advantages; description of boiler; Lancashire; locomotive; Babcock; Wilcox etc.; boiler mountings; stop valve; safety valve; blow off valve; feed check etc.; water level indicator; fusible plug; pressure gauge; boiler accessories; feed pump; feed water heater; preheater; superheater; economizer; natural draught chimney design; artificial draught; stream jet draught; mechanical draught; calculation of boiler efficiency and equivalent evaporation(no numerical problem)

UNIT II

Carnot cycle; simple and modified Rankine cycle; effect of operating parameters on rankine cycle performance; effect of superheating; effect of maximum pressure; effect of exhaust pressure; reheating and regenerative Rankine cycle; types of feed water heater; reheat factor; binary vapour cycle. Simple steam engine, compound engine; function of various components.

UNIT III

Function of steam nozzle; shape of nozzle for subsonics and supersonics flow of stream; variation of velocity; area of specific volume; steady state energy equation; continuity equation; nozzle efficiency; critical pressure ratio for maximum discharge; physical explanation of critical pressure; super saturated flow of steam; design of steam nozzle. Advantage of steam condensation; component of steam condensing plant; types of condensers; air leakage in condensers; Dalton's law of partial pressure; vacuum efficiency; calculation of cooling water requirement; air expansion pump.

UNIT IV

Introduction; classification of steam turbine; impulse turbine; working principal; compounding of impulse turbine; velocity diagram; calculation of power output and efficiency; maximum efficiency of a single stage impulse turbine; design of impulse turbine blade section; impulse reaction turbine; working principle; degree of reaction; parsons

turbine; velocity diagram; calculation of power output; efficiency of blade height; condition of maximum efficiency; internal losses in steam turbine; governing of steam turbine.

Text Books :

1. Thermal Engineering – P L Ballaney, Khanna Publishers
2. Thermodynamics and Heat Engines vol II – R Yadav, Central Publishing House

Reference Books :

1. Applied Thermodynamics for Engineering Technologists – T D Eastop and A. McConkey, Pearson Education
2. Heat Engineering – V P Vasandani and D S Kumar, Metropolitan Book Co Pvt Ltd.

Note: *Examiner will set eight questions by selecting two from each unit. Students will be required to attempt five questions selecting at least one question from each unit.*

Course No.	Course Title	Teaching Schedule			Allotment of Marks			Duration of Exam (Hrs.)
		L	T	P	Theory	Sessional	Total	
ME-206N	MECHANICS OF SOLIDS-II	3	1	0	75	25	100	3
Purpose	The objective of this course is to show the development of strain energy and stresses in springs, pressure vessel, rings, links, curved bars under different loads. The course will help the students to build the fundamental concepts in order to solve engineering problems							
Course Outcomes (CO)								
CO-1	Identify the basics concepts of strain energy and various theories of failures and solve the problems							
CO-2	Differentiate different types of stresses induced in thin pressure vessel and solve the problems. Use of Lame's equation to calculate the stresses induced in thick pressure vessel.							
CO-3	Able to compute stresses in ring, disk and cylinder due to rotation. Classify the different types of spring and analyze the stresses produced due to loading							
CO-4	Determine the stresses in crane hook, rings, chain link for different cross section and also the deflection of curved bars and rings. Analyze the stresses due to unsymmetrical bending and determine the position of shear centre of different section.							

Unit-I

Strain Energy & Impact Loading: Definitions, expressions for strain energy stored in a bodywhen load is applied (i) gradually, (ii) suddenly and (iii) with impact, strain energy of beamsin bending, beam deflections, strain energy of shafts in twisting, energy methods in determining spring deflection, Castigliano's theorem, Numerical.

Theories of Elastic Failure: Various theories of elastic failures with derivations and graphicalrepresentations, applications to problems of 2- dimensional stress system with (i) Combined direct loading and bending, and (ii) combined torsional and direct loading, Numericals.

Unit-II

Thin Walled Vessels: Hoop & Longitudinal stresses & strains in cylindrical &spherical vessels & their derivations under internal pressure, wire would cylinders, Numericals.

Thick Cylinders & Spheres: Derivation of Lame's equations, radial & hoop stresses andstrains in thick, and compound cylinders and spherical shells subjected to internal fluid pressure only, hub shrunk on solid shaft, Numericals.

Unit-III

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. Numericals.

Springs: Stresses in closed coiled helical springs, Stresses in open coiled helical spring subjected to axial loads and twisting couples, leaf springs, flat spiral springs, concentric springs, Numericals.

Unit-IV

Bending of Curved Bars : Stresses in bars of initial large radius of curvature, bars of initialsmall radius of curvature, stresses in crane hooks, rings of circular & trapezoidal sections,deflection of curved bars & rings, deflection of rings by Castigliano's theorem, stresses in simple chain link, deflection of simple chain links, Problems.

Unsymmetrical Bending: Introduction to unsymmetrical bending, stresses due to unsymmetrical bending, deflection of beam due to unsymmetrical bending, shear center for angle, channel, and I-sections, Numericals.

Text Books:

1. Strength of Materials – R.K. Rajput, Dhanpat Rai & Sons.
2. Strength of Materials – Sadhu Singh, Khanna Publications.
3. Strength of Materials – R.K. Bansal, Laxmi Publications.

Reference Books:

1. Strength of Materials – Popov, PHI, New Delhi.
2.Strength of Materials – Robert l. Mott, Pearson, New Delhi
3. Strength of Material – Shaums Outline Series – McGraw Hill
4. Strength of Material – Rider – ELBS

Note: *Examiner will set eight questions by selecting two from each unit. Students will be required to attempt five questions selecting at least one question from each unit.*

Course No.	Course Title	Teaching Schedule			Allotment of Marks			Duration of Exam (Hrs.)
		L	T	P	Theory	Sessional	Total	
ME-208N	FLUID MECHANICS	4	1	0	75	25	100	3
Purpose	To familiarize the students with the basic concepts of Fluid Mechanics.							
Course Outcomes (CO)								
CO-1	Understand the basic concepts of fluid and learn about fluid statics.							
CO-2	Understand the basic concepts of fluid kinematics and analyse the laws of fluid dynamics and its applications.							
CO-3	Determine the major and minor losses through pipes and learn to draw the hydraulic gradient and total energy lines.							
CO-4	Understand the concept of boundary layer and flow over bodies.							

Unit I

Fluid Properties: Concept of fluid and flow, ideal and real fluids, continuum concept, Properties of fluid: mass density, weight density, specific volume, specific gravity, viscosity, causes of 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, manometers, hydrostatic forces on submerged plane and curved surfaces, buoyancy, stability of floating and submerged bodies, liquids in relative equilibrium. Problems.

Unit II

Fluid Kinematics: Eulerian and Lagrangian description of fluid flow; types of fluid flows, stream, streak and path lines; acceleration of a fluid particle, flow rate and continuity equation, differential equation of continuity in cartesian and polar coordinates, rotation and vorticity, circulation, stream and potential functions, flow net. Problems.

Fluid Dynamics: Concept of system and control volume, Euler's equation, Bernoulli's equation and its practical applications, venturimeter, orificemeter, orifices, mouthpieces, Impulse momentum equation, kinetic energy and momentum correction factors. Problems.

Unit III

Viscous Flow: Flow regimes and Reynold's number, Navier-Stokes equation, relationship between shear stress and pressure gradient, flow of viscous fluids in circular pipe and between stationary and moving parallel plates, hydrodynamic lubrication, movement of piston in a dashpot, power absorbed in bearings. Problems.

Turbulent Flow Through Pipes: Transition from laminar to turbulent flow, Reynold's equation of turbulence, Shear stress in turbulent flow, Prandtl mixing length hypothesis, Major and minor losses in pipes, hydraulic gradient and total energy lines, series and parallel connection of pipes, branched pipes; equivalent pipe, power transmission through pipes, hydraulically smooth and rough pipes, velocity distribution in pipes, friction coefficients for smooth and rough pipes. Problems.

Unit IV

Boundary Layer Flow: Boundary layer concept, displacement, momentum and energy thickness, Blasius solution, von-Karman momentum integral equation, laminar and turbulent boundary layer flows, separation of boundary layer and its control.

Flow over Bodies: Drag and lift, friction and pressure drag, lift and drag coefficients, stream lined and bluff bodies, drag on a flat plate, drag on a cylinder and an airfoil, circulation and lift on a circular cylinder and an airfoil. Problems.

Reference and Text Books:

1. Introduction to Fluid Mechanics – R.W. Fox, Alan T. McDonald, P.J. Pritchard, Wiley Publications.
2. Fluid Mechanics – Frank M. White, McGraw Hill
3. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar, S.K. Kataria and Sons
4. Fluid Mechanics – Streeter V L and Wylie E B, Mc Graw Hill
5. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas, Tata McGraw Hill.
6. Mechanics of Fluids – I H Shames, Mc Graw Hill
7. Fluid Mechanics: Fundamnetals and Applications -YunusCengel and John Cimbala, McGraw Hill.
8. Fluid Mechanics: Pijush K. Kundu, Ira M. Cohen and David R. Rowling, Academic Press.

Note: *Examiner will set eight questions by selecting two from each unit. Students will be required to attempt five questions selecting at least one question from each unit.*

Course No.	Course Title	Teaching Schedule			Allotment of Marks			Duration of Exam (Hrs.)
		L	T	P	Theory	Sessional	Total	
ME-210N	DYNAMICS OF MACHINES	4	0	0	75	25	100	3
Purpose	To familiarize the students with the effect of dynamic forces in various machines and vehicles.							
Course Outcomes (CO)								
CO-1	To study the effect of static and dynamic forces on the components of mechanisms							
CO-2	To study the design and working of various gears and gear trains.							
CO-3	To study the various types of brakes and dynamometers.							
CO-4	To study the unbalanced forces and vibrations in various components of rotating and reciprocating machines.							
CO-5	To study the gyroscopic effect in aeroplanes, ships, two and four wheelers.							

UNIT I

Static force analysis: Static equilibrium, Equilibrium of two and three force members,Members with two forces and a torque, Equilibrium of four force members, free body diagram, Principle of Superposition, static forces Analysis of four barmechanisms and slider crank mechanism,

Dynamic Force Analysis: D'Alembert's principle, Equivalent offset inertia force, Dynamic force analysis of four bar mechanism and slider crank mechanismEngine force analysis, Turning moment on crank shaft,Dynamic Equivalent systems, Inertia of connecting rods, Inertia force in reciprocating engines(Graphical and Analytical methods), Turning moment diagrams, fluctuation of energy, Flywheels, Flywheel dimensions, Punching Press.

UNIT II

Gears: Classification of gears, Gear terminology, Fundamental law of gearing, Forms of Teeth, Cycloidal and involutes profiles of gear teeth, Interchangeable Gears, path of contact, arc of contact, number of pairs of teeth in contact (Contact Ratio), Interference in involute gears, minimum number of teeth, undercutting,

Helical, Spiral, Bevel and worm & worm gears, Terminology, Efficiency

Gear trains: Simple, compound, reverted, Planetary or epicyclic gear trains, Analysis of Epicyclic Gear trains, Torques in epicyclic gear trains, Sun and Planet gear, Automotive transmissions gear train. Differential.

UNIT III

Brakes: Types of brakes, Block and shoe brake, band brake, band and block brakes, internal expanding shoe brake, Effect of Braking.

Dynamometers: Types of Dynamometers, Pony and Rope Brake Dynamometer, Hydraulic Dynamometer, Belt Transmission Dynamometer, Epicyclic train Dynamometer, Bevis Gibson torsion dynamometer.

Governors: Types of Governors, Watt, Porter, Proell, Hartnell, Hartung, Wilson-Hartnell, Inertia Governors, Sensitiveness, Hunting, Isochronism, Stability of Governors, Effort and Power of a Governor, Controlling Force.

UNIT IV

Balancing of rotating masses: Static and Dynamic Balancing, Single Rotating mass, Many Masses rotating in same plane and in different planes. Analytical method for balancing of rotating masses.

Balancing of reciprocating masses: Reciprocating Engine, Partial Primary balance, Balancing of Multi-cylinder in line engines, Balancing of Radial Engines, Balancing of V-Engines, Balancing of Rotors

Gyroscope: Angular Velocity, Angular Acceleration, pitching and rolling, Gyroscopic couple and its effect on Aeroplanes,Naval ships, Stability of an automobile (2 & 4-wheeers), taking a turn, Gyroscopic effect in stone crusher.

Suggested reading:

1. Theory of machines: S. S. Rattan, Tata McGraw Hill Publications.
2. Theory of Machines: V. P. Singh, Dhanpat Rai & Co. Pvt. Ltd.
3. Theory of machines: Kinematics and Dynamics by Sadhu Singh, Pearson Publications
4. Theory of Machines and Mechanisms.:Uicker, J.J., Pennock G.R and Shigley, J.E.,3rd Edition, Oxford University Press, 2009.
5. Mechanism synthesis and analysis: A.H. Soni, McGraw Hill Publications.
6. Mechanism: J.S. Beggs.
7. Mechanics of Machines: P.Black, Pergamon Press.
8. Theory of Machines: P.L.Ballaney, Khanna Publisher.

Note: *Examiner will set eight questions by selecting two from each unit. Students will be required to attempt five questions selecting at least one question from each unit.*

Course No.	Course Title	Teaching Schedule			Allotment of Marks			Duration of Exam (Hrs.)
		L	T	P	Sessional	Practical	Total	
ME-214N	FLUID MECHANICS LAB	0	0	2	40	60	100	3
Purpose	To familiarize the students with the equipment and instrumentation of Fluid Mechanics.							
Course Outcomes (CO)								
CO-1	Operate fluid flow equipment and instrumentation.							
CO-2	Collect and analyse data using fluid mechanics principles and experimentation methods.							
CO-3	Determine the coefficient of discharge for various flow measurement devices.							
CO-4	Calculate flow characteristics such as Reynolds number, friction factor from laboratory measurements.							
CO-5	Identify and discuss foundation-level fluid phenomena including laminar to turbulent transition, turbulence etc.							
CO-6	Measure pressure loss due to friction for pipe flow.							

List of Experiments:

1. To determine the meta-centric height of a floating body.
2. To determine the hydrostatic force and center of pressure on both a submerged or partially submerged plane surface and compare with the theoretical result.
3. To demonstrate the working of different pressure measuring devices.
4. To measure the pressure and pressure difference by pressure gauge, single column manometer, U-Tube manometer & Inclined tube manometer.
5. To verify the Bernoulli's Theorem.
6. To determine coefficient of discharge of an orifice meter.
7. To determine the coefficient of discharge of venturimeter.
8. To determine the coefficient of discharge of Notch (V and Rectangular types).
9. To determine the coefficient of discharge, contraction & velocity of an orifice.
10. To find critical Reynolds number for a pipe flow.
11. To determine the friction factor for the pipes.
12. To determine the minor losses due to sudden enlargement, sudden contraction and bends.
13. To show the velocity and pressure variation with radius in a forced vertex flow.

Note: Any 8 experiments from the above list and other 2 from others (developed by institute) are required to be performed by students in the laboratory.

Course No.	Course Title	Teaching Schedule			Allotment of Marks			Duration of Exam (Hrs.)
		L	T	P	Sessional	Practical	Total	
ME-216N	DYNAMICS OF MACHINES LAB	0	0	2	40	60	100	3
Purpose	To familiarize the students with the equipment and instrumentation of Fluid Mechanics.							
Course Outcomes (CO)								
CO-1	To learn about the working of Flywheel.							
CO-2	To experimentally calculate Gyroscopic couple of a motorised gyroscope							
CO-3	To learn about balancing of rotating mass.							
CO-4	To learn about the working of various types of governors.							
CO-5	To study various types of brakes used in automobiles.							

LIST OF EXPERIMENT

1. To determine experimentally, the moment of inertia of a flywheel and axle compare with theoretical values.
2. To find out critical speed experimentally and to compare the whirling speed of ashaft with theoretical values.
3. To find experimentally the Gyroscopic couple on motorized gyroscope andcompare with applied couple.
4. To perform the experiment of balancing of rotating parts and finds the unbalancedcouple and forces.
5. To determine experimentally the unbalance forces and couples of reciprocatingparts.
6. To calculate the torque on a planet carrier and torque on internal gear usingepicyclic gear train and holding torque apparatus.
7. To study the different types of centrifugal and inertia governors and demonstrateany one.
8. To study the automatic transmission unit.
9. To study the differential types of brakes.

Note: Any 8 experiments from the above list and other 2 from others (developed by institute) are required to be performed by students in the laboratory.

Course No.	Course Title	Teaching Schedule			Allotment of Marks			Duration of Exam (Hrs.)
		L	T	P	Sessional	Practical	Total	
ME-218N	STEAM GENERATION AND POWER LAB	0	0	2	40	60	100	3
Purpose	To make the students aware of different boilers and steam turbines using different experiments.							
Course Outcomes (CO)								
CO-1	Students will be able to collect broad knowledge of about the different boilers.							
CO-2	Students will be able to understand the working of the steam engine.							
CO-3	Ability to determine the power and efficiency of the steam turbine and cooling tower							
CO-4	Able to describe quantitatively the heat balance sheet of the boiler.							

List of Experiments:

1. To study the Babcock-Wilcox boiler (Model).
2. To study thelocomotive boiler (Model).
3. To study the Lancashire boiler (Model).
4. To study the Nestler'sboiler.(Model)
5. To study various parts of the vertical steam engine.
6. To prepare heat balance sheet for given boiler.
7. To find dryness fraction of steam by separating and throttling calorimeter.
8. To find power output & efficiency of a steam turbine.
9. To study cooling tower and find its efficiency.
10. To study the various mountings and accessories of a boiler
11. To study and find volumetric efficiency of a reciprocating air compressor.
12. To find the efficiency of condenser.

Note: Any 8 experiments from the above list and other 2 from others (developed by institute) are required to be performed by students in the laboratory.

Course No.	Course Title	Teaching Schedule			Allotment of Marks			Duration of Exam (Hrs.)
		L	T	P	Sessional	Practical	Total	
ME-220N	**PRODUCTION TECHNIOLOGY LAB**	0	0	3	40	60	100	3
Purpose	To make the students understand the different types of machines in production industries and welding machines.							
Course Outcomes (CO)								
CO-1	To practice on Milling machine							
CO-2	To make gears and study grinders.							
CO-3	To study the working CNC machines.							
CO-4	To carry welding out using TIG/MIG Welding machine.							

List of Experiments:

1. Practice of slab milling on milling machine.
2. Practice of slotting on milling machine.
3. To cut gear teeth on milling machine using dividing head.
4. Introduction to gear hobber, demonstration of gear hobbing and practice.
5. Introduction to various grinding wheels and demonstration on the surface grinder.
6. Introduction to tool and cutter grinder and dynamometer.
7. Study the constructional detail and working of CNC lathes Trainer.
8. To carry out welding using TIG/MIG welding set.
9. Introduction, demonstration & practice on profile projector & gauges.
10. To make a component on lathe machine using copy turning attachment.
11. To cut external threads on a lathe.
12. To cut multi slots on a shaper machine.
13. To perform drilling and boring operation on a Component.

Note: Any 8 experiments from the above list and other 2 from others (developed by institute) are required to be performed by students in the laboratory.

Course No.	Course Title	Teaching Schedule			Allotment of Marks			Duration of Exam (Hrs.)
		L	T	P	Theory	Sessional	Total	
MPC-202N	ENERGY STUDIES	3	0	0	75	25	100	3
Purpose	To make the students conversant with the basics concepts and conversion of various form of Energy							
Course Outcomes (CO)								
CO-1	An overview about Energy , Energy Management, Audit and tariffs							
CO-2	Understand the Layout and working of Conventional Power Plants							
CO-3	Understand the Layout and working of Non-Conventional Power Plants							
CO-4	To understand the role of Energy in Economic development and Energy Scenario in India							

UNIT-I

Introduction: Types of energy, Conversion of various forms of energy, Conventional and Non-conventional sources, Need for Non-Conventional Energy based power generation.

Energy Management: General Principles of Energy Management, Energy Management Strategy.

Energy Audit: Need, Types, Methodology and Approach.

UNIT-II

Conventional Energy sources: Selection of site**,** working of Thermal, Hydro, Nuclear and Diesel power plants and their schematic diagrams & their comparative advantages-disadvantages.

UNIT-III

Non-Conventional Energy sources: Basicprinciple, site selection of Solar energy power plant, photovoltaic technologies, PV Systems and their components, Wind energy power plant, Bio energy plants,Geothermal energy plantsand tidal energy plants.MHD

UNIT-IV

Energy Scenario: Lay out of power system, Role of Energy in Economic development, energy demand, availability and consumption, Commercial and Non-commercial energy, Indian energy scenario, long term energy scenario, energy pricing, energy sector reforms in India, energy strategy for the future.

References:

1. Energy Studies-Wiley Dream tech India.
2. Non-conventional energy resources- Shobhnath Singh, Pearson.
3. Soni, Gupta, Bhatnagar: Electrical Power Systems – Dhanpat Rai& Sons
4. NEDCAP: Non Conventional Energy Guide Lines
5. G.D. Roy :Non conventional energy sources
6. B H Khan :Non Conventional energy resources - McGraw Hill
7. Meinel A B and Meinal M P,Addison: Applied Solar Energy- Wesley Publications
7. George Sutton: Direct Energy Conversion –McGraw

Note: *Examiner will set eight questions by selecting two from each unit. Students will be required to attempt five questions selecting at least one question from each unit.*