Bachelor of Technology (Mechanical Engineering) Kurukshetra University, Kurukshetra

*SCHEME OF STUDIES/EXAMINATIONS(**w.e.f. 2015-16 onwards**)*

Semester–III

S. No.	Course No.	Course Title	Teaching Schedule				Allotment of Marks				Duration of Exam (Hrs.)
			L	T	P	Hours/ Week	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 Solid –I	3	1	0	4	75	25	0	100	3
4	ME-205N	Machine Drawing	2	3	0	5	75	25	0	100	4
5	ME-207N	Kinematics 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	Kinematics of Machine 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 Solid Lab	0	0	2	2	0	40	60	100	3
		Total	**18**	**7**	**6**	**31**	**450**	**270**	**180**	**900**	
10	MPC-201N	Environmental Studies*	3	0	0	3	75	25	0	100	3

**MPC-201N is a mandatory course and student has to get passing marks in order to qualify for the award of degree but its marks will not be added in the grand total.*

B. Tech. 3rd Semester Mechanical Engineering

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 automation 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.*

B. Tech. 3rd Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Theory**	**Sessional**	**Total**	
HS-201N	**FUNDAMENTALSOF 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.*

B. Tech. 3rd Semester Mechanical Engineering								
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. Numerical

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, TemperatureEntropy 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.*

B. Tech. 3rd Semester Mechanical Engineering								
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.

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 – Schaums 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.*

B. Tech. 3rd Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Theory**	**Sessional**	**Total**	
ME-205N	**MACHINEDRAWING**	2	3	0	75	25	100	4
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.

B. Tech. 3rd Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Theory**	**Sessional**	**Total**	
ME-207N	**KINEMATIC OFMACHINES**	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.*

B. Tech. 3rd Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Theory**	**Sessional**	**Total**	
ME-209N	**MATERIALSCIENCE**	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, ReCrystallization 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

Materials Characterization Techniques:
Characterization techniques such as, scanning electron microscopy, transmission electron microscopy, atomic force microscopy, scanning tunnelling 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.*

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Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Sessional**	**Practical**	**Total**	
ME-211N	**KINEMATIC OFMACHINES 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.

B. Tech. 3rd Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Sessional**	**Practical**	**Total**	
ME-213N	**MATERIALSCIENCE 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 geometrical discontinuity
5. 5.To observe and learn about the strain hardening effect in metals.
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.

B. Tech. 3rd Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Sessional**	**Practical**	**Total**	
ME-215N	**MECHANICSOF 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.
11. 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.

B. Tech. 3rd Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Theory**	**Sessional**	**Total**	
MPC-201N	**ENVIRONMENTALSTUDIES**	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 overgrazing, 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 ssetsriver/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.***