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.*

Bachelor of Technology (Mechanical Engineering)Kurukshetra University, Kurukshetra

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

Semester – IV

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-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 Solid-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 Machine	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 Machine 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	
		Total	**20**	**5**	**9**	**34**	**450**	**310**	**240**	**1000**	
11	MPC-202N	Energy Studies*	3	0	0	3	75	25	0	100	3

**MPC-202N 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.*

Note:*All the students have to undergo six weeks industrial training after IVth semester and it will be evaluated in Vth semester.*

Bachelor of Technology (Mechanical Engineering)Kurukshetra University, Kurukshetra

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

Semester – V

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	ME-301N	I.C. Engine & Gas Turbine	3	1	0	4	75	25	0	100	3
2	ME-303N	Fluid Machines	3	1	0	4	75	25	0	100	3
3	ME-305N	Heat Transfer	3	1	0	4	75	25	0	100	3
4	ME-307N	Industrial Engineering	3	1	0	4	75	25	0	100	3
5	ME-309N	Machine Design-I	2	4	0	6	75	25	0	100	3
6	ME-311N	Production Technology-II	4	0	0	4	75	25	0	100	3
7	ME-313N	I.C. Engine Lab	0	0	2	2	0	40	60	100	3
8	ME-315N	Fluid Machines Lab	0	0	2	2	0	40	60	100	3
9	ME-317N	Heat Transfer Lab	0	0	2	2	0	40	60	100	3
10	ME-319N	Industrial Training (Viva-Voce)*	2	0	0	2	0	40	60	100	3
		Total	**20**	**08**	**06**	**34**	**450**	**310**	**240**	**1000**	

**The performance of the student will be evaluated after the presentation delivered and the report submitted by him/her related to Industrial training undertaken after IVth semester.*

Bachelor of Technology (Mechanical Engineering)Kurukshetra University, Kurukshetra

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

Semester – VI

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	ME-302N	Refrigeration and Air Conditioning	3	1	0	4	75	25	0	100	3
2	ME-304N	Tribology & Mechanical Vibration	3	1	0	4	75	25	0	100	3
3	ME-306N	Operation Research	3	1	0	4	75	25	0	100	3
4	CSE-209N	Essentials of IT	3	1	0	4	75	25	0	100	3
5	ME-308N	Computer Aided Design and Manufacturing	4	0	0	4	75	25	0	100	3
6	ME-310N	Machine Design-II	2	4	0	6	75	25	0	100	4
7	ME-312N	Refrigeration and Air Conditioning Lab	0	0	2	2	0	40	60	100	3
8	ME-314N	Tribology & Mechanical Vibration Lab	0	0	2	2	0	40	60	100	3
9	ME-316N	Computer Aided Design and Manufacturing Lab	0	0	2	2	0	40	60	100	3
		Total	**18**	**8**	**6**	**32**	**450**	**270**	**180**	**900**	

Note:*All the students have to undergo six weeks industrial training after VIth semester and it will be evaluated in VIIth semester.*

Bachelor of Technology (Mechanical Engineering) Kurukshetra University, Kurukshetra

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

Semester – VII

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	ME-401N	Measurement and Control	4	0	0	4	75	25	0	100	3
2	ME-403N	Mechatronics	4	0	0	4	75	25	0	100	3
3	HS-401N	Entrepreneurship	3	0	0	3	75	25	0	100	3
4		DEC – I*	4	0	0	4	75	25	0	100	3
5		DEC –II*	3	0	0	3	75	25	0	100	3
6	ME-405N	Measurement and Control Lab	0	0	2	2	0	40	60	100	3
7	ME-407N	Mechatronics Lab	0	0	2	2	0	40	60	100	3
8	ME-409N	Project-I**	0	0	8	8	0	100	100	200	3
9	ME-411N	Industrial Training (Viva-Voce)***	2	0	0	2	0	40	60	100	3
10	ME-413N	Seminar-I	0	2	0	2		100	0	100	
		Total	**20**	**02**	**12**	**34**	**375**	**445**	**280**	**1100**	

** The students should select two Departmental Elective Courses (DEC) from the following list.*

Course No.	DEC-I	Course No.	DEC-II
ME-415N	Non-Conventional Machining	ME-427N	Finite Element Methods in Engineering
ME-417N	Soft Computing Techniques	ME-429N	Advanced Manufacturing Technology
ME-419N	Non-Destructive Evaluation & Testing	ME-431N	Robotics: Mechanics and Control
ME-421N	Design and Optimization	ME-433N	Simulation of Mechanical Systems
ME-423N	Computational Fluid Dynamics	ME-435N	Control Engineering
ME-425N	**Fundamentals of Gas Dynamics**	ME-437N	Environmental Pollution and Abatement

***The project should be initiated by the students in the beginning of VII^{h} semester and will be evaluated at the end of the semester on the basis of a presentation and report.*

****The performance of the student will be evaluated after the presentation delivered and the report submitted by the student related to Industrial training undertaken after VIth semester.*

Bachelor of Technology (Mechanical Engineering) Kurukshetra University, Kurukshetra

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

Semester – VIII

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	ME-402N	Automobile Engineering	4	0	0	4	75	25	0	100	3
2		DEC-III*	4	0	0	4	75	25	0	100	3
3		DEC-IV*	4	0	0	4	75	25	0	100	3
4	ME-404N	Power Plant Engineering	4	0	0	4	75	25	0	100	3
5	ME-406N	Quality Assurance & Reliability	4	0	0	4	75	25	0	100	3
6	ME-408N	Automobile Engineering Lab	0	0	2	2	0	40	60	100	3
7	ME-410N	Project-II**	0	0	10	10	0	100	100	200	3
8	ME-412N	Seminar-II	0	2	0	2	0	100	0	100	
		Total	**20**	**2**	**12**	**34**	**375**	**365**	**160**	**900**	

**The student should select two Departmental Elective Courses (DEC) from the following list.*

Course No.	DEC-III	Course No.	DEC-IV
ME-414N	Smart Materials Structures & Devices	ME-426N	Manufacturing Management
ME-416N	Lubrication Technology	ME-428N	Design of Pressure Vessels and Piping
ME-418N	Energy Management	ME-430N	Concurrent Engineering
ME-420N	Waste Heat Recovery System	ME-432N	Industrial Combustion
ME-422N	Foundry Engineering	ME-434N	Metal Forming and Finishing
ME-424N	Ergonomics in Design	ME-436N	Air Craft and Rocket Propulsion

********The project should be initiated by the students in the beginning of VIIIth semester and will be evaluated at the end of the semester on the basis of a presentation and report.* ***Note:*** *Project-II should not be related to Project-I unless it involves large amount of work, time and effort.*

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.*

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-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.***

B. Tech. 4th Semester Mechanical Engineering								
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.*

B. Tech. 4th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Theory**	**Sessional**	**Total**	
ME-204N	**STEAMGENERATION & 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.*

B. Tech. 4th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Theory**	**Sessional**	**Total**	
ME-206N	**MECHANICS OFSOLIDS-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.*

B. Tech. 4th Semester Mechanical Engineering								
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.*

B. Tech. 4th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Theory**	**Sessional**	**Total**	
ME-210N	**DYNAMICS OFMACHINES**	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 VEngines, 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.*

B. Tech. 4th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Sessional**	**Practical**	**Total**	
ME-214N	**FLUIDMECHANICSLAB**	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. o 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.

B. Tech. 4th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Sessional**	**Practical**	**Total**	
ME-216N	**DYNAMICS OFMACHINESLAB**	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.

B. Tech. 4th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Sessional**	**Practical**	**Total**	
ME-218N	**STEAMGENERATION AND POWERLAB**	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.

B. Tech. 4th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Sessional**	**Practical**	**Total**	
ME-220N	**PRODUCTION TECHNIOLOGYLAB**	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.

B. Tech. 4th Semester Mechanical Engineering								
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 energyscenario, 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.
8. 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.*

B. Tech. 5th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Theory**	**Sessional**	**Total**	
ME-301N	**I.C. ENGINE & GAS TURBINE**	3	1	0	75	25	100	3
Purpose	Detailed study of engines, compressors and gas turbines.							
Course Outcomes								
CO1	Introduction to basic parts of engine and basic cycles.							
CO2	Study of carburettor, injection system and to understand the combustion process.							
CO3	Lubrication system of engine and its performance parameters.							
CO4	To study the compressors and gas turbines.							

UNIT 1

Heat engines; Internal and external combustion engines; Classification of I.C. Engines; Cycle of operations in four strokes and two-stroke IC engines; Wankle Engine.

Air standard cycles: Assumptions made in air standard cycles; Otto cycle; Diesel cycle; Dual combustion cycle; Comparison of Otto, diesel and dual combustion cycles; Sterling and Ericsson cycles; Air standard efficiency, Specific work output. Specific weight; Work ratio; Mean effective pressure; Deviation of actual engine cycle from ideal cycle.

UNIT II

Mixture requirements for various operating conditions in S.I. Engines; Elementary carburetor, Calculation of fuel air ratio; The complete carburetor; Requirements of a diesel injection system; Type of injection system; Petrol injection; Requirements of ignition system; Types of ignition systems, ignition timing; Spark plugs.

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

UNIT III

Functions of a lubricating system, Types of lubrication system; Mist, Wet sump and dry sump systems; Properties of lubricating oil; SAE rating of lubricants; Engine performance and lubrication; Necessity of engine cooling; Disadvantages of overcooling; Cooling systems; Air-cooling, Water-cooling; Radiators.

Performance parameters; BHP, IHP, Mechanical efficiency; Brake mean effective pressure and indicative mean effective pressure, Torque, Volumetric efficiency; Specific fuel consumption (BSFG, ISFC); Thermal efficiency; Heat balance; Basic engine measurements; Fuel and air consumption, Brake power, Indicated power and friction power, Heat lost to coolant and exhaust gases; Performance curves; Pollutants from S.I. and C.I. Engines; Methods of emission control, Alternative fuels for I.C. Engines; The current scenario on the pollution front.

UNIT IV

Working of a single stage reciprocating air compressor; Calculation of work input; Volumetric efficiency; Isothermal efficiency; Advantages of multi stage compression; Two stage compressor

with inter-cooling; Perfect inter cooling; Optimum intercooler pressure; Rotary air compressors and their applications; Isentropic efficiency.
Brayton cycle; Components of a gas turbine plant; Open and closed types of gas turbine plants; Optimum pressure ratio; Improvements of the basic gas turbine cycle; Multi stage compression with inter-cooling; Multi stage expansion with reheating between stages; Exhaust gas heat exchanger; Application of gas turbines.

Text books:

1. Internal combustion engine by Ramalingam sci-tech publication
2. Internal combustion engine by Ganeshan TMG

Reference Books

1. Internal combustion engine by Mathur & Sharma
2. Heat power engineering by Dr. V.P. Vasandhani& Dr. D.S. Kumar

NOTE: In the semester examination, the examiner will set 8 questions in all, at least one question from each unit, and students will be required to attempt only 5 questions.

B. Tech. 5th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Theory**	**Sessional**	**Total**	
ME-303N	**FLUID MACHINES**	3	1	0	75	25	100	3
Purpose	To make students aware of Momentum induced by Jets. Classification, Working & Design of Hydropower Plants, Turbines, Pumps and Hydraulic Machines.							
COURSE OUTCOMES								
CO1	Analysis of Momentum induced by Water Jets on stationary & moving; curved, flat & unsymmetrical single or multiple plates & vanes & on ships. Study of Dimensional Analysis Methods.							
CO2	Classification, Working, Design, Efficiencies, Characteristics & Model Testing of Hydraulic Turbines & study of Hydropower Plant & associated terms.							
CO3	Study of Classification, Working, Design, Efficiencies, Heads & Model Testing of Hydraulic Pumps.							
CO4	Study of various types of Hydraulic Machines.							

UNIT I

IMPULSE MOMENTUM BY WATER JETS: Impact of water jet: On Stationary &Moving Flat &Curved Plates, On Series of vanes Flat & Radial; Ship Propulsion by Jets; Numericals.

DIMENSIONAL ANALYSIS: Units and dimensions; Dimensional homogeneity; Dimensional analysis: Rayleigh Method & Buckingham's Pi-Theorem; Applications & limitations of dimensional analysis; Dimensionless numbers; Similitude laws; Numericals.

UNIT II:

HYDRAULIC TURBINES

INTRODUCTION: Classification of Hydraulic Machines; Hydropower plant& its Components; Surge tank and its type; Classification of turbines; Effective head, available power & Efficiencies.

PELTON TURBINE: Components; Work done & efficiency; Design: Number & Dimensions of Buckets, Speed ratio, Jet ratio, Run-away speed, jet velocity, mean wheel diameter, number of jets, maximum efficiency; Governing; Numericals.

FRANCIS TURBINE: Components; Work done & efficiency; Design: Runner, Width-Diameter ratio, Speed ratio, Flow ratio; Outward vs. Inward flow reaction turbines; Governing; Numericals.

AXIAL FLOW TURBINES: Propeller Turbine; Kaplan turbine; Components, Work done Power & Efficiency, Governing; Draft Tube: Efficiency &Types; Numericals.

DESIGN & OPERATIONAL PARAMETERS: Model testing of turbines; Specific Speed; Unit quantities; Performance Characteristic curves.

UNIT III:

HYDRAULIC PUMPS

CENTRIFUGAL PUMPS: Introduction; Components; Various Heads; Euler's head and its variation with vane shapes; Effect of finite number of vanes; Losses & efficiencies; Minimum starting speed; Limitation of suction lift; Net Positive Suction Head (NPSH); Priming; Cavitation and its effects, Cavitation parameters, Detection and Prevention of Cavitation; Multistage pumps; Specific speed and Performance; Numericals.

RECIPROCATING PUMPS: Introduction; Working principles; Classification; Components; Discharge Coefficient & slip; Work &Power input; Indicator diagram; Effect of Friction, Acceleration and Pipe friction; Maximum speed; Air vessels; Comparison with centrifugal pumps; Model testing of pumps; Numericals.

UNIT IV:

HYDRAULIC SYSTEMS

PUMPS: Propeller pump; Jet pump; Airlift pump; Gear pump; Screw pump; Vane pump; Radial piston pump; Submersible pump; Pump problems.

MACHINES: Hydraulic accumulators; Hydraulic intensifier; Hydraulic lift; Hydraulic crane; Hydraulic coupling; Torque converter; Hydraulic ram.

Text books:

1. Introduction to fluid mechanics and machinery by Som and Bishwas, TMH
2. A textbook of Fluid Mechanics & Hydraulic Machines by R. K. Bansal, Laxmi Publications

Reference Books:

1. Fluid mechanics and machinery by S. K. Aggarwal TMG
2. Fluid mechanics & fluid power engineering by D.S kumar, Katson publisher
3. Fluid mechanics and Hydraulic machine by S.S rattan, Khanna publisher

NOTE: In the semester examination, the examiner will set 8 questions in all, at least one question from each unit, and students will be required to attempt only 5 questions.

B. Tech. 5th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Theory**	**Sessional**	**Total**	
ME-305N	**HEAT TRANSFER**	3	1	0	75	25	100	3
Purpose	To familiarize the students with the basic concepts of Heat Transfer.							
Course Outcomes								
CO1	Understand the basic modes of heat transfer and develop the general heat conduction equation.							
CO2	Analyse the one dimensional steady state heat conduction with and without heat generation.							
CO3	Determine the temperature distribution and effectiveness of extended surfaces.							
CO4	Differentiate between free and forced convection and discuss the dimensional analysis of free and forced convection.							
CO5	Understand the concept of hydrodynamic and thermal boundary layer and develop the related equations.							
CO6	Develop knowledge about the laws of thermal radiation and the concept of black body.							
CO7	Classify different types of heat exchangers and discuss LMTD and NTU approaches for the design of heat exchangers.							

UNIT I

Introduction: definition of heat, modes of heat transfer; basic laws of heat transfer, application of heat transfer, simple problems.

Conduction: Fourier equation, electrical analogy of heat conduction; thermal conductivity, the general conduction equation in cartesian, cylindrical and spherical coordinates, steady one dimensional heat conduction without internal heat generation: conduction through plane and composite wall, the cylindrical shell; the spherical shell; critical thickness of insulation; variable thermal conductivity, steady one dimensional heat conduction with uniform internal heat generation: the plane slab; cylindrical and spherical systems, unsteady heat conduction: lumped parameter analysis, introduction to Heisler charts.

UNIT II

Convection: Introduction: Newton's law of cooling, convective heat transfer coefficient, Nusselt number, convection boundary layers: Introduction of velocity and thermal boundary layers and its significance with respect to convection (without derivations of boundary layer equations), local and average convection coefficient, functional form of the solution of boundary layer equations, Physical significance of the dimensionless parameters, Reynolds analogy, ***External Forced Convection:*** Introduction to empirical method of solution, flow over a flat plate with both conditions of constant heat flux and constant temperature, cylinder in cross flow, flow over a sphere, ***Internal Forced Convection:*** Introduction to velocity profile, pressure gradient and friction factor in fully developed flow, mean temperature, energy balance considering constant surface heat flux and for constant surface temperature, convection correlations for laminar flow in circular tubes both in entry region and in the fully developed region, ***Natural convection:*** Physical considerations, governing equations (without derivations), functional form of the solution of governing equations, empirical correlations for external free convection flow over the vertical plate, horizontal and inclined plates, horizontal cylinder and sphere.

UNIT III

Radiation: fundamental concepts, absorption, reflection and transmission, black body concept, monochromatic and total emissive power, Planck's distribution law, Stefan Boltzman law, Wien's displacement law, Kirchoff's law, intensity of radiation, Lambert's cosine law, heat transfer between black surfaces, radiation shape factor, heat transfer between non-black surfaces: infinite parallel planes, infinite long concentric cylinders, small gray bodies and small body in large enclosure, electrical network approach, radiation shields.

UNIT IV

Extended Surfaces: governing equation for fins of uniform cross section, temperature distribution and heat dissipation rate in infinitely long fin, fin insulated at tip, fin losing heat at tip; efficiency and effectiveness of fins.

Heat Exchangers: classification of heat exchangers; overall heat transfer coefficient, logarithmic mean temperature difference, effectiveness of heat exchangers, NTU method of heat exchanger design, applications of heat exchangers.

Text books:

1. Fundamentals of Heat and Mass transfer – Frank P. Incropera, David P. Dewitt, T.L. Bergman and A.S. Lavine, Wiley Publications.
2. Heat Transfer: A Practical Approach - Yunus A Cengel, Tata McGraw Hill.
3. Heat Transfer – J.P. Holman, Tata McGraw Hill.

Reference Books:

1. A Text book of Heat Transfer - S.P Sukhatme, University press
2. Heat and Mass Transfer - D.S Kumar, S.K. Kataria& Sons
3. Heat and Mass Transfer – P.K. Nag, Tata McGraw Hill.
4. Heat Transfer – Y.V.C. Rao, University Press.
5. Heat Transfer – P.S.Ghoshdastidar, Oxford Press.

NOTE: In the semester examination, the examiner will set 8 questions in all, at least one question from each unit, and students will be required to attempt only 5 questions.

B. Tech. 5th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Theory**	**Sessional**	**Total**	
ME 307N	**INDUSTRIAL ENGINEERING**	3	1	0	75	25	100	3
Purpose	To give the basic idea of industrial concept.							
Course Outcomes								
CO1	Introduction to different recording charts and technique.							
CO2	Understand the concept of industrial organization & ppc.							
CO3	Introduction, Objectives and importance of sales forecasting & inventory control.							
CO4	Introduction to wages, JIT, SCM, VE, TIME MANAGEMENT.							

UNIT I

Introduction to work study; Method study; Basic procedure, Recording techniques (Charts and diagrams); Elemental breakdown; Micro-motion studies; Therbligs; SIMO- chart principles of motion- economy. Introduction; Objectives; techniques (time) information recording; methods of things, Time study allowances; work sampling technique, Performances rat ing and its determinant ion technique, Performance rating and its determination PMTS; M.T.M., Work factor.

UNIT II

Principle of organization; Importance and characteristics of organization; Organization theories; Classical Organization theory; Neo-Classical organization theory, modern organization theory; Types of organization. Military or line organization, Functional organization, line and staff organization, Committee objectives of PPC; Functions of PPC Preplanning and planning; Routing; Estimating; scheduling; master schedule; Daily schedule; Gantt chart; Dispatching; centralized vs

UNIT III

Introduction, Objectives and importance of sales forecasting, Types of forecasting, Methods of sales forecasting, Collective opinion method, Delphi technique, economic indicator method; Regression analysis, introduction, Functions of inventory; Types of inventory; Control importance functions, Inventory costs, factors affecting inventory control, Various inventory controls models; A.B.C. analysis, lead-time calculations.

UNIT IV

Introduction, Objective; Concept and life cycle of a product and V.E.; Steps in V.E. Methodology and techniques, Fast diagram, Matrix method. Various concepts in industrial engineering.

a) WAGES AND INCENTIVES ; Concept ; Types, plans, Desirable characteristics.

b) SUPPLY CHAIN MANAGEMENT; Its Definition, Concept, Objectives, Applications, Benefits, some successful cases in Indian Industries.

c) JIT; Its definition, concept, importance, misconception, relevance, Applications, Elements of JIT (brief description)

d) TIME MANAGEMENT; Introduction, steps of time man agreement, Ways for saving time KEY for time saving.

REFERENCES AND TEXT BOOKS:

1. Industrial Engg. by M. Mahajan/lndustrial Engg. by Savita Sharma.
2. Production planning and control by S. Elion.

3. Modern Production Management by S.S. Buffa.
4. Industrial Engg. and Management manufacturing system by Surender Kumar, Satya Parkashan.
5. Essence of Supply Chain Management by R.P. Monaty and S.G. Deshmukh.
6. Industrial Engg., and management by S. Sharma and Savita Sharma.
7. Industrial Engineering and management by I P Singh, Neelam Publications..

NOTE: In the semester examination, the examiner will set 8 questions in all, at least one question from each unit, and students will be required to attempt only 5 questions.

B. Tech. 5th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Theory**	**Sessional**	**Total**	
ME-309N	**MACHINE DESIGN-I**	2	4	0	75	25	100	3
Purpose	To understand the fundamentals for solving engineering problems relating to machine components.							
Course Outcomes								
CO1	To design the machine components for static and fluctuating loads.							
CO2	To solve the design problems of different types of joints i.e. riveted joint, welded joint, cotter and knuckle joints under different loading conditions.							
CO3	To solve the design problems of transmission shafts, keys and lever for different loading conditions							
CO4	To solve the design problems of different types of couplings, pipe joints and crane hook.							

UNIT-I

Introduction: Design concepts, overall design considerations, codes and standards, methodology for solving machine component problems. **Engineering materials:** properties, ferrous metals, non-ferrous metals, plastics and composite materials, BIS system of designation of steels, selection of engineering materials.

Design against static load: Modes of failure, factor of safety, stress concentration: causes and mitigation, **Design against fluctuating load:** Fluctuating stresses, endurance limit, low cycle and high cycle fatigue, notch sensitivity, endurance limit-approximate estimation, reversed stresses-design for finite and infinite life, cumulative damage in fatigue, Soderberg and Goodman Lines, Modified Goodman Diagrams.

UNIT-II

Threaded Joints: Basic types of screw fastening, Bolts of uniform strength, locking devices, terminology of screw threads, ISO metric screw threads, materials and manufacture, design of bolted joints, bolted joints with eccentric loads. **Cotter and Knuckle Joints:** design of cotter and knuckle joints.

Riveted and Welded Joints: Riveted joints for boiler shell according to I. B. R., riveted structural joint, eccentrically loaded riveted joint, types of welded joints, strength of welds under axial load, welds under eccentric loading.

UNIT-III

Transmission Shafts: Shaft design on strength basis and torsional rigidity basis, ASME code for shaft design, design of hollow shaft on strength basis and torsional rigidity basis.

Keys: Design of square and flat keys.

Levers: Hand and foot levers, cranked lever, lever for a lever safety valve, Bell crank lever. Miscellaneous levers.

UNIT-IV

Couplings: Types of shaft couplings, design of sleeve or muff coupling, clamp coupling, rigid flange couplings and bushed-pin flexible couplings.

Curved Beams: Design of crane hook. **Pipe Joints:** Design of circular, oval shaped and square flanged pipe joints.

Text books:

1. Mechanical Engineering Design, Joseph E. Shigley and Charles R. Mischke, Tata McGraw Hill Book Co.
2. Design of Machine Element,V. B. Bhandari, Mc Graw Hill Edu. Pvt. Ltd.
3. Machine Component Design, Robert C. Juvinall and Kurt M. Marshek, Wiley India Pvt. Ltd.
4. Mechanical Design of Machine Elements and Machines, Collins and Busby, Wiley India Pvt. Ltd.

References books:

1. Machine Design by Sharma and Aggarwal
2. Machine Design-an integrated Approach, Robert L. Norton, Addison Wisley Longman
3. PSG Design Data Book by PSG college of Engineering, PSG Publication.
4. Design Data Hand book for Mechanical Engineers by K. Mahadevan and K. Balaveera Reddy.

NOTE: In the semester examination, the examiner will set 8 questions in all, at least one question from each unit, and students will be required to attempt only 5 questions.

B. Tech. 5th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Theory**	**Sessional**	**Total**	
ME-311N	**PRODUCTION TECHNOLOGY-II**	4	0	0	75	25	100	3
Purpose	To understand the kinematics design of machine tools and working of traditional and non-traditional production processes.							
Course Outcomes								
CO1	To learn about kinematics of machine tools which drives classification of spindle speed on lathe, design of gearbox and geared head stock.							
CO2	To understand about thread manufacturing, gear production, generation and various process on gears including gear finishing etc.							
CO3	To understand the UCM process and details about machine tool vibrations.							
CO4	To analyse jigs and fixtures.							

UNIT-I

Machine Tool Power Drives:

Power sources used in Machine tools, estimation of power requirement for machine tool Drives, hydraulic drives in machine tools, Role and general constituents of the Kinematics Structure of machine tools, different forms of machine tool kinematic structure, mechanism. Commonly used in machine tool kinematic systems, method of changing speed feed in machine Tools, need of large no of speeds and feed in machine tools, method of changing speed and feed in machine tools.

Design of speed gearbox of machine tool, procedural steps in design of SGB, Layout of spindle speed in machine tools, selection of gear layout and ray-diagram for speed gearbox, determination of dimensions of the gears and shafts of speed gear box.

UNIT-II

Thread Manufacturing:

Thread casting, thread chasing, thread rolling, die-threading and tapping, thread milling, thread grinding, thread measurement and inspection.

Gear Manufacturing and finishing:

Introduction, Classification of gear production method, Gear generation processes: gear hobbing, gear shaping, rack planning. Gear finishing methods: shaving, roll finishing, burnishing, grinding, lapping, honing.

UNIT-III

Unconventional Machining processes:

Introduction, Need for unconventional processes, Classification of unconventional machining processes, process selection, Abrasive jet machining (AJM), Water jet machining(WJM), Ultrasonic machining(USM), chemical machining (CHM), Electrochemical machining (ECM), Electric discharge machining (EDM), Wire cut EDM, laser beam machining(LBM), Electron beam machining (EBM); their process parameters, Principle of metal removal , applications, advantages and limitations.

Machine Tools vibration:

Introduction, effects of vibration on machine tools, source of vibration, types of machine tool vibrations: and self-excited vibration (chatter), causes of self-excited vibration, chatter prediction, avoidance of chatter and vibration on existing machine tools and on proposed machine tools, vibration control and isolation.

UNIT-IV

Jigs and fixtures:

Introduction to Jig and fixtures, locating and clamping, design principles common to jig and fixtures, types of jig and fixtures, indexing jig and fixtures, automated jigs and fixtures.

Fundamentals jig and fixture design, jig and fixture construction, materials for jig and fixtures, tolerance and error analysis, analysis of clamping forces.

Text books:

1. Machining and machine tools by A.B. Chattopadhyay, Wiley India.
2. Fundamentals of metal cutting and machine Tools by Juneja, New age.
3. A text book of production engineering: Dr. P.C.Sharma, S Chand Technical.

Reference Books:

1. Tool design by Donaldson, TMH.
2. Workshop Technology, vol.-II: B.S.Raghuwanshi, Dhanpat Rai publications.
3. Production Technology: R.K. JAIN, Khanna Publishers.
4. Machine Tools: Dr. R. Kesavan & B.Vijaya, Ramnath, Laxmi publications.

NOTE: In the semester examination, the examiner will set 8 questions in all, at least one question from each unit, and students will be required to attempt only 5 questions.

B. Tech. 5th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Sessional**	**Practical**	**Total**	
ME-313N	**I. C. Engine Lab**	0	0	2	40	60	100	3
Purpose	To understand the performance of C. I. and S. I. engines. Also to study cooling towers, boiler and detail parts of I C engines.							
COURSE OUTCOMES								
CO1	To understand the principle, construction and working of S.I. and C.I. engine.							
CO2	To calculate the performance parameters of reciprocating air compressor, petrol and diesel engine.							
CO3	To study lubrication, cooling systems of I C engine. Also to understand the braking system of automobile.							
CO4	To study boiler performance, fuel injection system of C I engine and brake ignition system of S I engine.							

LIST OF EXPERIMENTS

1. To make a trial on single cylinder 4-stroke Diesel Engine to calculate B. H. P., S.F.C. and to draw its characteristics curves.
2. To make a trial on 4-stroke high-speed diesel engine and to draw its Heat Balance Sheet.
3. To make a trial on Wiley's jeep Engine at constant speed to calculate B. H. P., S. F. C. Thermal efficiency and to draw its characteristic Curves.
4. To make Morse Test to calculate IHP of the multi cylinder petrol engine and to determine its mechanical efficiency.
5. To calculate the isothermal efficiency and volumetric efficiency of a 2 stage reciprocating air compressor.
6. To find out the efficiency of an air Blower.
7. To make a trial on the Boiler to calculate equivalent evaporation and efficiency of the boiler.
8. To study the following models;
   (a) Gas Turbine (b) Wankle Engine.
9. To study
   (a) Lubrication and cooling systems employed in various I. C. Engines in the Lab
   (b) Braking system of automobile in the lab
10. To study a Carburetor.
11. To study (I) the Fuel Injection System of a C. I. Engine. (II) Battery Ignition system of a S.I. Engine
12. To study Cooling Tower.
13. To study multi Cylinder four strokes vertical Diesel Engine test Rig With Hydraulic Dynamometer.

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. 5th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Sessional**	**Practical**	**Total**	
ME-315N	**FLUID MACHINES LAB**	0	0	2	40	60	100	3
Purpose	To provide students with practical knowledge of working of Hydraulic Turbines, Pumps and Machines.							
COURSE OUTCOMES								
CO1	Students will gain knowledge of the practical working of various hydraulic turbines.							
CO2	Students will gain knowledge of the practical working of various hydraulic pumps.							
CO3	Students will gain knowledge of the practical working of various hydraulic machines.							

LIST OF EXPERIMENTS

1. To study and perform lest on the Pelton wheel and to plot curves Q, P Vs N at full, three fourth gate opening.
2. To study and perform test in the Francis Turbine and to plot curves Q, P Vs N at full, three-fourth gate opening.
3. To study and perform test on the Kaplan Turbine and to plot curves Q, P Vs N at full, three-fourth half opening.
4. To study and perform test on Centrifugal Pump and to plot curves η, Power Vs Q.
5. To study and perform test on a Hydraulic Ram and to find its Rankine, Aubussion η.
6. To study and perform test on a Reciprocating pump and to plot the P and η Vs H.
7. To study and perform test on a Gear Pump and to plot the curves Q.P Vs Pressure rise.
8. Study and perform test on a Torque Convertor and to plot the curves η & Np.
9. To study and perform test on Submersible Pump and to plot curves η, Power Vs Q.
10. To study and analyse experimentally the Impact of Jet on flat vanes.

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. 5th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Sessional**	**Practical**	**Total**	
ME-317N	**HEAT TRANSFER LAB**	0	0	2	40	60	100	3
Purpose	To familiarize the students with the equipment and instrumentation of Heat Transfer.							
Course Outcomes								
CO1	Design and conduct experiments, acquire data, analyze and interpret data.							
CO2	Measure the thermal conductivity of metal rod, insulating material and liquids.							
CO3	Understand the concept of composite wall and determine its thermal resistance.							
CO4	Plot the temperature profile in free and forced convection.							
CO5	Measure the performance of a heat exchanger.							
CO6	Understand the concept of solar heating and measure the performance of solar equipment.							

LIST OF EXPERIMENTS:

1. To determine the thermal conductivity of a metal rod.
2. To determine the thermal conductivity of an insulating slab.
3. To determine the thermal conductivity of a liquid using Guard plate method.
4. To determine the thermal conductivity of an insulating powder.
5. To determine the thermal resistance of a composite wall.
6. To plot the temperature distribution of a pin fin in free-convection.
7. To plot the temperature distribution of a pin fin in forced-convection.
8. To study the forced convection heat transfer from a cylindrical surface.
9. To determine the electiveness of a concentric tube heat exchanger.
10. To determine the Stefan-Boltzman constant.
11. To determine the critical heat flux of a given wire.
12. To study the performance of glass in glass solar collector.
13. To study the performance of an evacuated tube based solar water heater.

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. 5th Semester Mechanical Engineering							
ME-319N	**INDUSTRIAL TRAINING (VIVA-VOCE)**						
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessional**	**Practical**	**Total**	**Duration of exam. (Hrs.)**
2	**0**	**0**	**-**	**40**	**60**	**100**	**3**

Student will submit summer training (about 8 weeks industrial training) report and Viva-voce will be conducted for his/her assessment.

B. Tech. 6th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Theory**	**Sessional**	**Total**	
ME-302N	**REFRIGERATION AND AIR-CONDITIONING**	3	1	0	75	25	100	3
Purpose	The objective of this course is to make the students aware of refrigeration, Air-conditioning, various methods of refrigeration. The course will help the students to build the fundamental concepts in order to solve engineering problems and to design HVAC applications.							
Course Outcomes								
CO 1	Understanding of different refrigeration processes like ice refrigeration, evaporative refrigeration, refrigeration by expansion of air, steam jet refrigeration systems etc.							
CO 2	Identify, formulate and solve air refrigeration, vapour refrigeration and vapour absorption refrigeration problems.							
CO 3	Identify and understand refrigerants and their uses as per their properties and environmental effects etc.							
CO 4	Knowledge of psychometric properties, psychometric chart and its use for different cooling and heating processes along with humidification and dehumidification.							
CO 5	Design of various air-conditioning systems by including the internal and external heat gain.							

(a) REFRIGERATION

UNIT I

Basics of heat pump & refrigerator; Carnot's refrigeration and heat pump; Units of refrigeration; COP of refrigerator and heat pump; Carnot's COP; ICE refrigeration; evaporative refrigeration; refrigeration by expansion of air; refrigeration by throttling of gas; Vapour refrigeration system; steam jet refrigeration; thermoelectric cooling; adiabatic demagnetization.

Basic principles of operation of air refrigeration system, Bell-Coleman air refrigerator; advantages of using air-refrigeration in aircrafts; disadvantages of air refrigeration in comparison to other cold producing methods; simple air refrigeration in air craft; simple evaporative type air refrigeration in aircraft; necessity of cooling the aircraft.

UNIT II

Simple Vapour Compression Refrigeration System; different compression processes(wet compression, dry or dry and saturated compression, superheated compression); Limitations of vapour compression refrigeration system if used on reverse Carnot cycle; representation of theoretical and actual cycle on T-S and P-H charts; effects of operating conditions on the performance of the system; advantages of vapour compression system over air refrigeration system.

Methods of improving COP; flash chamber; flash inter cooler; optimum interstate pressure for two stage refrigeration system; single expansion and multi expansion processes; basic introduction of single load and multi load systems; Cascade systems.

Basic absorption system; COP and Maximum COP of the absorption system; actual NH_3 absorption system; functions of various components; Li-Br absorption system; selection of refrigerant and absorbent pair in vapour absorption system; Electro refrigerator; Comparison of Compression and Absorption refrigeration systems; nomenclature of refrigerants; desirable properties of refrigerants; cold storage and ice-plants.

(b) AIR-CONDITIONING

UNIT III

Difference in refrigeration and air conditioning; Psychometric properties of moist air (wet bulb, dry bulb, dew point temperature, relative and specific humidity of moist air, temperature of adiabatic saturation); empirical relation to calculate P_v in moist air.

Psychometric chart, construction and use, mixing of two air streams; sensible heating and cooling; latent heating and cooling; humidification and dehumidification; cooling with dehumidification; cooling with adiabatic humidification; heating and humidification; by-pass factor of coil; sensible heat factor; ADP of cooing coil; Air washer.

UNIT IV

Classification; factors affecting air conditioning systems; comfort air-conditioning system; winter air conditioning system; summer air- conditioning system; year round air conditioning. unitary air-conditioning system; central air conditioning system; room sensible heat factor; Grand sensible heat factor; effective room sensible heat factor.

Inside design conditions; comfort conditions; components of cooling loads; internal heat gains from (occupancy, lighting, appliances, product and processes); system heat gain (supply air duct, A.C. fan, return air duct); external heat gain (heat gain through building, solar heat gains through outside walls and roofs); solar air temperature; solar heat gain through glass areas; heat gain due to ventilation and infiltration.

Transport air conditioning; evaporative condensers, cooling towers; heat pumps.

Text books

1. Basic Refrigeration and air-conditioning by Annanthana and Rayanan, TMG
2. Refrigeration and air-conditioning by R.C.Arora, PHI

References books

1. Refrigeration and air-conditioning by C.P arora
2. Refrigeration and air-conditioning by Arora and Domkundwar, Dhanpat rai

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B. Tech. 6th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Theory**	**Sessional**	**Total**	
ME-304N	**Tribology & Mechanical Vibration**	3	1	0	75	25	100	3
Purpose:	To understand the vibration systems with different degrees of freedom in different modes and conditions and the basics of tribology.							
Course Outcomes								
CO 1	To understand the fundamentals of vibrations and study the systems in single D.O.F. under free and damped vibrations.							
CO 2	To study and analyze the different types of forced vibration system in single D.O.F.							
CO 3	To understand the concept of principle modes of vibrations using different methods and study lateral, longitudinal and torsional vibration in case of beams, bars and shafts respectively.							
CO 4	To understand the fundamentals of tribology of lubrication, friction and wear.							

UNIT I

Fundamentals of Vibration: Elements of a vibratory system, S.H.M., degrees of freedom, Types of vibrations, Work done by a harmonic force, Beats. **Undamped free vibrations:** Natural frequency by equilibrium and energy methods, equivalent spring, linear and torsional systems, compound pendulum, Bifilar and Trifilar suspensions.

Damped free vibrations: Different types of damping, differential equations of damped free vibrations, initial conditions, logarithmic decrement, vibrational energy and logarithmic decrement.

UNIT II

Single Degree of Freedom Systems- Forced Vibrations: Sources of excitation**,** equations of motion with harmonic force, response of rotating and reciprocating unbalanced system, Support motion,Vibration Isolation, Force and Motion transmissibility.

Forced vibrations with coloumb damping, structural damping and viscous dampings.

UNIT III

Multi-degree of freedom systems: Principle modes of vibrations, Influence co-efficient, Matrix method, orthogonality principle, Dunkerleys equation, Matrix iteration method, Holzer Method, Rayleigh Method and Rayleigh-Ritz methods, Stodola method, Hamilton principle.

Continuous systems: Transverse vibrations of strings, Longitudinal Vibrations of bars, Lateral vibration of beams, Torsional vibration of circular shafts.

UNIT IV

Introduction to Tribology, Tribology in design, Tribology in industry, economic aspects of Tribology, **Lubrication:** Basic modes of lubrication, lubricants, properties of lubricants - physical and chemical, types of additives, extreme pressure lubricants, recycling of used oils and oil conservation, disposal of scrap oil, oil emulsion.

Friction and Wear: Introduction, laws of friction, kinds of friction, causes of friction, friction measurement, theories of friction, effect of surface preparation. Introduction to Wear, Types of wear, various factors affecting wear, measurement of wear, wear between solids and liquids, theories of wear.

Text Books:

1. Grover G. K. “Mechanical Vibrations”, Nem Chand and Bros.,Roorkee
2. Meirovitch, “Elements of Mechanical Vibrations”, McGraw Hill

3. J.S.Rao and K.Gupta, 'Introductory course on theory and practice of Mechanical Vibration, New Age International.
4. Friction and wear of Materials- By E. Robinowicz, Johan Wiley
5. Tribology an Introduction - By Sushil Kumar Srivastava
6. B. C. Majumdar, "Introduction to Tribology and Bearings", S.Chand and Company Ltd. New Delhi.

Reference Books:

1. Rao S. S. "Mechanical Vibrations", Pearson Education Inc. Dorling Kindersley (India) Pvt. Ltd. New Delhi.
2. V.P. Singh, "Mechanical Vibrations", Dhanpat Rai & Co. Pvt. Ltd., Delhi
3. Prashant Sahoo, ''Engineering Tribology'', PHI publications.
4. Halling J., "Principles of Tribology", McMillan Press Ltd.

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B. Tech. 6th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Theory**	**Sessional**	**Total**	
ME-306N	**OPERATION RESEARCH**	3	1	0	75	25	100	3
Purpose	To make the students aware of various optimization techniques used for solving engineering problems.							
Course Outcomes								
CO1	To study necessity, applications, scope related to industry. To make the students aware of linear programming and its graphical representation.							
CO 2	To minimize the transportation cost using transportation models. To discuss and understand the network analysis representations.							
CO 3	To understand simulation. Its applications, merits and demerits. Furthermore, waiting line theory and decision theory are also helpful to solve various engineering problems.							
CO 4	Solve the problems related to Queuing theory and game theory.							

UNIT 1

Introduction: Definition and Development of Operations Research, Necessity and scope of OR in Industry, Operations Research in Decision making, Models in OR, Fields of application, Difficulties and Limitation of OR.

General Linear Programming Problems: Introduction, Maximization and minimization of function with or without Constraints, Formulation of a linear programming problem, Graphical method and Simplex method, Big M method, Degeneracy, Application of linear Programming (LPP) in Mechanical Engineering.

UNIT 2

The Transportation Problems: Mathematical formulation, Stepping stone method, Modified Distribution Method, Vogels Approximation Method, Solution of balanced and unbalanced transportation problems and case of degeneracy, Assignment problems, Least time transportation problem

Network Analysis: CPM/PERT, Network Representation, Techniques for drawing network, Numbering of events (Fulkersen Rule), PERT calculations - Forward path, back-ward path, Slack, probability, comparison with PERT, Critical path, Float, Project cost, Crashing the net work, updating (PERT and CPM).

UNIT 3

Simulation: Basic concept of simulation, Applications of simulation, Merits and demerits of simulation, Monte Carlo simulation, Simulation of Inventory system, Simulation of Queuing system.

Waiting Line Theory: Basic queuing process, Basic structure of queuing models, some commonly known queuing situations, Kendall's notation, Solution to M/M/1: ∞ /FCFS models.

Decision Theory: Steps in decision theory approach, Decision Machinery environment, Decision machining under certainty and uncertainty, Decision machining under condition of risk, Decision trees, Minimum enchained criteria, Advantages and limitations of decision tree solutions, Post Optimality.

Unit 4

Queuing Theory: Introduction, Applications of queuing Theory, Waiting time and idle time costs, Single channel queuing theory and multi-channel queuing theory with Poisson arrivals and exponential services, Numerical on single channel and multi channel queuing theory.

Game Theory: Theory of games, competitive games, Rules and Terminology in game Theory, Rules for game theory- saddle point, dominance, Mixed strategy (2 x2 games) , Mixed strategy (2 x n games or m x 2 games), Mixed strategy (3 x3 games),Two person zero sum games, N-person zero sum games.

Text books

1. Operations Research by Prem Kumar Gupta and D. S. Heera, S. Chand Publications
2. Introduction to Operations Research, by F.S. Hillier and G.J. Lieberman, seventh edition, McGraw Hill publications

Reference Books:

1. Introduction to Mathematical Programming by Winston, W.L. (4th ed.), Duxbury Press.
2. Operations Research by P Sankara Iyer, Mc Graw Hill publications.

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For Mechanical Engg, Electronics Engg and Bio Tech Engg students only

B. Tech. 6th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Theory**	**Sessional**	**Total**	
CSE-209N	**ESSENTIALS OF IT**	3	1	0	75	25	100	3
Purpose	**To introduce the concepts of Object Oriented Programming using Java and RDBMS**							
COURSE OUTCOMES								
CO-1	Solve Problems using various efficient and reliable Algorithms							
CO-2	Design and Study the basic concepts in Java							
CO-3	Document and implement Object oriented paradigms and design models in Java							
CO-4	Design and study RDBMS Modeling and its program implementation							

UNIT I

Problem Solving Techniques: Introduction to Problem Solving, Introduction to Algorithms and Flowchart, Searching algorithms: Linear search, Binary search and Sorting algorithms: Insertion and Selection sort, Basic Data Structures: Stack, and Linear Queue.

UNIT II

Programming Basics: Identifiers, Variables, Data Types, Operators, Control Structures: Loop, If else, Nested If, Switch Statement, Arrays, Strings, Object Oriented Concepts: Class & Object, Operator, Instance Variables & Methods, Access Specifiers, Reference Variables: This, Super, Parameter Passing Techniques, Constructors, Static, and Command Line Arguments.

UNIT III

Relationships: Inheritance, Types of Inheritance, Static Polymorphism: Method Overloading, Constructor Overloading, Method Overriding, Abstract, Interface, Introduction to Packages.

UNIT IV

RDBMS: Data Processing, Database Technology, Data Models, Data Independence, ER Modeling Concept, ER-notations, Converting ER Diagram into Relational Schema, Definition of Keys: Primary key, Foreign key, UniqueKey.

SQL: DDL Statements, DML Statements, DCL Statements, Joins, Sub queries, Views.

Books on Java

1. Java: The Complete Reference, Seventh Edition. Herbert Schildt, McGraw-Hill Education. Programming with Java 3e A Primer, E Balagurusamy, McGraw Hill Education.
2. Introduction to Java Programming, K. Somasundaram , Jaico Publishing House; 1st edition

Books on RDBMS, Oracle, MYSQL

1. Fundamentals of Database Systems, with E-book (3rd Edition) by Shamkant B.Navathe, Ramez Elmasri, Published by Addison Wesley Longman , January 15th, 2002
2. MySQL by Paul DuBois Published by New Riders.
3. Murach's MySQL Paperback, Joel Murach , Published by Shroff/Murach, 2012.
4. SQL: The Complete Reference , James R. Groff, Paul N. Weinberg, Published by McGraw-Hill Companies, March 1999.
5. Schaum's Outline of Fundamentals of Relational Databases, Ramon Mata-Toledo, Published by McGraw-Hill, 2000.

NOTE: In the semester examination, the examiner will set 8 questions in all, at least one question from each unit, and students will be required to attempt only 5 questions.

B. Tech. 6th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Theory**	**Sessional**	**Total**	
ME-308N	**COMPUTER AIDED DESIGN AND MANUFACTURING**	4	0	0	75	25	100	3
Purpose	The subject empowers the students to know about the extreme function of computer in designing, manufacturing as well as in the business scenario.							
Course Outcomes								
CO1	Student gets aware about the introduction of CAD/CAM, and CIM. This unit explains the history and application CAD/CAM.							
CO 2	Student gets aware about the Modeling of different types of curves, surface and solid. The modeling is used for further analysis.							
CO 3	To know about the transformation of points and lines in computer aided software. Group technology is used for utilization machines.							
CO 4	Student knows the usages of the numerical control machines and its code. How computer is useful in making the process planning.							

UNIT-I

Introduction to CAD/CAM, Historical Development, Industrial look at CAD/CAM Application of CA/CAM, Display devices, Input/ Output Devices, CPU.
Introduction to CIM, Definition, Nature of Elements of CIM, CIM Wheel,
Introduction to computer aided quality control, Contact and Non Conduct Inspection Method.

UNIT-II

Wireframe modeling, Representation of curves, Parametric and non-parametric curves, straight lines, Hermite cubic splines, B splines curves.
Plane surface, ruled surface, surface of revolution, bi-cubic surface, Bezier surface, B spline surface, Solid modeling, boundary representation, sweeping, parametric solid modeling.
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UNIT-III

Introduction, Transformation of points & line, 2-D translation, rotation, Reflection, Scaling, shearing and combined transformation, Homogeneous coordinates, Orthographic and perspective Projections.
Group technology, Part families, Part classification and coding, Optiz method, product flow analysis, Machine cell Design, Advantages of GT

UNIT-IV

Numerical control, Types of NC systems, MCU & other components, Co-ordinate system, NC manual part programming, G & M codes, part program for simple parts, Computer assisted part programming.
Introduction, FMS component, Types of FMS, FMS layout, planning for FMS, advantage and applications
Introduction, conventional process planning, Steps in variant process planning, types of CAPP, planning for CAPP

Text books:

1. **Chris McMahon and Jimmie Browne**, CAD/CAM – Principle Practice and Manufacturing Management, Addison Wesley England, Second Edition, 2000.

2. **Rogers, D.F. and Adams, A**., Mathematical Elements for Computer Graphics, McGraw Hill Inc, NY, 1989
3. **Ibrahim Zeid**, CAD/CAM theory and Practice, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1992.
4. **M.P. Groover**, Automation, Productions systems and Computer-Integrated Manufacturing by Prentice – Hall

Reference Books:

1. **Ibrahim Zeid**, Mastering CAD/CAM, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2. **P. Radhakrishnan, S. Subramanayan and V.Raju**, CAD/CAM/CIM, New Age International (P) Ltd., New Delhi.
3. **Groover M.P. and Zimmers E. W.**, CAD/CAM: Computer Aided Design and Manufacturing, Prentice Hall International, New Delhi, 1992.
4. **Dr. Sadhu Singh**, Computer Aided Design and Manufacturing, Khanna Publishers, New Delhi, Second Edition, 2000.
5. **Chang, Wang &Wysk** Computer Aided Manufacturing. Prentice Hall
6. **Kundra** &**Rao**, Numerical Control and Computer Aided Manufacturing by, Rao and Tiwari, Tata Mc-Graw Hill.
7. **Mattson**, CNC programming Principles and applications, Cengage Learning India Pvt. Ltd. Delhi

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B. Tech. 6th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Theory**	**Sessional**	**Total**	
ME-310N	**MACHINE DESIGN-II**	2	4	0	75	25	100	4
Purpose	To deal effectively with engineering problems associated with an individual machine component.							
Course Outcomes								
CO 1	To analyze the force components acting on the gears and solve design problems of different types of gears.							
CO 2	To solve design problems of belts, chains, pulleys and friction clutches and brakes.							
CO 3	To make selection of bearings from manufacturer's catalogue and solve spring design problems.							
CO 4	To design and solve the problems of IC engine components and flywheels.							

UNIT-I

Gear Drives: Classification of gears, selection of type of gears, law of gearing, standard systems of gear tooth, interference and undercutting, backlash, **Spur Gears:** geometry and nomenclature, force analysis, material selection, beam strength of gear tooth, effective load on gear tooth, module estimation based on beam strength, wear strength of gear tooth, module estimation based on wear strength, spur gear design procedure. **Helical Gears:** geometry and nomenclature, force analysis, beam strength of helical gears, effective load on gear tooth, wear strength of helical gears, design procedure. **Bevel Gears:** geometry and nomenclature, force analysis, beam strength of bevel gears, effective load on gear tooth, wear strength of bevel gears, design procedure. **Worm Gears:** terminology, force analysis, friction in worm gears, material selection, strength rating and wear rating, thermal considerations and design procedure.

UNIT-II

Flat Belt Drives and Pulleys: Introduction, Selection of flat belts from manufacturer's catalogue, Pulleys for flat belts. **V-Belts and Pulley:** selection of V-Belts and V-grooved pulley. **Chain Drives:** roller chains, geometric relationships, polygonal effect, power rating, sprocket wheels, design of chain drives, chain lubrication.

Clutches: Various types of clutches in use, design of friction clutches-single disc, multidisc, cone & centrifugal, torque transmitting capacity, friction materials, thermal considerations. **Brakes:** Various types of brakes, self-energizing condition of brakes, design of shoe brakes – internal & external expanding, band brakes, thermal considerations in brake designing.

UNIT-III

Springs: Types of springs, design for helical springs against tension and their uses, compression and fluctuating loads, design of leaf springs, surging in springs.

Bearings: Classification, selection of bearing type, static and dynamic load carrying capacity, equivalent bearing load, load-life relationship, selection of bearings from manufacturer's catalogue, selection of taper roller bearing, design for cyclic loads and speeds, bearing failure-causes and analysis. **Sliding Contact Bearings:** design of journal bearings using Raimondi and Boyd's Charts.

UNIT IV

I.C. Engine Components: Design of cylinder, design of studs for cylinder head, design of piston, design of crank shaft, design of connecting rod.

Flywheel: Flywheel materials, torque analysis, coefficient of fluctuation of energy, design of solid disc and rimmed flywheel.

Text books:

1. Mechanical Engineering Design, Joseph E. Shigley and Charles R. Mischke, Tata McGraw Hill Book Co.
2. Design of Machine Element,V. B. Bhandari, Mc Graw Hill Edu. Pvt. Ltd.
3. Machine Component Design, Robert C. Juvinall and Kurt M. Marshek, Wiley India Pvt. Ltd.
4. Mechanical Design of Machine Elements and Machines, Collins and Busby, Wiley India Pvt. Ltd.

References books:

1. Machine Design by Sharma and Aggarwal
2. Machine Design-an integrated Approach, Robert L. Norton, Addison Wisley Longman
3. PSG Design Data Book by PSG college of Engineering, PSG Publication.
4. Design Data Handbook for Mechanical Engineers by K. Mahadevan and K. Balaveera Reddy.

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B. Tech. 6th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Sessional**	**Practical**	**Total**	
ME-312N	**Refrigeration and Air Conditioning Lab**	0	0	2	40	60	100	3
Purpose	To make students understand about the applications of refrigeration and Air-conditioning.							
Course Outcomes:								
CO1	To understand about the basics and working principle of water cooler.							
CO2	Identify the different cycle of operation in air-conditioning							
CO3	To analyze the humidity measurement and its importance in air-conditioning							
CO4	To learn about the various control devices and parts of refrigeration and air-conditioning systems							

List of Experiments

1. To study and perform experiment on basic vapour compression Refrigeration Cycle.
2. To study and perform experiment on Solar Air-conditioner based on vapour absorption cycle.
3. To find COP of water cooler.
4. To study and perform experiments on compound compression and multi-load systems.
5. To study and perform experiment on vapour absorption apparatus.
6. Perform the experiment & calculate various performance parameters on a blower apparatus.
7. To find the performance parameter of cooling tower.
8. To study various components in room air conditioner.
9. To find RH of atmospheric air by using Sling Psychrometer.
10. To find performance of a refrigeration test rig system by using different expansion devices.
11. To study different control devices of a refrigeration system.
12. To find the performance parameters of Ice Plant.

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. 6th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Sessional**	**Practical**	**Total**	
ME-314N	**TRIBOLOGY & MECHANICAL VIBRATION LAB**	0	0	2	40	60	100	3
Purpose:	To make the students understand about the tribological properties of specimen and principles of vibration.							
Course outcomes:								
CO 1	To understand the concept of sliding and abrasive wear using wear and friction monitoring apparatus and dry abrasion tester.							
CO 2	To measure the extreme pressure properties of a lubricant using four ball tester.							
CO 3	To study the concept of free and forced vibration for a spring mass system and determine the natural frequency.							

LIST OF EXPERIMENTS:

1. To study undamped free vibrations of equivalent spring mass system and determine the natural frequency.
2. To study the free vibration of system for different damper settings. Draw decay curve and determine the log decrement and damping factor. Find also the natural frequency.
3. To study the torsional vibration of a single rotor shaft system and determine the natural frequency.
4. To determine the radius of gyration of given bar using bifilar suspension.
5. To verify the dunker ley's rule.
6. To study the forced vibration of system with damping. Load magnification factor vs. Frequency and phase angle vs frequency curves. Also determine the damping factor.
7. To determine the two frequencies of torsional spring type double pendulum & compare them with theoretical values.
8. To determine the radius of gyration of a compound pendulum.
9. To determine the radius of gyration of disc using trifilar suspension.
10. To determine the wear rate, friction force and coefficient of friction of a metallic pin/ball by using wear and friction monitor apparatus.
11. To determine abrasion index of a material with the help of dry abrasion test rig.
12. To evaluate the wear and extreme pressure properties of a lubricating oil by using four ball tester.

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. 6th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Sessional**	**Practical**	**Total**	
ME-316N	**COMPUTER AIDED DESIGN AND MANUFACTURING LAB**	0	0	2	40	60	100	3
Purpose	The lab empowers the students to know about the computer aided manufacturing by using CAD							
Course Outcomes								
CO1	Student gets aware about the 2D drawing and modelling.							
CO 2	Student knows how to use 3D software in part designing.							
CO 3	To know about the assembly and aware about the G codes and M codes.							
CO 4	Students will aware about the NC part programming and OPTIZE method.							

List of experiments:

1 To study the 2 dimensional drawing, orthographic views, front view, top view and side view.
2 To study the wireframe, surface and solid modelling.
3 Draw the part drawing of product 1 using any 3D software.
4 Draw the part drawing of product 2 using any 3D software.
5 Make assembly by using any 3D software.
6 To study the G codes and M codes.
7 Write a NC program for milling operation.
8 Write a NC program for drilling operation.
9 Write a NC program for turning operation.
10 To study the optiz method.

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. Product 1 and Product 2 must be based on ME 308N.