SCHEME OF STUDIES & EXAMINATION
B.TECH. 2nd year Mechanical Engg. Semester-III

S. No	Course Title	Code	Teaching Schedule				Marks for Class Work		Marks for Exam	Total Marks
			L	T	P	Total		Theory	Practical	
1	Basics of Industrial Sociology, Economics & Management / Mathematics-III	HUM-201 E/ MATH-201E	3	1	-	4	50	100	-	150
2	Thermodynamics	ME-201 E	3	1	-	4	50	100	-	150
3	Strength of Materials-I	ME-203 E	3	1	-	4	50	100	-	150
4	Machine Drawing	ME-205 E	2	-	4	6	50	100	-	150
5	Kinematics of Machine	ME-207 E	3	1	-	4	50	100	-	150
6	Production Technology-I	ME-209 E	3	1	-	4	50	100	-	150
7	Kinematics of Machine Lab	ME-211 E	-	-	3	3	50	-	50	100
8	Thermodynamics Lab	ME-213 E	-	-	3	3	50		25	75
9	Strength of Materials Lab	ME-215 E	-	-	3	3	50	-	25	75
	TOTAL		17	5	13	35	450	600	100	1150

Note: Students will be allowed to use Non-Programmable scientific calculator. However, sharing of calculator will not be permitted. Duration of theory as well as practical exams time is three hrs for all courses except ME-205E for which it is 4 hrs.

SCHEME OF STUDIES & EXAMINATIONS
B.TECH. 2nd YEAR (SEMESTER – IV) MECHANICAL ENGINEERING (2004-2005)

S. No	Subjects Name	Code	Teaching Schedule (Hrs)				Examination Schedule (Marks)			Total Marks	Duration of Exam (Hrs)
			L	T	P/D	Total	Sessional	Theory	Practical/ viva-voce		
1	Basics of Industrial Sociology, Economics & Management / Mathematics-III	HUM-201 E/ MATH-201E	3	1	-	4	50	100	-	150	
2	Production technology-II	ME-202 E	3	1	-	4	50	100	-	150	
3	Material Science	ME-204 E	4	-	-	4	50	100	-	150	
4	Strength of Materials – II	ME-206 E	3	1	-	4	50	100	-	150	
5	Fluid Mechanics	ME-208 E	3	1	-	4	50	100	-	150	
6	Dynamics of Machine	ME-210 E	3	1	-	4	50	100	-	150	
7	Production technology lab	ME-212 E	-	-	4	4	50	-	50	100	
8	Fluid Mechanics Lab	ME-214 E	-	-	3	3	25	-	25	50	
9	Dynamics of machine lab	ME-216 E	-	-	3	3	25	-	25	50	
	TOTAL		19	5	10	34	400	600	100	1100	

Note: Students will be allowed to use Non-Programmable Scientific Calculator. However, Sharing of calculator will not be permitted.

Scheme of Examination
B. Tech 5th Sem (Mechanical Engineering)

S. No	Subjects Name	Code	Teaching Schedule (Hrs)				Examination Schedule (Marks)			Total Marks	Duration of Exam (Hrs)
			L	T	P/D	Total	Sessional	Theory	Practical/ viva-voce		
1	I.C. Engine & Gas Turbine	ME 301 E	3	1	----	4	50	100	----	150	3
2	Fluid Machines	ME 303 E					50	100	----	150	3
3	Heat Transfer	ME 305 E					50	100	----	150	3
4	Industrial Engineering	ME 307 E	3	1	----	4	50	100	----	150	3
5	Machine Design – 1	ME 309 E	2	--	5	7	50	100	----	150	3
6	Steam Generation & Power	ME 311 E	3	1	----	4	25	100	----	125	3
7	Thermal Engineering (PR)	ME 313 E	-	-	2	2	25	----	25	50	3
8	Fluid Machines (PR)	ME 315 E	-	-	2	2	25	----	25	50	3
9	Heat Transfer (PR)	ME 317 E	-	-	2	2	25	----	25	50	3
10	Industrial Engineering	ME 319 E	-	-	2	2	25	----	25	50	3
11	Machine Design – I (Viva-voce)	ME 321 E	-	-	----	----	-----	----	25	25	3
	Total		**17**	**5**	**13**	**35**	**425**	**600**	**125**	**1150**	

Note: Students will be allowed to use Non-Programmable scientific calculator. However, sharing of calculator will not be permitted. Duration of theory as well as practical exams time is three hrs for all courses.

Scheme of Examination
B. Tech 6th Sem (Mechanical Engineering)

S.No	Subjects Name	Code	Teaching Schedule (Hrs)				Examination Schedule (Marks)			Total Marks	Duration of Exam (Hrs)
			L	T	P/D	Total	Sessional	Theory	Practical/ viva-voce		
1	Refrigeration and air conditioning	ME 302 E	3	1	---	4	50	100	---	150	3
2	Tribology	ME 304 E					50	100	---	150	3
3	Mechanical vibration	ME 306 E					50	100	---	150	3
4	Fundamentals of management	HUT-302E	3	1	---	4	50	100	---	150	3
5	Computer aided design and manufacturing	ME 308 E	4	1	---	5	50	100	---	150	3
6	Machine design-II	ME 310 E	2	--	6	8	50	100	---	150	4
7	Refrigeration and air conditioning lab	ME 312 E	---	---	2	2	25	---	25	50	3
8	Tribology and Mechanical vibration lab	ME 314 E	---	---	2	2	50	---	25	75	3
9	Computer aided design and manufacturing lab	ME 316 E	---	---	2	2	50	---	25	75	3
10	Machine design-II (viva –voce)	ME 318 E	---	---	---	---	---	---	50	50	3
Total			**18**	**5**	**12**	**35**	**425**	**600**	**125**	**1150**	

Note: Students will be allowed to use Non-Programmable scientific calculator. However, sharing of calculator will not be permitted. Duration of theory as well as practical exams time is three hrs for all courses except ME-310E.for which it is 4 hrs.

Scheme of Examination
B. Tech 7th Sem (Mechanical Engineering)

S. No	Subjects Name	Code	Teaching Schedule (Hrs)				Examination Schedule (Marks)			Total Marks	Duration of Exam (Hrs)
			L	T	P/D	Total	Sessional	Theory	Practical/ viva-voce		
1	Automobile Engineering	ME 401 E	4	1	---	5	50	100	---	150	3
2	Measurement and control	ME 403 E					50	100	---	150	3
3	Elective* -I	ME					50	100	---	150	3
4	Elective*-II	ME	3	1	---	4	50	100	---	150	3
5	Statistical Quality Control & Reliability	ME 405 E	4	1	---	5	50	100	---	150	3
6	Measurement (PR)	ME 407 E	-	-	2	2	50	---	50	100	3
7	Project-1	ME 409 E	---	---	7	7	100	---	100	200	3
8	Seminar	ME 411 E	2	-	-	2	-	---	---	---	-----
9	In plant Training Report	ME 413 E	---	---	-	-	125	---	---	125	---
	Total		**21**	**05**	**9**	**35**	**525**	**500**	**150**	**1175**	

Under ME-411E Some of the students may be evaluated in 7th semester and remaining in 8th Sem. Marks will be added in 8th Sem.
*** Refer List of Elective I and II**

Scheme of Examination
B. Tech 8th Sem (Mechanical Engineering)

S.No	Subjects Name	Code	Teaching Schedule (Hrs)				Examination Schedule (Marks)			Total Marks	Duration of Exam (Hrs)
			L	T	P/D	Total	Sessional	Theory	Practical/ viva-voce		
1	Entrepreneurship	ME 402 E	3	1	---	4	50	100	---	150	3
2	Elective* – III	ME	4	1			50	100	---	150	3
3	Elective* - IV	ME	3	1			50	100	---	150	3
4	Power Plant Engineering	ME 404 E	4	1	---	5	50	100	---	150	3
5	Operation research	ME 406 E	3	1	-	4	50	100	-	150	3
6	Entrepreneurship (PR)	ME 408 E	-	-	2	2	50	-	25	75	3
7	Project –II	ME 410 E	---	---	9	9	100	-	100	200	3
8	Seminar	ME 411 E	2	---	---	2	25	---	-	25	-
9	Comprehensive Viva - Voce	ME 412 E	---	---	---	---	50	---	---	50	3
10	General Fitness & Professional Aptitude	ME 414 E	---	---	---	---	---	---	75	75	3
Total			**19**	**5**	**11**	**35**	**475**	**500**	**200**	**1175**	

***Refer List of Electives**
Under ME-411E some of the students may be evaluated in 7th semester and remaining in 8th Sem. Marks will be added in 8th Sem

B. Tech. (Third semester) Mechanical engineering
BASICS OF INDUSTRIAL SOCIOLOGY, ECONOMICS & MANAGEMENT
HUM – 201 E

			Sessional	:	50
L	T	P	Theory	:	100
3	1	-	Total	:	150
			Duration of Exam.	:	3 Hrs.

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

UNIT-I

Meaning of social change, nature of social change, theories of social change. The direction of social change, the causes of social change, the process of social change. Factors of social change – the technological factors, the cultural factors, effects of technology on major social institutions, social need of status system, social relations in industry.

UNIT-II

Meaning of Industrial Economic, Production Function, its types, Least Cost Combination, Law of Variable Proportion, Laws of Return – Increasing, Constant & Diminishing.

Fixed & variable costs in short run & long run, opportunity costs, relation between AC & MC, U-shaped short run AC Curve.

Price & Output Determination under Monopoly in short run & long run. Price Discrimination, Price Determination under Discriminating Monopoly. Comparison between Monopoly & Perfect Competition.

UNIT – III

Meaning of Management, Characteristics of Management, Management Vs. Administration, Management – Art, Science & Profession, Fayol's Principles of Management.

Personnel Management – Meaning & Functions, Manpower – Process of Manpower Planning, Recruitment & Selection – Selection Procedure.

Training – Objectives & Types of Training, Various Methods of Training. Labour Legislation in India – Main provisions of Industrial disputes Act 1947;

UNIT – IV

Marketing Management – Definition & Meaning, Scope of Marketing Management, Marketing Research – Meaning, Objectives.

Purchasing Management – Meaning & Objectives, Purchase Procedure, Inventory Control Techniques.

Financial Management – Introduction, Objectives of Financial decisions, Sources of Finance.

TEXT BOOKS :

1. "Modern Economic Theory" Dewett, K.K., S. Chand & Co.
2. "Economic Analysis" K.P. Sundharam & E.N. Sundharam (Sultan Chand & Sons).
3. "Micro Economic Theory" M.L. Jhingan (Konark Publishers Pvt. Ltd.).
4. "Principles of Economics" M.L. Seth (Lakshmi Narain Aggarwal Educational Publishers – Agra).
5. "An Introduction to Sociology", D.R. Sachdeva & Vidya Bhusan.
6. "Society – An Introductory Analysis", R.M. Maclver Charles H. Page.
7. "Principles and Practices of Management : R.S. Gupta; B.D. Sharma; N.S. Bhalla; Kalyani.

REFERENCE BOOKS

1. "Organization and Management : R.D. Aggarwal, Tata McGraw Hill.
2. Business Organization and Management : M.C. Shukla

B. Tech. (Third semester) Mechanical engineering
MATHEMATICS - III
MATH-201 E

L	T	P			
3	1	-	Theory	:	100
			Sessional	:	50
			Total	:	150
			Duration of Exam:		3 Hrs.

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

UNIT – I

Fourier Series : Euler's Formulae, Conditions for Fourier expansions, Fourier expansion of functions having points of discontinuity, change of interval, Odd & even functions, Half-range series.

Fourier Transforms : Fourier integrals, Fourier transforms, Fourier cosine and sine transforms. Properties of Fourier transforms, Convolution theorem, Perseval's identity, Relation between Fourier and Laplace transforms, Fourier transforms of the derivatives of a function, Application to boundary value problems.

UNIT-II

Functions of a Complex Variables : Functions of a complex variable, Exponential function, Trigonometric, Hyperbolic and Logarithmic functions, limit and continuity of a function, Differentiability and analyticity.

Cauchy-Riemann equations, Necessary and sufficient conditions for a function to be analytic, Polar form of the Cauchy-Riemann equations, Harmonic functions, Application to flow problems, Conformal transformation, Standard transformations (Translation, Magnification & rotation, inversion & reflection, Bilinear).

UNIT-III

Probability Distributions : Probability, Baye's theorem, Discrete & Continuous probability distributions, Moment generating function, Probability generating function, Properties and applications of Binomial, Poisson and normal distributions.

UNIT-IV

Linear Programming : Linear programming problems formulation, Solution of Linear Programming Problem using Graphical method, Simplex Method, Dual-Simplex Method.

Text Book

1. Higher Engg. Mathematics : B.S. Grewal
2. Advanced Engg. Mathematics : E. Kreyzig

Reference Book

1. Complex variables and Applications : R.V. Churchil; Mc. Graw Hill
2. Engg. Mathematics Vol. II: S.S. Sastry; Prentice Hall of India.
3. Operation Research : H.A. Taha
4. Probability and statistics for Engineer : Johnson. PHI.

B. Tech. (Third semester) Mechanical engineering
THERMODYNAMICS
ME- 201 E

L	T	P
3	1	-

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam. : 3 hrs.

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

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 1^{st} law of Thermodynamics, Internal Energy and Enthalpy, 1^{st} Law Applied to Non-Flow Process, Steady Flow Process and Transient Flow Process, Throttling Process and Free Expansion Process.

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.

Unit III

Entropy: Clausius Inequality and Entropy, Principle of Entropy Increase, Temperature Entropy Plot, Entropy Change in Different Processes, Introduction to Third Law of Thermodynamics.
Availability, Irreversibility and Equilibrium: High and Low Grade Energy, Availability and Unavailable Energy, Loss of Available Energy Due to Heat Transfer Through a Finite Temperature Difference, Availability of a Non-Flow or Closed System, Availability of a Steady Flow System, Helmholtz and Gibb's Functions, Effectiveness and Irreversibility.

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.

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

B. Tech. (Third semester) Mechanical engineering
STRENGTH OF MATERIALS –I
ME- 203 E

L	T	P	
3	1	-	Sessional : 50 Marks Theory : 100 Marks Total : 150 Marks Duration of Exam. : 3 Hrs.

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

Unit 1

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.

Compound stresses & strains: Concept of surface and volumetric strains, two dimensional stress system, conjugate shear stress at a point on a plane, principle stresses & strains and principal- planes, Mohr's circle of stresses, Numerical.

Unit II

Shear Force & Bending Moments : Definitions, SF & BM diagrams for cantilevers, simply supported beams with or without over-hang and calculation of maximum BM & SF and the point of contraflexture under (i) concentrated loads, (ii) uniformly distributed loads over whole span or a part of it, (iii)combination of concentrated loads and uniformly distributed loads, (iv) uniformly varying loads and (v) application of moments, relation between the rate of loading, the shear force and the bending moments, Problems.

Torsion of circular Members : Torsion of thin circular tube, Solid and hollow circular shafts, tapered shaft, stepped shaft & composite circular shafts, combined bending and torsion, equivalent torque, effect of end thrust. Numericals.

Unit III

Bending & shear Stresses in Beams: Bending stresses in beams with derivation & application to beams of circular, rectangular, I,T and channel sections, composite beams, shear stresses in beams with derivation combined bending torsion & axial loading of beams. Numericals.

Columns & Struts: Column under axial load, concept of instability and buckling, slenderness ratio, derivation of Eulers formulae for the elastic buckling load, Eulers, Rankine, Gordom's formulae Johnson's empirical formula for axial loading columns and their applications, eccentric compression of a short strut of rectangular & circular sections, Numerical.

Unit IV

Slope & Deflection : Relationship between bending moment, slope & deflection, Mohr's theorem, 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.

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

Text Books:

1. Strength of Materials – G.H.Ryder - Third Edition in S I units 1969 Macmillan India
2. Strength of Materials – Andrew Pytel and Fredinand L.Singer Fourth Edition, Int. Student Ed. Addison – Wesley Longman

Reference Books :

1. Strength of Materials – Popov, PHI, New Delhi.
2. Strength of Materials – Sadhu Singh, Khanna Publications
3. Strength of Materials A Rudimentary Apprach – M.A. Jayaram, Revised Ed.2001, Sapna Book House, Bangalore
4. Strength of Materials – U.C.Jindal
5. Strength Materials – I. Kripal Singh

B. Tech. (Third semester) Mechanical engineering
MACHINE DRAWING
ME- 205 E

L	T	P			
2	-	4	Theory	:	100 Marks
			Sessional	:	50 Marks
			Total	:	150 Marks
			Duration of Exam	:	4 hrs.

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 20 marks each. Question from Unit III will carry 60 marks.

Unit I

Introduction to BIS Specification SP : 46 – 1988 Code of Engineering drawing – Limits, fits and Tolerance (Dimensional and Geometrical tolerance) , Surface finish representation.

Gear : Gear terminology, I.S. convention , representation of assembly of spur gears, helical gears, bevel gears , worm and worm wheel.

Unit II

Orthographic view from isometric views of machine parts / components. Dimensioning , Sectioning. Exercises on Coupling , Crankshaft , pulley , piston and Connecting rod , Cotter and Knuckle joint. Riveted Joint and Welded Joint.

Unit III

Assembly drawing with sectioning and bill of materials from given detail drawings of assemblies : Lathe Tail stock , machine vice , pedestal bearing , Steam stop valve , drill jigs and milling fixture.

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

Reference Books :

1. A Text Book of Machine Drawing : Laxmi narayana 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.

B. Tech. (Third semester) Mechanical engineering
KINEMATICS OF MACHINES
ME 207 E

L	T	P		
3	1		Sessional	: 50 Marks
			Theory	: 100 Marks
			Total	: 150 Marks
			Duration of Exam.	: 3 Hrs.

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

UNIT I

Kinematics, introduction to analysis and synthesis of mechanisms, Kinematics' pairs, Degree of freedom, Dynamitic chain mechanism, Machine, Four-bar chain, inversions, Single and double slider crank chain, Quick return mechanisms, Introduction to function generation, Path generation and rigid bodied guidance.

Velocity determination; Relative velocity methods, Instantaneous center method Acceleration determination, Kennedy's Space cent rode and body cent rode,

UNIT II

Centripetal and tangential accelerations, Acceleration determination by graphical method using velocity polygons, Cariole's component of acceleration, Klein's and other constructions.

Analytical methods to find velocity and acceleration of four –link mechanism, slider crank mechanism, freumdenstein's equation, Coordinate a angular displacements of input and output links (Path generation function generation), Least square technique, Rigid body guidance.

UNIT III

Pantograph, straight-line motion mechanisms (Peculiar, Hart, Scott Russell, Grasshopper, Watt, Kemp's Tchybishev, Parallel linkages) Indicator mechanisms (Simplex Crosby , Thomson, etc) Automobile steering gears (Davis and Ackerman),Hooks joint (universal coupling), Double hooks joints.

Types of friction, Laws of dry friction, Motion along inclined plane Screw threads, Wedge, Pivots and collars, Plate and cone clutches, Antifriction bearings, friction circle and friction axis, bearings and lubrication. Motion along inclined plane and screws, Pivots and Collars Thrust Bearings lubrication

UNIT IV

Types of cams and followers, various motions of the follower, Construction of cam profiles, Analysis for velocities and accelerations of tangent and circular arc cams with roller and flat –faced followers.

Open and crossed belt drives, velocity ratio, slip , material for belts, crowning of pulleys, law of belting, types of pulleys, length of belts ratio 0f tensions, centrifugal tension, power transmitted by belts and ropes, 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 Mechanism and Machines: Jagdish Lal, Metropolitan Book Co.
3. Mechanism synthesis and analysis: A.H. Soni, McGraw Hill Publications.
4. Mechanism: J.S. Beggs.
5. Mechanics of Machines: P.Black, Pergamon Press.
6. Theory of Machines: P.L.Ballaney, Khanna Publisher.

B. Tech. (Third semester) Mechanical engineering
PRODUCTION TECHNOLOGY-1
ME-209 E

L	T	P		
3	1	-	Sessional	: 50 Marks
			Theory	: 100 Marks
			Total	: 150Marks
			Duration of Exam.	: 3 Hrs.

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

UNIT I

Metal cutting & Tool life

Basic tool geometry, single point tool nomenclature, chips-various types and their characteristics, mechanism of chip formation, theoretical and experimental determination of shear angle, orthogonal and oblique metal cutting, metal cutting theories, relationship of velocities, forces and power consumption.

Effect of operating parameters life tool geometry, cutting speed, feed depth of out, coolant, materials etc on forces temp. tool life, surface finish etc., tool life relationship, tailor equation of tool life , tool material and mechanism.

UNIT II

Economics of metal machining & Multi edged tools

Element of machining cost, tooling economics, machines economics and optimization.

Broach tools-types materials and applications, geometry of twist drills, thrust torque and power calculation in drills, form tools-application.

UNIT III

Metal forming & Jigs and Fixtures

Metal blow condition, theories of plasticity conditions of plane strains, friction condition in metal working, wire drawing-extension of rods, theory of forging, roiling of metals and elementary rolling theory, no slip angle and forward slip.

Tool engineering, types of tools, usefulness, principles of lactation, locating and clamping devices, Jigs bushes, drilling Jigs, milling fixtures, turning fixtures, boring and broaching fixtures, different materials for Jigs and fixtures, economic of jigs and fixtures.

UNIT IV

Metrology

Measurements, linear and angular simple measuring instruments various clampers, screw gauge, sine bar, auto-collimator, comparator-mechanical, electrical, optical, surface finish and its measurement, micro and macro deviation, factors influencing surface finish and evaluation of surface finish.

Suggested reading:

1. Manufacturing science: Ghosh and Malik, E.W. Press
2. Principles of metal cutting: Sen and Bhattacharya, New Central Book.
3. Metal cutting principles: Shaw, MIT Press Cambridge
4. Manufacturing analysis: Cook, Adisson-Wesley
5. Modern machining processes: Pandey and Shan, Tata McGraw Hill 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. (Third semester) Mechanical engineering
KINEMATICS OF MACHINES (LAB.)
ME 211 E

L	T	P		
-	-	3	Class Work	: 50 Marks
			Exam	: 50 Marks
			Total	: 100Marks
			Duration of Exam	: 3 Hrs.

List of experiments

1. To determine the modulus of rigidity of the material of a closed coil helical spring and the stiffness of a spring
2. To determine the value of coefficient of friction for a given pair of surfaces using friction apparatus
3. To determine the modulus of rigidity of horizontal shaft
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 value of coefficient of friction between the screw and nut of the jack, while:
    a. Raising the load
    b. Lowering the load
6. 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.
7. To determine the coefficient of friction between belt and pulley and plot a graph between $\log_{10} T_1/T_2$ v/s, θ.
8. To determine the displacement, velocities, & accelerations of the driven shaft of a Hooke's joint for a constant speed of the driver shaft.
9. 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.)**.**
10. Study of the inversions of the single slider crank mechanism.
11. To verify the law of moment using Bell- crank lever.

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. (Third semester) Mechanical engineering
THERMODYNAMICS (LAB.)
ME-213 E

L	T	P			
-	-	3	Class Work	:	50 Marks
			Exam	:	25 Marks
			Total	:	75 Marks
			Duration of exam	:	3 Hrs.

List of Experiments

1. Study of 2 stroke petrol and diesel engine models.
2. Study of 4-stroke petrol/diesel engine model.
3. Study of boilers.
4. Study of Babcock-Wilcox boiler (Model).
5. Study of locomotive boiler (Model).
6. Study of Lancashire boiler (Model).
7. To study the Red wood viscometer and measure the viscosity of fluid.
8. To measure the flash point of the given fuel
9. To study the Nestler's boiler.
10. To study various parts of the vertical steam engine.
11 To study the diesel engine and make a trial on it.

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. (Third semester) Mechanical engineering
STRENGTH OF MATERIALS LAB
ME- 215 E

L	T	P			
-	-	3	Class Work	:	50 Marks
			Exam	:	25 Marks
			Total	:	75 Marks
			Duration of exam:		3 Hrs.

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 erichsen sheet metal testing machine & perform the erichsen 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 test.
7. To perform compression & bending tests on UTM.
8. To perform the sheer test on UTM.
9. To study the torsion testing machine and perform the torsion test.
10. To draw shear Force, Bending Moment Diagrams for a simply Supported Beam under Point and Distributed Loads.
11. To determine Mechanical Advantage and Efficiency of Single and Double Purchase Winch Crab.
12. To determine Mechanical Advantage and Efficiency of Worm and Worm Wheel.
13. To determine Mechanical Advantage, Efficiency of Simple and Compound Screw Jack.
14. To find Moment of Inertia of a Fly Wheel.

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. (Fourth semester) Mechanical engineering
PRODUCTION TECHNOLOGY-II
ME-202 E

L	T	P		
3	1	-	Sessional	: 50 Marks
			Theory	: 100 Marks
			Total	: 150 Marks
			Duration of Exam	: 3 Hrs

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

UNIT I

Kinematics of Machine Tools.

Drives in machine tools for rotation movement, stepped and step less drives, mechanical and hydraulic drives, Individual and group drives, selection of extreme values of spindle speed on a lathe, principle of stepped regulation, Layout of spindle speeds. A.P., G.P. and Logarithmic progressions, Kinematics advantage of G. P. for gear box design, selection of common ratio, Number of steps in a given speed range, design of all geared head stock.

UNIT II

Manufacturing Methods

Characteristics of turret Lathes, turret-indexing mechanism, tooling equipment for turrets, tool Layout or turrets. Classification of gear production methods, gear generation, gear hobbling gear shaping, gear finishing methods; shaving, burnishing grinding, Lapping gear shaping, gear finishing methods; shaving, burnishing grinding, honing.

UNIT III

Unconventional Machining Processes & Press Working Tools

Need for unconventional processes, Ultrasonic machining, electrochemical machining, electrochemical grinding, Laser beam machining their process parameters, principle of metal removal, applications advantages and limitations.

Introduction, classifications of presses and dies, hear, action in die cutting operations, center of pressure, mathematical calculation of center of pressure, clearances, cutting forces, punch dimensioning.

UNIT IV

Machine Tools Vibration and Dynamometry

Introduction, effects of vibration no-machine tools, cutting conditions, work piece and tools life, source of vibration, machine tool chatter, Need for measuring forces, basic requirements of measuring techniques, design requirements of dynamometers, 3-divisional turning dynamometer and its calibration, drill dynamometers.

Suggested reading:

1. Manufacturing science: Ghosh and Malik, E.W. Press
2. Principles of metal cutting: Sen and Bhattacharya, New Central Book.
3. Metal cutting principles: Shaw, MIT Press Cambridge
4. Manufacturing analysis: Cook, Adisson-Wesley
5. Modern machining processes: Pandey and Shan, Tata McGraw Hill Publications

B. Tech. (Fourth semester) Mechanical engineering

MATERIAL SCIENCE

ME- 204 E

L	T	P		
4	-	-	Sessional	: 50 Marks
			Theory	: 100 Marks
			Total	: 150 Marks
			Duration of Exam	: 3 Hrs

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

Unit I

Crystallography: Review of crystal structure, space lattice, crystal planes and crystal directions, co-ordination number, number of atoms per unit cell, atomic packing factor, Numericals related to crystallographic 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.

Unit II

Solid solutions and phase diagram: Introduction to single and multiphase solid solutions and types of solid solutions, importance and objectives of phase diagram, systems, phase and structural constituents, cooling curves, unary & binary phase diagrams, Gibbs's phase rule, Lever rule, eutectic and eutectoid systems, peritectic and peritectoid systems, iron carbon equilibrium diagram and TTT diagram. Heat Treatment: Principles, purpose, classification of heat treatment processes, annealing, normalizing, stress relieving, hardening, tempering, carburizing, nitriding, cyaniding, flame and induction hardening. Allotropic transformation of iron and steel, Properties of austenite, ferrite, pearlite, martensite.

UNIT III

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, season cracking. Recovery, re-crystallization and grain growth. Failures of metals: Failure analysis, fracture, process of fracture, types of fracture, fatigue, characteristics of fatigue, fatigue limit, mechanism of fatigue, factors affecting fatigue.

UNIT IV

Creep & Corrosion: Definition and concept, creep curve, mechanism of creep, impact of time and temperature on creep, creep fracture, creep testing and prevention against creep. Corrosion: Mechanism and effect of corrosion, prevention of corrosion. Plastic, Composite and Ceramics: Polymers, formation of polymers, polymer structure and crystallinity, polymers to plastics types, reinforced particles-strengthened and dispersion strengthened composites. Ceramic materials: Types of ceramics, properties of ceramic, ceramic forming techniques, mechanical behavior of ceramic.

Text Books:

1. Elements of Material Science and Engineering: VanVlack, Wesley Pub. Comp.
2. Material Science - Narula, Narula and Gupta. New Age Publishers

Reference Books:

1. Material Science & Engineering –V. Raghvan, Prentice Hall of India Pvt. Ltd, New Delhi
2. Text Book of Material Science & Metallurgy – O.P. Khanna, Dhanpat Rai & Sons
3. Material Science & Engineering-an Introduction-Callister;W.D.John Wiley & Sons., Delhi.
4. Engineering Materials: Kenneth G. Budinski, Prentice Hall of India, New Delhi

B. Tech. (Fourth semester) Mechanical engineering
STRENGTH OF MATERIALS-II
ME- 206 E

L	T	P	Sessional	: 50Marks
3	1	-	Theory	: 100 Marks
			Total	: 150 Marks
			Duration of Exam: 3Hrs.	

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

Unit I

Strain Energy & Impact Loading: Definitions, expressions for strain energy stored in a body when load is applied (i) gradually, (ii) suddenly and (iii) with impact, strain energy of beams in bending, beam deflections, strain energy of shafts in twisting, energy methods in determining spring deflection, Castigliano's & Maxwell's theorems, Numerical. Theories of Elastic Failure: Various theories of elastic failures with derivations and graphical representations, 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

Unsymmetrical Bending: Properties of beam cross section, product of inertia, ellipse of inertia, slope of the neutral axis, stresses & deflections, shear center and the flexural axis Numericals. Thin Walled Vessels : Hoop & Longitudinal stresses & strains in cylindrical & spherical vessels & their derivations under internal pressure, wire would cylinders, Numericals.

UNIT III

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

UNIT IV

Bending of Curved Bars : Stresses in bars of initial large radius of curvature, bars of initial small 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. Springs: Stresses in open coiled helical spring subjected to axial loads and twisting couples, leaf springs, flat spiral springs, concentric springs, Numericals.

Text Books:

1. Strength of Materials – G.H.Ryder, Third Edition in SI Units 1969 Macmillan, India.
2. Mechanics of Materials – (Metric Edition) : Ferdinand P. Beer and E. Russel Johnston, Jr. Second Edition, McGraw Hill.

Reference Books :.

1. Book of Solid Mechanics – Kazmi, Tata Mc Graw Hill
2. Strength of Materials – D.S. Bedi - S. Chand & Co. Ltd.
3. Advanced Mechanics of Solids and Structures – N. Krishan Raju and D.R.Gururaje-Narosa Publishing House.
4. Strength of Materials – Andrew Pytel and Fredinand L. Singer Fourth Edition, Int. Student Ed. Addison – Wesley Longman.

B. Tech. (Fourth semester) Mechanical engineering
ME- 208 E FLUID MECHANICS

L	T	P		
3	1	-	Sessional	: 50 Marks
			Theory	: 100 Marks
			Total	: 150 Marks
			Duration of Exam	: 3 Hrs.

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

Unit I

Fluid Properties and Fluid Statics: Concept of fluid and flow, ideal and real fluids, continuum concept, properties of fluids, Newtonian and non-Newtonian fluids. Pascal's law, hydrostatic equation, hydrostatic forces on plane and curved surfaces, stability of floating and submerged bodies, relative equilibrium. Problems. Fluid Kinematics: Eulerian and Lagrangian description of fluid flow; stream, streak and path lines; types of flows, flow rate and continuity equation, differential equation of continuity in cylindrical and polar coordinates, rotation, vorticity and circulation, stream and potential functions, flow net. Problems.

Unit II

Fluid Dynamics: Concept of system and control volume, Euler's equation, Bernoulli's equation, venturimeter, orifices, orificemeter, mouthpieces, kinetic and momentum correction factors, Impulse momentum relationship and its applications. Problems.Potential Flow: Uniform and vortex flow, flow past a Rankin half body, source, sink, source-sink pair and doublet, flow past a cylinder with and without circulation. Problems.

UNIT III

Viscous Flow: Flow regimes and Reynold's number, Relationship between shear stress and pressure gradient, uni-directional flow between stationary and moving parallel plates, movement of piston in a dashpot, power absorbed in bearings. Problems. Flow Through Pipes: Major and minor losses in pipes, Hagen-Poiseuilli law, hydraulic gradient and total energy lines, series and parallel connection of pipes, branched pipes; equivalent pipe, power transmission through pipes. Problems.

UNIT IV

Boundary Layer Flow: Boundary layer concept, displacement, momentum and energy thickness, von-karman momentum integral equation, laminar and turbulent boundary layer flows, drag on a flat plate, boundary layer separation and control. Streamlined and bluff bodies, lift and drag on a cylinder and an airfoil, Problems. Turbulent Flow: Shear stress in turbulent flow, Prandtl mixing length hypothesis, hydraulically smooth and rough pipes, velocity distribution in pipes, friction coefficients for smooth and rough pipes. Problems.

Text Books:

1. Fluid Mechanics – Streeter V L and Wylie E B, Mc Graw Hill
2. Mechanics of Fluids – I H Shames, Mc Graw Hill

References Books:

1. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas, TMH
2. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar, S.K. Kataria and Sons
3. Fluid Mechanics and Machinery – S.K. Agarwal, TMH, New Delhi

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

B. Tech. (Fourth semester) Mechanical engineering

MET –210 E DYNAMICS OF MACHINES

L	T	P		
3	1	-	Sessional	: 50 Marks
			Theory	: 100 Marks
			Total	: 150 Marks
			Duration of Exam	: 3 Hrs.

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

UNIT I

Static force analysis, Static equilibrium, free by diagram, Analysis of static forces in mechanism. D'Alembert's principal, Equivalent offset inertia force, Dynamics of reciprocation parts, Piston effort, Crank effort, Equivalent dynamical systems, and Inertia force in reciprocating engines by graphical and analytical method. Turning moment and crank effort diagrams for single cylinder and multi-cylinder engines, coefficient of fluctuation of energy, coefficient of fluctuation of speed, flywheel and its function.

UNIT II

Types of gears, terminology, condition for correct gearing, cyclical and involutes profiles of gear teeth, pressure angle, path of contact, arc of contact, Interference, undercutting, minimum number of teeth, number of pairs of teeth in contact, helical, spiral, worm and worm gear, bevel gear. Gear trains; simple, compound, reverted, and epicyclical, Solution of gear trains, sun and planet gear, bevel epicyclical gear, compound epicyclical gear, pre-selective gear box, differential of automobile, torque in gear taints.

UNIT III

Types of brakes, friction brakes, external shoe brakes, band brakes, band and block brakes, internal expanding shoe brake, dynamometers; absorption, and tensional. Types of governors; watt, Porter, Proell, spring loaded centrifugal, Inertia,, Sensitiveness, Stability, Isochronism's, Hunting, Effort and power of governor, controlling force, Static and dynamic balancing of rotating parts, balancing of I. C. Engines, balancing of multi-cylinder engine; V-engines and radial engines, balancing of machines.

UNIT IV

Gyroscope, Gyroscopic couple and its effect on craft, naval ships during steering, pinching and rolling, Stability of an automobile (2-wheeers), Introduction, open and closed lop control, terms related to automatic control, error detector, actuator, amplification, transducers, lag in responses, damping, block diagrams, system with viscous damped output, transfer functions, relationship between open –loop and closed loop transfer function.

Suggested reading:

1. Theory of machines: S. S. Rattan, Tata McGraw Hill Publications.
2. Theory of Mechanism and Machines: Jagdish Lal, Metropolitan Book Co.
3. Mechanism synthesis and analysis: A.H. Soni, McGraw Hill Publications.
4. Mechanism: J.S. Beggs.
5. Mechanics of Machines: P.Black, Pergamon Press.
6. Theory of Machines: P.L.Ballaney, Khanna Publisher.

B. Tech. (Fourth semester) Mechanical engineering

ME- 214 E FLUID MECHANICS LAB

L	T	P
-	-	3

Sessional : 25 Marks
Practical/Viva : 25 Marks
Total : 50 Marks
Duration of Exam. : 3 Hrs.

List of Experiments:

1. To determine the coefficient of impact for vanes.
2. To determine coefficient of discharge of an orificemeter.
3. To determine the coefficient of discharge of Notch (V and Rectangular types).
4. To determine the friction factor for the pipes.
5. To determine the coefficient of discharge of venturimeter.
6. To determine the coefficient of discharge, contraction & velocity of an orifice.
7. To verify the Bernoullis Theorem.
8. To find critical Reynolds number for a pipe flow.
9. To determine the meta-centric height of a floating body.
10. To determine the minor losses due to sudden enlargement, sudden contraction and bends.
11. To show the velocity and pressure variation with radius in a forced vertex flow.

Note:

1. At least ten experiments are to be performed in the semester.

2. At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or designed & set by the concerned institute as per the scope of the syllabus.

B. Tech. (Fourth semester) Mechanical engineering
ME- 212 E PRODUCTION TECHNIOLOGY LAB

L	T	P		
-	-	4	Sessional	: 50 Marks
			Practical/Viva	: 50 Marks
			Total	: 100 Marks
			Duration of Exam	: 4 Hrs

List of Experiments:

Introduction to milling machines its types functions applications etc.

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: At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or designed & set by the concerned institute as per the scope of the syllabus.

B. Tech. (Fourth Semester) Mechanical Engineering
ME 216E DYNAMICS OF MACHINE (LAB.)

L	T	P		
-	-	3	Sessional	: 25 Marks
			Practical/Viva	: 25 Marks
			Total	: 50 Marks
			Duration of Exam	: 3 Hrs

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 a shaft with theoretical values.
3. To find experimentally the Gyroscopic couple on motorized gyroscope and compare with applied couple.
4. To perform the experiment of balancing of rotating parts and finds the unbalanced couple and forces.
5. To determine experimentally the unbalance forces and couples of reciprocating parts.
6. To calculate the torque on a planet carrier and torque on internal gear using epicyclic gear train and holding torque apparatus.
7. To study the different types of centrifugal and inertia governors and demonstrate any one.
8. To study the automatic transmission unit.
9. To study the differential types of brakes.
10. To find out experimentally the corolis component of acceleration and compare with theoretical values.

Note: At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or designed & set by the concerned institute as per the scope of the syllabus.

B. Tech. (Fifth semester) Mechanical engineering
I.C.ENGINE AND GAS TURBINES
ME 301 E

L	T	P/D	Total	
3	1	-	4	Theory: 100 Marks Sessional: 50 marks Duration of Exam: 03 hours

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

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.
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;

UNIT IV

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.
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.

Recommended books

- Internal combustion engine by Ramalingam scitech publication
- Internal combustion engine by Ganeshan TMG
- Internal combustion engine by Mathur & Sharma
- 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 two question from each unit, and students will be required to attempt only 5 questions, at least one from each unit.

B. Tech. (Fifth semester) Mechanical engineering
FLUID MACHINES
ME 303 E

L	T	P/D	Total	
3	1	-	4	Theory: 100 Marks Sessional: 50 marks Duration of Exam: 03 hours

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

UNIT I

Impact of jet stationary and moving flat and curved plates, Force on series of vanes, Radial vanes, Vortex motion, Free and forced vortex , jet propulsion of ships
Units and dimensions; Dimensional homogeneity; Dimensional analysis' methods; Ray Leigh and Buckingham methods, Applications and limitations of dimensional analysis Dimensionless numbers, Similitude laws.

UNIT II

Introduction; Development of hydraulic turbines; Components of hydropower plant; Classification of turbines; Surge tank and its type.
Pelton turbine, Its components, Number and dimension of buckets, Speed ratio, Jet ratio, Energy conversion, Condition for maximum efficiency; Design considerations. Governing etc.
Francis turbine, its components, working principles. Draft tube, Types of draft tube, Design considerations; Outward vs. Inward flow reaction turbines, Introduction to Deriaz turbine, Evolution of axial flow turbines, Kaplan turbine, Operation at off-design loads, Governing etc.
Unit quantities, Specific speed, Runway speed, Characteristics of turbines,

UNIT III

Introduction, Classification, Components, Principle of working, various heads, Energy conversion, Euler's head and its variation with vane shapes. Effect of finite number of vanes, Losses and efficiencies, Minimum starting speed, Limitation of suction lift, Net Positive Suction Head (NPSH); Multistage pumps, Specific speed and performance.
Working principles, Classification, Components, Discharge, Discharge slip, Power input, Indicator diagram, Effect of friction, Acceleration and pipe friction, Maximum speed, Air vessels, Comparison with centrifugal pumps. Model testing of pumps.

UNIT IV

Cavitations and its effects, Cavitation parameters, Detection and Prevention of cavitations. Model testing of turbine
Propeller pump, Jet pump, Airlift pump, Gear pump, Screw pump, Vane pump, Radial piston pump, Submersible pump, Pump problems
Hydraulic accumulators, Hydraulic intensifier, Hydraulic lift, Hydraulic crane. Hydraulic coupling, Torque converter, Hydraulic ram.

Recommended books

- Fluid mechanics and machinery by S.K.Aggarwal TMG
- Fluid mechanics & fluid power engineering by D.S kumar, Katson publisher
- Fluid mechanics and Hydraulic machine by S.S rattan, Khanna publisher
- Introduction to fluid mechanics and machinery by Som and Bishwas, TMH

B. Tech. (Fifth semester) Mechanical engineering
HEAT - TRANSFER
ME 305 E

L	T	P/D	Total	
3	1	-	4	Theory: 100 Marks Sessional: 50 marks Duration of Exam: 03 hours

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

UNIT I

Definition of heat; Modes of Heat Transfer; Basic Laws of heat transfer, Electrical Analogy of heat conduction; Conduction through composite Walls; Overall heat transfer coefficient.
The general conduction equation in Cartesian, cylindrical and spherical coordinates Steady one dimensional heat conduction without internal heat generation; The plane slab; 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; Fins of uniform cross section; Governing equation; Temperature distribution and heat dissipation rate; Efficiency and effectiveness of fins.

UNIT II

Free and forced convection; Newton's law of cooling, Convective heat transfer Coefficient; Nusselt number; Dimensional analysis of free and forced convection; Analytical solution to forced convection problems; The concept of boundary layer; Hydrodynamic and thermal boundary layer; Momentum and Energy equations for boundary layer; Exact solution for laminar flow over an isothermal plate using similarity transformation; The integral approach; Integral momentum and energy equations; Solution of forced convection over a flat plate using the integral method. Analysis of free convection; governing equations for velocity and temperature fields. Relation between fluid friction and heat transfer, Reynolds analogy Dimensionless numbers; Reynolds, Prandtl Nusselt , Grashoff and Stanton Numbers and their significance, Heat transfer with change of phase; Nusselt theory of laminar film Condensation.

UNIT III

Theories of thermal radiation; Absorption, Reflection and transmission, Monochromatic and total emissive power; Black body concept; Planck's distribution law; Stefan Boltzman law; Wien's displacement law; Lambert's cosine law; Kirchoff's law; Shape factor; Heat transfer between black surfaces.

UNIT IV

Introduction; Classification of heat exchangers; Logarithmic mean temperature Difference; Area calculation for parallel and counterflow heat exchangers; Effectiveness of heat exchangers; N T U method of heat exchanger design; Applications of heat exchangers.

Reference and Text books:

- A Text book of Heat Transfer by S.P Sukhatme, university press
- Heat transfer by Holman, TMG
- Heat and Mass transfer by D.S Kumar

B. Tech. (Fifth semester) Mechanical engineering
INDUSTRIAL ENGINEERING
ME 307 E

L	T	P/D	Total	
3	1	-	4	Theory: 100 Marks Sessional: 50 marks Duration of Exam: 03 hours

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

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; technique; (time) information recording; methods of timings; Time study allowances; Work sampling technique; Performance rating and its determination PMTS; M. T. M.; Work factor.

UNIT II

Principles 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, Committees.

Objectives of PPC; Functions of PPC; Preplanning and planning; Routing; Estimating; scheduling-master schedule; Daily schedule; Gantt chart; Dispatching –centralized vs. decentralized; Control; Follow up and progress reporting.

Introduction; Product development; Product characteristics; Role of product development; 3Ss – Standardization; Simplification and Specialization.

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, Moving average method, Time series analysis.

Introduction, Functions of inventory; Types of inventory; Control importance and functions, Inventory costs, Factors affecting inventory control, Various inventory control models. A. B. C. analysis, Lead-time calculations.

UNIT IV

Introduction; Objectives; Concept and life cycle of a product and V.E.; Steps in VE., Methodology and techniques, Fast diagram, Matrix method.

Various concepts in industrial engineering

a) WAGES AND INCENTIVES; -Concept; Types; Plans; Desirable characteristics.
b) ERGONOMICS; - its importance; Man-machine work place system; Human factors considerations in system design.
c) SUPPLY CHAIN MANAGEMENT; - its definition, Concept, Objectives, Applications, benefits, Some successful cases in Indian Industries.
d) JIT; - Its definition, Concept, Importance, Misconception, Relevance, Applications, Elements of JIT (brief description).
e) MRP;-Introduction, Objectives, factors, Guide lines, Techniques Elements of MRP system, Mechanics of MRP, MRP-II
f) TIME MANAGEMENT;-Introduction, Steps of time management, Ways for saving time, Key for time saves.

Reference and Text books:

- Production planning and control by S.Elion
- Modren production Management by S.S Buffa

- Industrial engg. and management manufacturing system by Surender kumar, Satya prakashan
- Essence of Supply Chain Management by R.P mohanty and S.G Deshmukh
- Industrial engg. and management by S Sharma and Savita sharama

B. Tech. (Fifth semester) Mechanical engineering

ME 309 E Machine Design- 1

L	T	P/D	Total	
2	-	5	7	Theory: 100 Marks Sessional: 50 marks Duration of Exam: 03 hours

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

UNIT I

Properties: Chemical, Physical, Mechanical and Dimensional; Ferrous metals, Non-ferrous metals, Plastics, Composite materials etc.; Selection of Engineering Materials.

Design methodology; Design criterion based on fracture; Deformation and elastic stability design stresses; Factor of safety; Significant stress and significant strength; Stresses-concentration; Causes and mitigation; Endurance limit; Effect of concentration; Notch sensitivity; Size and surface finish; Goodman diagram; Gerber's parabola and Soderberg line.

UNIT II

Supports and retainment of rotating assemblies; manufacturing considerations of design, design of castings and weldments.

Riveted joints for boiler shell according to I. B. R.; riveted structural joint; and riveted joint with eccentric loading; Types of welded joints; strength of welds under axial load; Welds under eccentric loading; Designation of various types of bolts and nuts, Design of bolted joints, Bolts of uniform strength, Bolted joints with eccentric loads, Design of Keys, Cotter joint and knuckle joints.

UNIT III

Design of shafts subjected to pure torsion; Pure bending load; Combined bending and torsion; Combined torsion; Bending and axial loads.

Introduction, hand and foot levers, cranked lever, lever for a lever safety valve, Bell crank lever. Miscellaneous levers.

UNIT IV

Types of shaft couplings, Design of sleeve or muff coupling; Flange coupling and bush type flexible couplings.

Introduction, Design of circular, oval shaped and square flanged pipe joints.

Function, types of power screws, stresses in screws, design calculations.

References and text books:

- Design of machine element By Bhandari
- Machine design by Malvee and Hartmann, CBS publication
- Machine design by Sharma and Aggarwal
- PSG Design Data Book by PSG College of Engg PSG Publication
- Machine Design an integrated Approch Robert l Norton, prentice hall
- Fundamental of machine component design R.C Juvinnal, Johan wiley& sons

B. Tech. (Fifth semester) Mechanical engineering

ME 311 E STEAM GENERATION & POWER

L	T	P/D	Total	
3	1	-	4	Theory: 100 Marks Sessional: 25 marks Duration of Exam: 03 hours

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

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

B. Tech. (Fifth semester) Mechanical engineering

ME 313 E Thermal Engineering (Practical)

L	T	P/D	Total	
-	-	2	2	Theory: 25 Marks Sessional: 25 marks Duration of Exam: 03 hours

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: Total Ten experiments must be performed. **At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or outside the list.**

B. Tech. (Fifth semester) Mechanical engineering
ME 315 E Fluid Machines (Practical)

L	T	P/D	Total	
-	-	2	2	Theory: 25 Marks Sessional: 25 marks Duration of Exam: 03 hours

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 ηVs 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.

B. Tech. (Fifth semester) Mechanical engineering

ME 317 E Heat Transfer (Practical)

L	T	P/D	Total	
-	-	2	2	Theory: 25 Marks Sessional: 25 marks Duration of Exam: 03 hours

List of Experiments

1. Determination of thermal conductivity of a metal rod
2. Determination of thermal conductivity of an insulating powder
3. Determination of thermal conductivity of a liquid using Guard plate method
4. Determination of thermal resistance of a composite wall
5. Temperature distribution of a pin fin in free-convection
6. Temperature distribution of a pin fin in forced-convection
7. Forced convection heat transfer from a cylindrical surface
8. Determination of Electiveness of a Heat exchanger
9. Determination of Stefan-Boltzman constant
10. Performance of Solar still
11. Determination of critical heat flux
12. Performance of solar water heater
13. Measurement of solar radiation using solar integrator.

Note: Total Ten experiments must be performed. At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or outside the list.

B. Tech. (Fifth semester) Mechanical engineering
Industrial Engineering (Practical)
ME 319 E

L	T	P/D	Total	
-	-	2	2	Theory: 25 Marks Sessional: 25 marks Duration of Exam: 03 hours

List of Experiments

1. To study various Rating Factor systems and find standard time for making small sand mould.
2. To study various plat layouts and suggest improvements in existing Machines Shop layout.
3. To study and draw organizational structure of a near by industry and suggest changes.
4. To draw X and R charts for a given sample of products to check their acceptance.
5. To draw p chart for a given product lot and verify its acceptance
6. Draw a flow process chart with time estimates for a simple welding process.
7. Draw a two handed process chart for a simple process of a job preparation on a lathe.
8. To study various purchase procedures and draw organizational structure of college purchase department.
9. A case study on ABC/VED analysis.
10. A case study on Quality Improvement Techniques (e.g. Hostel Mess/ Workshop / Canteen etc.)
11. A market survey and analysis.
12. A “preliminary project report” preparation for any small-scale unit.

Note: Total Ten experiments must be performed. At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or outside the list.

B. Tech. (Sixth semester) Mechanical engineering
Refrigeration and Air-Conditioning
ME 302 E

L	T	P/D	Total	
3	1	-	4	Theory: 100 Marks Sessional: 50 marks Duration of Exam: 03 hours

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

(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; Vapor 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 Vapor 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.

References and Text books

1. Refrigeration and air-conditioning by C.P arora
2. Basic Refrigeration and air-conditioning by Annanthana and Rayanan, TMG
3. Refrigeration and air-conditioning BY Arora and Domkundwar, Dhanpat rai

B. Tech. (Sixth semester) Mechanical engineering
TRIBOLOGY
ME 304 E

L	T	P/D	Total	
3	1	-	4	Theory: 100marks Sessional: 50 marks Duration of Exam: 03 hours

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

UNIT I

Introduction to tribological systems and their characteristic features; analysis and assessment of surface; topography; deterministic and stochastic tribo-models for asperity contacts; techniques of surface examination; technological properties of surfaces.
Quantitative laws of sliding friction, causes of friction, adhesion theory, laws of rolling friction, measurement of friction

UNIT II

Introduction, mechanism of wear, types of wear, quantitative laws of wear, measurement of wear, wears resistance materials

UNIT III

Introduction, dry friction, boundary lubrication, hydrodynamic, hydrostatic and elasto-hydrodynamic lubrication, functions of lubricants, types and properties, lubricant additives. Principles, application to rolling contact bearings, cams, Gears

UNIT IV

Geometry and pressure equation of journal bearing, hydrostatic bearings, thrust bearings, porous bearings and hydrodynamic gas bearings. Journal bearings with specialized applications. General requirements and different types of bearing materials.

Suggested Reading

1. Tribology an Introduction - By Sushil Kumar Srivastava
2. Introduction to Tribology of Bearings- By B.C. Majumdar ; A.H.Wheeler
3. Principles of Tribology – By J. Halling, Macmillan
4. Mechanics and Chemistry in Lubrication- By Dorinson and Ludema , Elsevier
5. Friction and wear of Materials- By E. Robinowicz, Johan Wiley
6. Principles of Lubrication-By A. Cameron, Longmans

B. Tech. (Sixth semester) Mechanical engineering
MECHANICAL VIBRA0TION
ME 306 E

L	T	P/D	Total	
3	1	-	4	Theory: 100 Marks Sessional: 50 marks Duration of Exam: 03 hours

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

UNIT I

Kinematics of simple vibrating motion, Simple harmonic motions, Vectorial representation of harmonic motion. Degree of freedom, Equations of motions, general solution of free vibration, Phase plane method

UNIT II

Damped free vibration, undamped and damped forced vibrations, Vibrating isolation, Vibrating instruments.
Undamped free vibration ,Principle modes , Influence coefficients, Coordinate coupling, Orthogonality, Vibration absorbers.

UNIT III

Geometric method, Stability of equilibrium points, Method of harmonic balance.
Influence coefficients, Dunkerleys equation, Matrix iteration, Holzer method, Rayleigh method, and Rayleigh-Ritz method.

UNIT IV

Transverse vibration of strings, Longitudinal vibrations of bars, Lateral vibration of beams, Torsional vibration of circular shafts, Whirling of shafts.
Introduction, Method of Laplace transformation and response to an impulsive output, response to step-input, pulse-input, and phase plane method.

REFERENCE AND TEXT BOOKS: -

- Mechanical vibration - By G.K. Grover; Nemchand Chand and Sons
- Mechanical Vibration – By Thomson; Prentice Hall
- Mechanical Vibration - By Den Hartog; Mc Graw Hill
- Introductory course to mechanical vibrations – By Rao and Gupta; Wiley Eastern

B. Tech. (Sixth semester) Mechanical engineering
FUNDAMENTALS OF MANAGEMENT
HUT-302E

L	T
3	1

Theory : 100 Marks
Sessional : 50 Marks
Total : 150 Marks
Time : 3 hours

NOTE : The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all , selecting at least one question from each unit.

UNIT-I Financial Management

Introduction of Financial Management, Objectives of Financial Decisions, Status and duties of Financial Executives. Financial Planning – Tools of financial planning. Management of working capital, Factors affecting requirements of working capital. Capital structure decisions. Features of appropriate capital structure. Sources of finance.

UNIT-II Personnel Management

Personnel Management – Meaning, Nature and Importance; Functions of Personnel Management – (a) Managerial Functions and (b) Operative functions. Job Analysis: Meaning and Importance; Process of Job Analysis; Job Description and Job specification. Human Resource Development-Meaning and concept.

UNIT-III Production Management

Production Management : Definition and Objectives
Plant location: Ideal plant location. Factors affecting plant location.
Plant Layout : Ideal plant layout, factors affecting plant layout.
Work Measurement : Meaning, Objectives and Essentials of work measurement.
Production Control : Meaning and importance of production control and steps involved in production control.

UNIT-IV Marketing Management

Nature, scope and importance of marketing management. Modern Marketing concepts. Role of marketing in economic development. Marketing Mix. Marketing Information System. Meaning, nature and scope of International Marketing.

B. Tech. (Sixth semester) Mechanical engineering
COMPUTER AIDED DESIGN AND MANUFACTURING
ME 308 E

L	T	P/D	Total	
4	1	-	5	Theory: 100 Marks Sessional: 50 marks Duration of Exam: 03 hours

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

UNIT I

Introduction to CAD/CAM, Historical Development, Industrial look at CAD/CAM, Introduction to CIM Basic of Geometric & Solid modeling, Coordinate systems, Explict, Implict, Intrinsic and parametric equation

Part families, Part classification and coding, product flow analysis, Machine cell Design, Advantages of GT

UNIT II

Introduction, Transformation of points & line, 2-D rotation, Reflection, Scaling and combined transformation, Homogeneous coordinates, 3-D scaling, shearing, rotation, reflection and translation, combined transformations, Orthographic and perspective projections

Algebric and geometric forms, tangent & normal blending functions, reparametrization Straight line, conics, cubic splines, bezier curves and B-spline curves

UNIT III

Algebraic and geometric forms, tangent & twist vectors, normal blending function, reparametrization, Sixteen point form, four Curve form, Plane surface, ruled surface

Surface of revolution, tabulated cylinder Bi-cubic surface, bezier surface, B-spline surface Solid models and representation scheme B-rep & CSG, sweep representation ,Cell decomposition, spatial occupancy enumeration

UNIT IV

Introduction, fixed programmable and flexible automation, 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

Suggested Reading:

- CAD/CAM theory & practice (Ibrahim Zeid)
- CAD/CAM (Groover & Zimmer)
- Numerical control and computer aided manufacturing by RAO and Tiwari, TMG

B. Tech. (Sixth Semester) Mechanical Engineering
MACHINE DESIGN II
ME 310 E

L	T	P/D	Total	
2	-	6	8	Theory: 100Marks Sessional: 50 marks Duration of Exam: 04 hours

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

UNIT I

Classification of Gears; Selection of type; Law of Gearing, Standard system of Gear tooth, Various Failure modes, Interference, undercutting & minimum no. of teeth

Force Analysis ,Beam strength of Gear tooth, Effective load on tooth, Estimation of module based on beam strength and wear strength, Gear lubrication, materials; Design Procedure, Gear Box design

Terminology, Force Analysis, Virtual no. of teeth, Beam strength, Effective load, Wear strength

Terminology, force analysis, beam strength & wear strength, effective load on gear tooth

Terminology, properties, force analysis, friction, material selection

UNIT II

Design of flat belts &Pulleys, Design /selection of V belts &Pulleys, Design/selection of wire ropes, Design/selection of chains

Single &multiple Plate clutch, Cone clutch

External shoe brake, Internal shoe brakes

UNIT III

Coil Springs, Leaf Springs

Hydro dynamically lubricated bearings, Selection of ball bearings, Selection of roller bearings, Selection of taper roller bearings

Mechanism Design, Design of cam & Follower

UNIT IV

Design of Cylinder, Design of Piston, Design of Crank shaft, Design of connecting rod

Design of Crane Hook

Design of Flywheels

SUGGESTED READING:

- Design of Machine Elements Bhandari TMH
- Machine Design Sharma Aggarwal Katson Publishers
- PSG Design Data Book PSG College of Engg PSG Publication
- Machine Design an integrated Approach Robert l Norton, prentice hall
- Fundamental of machine component design R.C Juvinnal, Johan wiley& sons

B. Tech. (Sixth semester) Mechanical engineering
Refrigeration and Air Conditioning (Practical)
ME 312 E

L	T	P/D	Total	
-	-	2	2	Practical: 25Marks Sessional: 25 marks Duration of Exam: 03 hours

List of Experiments

1. Study & Performance of basic vapour compression Refrigeration Cycle.
2. To find COP of water cooler.
3. To study the walk in cooler.
4. To study and perform experiment on vapour absorption apparatus.
5. Perform the experiment & calculate various. Performance parameters on a blower apparatus.
6. To find the performance parameter of cooling tower.
7. To study various components in room air conditioner.
8. To find RH of atmosphere air by using sling Psychometric and Psychometric.
9. To find performance of a refrigeration test rig system by using different expansion devices.
10. To study different control devices of a refrigeration system.
11. To study various compressor.
12. To find the performance parameters of Ice Plant.

Note: Total Ten experiments must be performed. At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or outside the list.

B. Tech. (Sixth semester) Mechanical engineering
TRIBOLOGY & MECHANICAL VIBRATION (PRACTICAL)
ME 314 E

L	T	P/D	Total	
-	-	2	2	**Practical: 25Marks**
				Sessional: 50 marks
				Duration of Exam: 03 hours

LIST OF EXPERIMENT:

1. To study undamped free vibrations of equivalent spring mass system and determine the natural frequency of vibrations
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 to 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 study the pressure distribution of a journal bearing using a journal bearing apparatus.
8. To determine the rate of wear of a metallic pin from the plot of displacement vs time curves by using friction and wear monitor apparatus.
9. To determine abrasion index of a material with the help of dry abrasion test rig.
10. To evaluate the load wear index and the weld point of a lubricant with the help of a four ball stream pressure tester.
11. To determine the two frequencies of torsional spring type double pendulum & compare them with theoretical values.
12. To determine the radius of gyration of a compound pendulum.
13. To determine the radius of gyration of disc using trifilar suspension.

Note: Total Ten experiments must be performed. At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or outside the list.

B. Tech. (Sixth semester) Mechanical engineering
COMPUTER AIDED DESIGN & MANUFACTURING (Practical)
ME 316 E

L	T	P/D	Total	
-	-	2	2	Practical: 25Marks Sessional: 50 marks Duration of Exam: 03 hours

List of Experiments

Note: Practical will base on course No. ME 308 E.

B. Tech (Seventh Semester) Mechanical Engineering
Automobile Engineering
ME 401 E

L	T	P/D	Total.	
4	1		5	

Theory : 100 marks
Sessional : 50 marks
Duration of Exams. : 03 hours

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

UNIT I

Brief history of automobiles, Main components of an automobile, Brief description of each component

Brief description of constructional details and working of a four stroke I.C. Engine (S.I. Engines and C.I. Engines) including lately developed overhead cam shaft, Multi-cylinder engines, Introduction to recent developments in I.C. Engines- Direct injection systems, Multi-point fuel injection systems, Microprocessor based fuel supply systems, Multi valve engines, Mechanical balancing, Firing Order, Power balancing, Power overlap, Power flow charts.

Introduction, Brief description of different components of Transmission System.

Clutch

Introduction to Clutch and its different types, Principle of Friction Clutch, Clutch Lining and friction materials used in Friction Clutches, Torque transmitted, Brief description of Cone Clutch, Single Plate and Multiplate Clutches, Dry and wet clutches, Automatic clutch action, Centrifugal clutches, Electromagnetic clutches, Fluid Flywheel.

UNIT II

Gear Box

Air resistance, gradient resistance and rolling resistance coming across a moving automobile, Tractive effort, Variation of tractive effort with speed, Performance curves (object and need of a gear box), Sliding mesh gear box, Control mechanism, Sliding type selector mechanism, Ball type selector mechanism, Steering column gear shift control, Constant mesh gear box, Synchromesh device, Automatic transmission in general, AP automatic gear box, Torque converter, Torque converter with direct drive, Lubrication of Gear Box.

Propeller Shaft:

Functions and requirements of a propeller shaft, Universal joints, Constructional forms of universal joints, Flexible-ring joints, Rubber-bushed flexible joints. Constant-velocity joints.

Differential:

Principle of operation, Constructional details of a typical Differential unit, Traction control differentials, Multi-plate clutch type
traction control device,

The back axle:

Live back axles, The final drive, Single reduction live axles Torque reaction, Driving thrust, Torque and thrust member arrangements Springs serving as torque and thrust member, Hotchkiss Drive with torque reaction member, Single combined torque-thrust reaction member, with springs taking only vertical and lateral loads

UNIT III

Running System

Wheels and rims, Tyre-its function and constructional details.

Brakes:

Functions and methods of operation, Brake efficiency. Elementary theory of shoe brake, brake shoe adjustments, A modern rear-wheel brake, Disc brakes, Brake linkages, Leverage and adjustment of the brake linkage, Servo- and power-operated brakes, Vacuum brake operation,' Hydraulic Brakes-constructional details and working, Bendix Hydrovac, Direct-action vacuum servos, Power-operated brakes, A dual power air brake system,

Suspension system

Suspension principles, Road irregularities and human susceptibility, Suspension system, Damping, Double tube damper, Single tube damper, Lever arm type damper, Springs-Leaf springs, Coil and torsion springs, variable rate springs, Composite leaf springs, Rubber springs, Air springs, Adjustable and self-adjusting suspensions, Interconnected suspension system, Interconnected air and liquid suspensions, Independent suspension system, Different independent suspension layouts, McPherson strut type, Rear suspension-live axle, McPherson strut rear suspension.

UNIT IV

Steering Mechanism

Steering geometry, Castor, Camber, Kingpin inclination, Combined angle, Toe-in, Steering system-basic aims, Ackerman linkage, Steering linkages for independent suspension, Center point steering, Costarring or trailing action, Cornering power, Self-righting torque, Steering characteristics-over steer and under steer, Axle beam, Stub-axle construction, Steering column, Reversible and irreversible steering, Rack-and-pinion steering mechanism, Effect of toe-in on steering, Power steering, Vickers System.

Recent trends in automobile engineering

Multi fuel automobiles, Automobiles running on alternate sources of energy, Emission control through catalytic converter, Double catalytic converter, Aspects of pollution control in Automobiles.

Reference and Text Books:

1. The Motor Vehicle - By Newton, Steeds and Garretle Basic
2. Automobile Engineering - By Kirpal Singh
3. Automobile Engineering -By K.M. Gupta, Umesh Publications
4. Automotive Mechanics -Grouse

B. Tech. (Seventh Semester) Mechanical Engineering
Measurements and Control
ME 403 E

L	T	P/D	Total		
4	1		5	Theory	: 100 marks
				Sessional	: 50 marks
				Duration of Exams.	: 03 hours

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

UNIT I

Introduction:

Definition, application of measurement instrumentation, functional elements' of a generalized measuring system, measuring standards, types of measurement, types of input to measuring instruments and instrument system, classification of measuring instruments, merits and demerits of mechanical measuring systems, comparison of mechanical measuring system with electrical measuring systems, calibration.

Introduction, types of error, types of uncertainties, propagation of uncertainties in compound quantity, Static performance parameters: accuracy, precision, resolution, static sensitivity, linearity, hysteresis, dead band, backlash, and drift., sources of error, selection of a measuring instruments, mechanical and electrical loading,

UNIT II

Fundamentals of dynamic characteristics, generalized mathematical model of measuring systems, types of input, dynamic performance parameters: dynamic error, speed of response etc, dynamic response of a first order mechanical systems with different inputs e.g. step, ramp, sinusoidal and impulse input

Introduction, types of measuring data, statistical attributes, various method of presentation, estimation of presentation and uncertainties, confidence level, precision and statistical treatments of single and multi sample type experimental data, Chauvenet's criteria of rejecting a dubious data, curve fitting, best linear calibration and its precision, significant figures and rounding off. Overall uncertainty estimation of measuring systems, common sense approach, and engineering applications.

UNIT III

Introduction, primary function, classification, electrostatic transducers: principle theory, types, advantages, and limitations, Fixed contact mechano-resistive transducers: classification, and uses, Metallic resistance strain gauge: types, construction theory of operation, Adhesive: property, selection criteria, mounting of strain gauges, Mathematical analysis of ballast and DC Wheatstone bridge circuits

Characteristic and comparison of ballast and DC Wheatstone bridge circuits, temperature effects and their compensation

Measurement of load, force, and thrust using resistant strain gauges, Elastic load cells, proving rings, fluid pressure measurement in pipe and containers, using strain gauges, Measuring of torque in transmission shaft under axial and bending loads in varying ambient conditions.

UNIT IV

Introduction, classification of control systems, control system terminology, servomechanism, process control and regulators, Manual and automatic control systems, physical systems and mathematical models, linear control systems, Laplace transform, transfer function, block diagram, signal flow graphs, system stability, Time and frequency domain.

Introduction, functional operation, desirable characteristics of hydraulic fluids, hydraulic control systems: hydraulic pump, hydraulic control valve, Pneumatic control systems: pneumatic nozzle, relay, advantages and limitation of such control systems.

Reference and Text Books:

1. Mechanical measurements & control - By D.S. Kumar, Metropolitan book
2. Instrumentation and Mechanical measurements-By A.K. Tayal, Galgotia Publ.
3. Measurements systems application and design-By Ernest Doebelin, McGraw-Hill

B. Tech. (Seventh Semester) Mechanical Engineering
Statistical Quality Control and Reliability
ME 405 E

L	T	P/D	Total	
4	1		5	

Theory : 100 marks
Sessional : 50 marks
Duration of Exams. : 03 hours

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

UNIT I

Quality-Basic Concepts: Issues in Quality, factors affecting quality, creating quality by design, product development cycle, economics of quality, Various definitions, ISO definition of quality and its meanings, and various phases till TQM and its meaning to industries, customers and employees, contribution of quality gurus etc. towards quality concepts. Total Quality Management: its scope, application and implementation. Quality Circle: its objectives, structure and techniques. Variability concept in manufacturing-cycle, fishbone diagrams, charts in time philosophy

UNIT II

Basic statistical concepts, various types of distributions, General theory X and R chart. Decision preparatory to the control charts. Trial control limits. Selection of subgroups. Charts with variable subgroups, Reject and Revoke, limits for average on X charts, modified control limits, specification limits, practical limitations. Control charts for fraction defectives, calculation and plotting of control limits, sensitivity of p chart, applications. Control charts for Defects, difference between defect and defective, calculation and plotting of control limits, applications, pi charts and u charts, plotting of charts. Tests of various control charts. Process capability- inherent and potential capability.

UNIT III

Purpose of Acceptance by Attributes, Single sampling plans. O.C. curve, selection of sampling plans, Acceptance number, Type A and Type B, O.C. curves, Double sampling plan and its analysis, Multiple and sequential sampling, A.O.Q.L, Acceptance sampling plans under risk. Design of various sampling plans, Dodge-Roming type system for acceptance sampling by attributes (use of various tables). Determination of process average, Acceptance sampling by variables.

UNIT IV

Control of reliability, factors affecting reliability, pattern of failure, mean time to failure, Fundamental of statistical concepts, consideration of reliability in series and parallel system, effect of redundancy and reliability, method of reliability evaluation, reliability optimization, Availability and Maintainability, means to improve reliability, reliability control during manufacture.

Reference and Text Books:

1. Statistical Quality ControlBy Grant and Leaven, McGraw-Hill
2. Quality Control and ReliabilityBy Mahajan, Dhanpat Rai.
3. Quality Control By Hansen, Prentice- Hall

B. Tech. (Seventh Semester) Mechanical Engineering
Measurement and Control (Practical)
ME 407 E

P/D	Total	
2	2	Practical : 25 marks Sessional : 50 marks Duration of Exams. : 03 hours

List of Experiments

1. Study of a strain gage based cantilever beam and measurement of strain on the beam
2. Study of a LVDT and measurement of linear displacement
3. Study of an inductive pick up and measurement of linear displacement
4. Study of a LDR and measurement of linear displacement
5. Study of capacitive pick up and measurement of angular displacement
6. Study of temperature transducers and measurement of temperature of fluid
7. Study of a LVDT (strain gage based) and measurement of linear displacement.
8. Study of a torque pick up and measurement of torque .
9. Study of a pressure pick up and measurement of pressure of fluid.
10. Study of load cell and measurement of load with load cell
11. Study of non-contact type speed pick up and measurement of rotational speed
12. Comparison of sensitivity of thermocouple, thermister and RTD

Note: Total Ten experiments must be performed. At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or outside the list.

B. Tech. (Seventh Semester) Mechanical Engineering
Project I
ME 409 E

P/D	Total
7	7

Viva voce : 75 marks
Sessional : 100 marks
Duration of Exams. : 03 hours

The students expected to take up a project under the guidance of teacher from the college. The project must be based on mechanical engineering problems, which can be extended up to the full academic session. The students may be asked to work individually or in a group not more than four students in a group. Viva- voce must be based on the preliminary report submitted by students related to the project.

B. Tech. (Seventh Semester) Mechanical Engineering
Seminar
ME 411 E

P/D	Total	
2	**2**	**Sessional: 50 marks**

Student will give a talk on some technical topics.

Note: The seminar will continue in eighth semester and will be evaluated in eighth semester.

B. Tech. (Seventh Semester) Mechanical Engineering
Practical training report
ME 413 E

P/D	Total	
-	-	**Sessional : 75 marks**
		Duration of Exams. : 03 hours

Student will submit summer training (about 8 weeks' industrial training) report for his/her assessment.

Electives I and II Seventh Semesters
(Mechanical Engineering)

ELECTIVE – I
(For Mechanical Engineering Students)

1. ME 419 E Advanced Manufacturing Technology
2. ME 420 E Finite Element Method
3. ME 423 E Applied Numerical Techniques and Computer Programming
4. ME 425 E Gas Dynamics
5. ME 427 E Machine Tool Design

ELECTIVE - II

1. ME 435 E Renewable Energy Resources
2. ME 437 E Maintenance Engineering
3. ME 439 E Cryogenic Engineering
4. ME 441 E Computational Fluid Dynamics
5. ME 443 E Mechatronics Engineering

Elective - I & II will be offered as departmental elective for Mechanical Engineering Students.

B.Tech. (Seventh Semester) Mechanical Engineering
ADVANCED MANUFACTURING TECHNOLOGY
ME 419 E

L	T	P/D	Total
4	I	_	5

Theory : 100 marks
Sessional : 5O marks
Duration of Exams. : 03 hours

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

UNIT I

Hot machining, Machining of Plastics, Unit heads, Plastics cooling, electro forming, Surface Cleaning and Surface Treatments, Surface Coatings, Paint Coating and Slushing, Adhesive Bonds, Adhesive Bond Joints, Adhesives, Surface Coating for Tooling, Graphite Mould Coating, Vacuum Mould Process.

Introduction, Types of Composites materials, Agglomerated Materials, Reinforced materials, Laminates, Surface Coated Materials, Production of Composite Structures, Fabrication of particulate composite Structures, Fabrication of reinforced Composite, Fabrication of Laminates, Machining, Cutting and Joining of Composites.

UNIT II

Introduction, Polymers, Polymerization, Addition of Polymers, Plastics, Types of plastics, Properties of Plastics, Processing of Thermoplastic Plastics, Injection Moulding, Extrusion Process, Sheet forming processes, Processing of Thermosetting Plastics, Compression Moulding, Transfer Moulding, Casting of Plastics, Machining of plastics, other processing methods of plastics

Introduction, casting, thread chasing, Thread Rolling, Die Threading and Tapping, Thread Milling, Thread Measurement and Inspection

UNIT III

Theoretical basis of metal forming, classification of metal forming processes, cold forming, hot working, Warm working, Effect of variables on metal forming processes, Methods of analysis of manufacturing processes, Open Die forging, Rolling Power Rolling, Drawing, Extrusion.

UNIT IV

Introduction, Product Application, Limitation of Die Casting, Die Casting Machines, Molten metal Injection systems, I lot chamber machines, Cold chamber machines, Die casting Design, Design of Die casting Dies, Types of Die casting Dies, Die design, Die material, Die Manufacture, Die Lubrication and Coating, Preheating of Dies, Vacuum Die Casting, Recent trends In Die Casting Process.

Definition, Cost accounting or costing, Elements of costing, cost structures, Estimation of cost elements, Methods of estimating, Data requirements of cost estimating, Steps in making cost estimate, Chief factors in cost estimating, Numerical examples, calculation of machining times, Estimation of total unit time.

Reference and Text Books:

1. Principles of Manufacturing
   - By J.S.Campbell, Tata McGraw-Hill
2. Production Engineering Sciences
   - By Pandey and Sinh Standard Pub.
3. A text book of Production Technology
   - By P.C. Sharma S.Chand & Company.
4. Manufacturing Materials and Processes
   - By Lindberg Prentice Hall
5. A text book of Production Engineering
   - By P.C. Sharma S.Chand & Company.

B. Tech. (Seventh Semester) Mechanical Engineering
FINITE ELEMENT METHOD
ME 421 E

L	T	P/D	Total	
4	1		5	

Theory :100 marks
Sessional : 50 marks
Duration of Exams. : 3 hrs

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

UNIT I

Basic Concept, Historical background, Engineering applications, general description, Comparison with other methods.
Need for weighted-integral forms, relevant" mathematical concepts and formulae, weak formulation of boundary value problems, variational methods, Rayleigh-Ritz method, and weighted residual approach.

UNIT II

Model boundary value problem, finite element discretization, element shapes, sizes and node locations, interpolation functions, derivation of element equations, connectivity, boundary conditions, FEM solution, post-processing, compatibility and completeness requirements, convergence criteria, higher order and isoparametric elements, natural coordinates, Langrange and Hermite polynomials.

UNIT III

External and internal equilibrium equations, one-dimensional stress-strain relations, plane stress and strain problems, axis-symmetric and three dimensional stress-strain problems, strain displacement relations, boundary conditions, compatibility equations, computer programs.

UNIT IV

Variational approach, Galerkin approach, one-dimensional and two-dimensional steady-state problems for conduction, convection and radiation, transient problems.
In viscid incompressible flow, potential function and stream function formulation, incompressible viscous flow, stream function, velocity-pressure and stream function-vorticity formulation, Solution of incompressible and compressible fluid film lubrication problems

Reference and Text Books:

1. The Finite Element Method
   - By Zienkiewicz, Tata McGraw
2. The Finite Element Method for Engineers
   -By Huebner, John Wiley
3. An Introduction to the Finite Element Method
   -By J.N.Reddy, McGraw Hill

B. Tech. (Seventh Semester) Mechanical Engineering
APPLIED NUMERICAL TECHNIQUES AND COMPUTER PROGRAMMING
ME- 423 E

L	T	P/D	Total			
4	1	-	5	Theory	:	100 marks
				Sessional	:	50 marks
				Duration of Exams. : 03 hours		

NOTE:

1. **The Instructor of the course may cover the use of software MATHEMATICA, in the tutorial class.**
2. **In the semester examination, the paper setter will set 8 questions in all, at least two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.**

Unit I

Interpolation and Curve Fitting : Lagrangian Polynomials, Divided differences, Interpolating with a cubic spline, Bezier Curves and B-Spline Curves, Polynomial approximation of surfaces, Least Square approximations, Flow Chart for Computer Programmes.

Unit II

Solving Non-Linear Equations: Bisection Method, Linear Interpolation Methods, Newton's Methods, Muller's Methods, Fixed-point Iteration Method, Flow Chart for Computer Programmes.

Solving Sets of Equations: The Elimination Method, Gauss and Gauss Jordan Methods, Other Direct Methods, Iterative Methods, The Relaxation Methods, Flow Chart for Computer Programmes.

Unit III

Numerical Differentiation and Integration: Derivatives from difference tables. High Order Derivative, Extra-polation Techniques. The Trapezoidal Rule, Simpson's Rules. Flow Chart for Computer Programmes.

Numerical Solution of Ordinary Differential Equations: The Taylor-Series Method, Euler and modified Euler-Methods, Range-Kutta Methods, Miline's Method. The adams-Moulton Method, Convergence Criteria, Errors and error Propagation. Flow Chart for Computer Programmes.

Unit IV

Boundary-Value and Characteristic- Value Problems: The Shooting Method, Rayleigh-Ritz Method, Collocation Method, Galerkin Method, The Power Method for Eigenvalues by Iteration. Flow Chart for Computer Programmes.

Numerical Solution of Partial Differential Equations: (A) P.D.equation representation as a difference equation, Iterative Methods for Laplace's Equation. The Possion Equation, Derivative Boundary Conditions. (B) The Crank- Nicolson Method for Parabolic Partial Differential Equations. Flow Chart for Computer Programmes.

Text Books :

1. Applied Numerical Analysis by Curtis f. Gerald and Patrick O. Wheatley – Published by Addison Wesley.
2. Introductory Methods of Numerical Methods – S.S. Sastry, PHI, New Delhi.

Reference Books :

1. MATHEMATICA – A system for doing mathematics by Computer by Wolfram, Stephen – Published by Addition – Wesley.
2. Applied Numerical Methods by Camahan, Brice,Et.al, Published by Wiley, New York.

3. Numerical Solution of partial differential equations by Smith, G.D. Published by Oxford University Press London.
4. Iterative Methods for the solution of Equations by J.F. Traub – Published by Prentice Hall.
5. Numerical Methods in Engineering and Science by B.S. Grewal- Published by Khanna Publishers.
6. Numerical Methods in Engineering by M.G. Salvadori and M.L. Baron- Published by Prentice Hall India.

B. Tech. (Seventh Semester) Mechanical Engineering
GAS DYANAMICS
ME-425E

L	T	P	total		
4	1		5	Sessional Marks	: 50
				Theory	: 100
				Duration of Exam:	3 Hrs.

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

Unit - I

Introduction, units, thermodynamics concepts for control mass analysis flow dimensionality and average velocity comment on entropy-pressure energy equation. The stagnation concept, stagnation pressure, energy equation, momentum equation problems.

Introduction, Objectives, speed of propagation of pressure front, Mach Number, sonic velocity, field due to a moving source of disturbance, mach cone mach, angle equation for a perfect gas in terms of mach. number. h. s.& t. s. diagram problems.

UNIT II

Introduction, adiabatic flow with and without losses, the reference concept, isentropic tables, conversant & divergent nozzles, diffuser performance, frictional effects on nozzle flow problems.

Introduction, shock analysis-general fluid, working equations for perfect gas, normal-shocks tables, shocks in nozzles, supersonic wind tunnel operation, thermodynamic directions of a normal shock, Rankins-Hugoniat relation, strength of shock, operation of nozzles, problems.

UNIT III

Introduction, normal shocks tangential velocity superposition -oblique shocks, oblique-shocks, analysis, oblique-shock tables and charge, boundary conditions of flow direction, boundary condition of pressure equilibrium, introduction to Prandtl Mayer expansion, problems.

Introduction, analysis for general fluid, working equations for a perfect gas, reference state and fanno tables, application, correlation with shocks, friction chocking, Rayleigh flow. Analysis for a general fluid, working equations for a perfect gas reference state and Rayleigh tables, applications, correlation with shocks, thermal shocking, and summary problems

UNIT IV

Introduction, Brayton cycle, propulsion engines. thrust power and efficiency, thrust consideration power consideration, power conskloiftlion and efficiency consideration, open Brayton cycle for propulsion systems, turbojet, turbo propulsion, ram jet, pulse jet, numerical.

Text Books:

1. Fundamentals of Gas Dynamics- YAHA, S.M. TMI-I, India.
2. Fluid Mechanics-A.K. Mohanty, Prentice Hall of India.

Reference Books:

1. Fundamentals of Fluid Mechanics- YUAN, S.W. Prentice Hall of India.
2. Fundamentals of Gas Dynamics - Robert D. Zucker, Met tire Publication.
3. Gas Dynamics -E-., Radha Krishnan, prentice Hall of India.
4. Gas Dynamics Vol. -I Zucrotuf, Wiley.
5. Gas Dynamics - Shapiro Wiley.

B. Tech. (Seventh Semester) Mechanical Engineering
MACHINE TOOL DESIGN
ME 427 E

L	T	P/D	TOTAL	
4	1	-	5	Sessional marks: 50 Marks Theory : 100 Marks Duration of Exam. : 3 hrs.

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

UNIT I

Definition and classification, Corking and auxiliary motion in m/c tools, parameters of working motion, machine tool drive, selection of electric motor, hydraulic and mechanical transmission and their elements, general requirement of m/c tool design. Engineering design process for m/c tool, and techno-economical consideration for design of new m/c tool.

Aims, stepped and stepless speed regulation, design of speed and feed gear box, m/c tool drives using multiple speed motors, gear box kinematics design, gearing diagram, no. of teeth, no. of teeth on gears in the gear train, classification speed and feed boxes, numerical problems.

UNIT II

Function and requirements, design criteria, criteria of selection of materials, static arid dynamic stiffness, profiles for m/c tool structure, stiffness, design procedure for m/c tool structure, numerical problems.

Function and types, profiles, material and clearance in slide ways, analysis of design of slide ways for wear and stiffness design of hydrostatic guide ways, aerostatic slide ways and antifriction guide or sliding friction power screws for wear, strength, friction bucking stability design of rolling friction, power screw for stiffness, numerical problems.

UNIT III

Function and requirements, material for spindle, effect of m/c tool compliance on machining accuracy, design of spindles for bending, permissible deflection strength, optimum spacing for spindle support, antifriction and different types of sliding bearings and their general characteristic, air lubricated bearing, numerical problems.

UNIT IV

Equivalent Elastic System (EES), general procedure for accessing dynamic stability of EES cutting process closed loop system dynamic characteristics of elements, systems, EES and culling process, stability analysis, forced vibration of machine tools.

Function requirements and classification, control system for forming and auxiliary motion, manual control systems, ergonomic considerations, automatic control systems and adaptive control system.

Text Books:

- Machine Tool Design & Numerical Control by N.K. Mehta, Published by TMH.
- Production Technology by R.K. Jain, Published by Khanna Publishers.

References Books:

1. Design of M/c Tool by S.K. Basu, Allied Publisher, New Delhi.
2. Principles of M/c Tool by Ballacharya A. and Sen. G.C., Published by New Central Book Agency, Calcutta.
3. Machine Tool Design -Vol-IV- by Acherkean N., Published by Mir Publication.
4. Design principles of Metal Cutting Machine Tools by Koenigsberyer F., Published by Pergrnan Press, Oxford.

B. Tech. (Seventh Semester) Mechanical Engineering
RENEWABLE ENERGY RESOURCES
ME 435 E

L	T	P	Total	
4	1		5	

Sessional : 50 marks
Theory: 100 marks
Duration of Exam : 3 hrs.

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

UNIT-I

Introduction and Essential of Fluid Mechanics and Meat Transfer Fundamentals and scientific principles of renewable energy resources, technical and social implications, Bernoulli's, equation, conservation of momentum, viscosity, turbulence, friction and pipe flow, heat circuit analysis and terminology, conductive, convective and radiative heat transfers, properties of transparent materials, heat transfer by mass transport, multimode heat transfer and circuit analysis, problems.

UNIT-II

Extraterrestrial solar radiation, components of radiation, geometry of earth and sun, geometry of collector arid the solar beam, effects of earth's atmosphere, measurements of solar radiation, calculation of heat balance for a solar collector, type of water heaters, selective surfaces, crop heaters, space heating, space cooling, water desalination, solar ponds, solar concentrators, electric power system, problems.

Introduction, the silicon p-n junction, photon absorption solar radiation input, photovoltaic circuit properties and loads, limits to cell efficiency, solar cell construction type and adaptations of photovoltaic, other types of photoelectric and thermo electric generation, problems.

UNIT III

Principles of hydro power, assessing the resource for small installations, an impulse turbine, reaction turbines, hydro electric systems, the hydraulic rain pump, wind turbine types and terms, linear momentum and basic theory, dynamic matching, steam tube theory, characteristics of the wind, power extraction by a turbine, electricity generation, mechanical power, problems.

Introduction, tropic level photosynthesis, photosynthesis at the plant level, thermodynamic considerations, photosynthesis, molecularlevel photosynthesis, synthetic photosynthesis, bio fuel classification, bio-mass production for energy farming, direct combustion for heat, pyrolysis (destructive distillation), alcoholic fermentation, anaerobic digestion for bio-gas, agrochemical fuel extractions, problems.

UNIT IV

Introduction, wave motion, wave energy and power, ;wave patterns, devices, the causes of tides, enhancement of tides flow power, tidal range power, world range power sites, problems.

Principles of Ocean Thermal Energy Conversion (OTEC), heal exchangers, pumping requirements, other practical considerations, introduction to geothermal energy, geophysics, dry rock and hot aquifer analysis, harnessing geothermal resources, problems.

Text Books:

1. Renewable Energy Rsources by John W. Twidell and Anthony D. Weir, published by E.& F. N. Spon Ltd. London.

B. Tech. (Seventh Semester) Mechanical Engineering
MAINTENANCE ENGINEERING
ME 437 E

L	T	P	Total	
4	1	-	5	Sessional : 50 marks Theory : 100 marks Duration of Exam : 3 hrs.

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

UNIT I

Evolution of maintenance, objective of maintenance, maintenance policies and philosophies, maintenance concept, maintenance management & terotechnology, relationship with other functional areas, importance of maintenance, elements of good maintenance, economics of maintenance, training and safety aspects in maintenance.

Classification of maintenance programs, corrective preventive and predictive maintenance, comparison of maintenance programs, preventive maintenance-concept, functions, benefits, limitations.

UNIT II

Objectives, what to monitor, when to monitor, principles of CBM, condition based maintenance techniques, manual inspections, performance monitoring, vibration monitoring, current monitoring, coil debris/spectroscopy, thermography and corrosion monitoring, steps in implementation of CBM, benefits of CBM.

RCM logic, maintenance and RCM, benefits of RCM, total productive maintenance (TPM), introduction, key supporting elements of TPM, methodology, evaluation and benefits.

UNIT III

Purpose and challenges: Techniques, visual aids-boroscopes, endoscopes, fiber optics scanners, magnetic particles inspection, liquid penetrants, eddy current, ultrasonic radiography, selection of NDT technique, metrits/demerits and applications of various techniques.

Basic ingredients, basic steps in maintenance management, maintenance planning and control system, documentation, maintenance-productivity areas for improvement

UNIT IV

Techniques for improvement of operational reliability, safety and availability of machines and production systems, maintainability criteria, checklist to assess the maintainability of a system, maintainability programs, objectives, key issues in availability improvements program, fault diagnosis, Pareto principle Ishikawa diagram.

Data processing systems for integrated maintenance, maintenance information and reporting systems.

Text Books:

1. Maintenance Planning and Control by Higgin L.R., McGiaw Hill Book Co1,1900
2. Maintenance Planning and Control by Kelly Anthony, East West Press Private Ltd, New Delhi, 1991.
3. Maintainability principle and practices by Blanchard B.S. and Lowey E.E. McGrawHill Book co.
4. Practical NOT by Raj B. Jaya Kumar T and Thavasimulyi K., Narora Publishing House, New Delhi, 1996.
5. Engineering Maintenance Management by Niebel Benjamin W. Marcel Dekher, 1994.

B. Tech. (Seventh Semester) Mechanical Engineering

CRYOGENIC ENGINEERING

ME 439 E

L	T	P/D	Total
4	1	-	5

Theory : 100 marks
Sessional : 50 marks
Duration of Exams. : 03 hours

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

UNIT I

Definition of cryogenics, physical properties of various cryogenic fluids and industrial application

UNIT II

Types of insulations, vacuum insulation: gas filled powders and fibrous materials, solid forms, comparison of various insulating materials.

UNIT III

Mechanical properties; Specific heat; Thermal expansion; Electrical resistance; Thermal conductivity; Emissivity; Reflectivity and Absorptive; Thermo-electric e. m. f.

UNIT IV

Types of insulated storage containers, transport techniques, various design considerations, safety aspects of cryogenic systems, flammability hazards, high-pressure gas hazards etc., design and fabrication of transfer line, transfer through non-insulated lines, liquid line indicators, valves for cryogenic "liquids, pumping of cryogenic liquids, other allied equipment.

Reference and Text Books:

1. Cryogenic Systems - by IJaiion
2. Refrigeration and Air Conditioning- By Spark and Dilio

B. Tech. (Seventh Semester) Mechanical Engineering
COMPUTATIONAL FLUID DYNAMICS
ME 441 E

L	T	P/D	Total	
4	1	-	5	Theory: 100 marks Sessional: 50 marks Duration of Exams. : 3 hrs

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

UNIT I

Methods of prediction: comparison of experimental investigation Vs theoretical calculation; Mathematical description of physical phenomena; significance of governing differential equations; the general form of governing differential equation.

Classification of problems: Physical classification: Equilibrium problems and Marching problems; Mathematical classification: Elliptic, parabolic and hyperbolic partial differential equations; Nature of co-ordinates; one way and two-way co-ordinates; Proper choice of co-ordinates.

UNIT II

The concept of discretisation; Finite differences; Taylor series formulation; Finite difference discretisation of ordinary and partial derivatives; Truncation error, round-off error, discretisation error; Consistency and stability of numerical schemes; Variation formulation; Method of weighted Residuals, control volume formulation.

UNIT III

Steady one- dimensional Conduction, The inter-face conductivity, Non linearity, Source-Term Linearization, Types of Boundary Conditions. Unsteady one-dimensional Conduction: Explicit, Crank-Nicolson and Fully Implicit scheme's Discretisation of two and three-dimensional problems, Stability analysis.

UNIT IV

Steady one dimensional convection and diffusion, The up wind scheme, Generalized Formulation, Discretisation equation for two and three dimensional problems, The outflow Boundary condition, false Diffusion.

Basic difficulty, Vorticity Based methods, Representation of the continuity equation, the staggered grid: the momentum equations, the pressure velocity corrections, and SIMPLE algorithm.

Reference and Text Books:

1. Computational Fluid Dynamics
   - By Anderson, McGraw-Hill
2. Numerical Heat Transfer and fluid flow
   - By Patankar, McGraw-Hill

B. Tech. (Seventh Semester) Mechanical Engineering
MECHATRONICS ENGINEERING
ME 443E

L	T	P	Total		
4	1	-	5	Sessional:	50 marks
				Theory	100 marks
				Duration of Exam: 3 hrs.	

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

UNIT I

What is Mechatronics? A measurement system with its constituent elements, open and closed loop systems, sequential controllers, micro processor based controllers, the Mechatronics approach.

A review of displacement, position velocity, motion, force fluid pressure, liquid flow, liquid level, temperature, light sensors/along with performance terminology, selection of sensors, input data by switches, signal conditioning, brief review of operational amplifier, projection, filtering, wheat stone bridge, digital signals, multiplexers, data acquisition, digital signal processing, pulse modulation, data presentation systems, displays, data presentation elements, magnetic recording, data acquisition systems, testing £ calibration, problems.

UNIT II

Pneumatic and hydraulic systems, directional control valves, valve symbols, pressure control valves, cylinder sequencing, process control valves, rotary actuators, mechanical systems -types of motion, kinematic chains, cams, gear trains, Ratchet & Pawl, belt and chain drives, bearings, mechanical aspects of motor selection, electrical systems, mechanical and solid state switches, solenoids, D.C. & A.C moto4rs, stepper motors, problems.

UNITIII

Continuous and discrete process- lag, steady state error, control modes, two step mode, proportional mode-electronic proportional controllers, derivative control- proportional plus derivative control, integral control-proportional plus integral control, PID controller-operational amplifier PID circuits, digital controllers -implementing control modes, control system performance, controller tuning, process, reaction method and ultimate cycle method, velocity control, adaptive control, problems.

Scale, a pick and place robot, automatic camera, engine management system and bar code recorder.

UNIT IV

A review of number systems and logic gates, Boolean algebra, Karnaugh maps, sequential logic basic structure of programmable logic controllers, input/output processing, programming mnemonics; timest, internal relays and counters, master and jump controls, data handling, analog input/output, selection of a PLC, PROBLEMS.

Control, microcomputer structure, micro-controllers, applications, programming languages, instruction sets, assembly language programs, subroutines, Why C Language? A review of program structure, branches, loops, arrays, pointers, examples of programs, interfacing, input/output, interface requirements. Peripheral interface adapters, serial communication interface, examples of interfacing, problems.

Text Book:

1. Mechatronics by W. Bolton, published by Addition Wesley.

B. Tech. (Eighth Semester) Mechanical Engineering
ENTERPRENURSHIP
ME 402 E

L	T	P/D	Total		
3	1		4	Theory	: 100 Marks
				Sessional	: 50 Marks
				Duration of Exams.	: 03 hrs

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

UNIT I

Definition and concept, Importance of economics for engineers, present value and future value, Wealth, Goods, Wants, Value and price, capital, money, utility of consumer and producer goods.

Introduction, Elements of cost, Prime cost, Overhead, Factory cost, Total cost, Selling price, Nature of cost, Types of cost.

Definition and concept, Causes of depreciation, Methods of calculating depreciation.

UNIT II

Introduction, Nature of selection problem, Nature of replacement problem, Replacement of items which deteriorate, Replacement of machines whose operating cost in crease with time and the value of money also changes with time, methods used in selection of investment and replacement alternatives.

Entrepreneurship, Role of Entrepreneur in Indian economy, Characteristics of an entrepreneur, Types of entrepreneurs, some myths and realities about entrepreneurship

UNIT III

Introduction, Role and scope of small scale industries, concept of small scale and ancillary industrial undertakings, How to start a small scale industry, Steps in launching own venture, procedure for registration of small scale industries, various developmental agencies-their functions and role in industrial and entrepreneurship development, Infrastructure facilities available for entrepreneurship development in India.

Introduction, Requirement of a good product design, product development approaches, Product development process, Elements of concurrent engineering, quality function development, Rapid prototyping, Various controlling agencies involved -their role and formalities for getting clearance before starting individual venture

UNIT IV

Financial concept for small-scale industries, financial requirements Financial support programmer of banks, government financial agencies, Hire-purchase facilities alternate sources of finance. The modern concept of marketing, Definitions, functions and principle of marketing, marketing research, Advertising, Market survey, Pre-feasibility and feasibility of project. Identification and evaluation of business opportunity, risk involved =and preparation of business plan. Tools for evaluation of techno economic feasibility project report, SWOT analysis

Reference and Text Books:

1. The practice of Entrepreneurship - By G. G. Meredikh, R.E. Nelson and P.A. Neck
2. Handbook of Entrepreneurship - By Rao and Pareek
3. Automobile Engineering -By K.M. Gupta, Umesh Publications
3. Engineering Economics -By Tarachand
4. Industrial Engineering and Management -By Ravi Shankar
5. Industrial Engineering and Organization Management -By S.K.Sharma and Sawita Sharma
6. Industrial Engineering and Management -By O.P. Khanna

B.Tech. (Eighth Semester) Mechanical Engineering
Power Plant Engineering
ME 404 E

L	T	P/D	Total		
4	1		5	Theory	: 100 Marks
				Sessional	: 50 Marks
				Duration of Exams.	: 03 hrs

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

UNIT I

Conventional and non-conventional sources of energy; Importance of electrical energy; Geothermal power plants; Tidal power plants; Windmills; Solar power plants; Direct energy conversion systems; Energy sources in India; Recent developments in power plants.

Hydrology: rainfall, runoff, hydrographs, flow duration curves; Site selection for hydro power plants; Classification of hydro power plants; Storage type hydro power plant and its operation; Estimation of power availability; Selection of water turbines; Combination of hydro power plants with steam plants; advantages and disadvantages of hydro power plants.

UNIT II

Analysis of steam power cycles for power plant application; High pressure boilers- La-Mont boiler, Benson boiler, Loeffler boiler; Velox boiler; Super pressure steam power plants; Economizers; Air-preheaters; Super heaters and reheaters; Feed water heaters. General layout of thermal power plant; Site selection for thermal power plant; Coal as fuel, classification of coals, analysis of coal; Coal handling; Dead and live storage; Combustion of coal: coal burning methods, overfeed stokers, underfeed stokers, pulverized fuels and burners. Ash handling and disposal; Dust collectors. Heat balance sheet for thermal power plants.

Introduction; Field of use; Outline of diesel electric power plant; Different systems of diesel power plant; Supercharging of diesel engines; Performance of diesel power plant; Advantages and disadvantages of diesel plants over thermal power plants.

UNIT III

Elements of plant; Thermal refinements; Performance of plants; Gas turbine characteristics; Comparison with other plants; Combined steam and gas turbine power plants.

Basic theory and terminology; Nuclear fission and fusion processes; Fission chain reaction; Moderation; Fertile materials; Nuclear fuels; General components of nuclear reactor; Different types of reactors; Breeder reactors; Nuclear power plants in India; Disposal of nuclear waste.

UNIT IV

Introduction; Load curves; Different terms and definitions; Effects of variable loads on power plant design and operation

Cost of electrical energy; Selection of type of generation; selection of generating equipment; performance and operating characteristics of power plants; Load division among generators; Tariffs methods for electrical energy.

Reference and Text Books:

1. Power Plant Engineering -By Morse
2. Power Plant Engineering -By Domkundwar
3. Power Plant Engineering -By P.C. Sharma
4. Power Plant Technology -By El-Wakil

B-Tech. (Eighth Semester) Mechanical Engineering
Operation Research
ME 406 E

L	T	P/D	Total		
3	1		4	Theory	: 100 Marks
				Sessional	: 50 Marks
				Duration of Exams:	03 hours

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

UNIT I

Development of operations Research, characteristics and scope of operations Research, operations Research in Management, Models in operations Research, Model Formulation, Types of mathematical models, Limitations of operations Research.

L.P. models, simplex method, the algebra of simplex method. (Minimization and Minimization problems), The big M method, post optimality analysis, essence of duality theory, Application of sensitivity analysis.

UNIT II

Introduction to model, matrix terminology, Formulation and solution of Transportation model (least cost method, Voyel's Approximation method), Least time transportation problem, Assignment problems.

Introduction to net work logic, Numbering of events (Fulkersen Rule), PERT calculations - Forward path, back-ward path. Slack, probability, comparison with PERT, Critical path, Floats. Project cost, crashing the net work, updating (PERT and CPM).

UNIT III

Introduction, applications of simulation, advantages and limitations of simulation technique, generation of random numbers, Time-flow mechanism, simulation languages.

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

Definition of arguments models, comparison with transport model, Mathematical representation of assignment model, Formulation and solution of argument models, variation of the argument model, Alternate optimal solutions

UNIT IV

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.

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.

Reference and Text Books:

1. Introduction to operation research- By Hillier and Lieberman, McGraw-Hill
2. Operations Research - By P.K. Gupta and D.S. Hira
3. Linear Programming -By N.P. Loomba

B. Tech. (Eighth Semester) Mechanical Engineering
Entrepreneurship (Practical)
ME 408 E

P/D	Total		
2	**2**	**Viva-voce :**	**25 Marks**
		Sessional :	**50 Marks**
		Duration of Exams: 3 Hrs	

1. Exercise on assessing the industrial potentiality of any particular area.
2. Exercise on market survey for product identification and demand estimation of the product.
3. Exercise on preparation of techno economic feasibility project report.
4. Presentation and group discussion on techno economic feasibility project report.

B. Tech. (Eighth Semester) Mechanical Engineering

Project-II
ME 410 E

L	T	P/D	Total	
-	-	9	9	

Theory : 75 marks
Sessional : 100 marks
Duration of Exams. : 3 hrs

The student is expected to finish the remaining portion of the project.

Electives (I) and Electives (II) Eight Semesters
(Mechanical Engineering)
ELECTIVE – III

ME 420 E Non Conventional Manufacturing
ME 422 E Industrial Robotics
ME 424 E Manufacturing Management
ME 426 E Total Quality Management
ME 428 E Piping Engineering

ELECTIVE - IV

ME 430 E Energy Management
ME 432 E Management Information System
ME 434 E Pneumatics & Hydraulics Control
ME 436 E Design of Air conditioning Systems
ME 438 E Automatic controls

Elective –III & IV will be offered as departmental elective for Mechanical Engineering Students.

B. Tech. (Eighth Semester) Mechanical Engineering
Non-Conventional Manufacturing
ME 420 E

L	T	P/D	Total		
4	1	-	5	Theory	: 100 marks
				Sessional	: 50 marks
				Duration of Exams.	: 3 hrs

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

UNIT I

Unconventional machining processes, Rapid prototyping processes, their classification, considerations in process selection.

Ultrasonic Machining

Elements of process, design of cutting tool, metal removal mechanism, effect of parameters, economic considerations, limitations and applications, surface finish.

UNIT II

Electrochemical Machining

Elements of process, process chemistry, metal removal mechanism, tool design, accuracy, surface finish and work material characteristics, economics advantages, limitations and applications, Electrochemical grinding, debarring and honing, Chemical machining.

Electric Discharge Machining

Principle and mechanism of metal removal, generators, electrode feed control, electrode material, tool electrode design, EDM wire cutting, surface finish, accuracy and applications.

UNIT III

Jet Machining

Principal and metal removal mechanism of abrasive and water jet machining, process variables, design of nozzle, advantages, limitations and applications.

Plasma arc machining, Electron beam machining, laser beam machining, their principles and metal removal mechanism, process parameters, advantages and limitations, applications.

UNIT IV

Rapid Prototyping

Fundamentals, process chain, physics of processes, principles and process mechanism of SLA, SGC, LOM, FDM and SLS processes, their advantages and limitations, applications of RP processes, RP data formats, STL file format, STL file problems, STL file repair, other translators and formats.

Rapid Tooling Process

Introduction, fundamentals, classification, indirect RT processes, Principles of Silicone Rubber Molding, Epoxy Tooling, Spray Metal Tooling, Pattern for Investment Casting, Vacuum Casting, and Vacuum forming processes, direct RT processes, Shape Deposition manufacturing, their advantages, limitations and applications.

Reference and Text Books:

1. Modern machining processes -By P.C. Pandey and M.S. Shan, 1 Ml I.
2. Machining Science -By Ghosh and Mallik, Affiliated East West
3. Nontraditional Manufacturing processes -By G.F. Benedict, Maicel Dekker.
4. Advanced Methods of Machining -By J.A. McGeongh, Chapman and Hall.
5. Electrochemical Machining of Metals -By Rurnyantsev & Davydov, Mir Pub.
6. Rapid prototyping: Principles and applications in Manufacturing

B. Tech (Eighth Semester) Mechanical Engineering
Industrial Robotics
ME 422 E

L	T	P/D	Total	
4	1		5	

Theory : 100 marks
Sessional : 50 marks
Duration of Exams. : 03 hours

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

UNIT I

Automation and robots, Robot classification, Applications, Robot specifications.

Dot and Cross products, Coordinate frames, , Homogeneous coordinates, Link Coordinates, The arm equation, Five-axis articulated robot (Rhino XR-3), Four-axis SCARA robot (Adept One), Six-axis articulated robot (Intelledex 660).

UNIT II

The Inverse kinematics problem, General properties of solutions, Tool Configuration, Inverse kinematics of Five-axis articulated robot (Rhino XR-3), Inverse Kinematics of Four-axis SCARA robot (Adept One), inverse kinematics of Six-axis articulated robot (Intelledex 660), and Inverse kinematics of a three-axis planar articulated robot, a robotic work cell.

Workspace analysis, Work envelope of a five-axis articulated robot (Rhino XR-3), Work envelope of a four-axis SCARA robot (Adept One), Workspace fixtures, The pick and place operations, Continuous path motion, Interpolated motion, Straight line motion.

UNIT III

The tool configuration and Jacobean matrix, Joint space singularities, Generalized inverses, Resolved motion rate controls, rate control of redundant robots, rate control using {1)-inverses, The manipulator Jacobean, Induced joint torque and forces.

Lagrange's equation, Kinetic and potential energy, Generalized force, Lagrange-Euler dynamic model, Dynamic model of a two-axis planner articulated robot, Dynamic model of a three-axis SCARA robot, Direct and inverse dynamics, Recursive Newton-Euler formulation, Dynamic model of a one-axis robot (inverted pendulum).

UNIT IV

The control problem, State equations, Constant solutions, Linear feedback systems, Single axis PID control, PD gravity control, Computed torque control, Variable structure control

image representation, template matching, polyhedral objects, shape analysis, Segmentation, Iterative processing, Perspective transformations, Structured Illumination, Camera Calibration.

Task level programming, Uncertainty, Configuration space, Gross motion planning, Grasp Planning, Fine motion planning, Simulation of planar motion.

Reference and Text Books:

1. Industrial Robotics - By M.P. Groover, McGraw Hill
2. Industrial Robotics and Automation - By S.R.Deb Tata McGraw Hill

B. Tech (Eighth semester) Mechanical Engineering
MANUFACTURING MANAGEMENT
ME 424 E

L	T	P	
4	1	-	Theory : 100 Marks
			Sessional : 50 Marks
			Total : 150 Marks
			Duration of Exam: 3 Hrs

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

Unit I

Manufacturing Systems Designs: Definition, Systems, Subsystems, Systems Approach Fundamentals, Systems Approach for designing, Manufacturing Systems, Systematic Layout Planning (SLP), Computerized Plant Layout-CRAFT, ALDEP, CORELAP, Assembly Line balancing, Problems and solutions of assembly lines, Group Technology & Cellular Systems, Classification & Grouping, overview of FMS. Strategic consideration for comparison of various systems.

Manufacturing Systems Economics: Concept of time value of money, Preparation of time profile of project, Single payment, Equal Series payment, various machine and project selection & evaluation techniques: Payback period, Present worth, Equivalent annual cost, Cost- benefit ratio, Evaluation for both equal & unequal life. Depreciation concept various methods-straight line, declining balance, Sum of the digits, Sinking fund.

Unit II

New Product Development (NPD): Product Development, Customer Need, Strategies for New Product Development, Product life cycle, Product status. Corporate Design Strategies, Japanese Approach to NPD. PUGH total Design approach, PAHL & BEITZ Approach, Project Approach, Cross functional Integration –Design, manufacturing, Marketing, Concurrent Engineering, Modular Design, Standardization Value Engineering & Analysis.

Manufacturing Planning & Control Systems: Overview of Aggregate Planning Models, Linear Decision Rules, Management Coefficient, Direct Search Methods, Master Production Schedule, Modular Bill and Materials, Capacity planning & control, language, medium range, short range capacity planning, Toyota Production System, Just- in Time (JIT), Manufacturing –Philosophy, Elements, KANBAN, effects on layout, workers & vendors, optimized production technology (OPT).

Unit III

Forecasting Methods: Forecasting Framework, Forecasting cost and accuracy, Forecasting Uses and Methods – Delphi, Exponential Smoothing, Forecasting Errors – MAD, Regression Methods-Linear Model for single & multiple variables, Brief idea of computerized forecasting systems.

Material Requirements Planning (MRP): Definition of MRP systems. MRP versus Order point, MRP Elements, Types of MRP – MRP I & II. Structured Bill of Materials. Regenerative & Net change MRP, Operating an MRP, Integration of Production & Inventory Control.

Unit IV

Maintenance & Reliability: Concept of preventive & breakdown maintenance, maintenance cost, optimal preventive maintenance simple replacement models-individual and group replacement, MAPI - methods, reliability definitions, failure analysis and curve, systems reliability- series parallel, redundancy, methods of improving reliability, MTBF, MTTR, Maintainability, availability, brief concept of terotechnology.

Text books:

1. Operations management – Schoroeder, Mc Graw Hill International
2. Production operations management – chary, TMH, New Delhi.

Reference books:

1. Production Operations Management – Adam & Ebert, PHI, New Delhi
2. Operational Management –Monks, Mcgraw Hill, Int.
3. Production & Operations Management – I. Hill, Prentice Hall Int.
4. Production Planning & Inventory Control – Narasimham etal, PHI, New Delhi
5. Production & Operation Management- Panneerselvam, PHI, New Delhi
6. Managing for Total Quality-Logothetis, PHI, New Delhi
7. Concept of Reliability Engineering –L.S. Srinath, Affiliated East West.
8. Revolutionizing Product Development – Wheelwright & Clark, Free press.
9. Management In Engineering – Freeman-Ball & Balkwill, PHI, New Delhi.
10. Production & operations management – Martinich, John Wiely , New Delhi.
11. The goal by Eliyahu M. Goldratt & Jeff Cox, Productivity Press India Ltd,, Bangalore
12. Toyota Production System by Taichi Ohno, Productivity Press India Ltd, Bangalore

B. Tech (Eighth Semester) Mechanical Engineering
ME-426 E Total Quality Management

L	T	P/D	Total		
4	1		5	Theory	: 100 marks
				Sessional	: 50 marks
				Duration of Exams.	: 03 hours

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

UNIT I

Concept of Quality, Quality as the basis of market competition, Historical review, Quality philosophy of Deming, Juran, crossby etc., Obstacles, Integrating productivity and Quality.

Organization of Quality, Quality council, Total Quality Culture, Quality leadership, Quality awards, Total employee involvement, Quality circles, Attitude of top management, executives and workers, Operators responsibility of Quality, causes of operator's errors, Motivation.

UNIT II

Introduction lo TQM, Models for TQM. TQM implementation, Advantages of TQM, Obstacles to TQM, TQM in service sector.

Concepts of Quality function deployment, cause and effect diagram, SWOT analysis, Continuous improvement, PDCA cycle, Supplier partnership, Supplier certification, Pareto diagram, Scalier diagram, Benchmarking, Taquchi's Quality Engineering, Failure mode and effect analysis, Total productive maintenance, Introduction to JIT, JIT Quality management, SQC, SPC.DPR, Kaizen, Six sigma concept.

UNIT III

Introduction to ISO 9000 series of standards, other quality systems, Implementation, Documentation, Internal audits', Registration, Closing Comments.

UNIT IV

Beyond ISO 9000 horizon, Introduction to ISO 14000, Series standards,
Concepts of ISO 14001, EMS Benefits, ISO 10011- 10014, Quality systems.

Suggested Books:

1. Total Quality Management: By Bosterfied el al., Pearson Education India, 2001.
2. The Essence of Total Quality Management: By Johan Bank, Prentice Hall of India 2000.
3. Managing for Total Quality: By Logothelis Prentice Hall of India, 2000.
4. Total Quality Management: By Sundra Raju, Tata Mcgraw Hills publishing company, 1997.
5. TQM and ISO 9000: By K.C. Arora, S.K. Kataria & Sons 2000.
6. ISO 9000 Quality System: By Dalde & Saurabh, Standard Publishing, 1994.

B. Tech. (Eight Semester) Mechanical Engineering
Piping Engineering
ME428 E

L	T	P/D	Total		
4	1	-	5	Theory	: 100 marks
				Sessional	: 50 marks
				Duration of Exams.	: 03 hours

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

UNIT I

Basics of fluid mechanics: viscosity, pressure, head, and hydraulic gradient, types of fluid flow, Remolds number. Euler's equation of motion, continuity equation, Bernoulli's equation, Gas laws and compressibility factor.

Determination of pipe size and pressure losses, thrusts in pipe line, water hammer in pipeline, design of gas pipeline, measurement of flow in pipes, Transportation of solid materials through pipelines.

UNIT II

Selection of materials, physical properties of pipe materials, recommended pipe materials

Standards and specifications, steel pipes, steel pipe fittings, cast iron pipes, cast iron fittings, joining of cast iron pipes, tubes of other materials, design of flanges and flanged joints

UNIT III

Load on structural supports, supporting structures of pipeline, pipe supports design considerations, platforms and ladders, foundation, supporting span of overhead pipe line, stiffening ribs, pipe clamping and supporting devices, flexible hanger supports

Valves, function of valves, valve materials and method of construction, pressure drop involves, valve size, Types of valves, valve fittings.

Codes and standards, piping construction, welding joints in pipe line, welding processes used in pipe fabrication, preparation of pipe edged,

UNIT IV

Piping systems, pipe expansion, methods of compensation, thermal force calculation, Permissible equivalent stresses by additional external loads, expansion devices, calculation of anchor force using a bellow, bellow material and life, use of hinged compensators

Kellogg method, Method of analysis, multi-line pipeline with two-fixed end

Corrosion control In critical task, corrosion process, types of corrosion, fluid and cavitation corrosion.

Reference and Text Books:

1. Handbook of piping design - By Sahu, New age Int. Pubs.
2. Design of piping systems - By Kellogg, Wiley & sons

B. Tech (Eighth Semester) Mechanical Engineering
ME 430 E ENERGY MANAGEMENT

L	T	P	Total			
4	1	-	5	Sessional Marks:		50 Marks
				Theory	:	100 Marks
				Duration of Exams:		3 Mrs.

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

UNIT I

Inerlialion phase, audit and analysis phase, implementation phase, general methodology for building and site energy audit, site survey, methodology, site survey-electrical system, steam and water systems, building survey methodology, basic energy audit instrumentation, measurement for building surveys.

General principles, the requirements for human comfort, description of typical systems-dual duct HVAC system. Multi zone HVAC systems, variable and volume systems, terminal repeat system, evaporative systems, package system, basic principle governing HVAC system, package system, basic principle governing HVAC system operation, energy management opportunities in HVAC systems, modeling of heating and cooling loads in buildings, problems.

UNIT II

General principles, illumination and human comfort, basic principles of lighting system, typical-illumination syst3em and equipment, fundamentals of single phase and 3 phase A.C. circuits, energy management opportunities for lighting systems, motors and electrical heat, electrical and analysis and their parameters, peak, demand control, problems.

General principles, process heat, combustion, energy saving in condensate return, steam generation and distribution, automotive fuel control, hot water and water pumping, direct and indirect fired furnaces over, process electricity, other process energy forms-compressed air and manufacturing processes, problems.

UNIT III

General consideration, life cycle costing, break-even analysis, cost of money, benefit/cost analysis, pay back period analysis, prospective rate of to return, problems.

Environmental conformation, passive design, conservation building envelope design consideration, integration of building system, energy storage problems.

UNIT IV

Energy management principle involving computers, basics of computer use, analysis-engineering and economic calculations, simulation, forecast, CAD/CAM controls - microprocessor and minicomputers, building cycling and control, peak demand limiting and control: industrial power management, problems.

Text Book:

1. Energy Management Principles by Criag B. Smith, Published by Pergamon Press.
2. Energy systems and developments – Jyoti Parikh, Oxford University Press.

Reference Books:

1. Energy – resources, demand and conservation with reference to India – Chaman Kashkari, Tata Mc Graw Hill Co. Ltd.
2. Integrated renewable energy for rural development – Proceedings of Natural solar energy convention, Calcutta.

B. Tech (Eighth Semester) Mechanical Engineering
ME 432 E MANAGEMENT INFORMATION SYSTEM

L	T	P/D	Total	
4	1		5	

Theory : 100 marks
Sessional : 50 marks
Duration of Exams. : 03 hours

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

UNIT I

What is MIS? Decision support systems, systems approach, the systems view of business, MIS, MIS organization within the company management organizational theory and the systems approach. Development of organizational theory, management and organizational behavior, management information and the system approach.

Evolution of an information systems, basic information systems, decision making and MIS, MIS as a technique for making programmed decision assisting information systems (r) strategic and project planning for MIS : General business planning, appropriate MIS planning-general, MIS planning -details.

UNIT II

Define the problems, set system objectives, establish system constraints, determine information needs, determine information sources, develop alternative conceptual ;designs and select one document the system concept, prepare the conceptual ;design report.

UNIT III

Inform and involve the organization, aim of detailed design, project management of MIS detailed design, identify dominant and trade off criteria, define the subsystems, Sketch the detailed operating subsystems and information flow. Determine the degree of automation of each operation, inform and involve the organization again, inputs, and processing, early system testing, software, hardware and tools, propose an organization to operate the system, document the detailed design, revisit the manager -user.

UNIT IV

Plan the Implementation , acquire floor space and plan space layouts, organize for implementation, develop, procedures for implementation, train (ho operating personnel, computer related acquisitions, develop forms for data collection and information dissemination, develop the files, test the system, cutover, document the system, evaluate the MIS control and maintain the system (r). Pitfalls in MIS development : Fundamental weakness, soft spots in planning, design problems, implementation: The TARPIT.

Text Books:

1.. Management Information system by W.S. JawadeKar - Tata McGraw Hill.

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

B. Tech (Eighth Semester) Mechanical Engineering
ME 434 E Pneumatics & Hydraulics Control

L	T	P/D	Total
4	1	-	5

Theory : 100 marks
Sessional: 50 marks
Duration of Exams. : 03 hours

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

UNIT I

Hydraulic systems, pneumatic systems, uses of fluid power, fluid power at work, standard symbols for hydraulic & pneumatic components -ANS
Graphical symbols -composite symbols.
Pressure applied in one direction, pressure applied in both directions, pressure applied and intensified in both directions, advantages of pressure boosters installation, causes of failure of boosters, maintenance
Positive displacement or pressure type reciprocating compressors, velocity or dynamic type compressors, location and installation, air intake, after cooler, air receivers, safety valves, compressor regulators or controls planning a compressed air plant, compressor selection.

UNIT II

Petroleum base fluids, synthetic base fluids, quantity requirement, maintenance, selection of hydraulic fluid, specific weight, viscosity, Say-bolt universal viscometer, viscosity problems, viscosity index, lubricating value, pour point, oxidation and contamination.
Rigid pipe, semi-rigid, flexible piping, general features of piping installation, planning a compressed air distribution system, Installation of rigid, semi-rigid and flexible piping - manifolds, causes of piping failures.
General features, air filters, pressure regulators, lubricators, combination units, protection of filters and lubricator bowls, mufflers.

UNIT III

Two-way valves, manual control, manual operation, mechanical operation, electrical operation, pilot control, installation, causes of failure, repair & maintenance, three way valves, actuation, maintenance of three way valves four way valves, installation & maintenance.
Types of flow control, parts names, installation causes of failure, repair and maintenance, pressure relief valves, sequence valves, unloading valves, other types of pressure controls.
General types, characteristics of air motors, General features of pneumatic tools, drills, hammers, hoists, rock drills and paving breakers.

UNIT IV

Gear type motors, Vane type motors, piston type motors, split speed, Schematic diagrams of various types of pneumatic and hydraulic circuits, common causes of failure, dirt, heat, misapplication, improper fluids, faulty installation, maintenance, improperly designed circuits.
Control systems, differential sensing or error-detecting devices, types of servo systems, characteristics of servo-systems.

Reference and Text Books:

1. Pneumatics and Hydraulics -By Stewart, Taraporevala Sons & Co. Pvt. Ltd,
2. Industrial Hydraulics -By Pippinger & Hicks, McGraw Hill, New York.
3. Hydraulic and Pneumatic Power for Production -By H.L. Stewart, Industrial Press Inc, New York.
4. Hydraulic Servo Systems -By M. Guillon.

B. Tech (Eighth Semester) Mechanical Engineering
DESIGN OF AIR CONDITIONING SYSTEMS
ME- 436E

L	T	P
4	1	-

Sessional: 50 Marks
Theory: 100 Marks
Total: 150 Marks
Duration of Exam: 3 Hrs.

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

Unit I

Application of Air Conditioning: Medium and large sized buildings, industrial air conditioning, residential air conditioning, air conditioning of vehicles and aircrafts.
Psychometry: Psychometric chart, combined heat and mass transfer, adiabatic saturation, enthalpy potential. Air Conditioning Load: Comfort and design conditions, thermal transmission, infiltration and ventilation loads, heating and cooling loads, solar radiation properties, periodic heat transfer through walls and roofs.

Unit II

Air Conditioning Systems: Thermal distribution systems, classic single-zone systems, outdoor air control, single-zone system design, multiple-zone systems, terminal reheat systems, dual duct or multizone system, variable air-volume systems, hydronic systems, unitary systems, passive air conditioning systems.

Unit III

Vapour Compression Cycle: Compressors: Reciprocating, rotary, screw, scroll vane and centrifugal compressors. Condensers and evaporators – heat transfer, pressure drop, extended surfaces, condensing capacity, condenser design, boiling in shell and tubes, evaporator performance, defrosting methods. Expansion devices – capillary tube design, constant pressure expansion valve, float valves, superheat controlled thermostatic expansion valve.
Refrigerants: Primary and secondary refrigerants, halocarbons, azeotropes, ozone depletion, eco friendly refrigerants.

Unit IV

Equipment Design: Fan and duct systems, fan laws, air-distribution in rooms, ventilation systems, diffusers and induction, fan coil units. Cooling and dehumidifying coils – Heat and mass transfer, moisture removal, coil performance, Controls: Pneumatic, electric and electronic controls, thermostats, dampers, outside air control, freeze protection, humidistat, acoustics and noise control.

Text Books:

1. Refrigeration and air conditioning – W.F. Stoecker, J.W. Jones, McGraw Hill Book Co.
2. Air conditioning Engineering – W.P. Jones, Edward Arnold

Reference Books:

1. Hand book of air conditioning system design- Carrier Air conditioning Co.,McGraw Hill Book co
2. Thermal Environmental Engg. – James L. Threlkeld, Prentice Hall, Inc
3. Refrigeration and Air conditioning – C P Arora, Tata McGraw Hill Pub. Co Ltd.
4. Refrigeration and Air conditioning – P L Ballaney, Khanna Publishers

B. Tech (Eighth Semester) Mechanical Engineering
AUTOMATIC CONTROLS
(THEORY AND APPLICATIONS)
ME- 438 E

L	T	P	
3	1	-	Sessional Marks : 50 Theory Marks : 100 Total Marks : 150 Duration of Exam : 3 hrs.

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

Unit I

Introduction And Applications: Types of control systems ; Typical Block Diagram :Performance Analysis; Applications – Machine Tool Control, Boiler Control, Engine Governing, Aerospace Control, Active Vibration Control; Representation of Processes & Control Elements – Mathematical Modeling, Block Diagram Representation, Representation of Systems or Processes, Comparison Elements; Representation of Feedback Control systems – Block Diagram & Transfer Function Representation, Representation of a Temperature, Control System, Signal Flow Graphs, Problems. Types Of Controllers: Introduction: Types of Control Action; Hydraulic Controllers; Electronic Controllers; Pneumatic Controllers; Problems.

Unit II

Transient And Steady State Response: Time Domain Representation; Laplace Transform, Representation; System with Proportional Control; Proportional – cum – Derivative control; Proportional – cum – Integral Control; Error Constants; Frequency Response Analysis: Introduction; Closed and Open Loop Transfer Function; Polar Plots; Rectangular Plots; Nichols Plots: Equivalent Unity Feed Back Systems; Problems.

Unit III

Stability Of Control Systems: Introduction; Characteristic Equation; Routh's Criterion; Nyquists Criterion, Gain & Phase Margins, Root Locus Method: Introduction; Root Ioci of a Second Order System; General Case; Rules for Drawing Forms of Root Ioci; Relation between Root Locus Locations and Transient Response; Parametric Variation; Problems.

Unit IV

Digital Control System : Introduction; Representation of Sampled Signal; Hold Device; Pulse Transfer Function; Block Diagrams; Transient Response; Routh's Stability Criterion; Root Locus Method; Nyquists Criterion; State Space Analysis of Control Systems: Introduction; Generalized State Equation; Techniques for Deriving System State – Space Equations; Transfer Function from State Equations; Solution of State Vector Differential Equations; Discrete Systems; Problems.

Text Books:

1. Theory & Applications of Automatic Controls by B.C. Nakra, Published by New Age International Pvt. Ltd. Publishers, New Delhi 1998.
2. Modern Control Engg. By Ugata, Prentice Hall of India, New Delhi.

Reference Books:

1. Automatic Control Systems by Kuo' Published by Prentice Hall of India, New Delhi.
2. Control System Engineering, I. J. Nagrath and M. Gopal, New Age International limited.