Program outcomes (POs)- Engineering & Technology

Engineering Graduates will be able to:

PO1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSO) – B.Tech(MECHANICAL ENGINEERING)

At the end of the program the shall be able to

PSO1: apply education in Mechanical Engineering to serve the global society at large.

PSO2: apply fundamental principles of Mechanical Engineering for solving problems in field of engineering.

PSO3: promote awareness among the students about the importance of multidisciplinary engineering approach.

PSO4: develop techno-commercial skills among students so that they may be able to design, develop and maintain mechanical equipments which are useful for the society. Also to nurture entrepreneurial ability to cater the societal problems.

PSO5: continuous learn and effective communication even after graduating from the Institute

MAHRASHSI DAYANAND UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATIONS
B.Tech 2nd YEAR MECHANICAL ENGINEERING, 3rd SEMESTER
Proposed 'F' Scheme w.e.f 2010-11

Course	Course Title	Teaching Schedule				Marks for class work	Marks for Examination		Total Marks	Duration of Exam
		L	T	P	Total		Theory	Practical		
MAT-201-F or HUM-201-F	Mathematics-III or Engineering Economics	3 or 3	2 or 1	- -	5 or 4	50	100	-	150	3
HUM-203-F	Fundamentals of Management	3	1	-	4	50	100	-	150	3
ME-201-F	Thermodynamics	3	1	-	4	50	100	-	150	3
ME-203-F	Computer Aided Design	3	1	-	4	50	100	-	150	3
ME-205-F	Engineering Mechanics	3	1	-	4	50	100	-	150	3
ME-207-F	Material Science	3	1	-	4	50	100		150	3
ME-209-F	Machine Drawing	1	-	3	4	50	-	50	100	4
ME-211-F	Computer Aided Design Lab	-	-	2	2	25	-	25	50	3
ME-213-F	Engineering Mechanics Lab	-	-	2	2	25	-	25	50	3
ME-215-F	Materials Science Lab	-	-	2	2	25	-	25	50	3
	Total	**19**	**6**	**10**	**34/35**	**425**	**600**	**125**	**1150**	

MAT-201-F MATHEMATICS-III

(Common to CSE, ME, ECE, BME, EE, EEE, E&I, I&C, IT, CE)

L	T	P
3	2	-

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

NOTE: Examiner will set 9 questions in total, with two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal mark (20 marks). Students have to attempt 5 questions in total at least one question from each section.

Section-A

Fourier Series and Fourier Transforms : Euler's formulae, conditions for a Fourier expansion, change of interval, Fourier expansion of odd and even functions, Fourier expansion of square wave, rectangular wave, saw-toothed wave, half and full rectified wave, half range sine and cosine series.

Fourier integrals, Fourier transforms, Shifting theorem (both on time and frequency axes), Fourier transforms of derivatives, Fourier transforms of integrals, Convolution theorem, Fourier transform of Dirac-delta function.

Section-B

Functions of Complex Variable: Definition, Exponential function, Trigonometric and Hyperbolic functions, 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. Integration of complex functions. Cauchy-Integral theorem and formula.

Section-C

Power series, radius and circle of convergence, Taylor's Maclaurin's and Laurent's series. Zeroes and singularities of complex functions, Residues. Evaluation of real integrals using residues (around unit and semi circle only).

Probability Distributions and Hypothesis Testing: Conditional probability, Bayes theorem and its applications, expected value of a random variable. Properties and application of Binomial, Poisson and Normal distributions.

Section-D

Testing of a hypothesis, tests of significance for large samples, Student's t-distribution (applications only), Chi-square test of goodness of fit.

Linear Programming: Linear programming problems formulation, solving linear programming problems using (i) Graphical method (ii) Simplex method (iii) Dual simplex method.

Course Outcomes

The students will learn:

CO1 - The tool of Fourier series and Fourier Transform for learning advanced Engineering Mathematics.

CO2 - The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.

CO3 - The ideas of probability and random variables and various discrete and continuous probability distributions and their properties.

CO4 - The basic ideas of statistics including various discrete and Continuous probability distributions.

CO5 - The statistical methods of studying data samples, the effective mathematical tools for the solutions of Linear Programming Problem (LPP).

TEXT BOOKS:

1. Engineering Mathematics by Babu Ram (Pearson media Publication)
2. Advanced Engg. Mathematics: F Kreyszig.
3. Higher Engg. Mathematics: B.S. Grewal.

REFERENCE BOOKS :

1. Advance Engg. Mathematics: R.K. Jain, S.R.K.Iyenger.
2. Advanced Engg. Mathematics: Michael D. Greenberg.
3. Operation Research: H.A. Taha.
4. Probability and statistics for Engineers: Johnson. PHI.

HUM-201-F ENGINEERING ECONOMICS

(Common to CSE, ME, ECE, BME, EE, EEE, E&I, I&C, IT, CE, TT, FAE, TC)

L	T	P
3	1	-

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

NOTE: Examiner will set 9 questions in total, with two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal mark (20 marks). Students have to attempt 5 questions in total at least one question from each section.

Section-A

Definition of Economics - various definitions, Nature of Economic problem, Production possibility curve Economic laws and their nature. Relation between Science, Engineering, Technology and Economics.

Concepts and measurement of utility, Law of Diminishing Marginal Utility, Law of equi-marginal utility - its practical application and importance.

Section-B

Meaning of Demand, Individual and Market demand schedule, Law of demand, shape of demand curve, Elasticity of demand, measurement of elasticity of demand, factors effecting elasticity of demand, practical importance & applications of the concept of elasticity of demand.

Meaning of production and factors of production; Law of variable proportions, Returns to scale, Internal and External economics and diseconomies of scale.

Section-C

Various concepts of cost - Fixed cost, variable cost, average cost, marginal cost, money cost, real cost opportunity cost. Shape of average cost, marginal cost, total cost etc. in short run and long run.

Meaning of Market, Types of Market - Perfect Competition, Monopoly, Oligopoly, Monopolistic Competition (Main features of these markets)

Section-D

Supply and Law of Supply, Role of Demand & Supply in Price Determination and effect of changes in demand and supply on prices.

Nature and characteristics of Indian economy (brief and elementary introduction), Privatization - meaning, merits and demerits. Globalisation of Indian economy - merits and demerits. Elementary Concepts of VAT, WTO, GATT & TRIPS agreement.

COURSE OUTCOMES

Upon successful completion of this course, the student will be able to:

CO1 - explain the basic economic principles of wants, scarcity, choice, opportunity cost, etc as applied to business organizations and engineering firms;

CO2 - understand the role of demand and supply law

CO3 - carry out the cost analysis of a manufactured product;

CO4 - fully understand nature and characteristics of Indian Economy

TEXT BOOKS:

1. Principles of Economics: P.N. Chopra (Kalyani Publishers).
2. Modern Economic Theory – K.K. Dewett (S.Chand)

REFERENCE BOOKS:

1. A Text Book of Economic Theory Stonier and Hague (Longman's Landon)
2. Micro Economic Theory – M.L. Jhingan (S.Chand)
3. Micro Economic Theory - H.L. Ahuja (S.Chand)
4. Modern Micro Economics : S.K. Mishra (Pragati Publications)
5. Economic Theory - A.B.N. Kulkarni & A.B. Kalkundrikar (R.Chand & Co.)
6. Indian Economy: Rudar Dutt & K.P.M. Sundhram

HUM-203-F FUNDAMENTALS OF MANAGEMENT

(Common to CSE, ME, ECE, BME, EE, EEE, E&I, I&C, IT, CE)

L	T	P
3	1	-

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

NOTE: Examiner will set 9 questions in total, with two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal mark (20 marks). Students have to attempt 5 questions in total at least one question from each section.

Section-A

Meaning of management, Definitions of Management, Characteristics of management, Management vs. Administration. Management-Art, Science and Profession. Importance of Management. Development of Management thoughts.

Principles of Management. The Management Functions, Inter-relationship of Managerial functions.

Nature and Significance of staffing, Personnel management, Functions of personnel management, Manpower planning, Process of manpower planning, Recruitment, Selection; Promotion - Seniority Vs. Merit. Training - objectives and types of training.

Section-B

Production Management : Definition, Objectives, Functions and Scope, Production Planning and Control; its significance, stages in production planning and control. Brief introduction to the concepts of material management, inventory control; its importance and various methods**.**

Section-C

Marketing Management - Definition of marketing, marketing concept, objectives & Functions of marketing.

Marketing Research - Meaning; Definition; objectives; Importance; Limitations; Process. Advertising - meaning of advertising, objectives, functions, criticism.

Section-D

Introduction of Financial Management, Objectives of Financial Management, Functions and Importance of Financial Management. Brief Introduction to the concept of capital structure and various sources of finance.

Course outcomes:

Students will be able to understand

CO1 - Evolution of Management and contribution of Management thinkers.

CO2 - importance of staffing and training

CO3 - the concept of material management and inventory control

CO4 - the components of marketing and advertising

CO5 - various sources of finance and capital structure

TEXT BOOKS:

1. Principles and Practice of Management - R.S. Gupta, B.D.Sharma, N.S. Bhalla. (Kalyani Publishers)
2. Organisation and Management - R.D. Aggarwal (Tata Mc Graw Hill)

REFERENCE BOOKS:

1. Principles & Practices of Management – L.M. Prasad (Sultan Chand & Sons)
2. Management – Harold, Koontz and Cyrilo Donell (Mc.Graw Hill).
3. Marketing Management – S.A. Sherlikar (Himalaya Publishing House, Bombay).
4. Financial Management - I.M. Pandey (Vikas Publishing House, New Delhi)
5. Management - James A.F. Stoner & R.Edward Freeman, PHI.

ME- 201-F THERMODYNAMICS

L	T	P
3	1	-

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

NOTE: Examiner will set 9 questions in total, with two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal mark (20 marks). Students have to attempt 5 questions in total at least one question from each section.

Section-A

Basic Concepts: Macroscopic and Microscopic Approaches, 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, Problems.

First Law of Thermodynamics: Energy and its Forms, Energy and 1^{st} law of Thermodynamics, Internal Energy and Enthalpy, PMMFK, Steady flow energy equation, 1^{st} Law Applied to Non- flow process, Steady Flow Process and Transient Flow Process, Throttling Process and Free Expansion Process. Problems.

Section-B

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, PMMSK. Carnot Cycle, Carnot Heat Engine and Carnot Heat Pump, Carnot Theorem and its Corollaries, Thermodynamic Temperature Scale. Entropy, Clausius Inequality, Principle of Entropy Increase, Temperature Entropy Plot, Entropy Change in Different Processes, Introduction to Third Law of Thermodynamics. Problems.

Availability and Irreversibility: High and Low Grade Energy, Availability and Unavailable Energy, Loss of Available Energy Due to Heat Transfer Through a Finite Temperature Difference, Dead state of a system, Availability of a Non-Flow or Closed System, Availability of a Steady Flow System, Helmholtz and Gibb's Functions, Effectiveness and Irreversibility, Second law efficiencies of processes & cycles. Problems.

Section-C

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. Problems.

Ideal and Real Gases: Concept of an Ideal Gas, Basic Gas Laws, Characteristic Gas Equation, Avogadro'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, Mass, Mole and Volume Fraction, Gibson Dalton's law, Gas Constant and Specific Heats, Entropy for a mixture of non-reactive gases. Problems.

Section-D

Thermodynamic Relations: Maxwell Relations, Clapeyron Equation, Relations for changes in Enthalpy and Internal Energy & Entropy, Specific Heat Capacity Relations, Joule Thomson coefficient & inversion curve.

Gas power Cycles: Carnot Cycle, Otto Cycle, Diesel Cycle, Dual Cycle,Stirling Cycle, Ericson cycle and Brayton cycle, Problems.

Course Outcomes (COs):

At the end of the course, the student shall be able to:

CO1- Understand the basic concepts of thermodynamics and apply zeroth and first law to analyse thermodynamic processes.

CO2- Comprehend the second law of thermodynamics and apply it solve the problems related to heat engines, refrigerators, heat pumps compressors and nozzles etc.

CO3- Learn and apply the concept of entropy, availability and irreversibility to thermodynamic processes.

CO4- Evaluate properties of pure substances, gases and their mixtures and to derive and apply property relations to thermodynamic problems.

Text Books:

1. Engineering Thermodynamics – Jones and Dugan, PHI, New Delhi.
2. Fundamentals of Engineering Thermodynamics – E. Radhakrishnan, PHI, New Delhi.

Reference Books:

1. Theory and Problems of Thermodynamics – Y. V.C. Rao, Wiley Eastern Ltd., New Delhi.
2. Engineering Thermodynamics – C P Arora, Tata McGraw Hill
3. Basics of Mechanical Engineering – Vineet Jain, Dhanpat Rai Publication
4. Engineering Thermodynamics – P K Nag, Tata McGraw Hill

ME- 203-F COMPUTER AIDED DESIGN

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

NOTE: Examiner will set 9 questions in total, with two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal mark (20 marks). Students have to attempt 5 questions in total at least one question from each section.

Section-A

Introduction: Introduction to CAD, Design Process, Introduction to CAM/ CIMS, Importance and Necessity of CAD, Applications of CAD, Hardware and Software requirement of CAD, Basics of geometric and solid modeling, coordinate systems.

Transformations: Introduction, transformation of points and line, 2-D rotation, reflection, scaling and combined transformation, homogeneous coordinates, 3-D scaling, shearing, rotation, reflection and translation, combined transformations.

Section-B

Curves: Algebraic and geometric forms, tangents and normal, blending functions reparametrization, straight lines, conics, cubic splines, Bezier curves and B-spline curves.
Surfaces and Solids: Plane surface, ruled surface, surface of revolution, tabulated cylinder, bi-cubic surface, Bezier surface, B-spline surface, Solid models and representation scheme, boundary representation, constructive solid geometry, sweep representation, cell decomposition.

Section-C

Automation and Numerical Control: Introduction, fixed, programmable and flexible automation, types of NC systems, MCU and other components, NC manual part programming, coordinate systems, G & M codes, Part program for simple parts, computer assisted part programming.

Group Technology: Part families, part classification and coding, production flow analysis, Machine cell design, Advantages of GT.

Section-D

Flexible Manufacturing Systems & Computer aided process planning: Introduction, FMS components, types of FMS, FMS layouts, planning for FMS, advantages and applications Conventional process planning, types of CAPP, Steps in variant process planning, planning for CAPP.

Finite Element Method: Introduction, Procedure, Finite Element Analysis, Finite Element Modeling, Analysis of 1D, 2D structural problems.

Course Outcomes (COs):

At the end of the course, the student shall be able to:

CO 1- Understand the basic fundamentals of computer aided designing.
CO 2- Learning Transformations and types of surfaces.
CO 3- Exploration of the techniques of 3D modeling of various mechanical parts.
CO 4- Expedite the procedure and benefits of FEA and CAE

Text Books:

1. CAD/ CAM by Groover and Zimmer, Prantice Hall.
2. CAD/ CAM Theory and Practice by Zeid, McGraw Hill
3. Numerical Control and Computer Aided Manufacturing by Kundra, Rao & Tiwari, TMH.

Reference Books:

1. CAD/CAM (Principles, Practice & Manufacturing Management) by Chirs Mc Mohan & Jimmie Browne, Published by Addison- Wesley.

ME-205-F ENGINEERING MECHANICS

L	T	P
3	1	-

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

NOTE: Examiner will set 9 questions in total, with two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal mark (20 marks). Students have to attempt 5 questions in total at least one question from each section.

Section-A

Introduction: Force system, dimensions and units in mechanics, laws of mechanics, vector algebra, addition and subtraction of forces, cross and dot products of vectors, moment of a force about a point and axis, couple and couple moment, transfer of a force to a parallel position, resultant of a force system using vector method, Problems involving vector application

Equilibrium: Static and dynamic equilibrium, static in determinacy, general equations of equilibrium, Varingnon's theorem, Lami's theorem, equilibrium of bodies under a force system, Problems.

Section-B

Truss and Frames:Truss, classification of truss, assumptions in truss analysis, perfect truss, analysis of perfect plane truss using method of joints and method of sections, Problems.
Centroid , Centre of mass and Centre of gravity, Determination of centroid, centre of mass and centre of gravity by integration method of regular and composite figures and solid objects, Problems.

Section-C

Moment of Inertia: Area moment of inertia, mass moment of inertia, parallel axis and perpendicular axis theorems, radius of gyration, polar moment of inertia, product of inertia, principle axis, problem based on composite figures and solid objects.

Kinematics: Concept of rigid body, velocity and acceleration, relative velocity, translation and rotation of rigid bodies, equations of motion for translation and rotation, problems.

Section-D

Particle Dynamics: Energy methods and momentum methods, Newton's laws, work energy equation for a system of particles, linear and angular momentum equations, projectile motion, problem.

Shear Force and Bending Moment Diagram for statically determinant beams Classification of beams, types of loads, shear force and bending moment calculation and their graphical presentation, point of inflection, problem.

Course Outcomes (COs):

At the end of the course, the student shall be able to:

CO 1- Understand the basic force system.
CO 2- Apply principles of particle kinematics.
CO 3- Grasp the concepts of particle dynamics.
CO 4- Learn energy methods & momentum methods.

Recommended Books:-

Engineering Mechanics – Irving H. Shames, PHI Publication
Engineering Mechanics – U.C.Jindal, Galgotia Publication
Engineering Mechanics – A.K.Tayal, Umesh Publication

ME- 207-F MATERIAL SCIENCE

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

NOTE: Examiner will set 9 questions in total, with two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal mark (20 marks). Students have to attempt 5 questions in total at least one question from each section.

Section-A

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

Imperfection in metal crystals: Crystal imperfections and their classifications, point defects, line defects, edge & screw dislocations, surface defects, volume defects & effects of imperfections on metal properties.

Section-B

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.

Section-C

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.

Section-D

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.

Course Outcomes (COs):

After studying this course, students will be able:

CO 1- know about the basics of materials, crystallography and classify crystal defects.

CO 2- Comprehend the deformation phenomena, mechanisms of fracture and modes of failure in materials.

CO 3- Classify solid solutions and interpret equilibrium phase diagrams of ferrous and nonferrous
alloys.

CO 4- Select suitable heat-treatment process to achieve desired properties of metals and alloys.

CO 5- Understand the application of advanced engineering materials and to analyse Environmental and societal issues related to material science and Engineering.

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. A Text Book of Material Science & Metallurgy – O.P. Khanna, Dhanpat Rai & Sons
3. Material Science and Engineering-An Introduction - Callister; W.D., John Wiley & Sons. Delhi.
4. Engineering Materials: Kenneth G. Budinski, Prentice Hall of India, New Delhi

ME-209-F MACHINE DRAWING

L	T	P		
1	-	3	Sessional	: 50 Marks
			Practical Examination	: 50 Marks
			Total	: 100 Marks
			Duration of Exam	: 4 hrs

NOTE: Examiner will set 9 questions in total, with two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal mark (20 marks). Students have to attempt 5 questions in total at least one question from each section.

Section A

Introduction graphic language classification of drawing, principal of drawing, IS codes for machine drawing, lines, scales, section dimensioning, standard abbreviation, – Limits , fits and Tolerance (Dimensional and Geometrical tolerance) , Surface finish, Gears : Gear terminology, I.S. convention representation of assembly of spur gears, helical gears, bevel gears , worm and worm wheel.

Section B

Orthographic projections: principle of first and third angle projection, orthographic views from isometric views of machine parts / components. Drawing of sectional views:- Coupling, Crankshaft, Pulley, Piston and Connecting rod, Cotter and Knuckle joint. Riveted Joint and Welded Joint.

Free hand sketching: Need for free hand sketching of standard parts and simple machines components.

Section C

Assembly drawing with sectioning and bill of materials from given detailed drawings of assemblies: Lathe Tail stock, Machine vice, Pedestal bearing

Section D

Assembly drawing with sectioning and bill of materials from given detailed drawings of assemblies Steam stop valve, Stuffing box, Drill jigs and Milling fixture.

Course Outcomes (COs):

At the end of the course, the student shall be able to:

CO 1- Learning the fundamentals of computer aided drafting using AutoCAD.

CO 2- Understanding of the drawing standards and gear terminology.

CO 3- Generation of the orthographic views of various mechanical parts using AutoCAD.

CO 4- Expedite the Isometric views and Assembly of various mechanical parts using AutoCAD.

Text Books:

1. Machine Drawing - N D Bhatt and V M Panchal, Charotar Publishing House.
2. A Text Book of Machine Drawing - P S Gill Pub.: S K Kataria & Sons.
3. Engineering Graphics with Auto CAD 2002 -JamesD.Bethune, Pearson Education.

Reference Books:

1. A Text Book of Machine Drawing Laxmi Narayana and Mathur, M/s. Jain Brothers, New Delhi.
2. Machine drawing by N Sidheshwar, Kannaieh, V S Sastry, TMH., New Delhi.

ME- 211- FCOMPUTER AIDED DESIGN LAB

L	T	P
-	-	2

Sessional : 25 Marks
Practical Examination : 25 Marks
Total : 50 Marks
Duration of Exam: 3 Hrs

The students will be required to carry out the following exercises using educational software
(AutoCAD, I-DEAS, Pro-Engineer etc).

1. Setting up of drawing environment by setting drawing limits, drawing units, naming the drawing, naming layers, setting line types for different layers using various type of lines in engineering drawing, saving the file with .dwg extension.

2. Layout drawing of a building using different layer and line colors indicating all Building details. Name the details using text commands, Make a title Block.

3. To Draw Orthographic projection Drawings (Front, Top and side) of boiler safety valve giving name the various components of the valve.

4. Make an Isometric dimensioned drawing of a connecting Rod using isometric grid and snap.

5. Draw quarter sectional isometric view of a cotter joint.

6. Draw different types of bolts and nuts with internal and external threading in Acme and square threading standards. Save the bolts and nuts as blocks suitable for insertion.

7. Draw 3D models by extruding simple 2D objects, dimension and name the objects.

8. Draw a spiral by extruding a circle.

Course Outcomes (COs):
At the end of the course, the student shall be able to:
CO 1- Display of the basic fundamentals of modeling package.
CO 2- Explore the surface and solid modeling features.
CO 3- Learning the techniques of 3D modeling of various mechanical parts.
CO 4- To expedite the procedure and benefits of FEA and CAE

Note:-
1. **At least seven experiments are to be performed in the semester.**
2. **At least five 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.**

ME- 213- FENGINEERING MECHANICS LAB

L	T	P
-	-	2

Sessional : 25 Marks
Practical Examination : 25 Marks
Total : 50 Marks
Duration of Exam: 3 Hrs

List of Experiments:

1. Verification of reciprocal theorem of deflection using a simply supported beam.
2. Verification of moment area theorem for slopes and deflections of the beam.
3. Deflections of a truss-horizontal deflections & vertical deflections of various joints of a pin-jointed truss.
4. Elastic displacements (vertical & horizontal) of curved members.
5. Experimental and analytical study of 3 hinged arch and influence line for horizontal thrust.
6. Experimental and analytical study of behavior of struts with various end conditions.
7. To determine elastic properties of a beam.
8. Experiment on a two-hinged arch for horizontal thrust & influence line for Horizontal thrust.
9. Experimental and analytical study of a 3 bar pin jointed Truss.
10. Experimental and analytical study of deflections for unsymmetrical bending of a Cantilever beam.

COURSE OUTCOMES

CO1 - Students will understand the concepts of engineering Mechanics.
CO2 - Students would be able to understand the practical concept of beams.
CO3 - Students would be able to understand the practical concept of various trusses and load distribution.
CO4 - Students will get familiar with joints and column applications.

Note:-

1. **At least eight experiments are to be performed in the semester.**
2. **At least six 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.**

ME- 215-F MATERIAL SCIENCE LAB.

L	T	P
-	-	2

Sessional : 25 Marks
Practical Examination : 25 Marks
Total : 50 Marks
Duration of Exam: 3 Hrs

List of Experiments:

1. To study crystal structures of a given specimen.
2. To study crystal imperfections in a given specimen.
3. To study microstructures of metals/ alloys.
4. To prepare solidification curve for a given specimen.
5. To study heat treatment processes (hardening and tempering) of steel specimen.
6. To study microstructure of heat-treated steel.
7. To study thermo-setting of plastics.
8. To study the creep behavior of a given specimen.
9. To study the mechanism of chemical corrosion and its protection.
10. To study the properties of various types of plastics.
11. To study Bravais lattices with the help of models.
12. To study crystal structures and crystals imperfections using ball models.

Course Outcomes (COs):

After studying this course, students will be:

CO 1- Learn the principles of materials science and engineering though lab investigation.
CO 2- Prepare formal laboratory reports describing the results of experiments.
CO 3- Operate basic instruments in materials science and engineering.
CO 4- Understand the basics structure of materials and ability to interpret the data from the experiments.

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.**

MAHARSHI DAYANAND UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATIONS
B.Tech 2nd YEAR MECHANICAL ENGINEERING,
4th SEMESTER
Proposed 'F' Scheme w.e.f 2010-11

Course	Course Title	Teaching Schedule				Marks for class work	Marks for Examination		Total Marks	Duration of Exam
		L	T	P	Total		Theory	Practical		
MAT-201-F or HUM-201-F	Mathematics-III or Engineering Economics	3 or 3	2 or 1	-	5 or 4	50	100	-	150	3
ME-202-F	Manufacturing Technology-I	3	1	-	4	50	100	-	150	3
ME-204-F	Kinematics of Machine	3	1	-	4	50	100	-	150	3
ME-206-F	Strength of Materials-I	3	1	-	4	50	100	-	150	3
ME-208-F	Fluid Mechanics	3	1	-	4	50	100	-	150	3
ME-210-F	Steam & Power Generation	3	1	-	4	50	100	-	150	3
ME-212-F	Kinematics of Machine Lab	-	-	2	2	25	-	25	50	3
ME-214-F	Strength of Materials Lab	-	-	2	2	25	-	25	50	3
ME-216-F	Fluid Mechanics Lab	-	-	2	2	25	-	25	50	3
ME-218-F	Steam & Power Generation Lab	-	-	2	2	25	-	25	50	3
GP-202-F	General Proficiency	-	-	2	2	50	-	-	50	-
	Total	**18**	**6**	**9**	**34/35**	**450**	**600**	**100**	**1150**	

MAT-201-F MATHEMATICS-III

L	T	P
3	2	-

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

NOTE: Examiner will set 9 questions in total, with two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal mark (20 marks). Students have to attempt 5 questions in total at least one question from each section.

Section-A

Fourier Series and Fourier Transforms : Euler's formulae, conditions for a Fourier expansion, change of interval, Fourier expansion of odd and even functions, Fourier expansion of square wave, rectangular wave, saw-toothed wave, half and full rectified wave, half range sine and cosine series.

Fourier integrals, Fourier transforms, Shifting theorem (both on time and frequency axes), Fourier transforms of derivatives, Fourier transforms of integrals, Convolution theorem, Fourier transform of Dirac-delta function.

Section-B

Functions of Complex Variable: Definition, Exponential function, Trigonometric and Hyperbolic functions, 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. Integration of complex functions. Cauchy-Integral theorem and formula.

Section-C

Power series, radius and circle of convergence, Taylor's Maclaurin's and Laurent's series. Zeroes and singularities of complex functions, Residues. Evaluation of real integrals using residues (around unit and semi circle only).

Probability Distributions and Hypothesis Testing: Conditional probability, Bayes theorem and its applications, expected value of a random variable. Properties and application of Binomial, Poisson and Normal distributions.

Section-D

Testing of a hypothesis, tests of significance for large samples, Student's t-distribution (applications only), Chi-square test of goodness of fit.

Linear Programming: Linear programming problems formulation, solving linear programming problems using (i) Graphical method (ii) Simplex method (iii) Dual simplex method.

Course Outcomes

The students will learn:

CO1 - The tool of Fourier series and Fourier Transform for learning advanced Engineering Mathematics.

CO2 - The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.

CO3 - The ideas of probability and random variables and various discrete and continuous probability distributions and their properties.

CO4 - The basic ideas of statistics including various discrete and Continuous probability distributions.

CO5 - The statistical methods of studying data samples.

CO6 - The effective mathematical tools for the solutions of Linear Programming Problem (LPP).

TEXT BOOKS:

1. Engineering Mathematics by Babu Ram (Pearson media Publication)
2. Advanced Engg. Mathematics: F Kreyszig.
3. Higher Engg. Mathematics: B.S. Grewal.

REFERENCE BOOKS :

1. Advance Engg. Mathematics: R.K. Jain, S.R.K.Iyenger.
2. Advanced Engg. Mathematics: Michael D. Greenberg.
3. Operation Research: H.A. Taha.
4. Probability and statistics for Engineers: Johnson. PHI.

HUM-201-F ENGINEERING ECONOMICS

L	T	P
3	1	-

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

NOTE: Examiner will set 9 questions in total, with two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal mark (20 marks). Students have to attempt 5 questions in total at least one question from each section.

Section-A

Definition of Economics - various definitions, Nature of Economic problem, Production possibility curve Economic laws and their nature. Relation between Science, Engineering, Technology and Economics.

Concepts and measurement of utility, Law of Diminishing Marginal Utility, Law of equi-marginal utility - its practical application and importance.

Section-B

Meaning of Demand, Individual and Market demand schedule, Law of demand, shape of demand curve, Elasticity of demand, measurement of elasticity of demand, factors effecting elasticity of demand, practical importance & applications of the concept of elasticity of demand.

Meaning of production and factors of production; Law of variable proportions, Returns to scale, Internal and External economics and diseconomies of scale.

Section-C

Various concepts of cost - Fixed cost, variable cost, average cost, marginal cost, money cost, real cost opportunity cost. Shape of average cost, marginal cost, total cost etc. in short run and long run.

Meaning of Market, Types of Market - Perfect Competition, Monopoly, Oligopoly, Monopolistic Competition (Main features of these markets)

Section-D

Supply and Law of Supply, Role of Demand & Supply in Price Determination and effect of changes in demand and supply on prices.

Nature and characteristics of Indian economy (brief and elementary introduction), Privatization - meaning, merits and demerits. Globalisation of Indian economy - merits and demerits. Elementary Concepts of VAT, WTO, GATT & TRIPS agreement.

COURSE OUTCOMES

Upon successful completion of this course, the student will be able to:

CO1 - explain the basic economic principles of wants, scarcity, choice, opportunity cost, etc as applied to business organizations and engineering firms;

CO2 - understand the role of demand and supply law

CO3 - carry out the cost analysis of a manufactured product;

CO4 - fully understand nature and characteristics of Indian Economy

TEXT BOOKS:

1. Principles of Economics: P.N. Chopra (Kalyani Publishers).
2. Modern Economic Theory – K.K. Dewett (S.Chand)

REFERENCE BOOKS:

1. A Text Book of Economic Theory Stonier and Hague (Longman's Landon)
2. Micro Economic Theory – M.L. Jhingan (S.Chand)
3. Micro Economic Theory - H.L. Ahuja (S.Chand)
4. Modern Micro Economics : S.K. Mishra (Pragati Publications)
5. Economic Theory - A.B.N. Kulkarni & A.B. Kalkundrikar (R.Chand & Co.)
6. Indian Economy: Rudar Dutt & K.P.M. Sundhram

ME-202-F MANUFACTURING TECHNOLOGY-I

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

NOTE: Examiner will set 9 questions in total, with two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal mark (20 marks). Students have to attempt 5 questions in total at least one question from each section.

Section-A

Metal Cutting & Tool Life: Introduction, basic tool geometry, single point tool nomenclature, chips types and their characters tics, mechanics of chips formation, theoretical and experimental determination of shear angle, orthogonal and oblique metal cutting, metal cutting theories, relationship of velocity, forces, and power consumption, cutting speed, feed and depth of cut, coolant, temperature profile in cutting, tool life relationship, tailor equation of tool life, tool material and mechanism

Economics of Metal Machining: Introduction, elements of machining cost, tooling economics, machining, economics and optimization, geometry of twist, drills and power calculation in drills.

Section-B

Metal forming Jigs and Fixtures: Introduction, Metal blow condition, theories of plasticity, conditions of plane strains, friction, conditions in metal working, wire drawing, theory of forging, rolling theory, no slip angle, and foreword slip, types of tools, principles of locations, locating and clamping devices, jigs bushes, drilling jigs, milling fixtures, turning fixtures, boring and broaching fixtures, welding fixtures, different materials, for jigs and fixtures, economics of jigs and fixtures.

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

Section-C

Machine tools: Introduction, constructional features, specialization, operations and devices of basic machine tools such as lathe, shaper, planner, drilling machining, and milling machine, indexing in milling operation, working principles of capstan and turret lathes.

Metal Casting Process: Introduction, Foundry: Introduction to Casting Processes, Basic Steps in Casting Processes. Pattern: Types of Pattern and Allowances. Sand Casting: Sand Properties, Constituents and Preparation. Mould & Core making with assembly and its Types. Gating System. Melting of Metal, Furnaces and Cupola, Metal Pouring, Fettling. Casting Treatment, Inspection and Quality Control, Sand Casting Defects & Remedies.

Section-D

.Welding: Introduction to Welding, Classification of Welding Processes, Gas Welding: Oxy-Acetylene Welding, Resistance Welding; Spot and Seam Welding, Arc Welding: Metal Arc, TIG & MIG Welding, Submerged arc welding (SAW), resistance welding principles, electrode types and selection, thermit welding, electro slag welding, electron beam welding, laser beam welding, forge welding, friction welding, Welding Defects and remedies, brazing & soldering.

Forming Processes: Basic Principle of Hot & Cold Working, Hot & Cold Working Processes, Rolling, Extrusion, Forging, Drawing, Wire Drawing and Spinning. Sheet Metal Operations: Measuring, Layout marking, Shearing, Punching, Blanking, Piercing, Forming, Bending and Joining.

Course Outcome (COs):

At the end of the course, the student shall be able to:

CO 1- Demonstrate the knowledge about different sand moulding and metal casting processes.

CO 2- Understand the plastic deformation of metals under rolling, extrusion, forging and sheet metal working.

CO 3- Acquire knowledge about basic welding processes and their selection for fabrication of different components.

CO 4 - Learn about different gear manufacturing and gear finishing operations.

CO 5- Acquire the basics of powder metallurgy.

TEXT BOOK:

1. Manufacturing Engineering Technology, K. Jain, Pearson Education
2. Manufacturing Technology: Foundry, Forming and Welding by P.N.Rao, TMH.
3. Principles of Manufacturing Materials and Processes, James S.Campbell, TMH.
4. Welding Metallurgy by G.E.Linnert, AWS.
5. Production Engineering Sciences by P.C.Pandey and C.K.Singh, Standard Publishers Ltd.
6. Manufacturing Science by A.Ghosh and A.K.Mallick, Wiley Eastern

ME-204-F KINEMATICS OF MACHINE

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

NOTE: Examiner will set 9 questions in total, with two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal mark (20 marks). Students have to attempt 5 questions in total at least one question from each section.

Section-A

Introduction: mechanism and machines, kinematics links, kinematics pairs, kinematics chains, degree of freedom, Grubler's rule, kinematics inversion, equivalent linkages, four link planar mechanisms, straight line mechanisms, steering mechanisms, pantograph, problems.

Kinematics Analysis of Plane Mechanisms: displacement analysis, velocity diagram, velocity determination, relative velocity method, instantaneous center of velocity, Kennedy's theorem, graphical and analytical methods of velocity and acceleration analysis, problems.

Section-B

Cams: Classification of cams and followers, disc cam nomenclature, construction of displacement, velocity and acceleration diagrams for different types of follower motions, analysis of follower motions, determination of basic dimension, synthesis of cam profile by graphical methods, cams with specified contours, problems.

Gears: fundamental law of gearing, involute spur gears, characteristics of involute and cycloidal action, Interference and undercutting, center distance variation, path of contact, arc of contact, non standard gear teeth, helical, spiral bevel and worm gears, problems.

Section-C

Gear Trains: synthesis of simple, compound and reverted gear trains, analysis of epicylic gear trains, problems.

Kinematics synthesis of Mechanisms: function generation, path generation, Freudenstein's equation, two and three position synthesis of four bar and slider crank mechanisms by graphical and analytical methods, , precision positions, structural error; Chebychev spacing, transmission angle, problems.

Section-D

Friction : Types of friction, laws of friction, motion along inclined plane, screw threads, efficiency on inclined plane, friction in journal bearing, friction circle and friction axis, pivots and collar friction, uniform pressure and uniform wear.

Belts and pulleys: Open and cross belt drive, velocity ratio, slip, material for belts, crowning of pulleys, law of belting, types of pulleys, length of belts, ratio of tension, centrifugal tension, power transmitted by belts and ropes, initial tension, creep, chain drives, chain length, classification of chains.

Course Outcomes

Students would be able

CO1 - To understand about the applications of mechanism and machines.

CO2 - To understand about the basics Cams and Friction

CO3 - Students get familiarity about power transmitted with Belts and pulleys and also Gears and Gear Trains.

CO4 - Students having familiarization with calculate Kinematics Analysis of Plane Mechanisms

CO5 - Students would be able to know the Kinematics synthesis of Mechanisms.

TEXT BOOKS:

1. Theory of Mechanisms and Machines: Amitabha Ghosh and Ashok kumar Malik, Third Edition Affiliated East-West Press.
2. Theory of Machines and Mechanisms: Joseph Edward Shigley and John Joseph Uicker, Jr. Second Edition, MGH, New York.

REFERENCE BOOKS:

1. Mechanism and Machine Theory : J.S. Rao and R.V. Dukkipati Second Edition New age International.
2. Theory and Machines: S.S. Rattan, Tata McGraw Hill.

ME-206-F STRENGTH OF MATERIALS–I

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

NOTE: Examiner will set 9 questions in total, with two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal mark (20 marks). Students have to attempt 5 questions in total at least one question from each section.

Section-A

Simple Stresses & Strains: Concept & types of Stresses and strains, Poison'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.

Section-B

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 contra-flexure 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.

Section-C

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 combined bending, torsion & axial loading of beams. Numericals.

Columns & Struts: Column under axial load, concept of instability and buckling, slenderness ratio, derivation of Euler's 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.

Section-D

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.

Course Outcomes

CO1 - Students would be able to understand various types of strength of materials like tensile strength, compressive strength, bending and torsional etc and their application in different fields.

CO2 - Students get familiarity about power transmitted with hollow and solid shaft.

CO3 - Students would be able to know the significance of drawing shear force and bending moment diagram.

CO4 - Students having familiarization with stresses & buckling of column and strut.

TEXT BOOKS:

1. Strength of Materials – G.H.Ryder - Macmillan, India
2. Strength of Materials– Andrew Pytel and Fredinand L.Singer, Addison – Wesley

REFERENCE BOOKS:

1. Strength of Materials – Popov, PHI, New Delhi.
2. Strength of Materials A Rudimentary Apprach – M.A. Jayaram, Sapna Book House, Bangalore

ME-208-F FLUID MECHANICS

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

NOTE: Examiner will set 9 questions in total, with two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal mark (20 marks). Students have to attempt 5 questions in total at least one question from each section.

Section-A

Fluid Properties and Fluid Statics: Concept of fluid and flow, ideal and real fluids, continuum concept, and 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.

Section-B

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.

Compressible Fluid Flow: Introduction, continuity momentum and energy equation, sonic velocity, propagation of elastic waves due to compression of fluid, propagation of elastic waves due to disturbance in fluid, stagnation properties, isentropic flow, effect of area variation on flow properties, isentropic flow through nozzles,diffusers,injectors,Problems.

Section-C

Viscous Flow: Flow regimes and Reynolds'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.

Section-D

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.

Course Outcomes (COs):

At the end of the course, the student shall be able to:

CO 1- Expedite the properties of fluid along with pressure measurement techniques and concept of stability.

CO 2- Understand the characteristics of fluid and application of continuity and Bernoulli's

equation.
CO 3- Conceptualisation of boundary layer, laminar and turbulent flow.
CO 4- Analyse flows through pipes and open channels.

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

ME-210-F STEAM & POWER GENERATION

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

NOTE: Examiner will set 9 questions in total, with two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal mark (20 marks). Students have to attempt 5 questions in total at least one question from each section.

Section-A

Introduction: Components of Steam Power System, Carnot Cycle, Rankine Cycle, Modified Rankine Cycle, p-v , h-s and T-s diagram for Rankine and Modified Rankine Cycle, Mollier's diagram, use of steam table, Problem

Steam Generators: Purpose, Classification of boilers, Fire tube and water tube boilers, Mountings and accessories, description of Lancashire, Locomotive, Babcock Wilcox boilers, draught, design of natural draught chimney, artificial draught, mechanical draught, efficiency of boiler and heat balance.

Section-B

Steam Nozzles: Function of steam nozzles, shape of nozzles for subsonic and supersonic flow of steam, Steady state energy equation, continuity equation, nozzle efficiency, critical pressure ratio for max. Discharge, design of steam nozzle, problems.

Steam Engine: Working of steam engine, single acting and double acting steam engine, compounding of steam engine, ideal and actual indicator diagram, mean effective pressure, diagram factor, mechanical efficiency, thermal efficiency of steam engine.

Section-C

Steam Turbine: Classification of steam turbine, impulse turbine, working principle, compounding of impulse turbine, velocity diagram, power output and efficiency of a single stage impulse turbine, reaction turbine, working principle, degree of reaction, velocity diagram, power output, efficiency, condition for max. Efficiency, governing of steam turbines, problem.

Improved Turbines: Back pressure and pass out turbines, Regenerative feed heating cycle, Binary vapour cycle.

Section-D

Steam Condensers: Classification of condensers, sources of air leakage in condensers, effect of air leakage in condenser, vacuum efficiency, condenser efficiency, air pumps, cooling water calculation, and problem.

Fuel and Combustion: Classification of fuels – solid, liquid and gaseous fuels, calorific values of fuels, stochiometric air fuel ratio, excess air requirement, analysis of exhaust gases, problem.

Course Outcomes

CO1 - Students will be able to understand the role of power plant in generation of electricity.

CO2 - Students will get understanding of working and design of different power plant parts.

CO3 - Students will endow with different types of fuel used and their importance accordingly.

CO4 - After all, students with theoretical and practical study of the subject will be able to work in power plant for better INDIA.

RECOMMENDED BOOKS:-

1. Thermodynamics and Heat Engines Vol II – R. Yadav, Central Publishing House
2. Heat Engineering – V.P.Vasandani and D.S.Kumar, Metropolitan Book Co. Pvt. Ltd.
3. I.C.Engines - M.L.Mathur and Sharma Dhanpat Rai & Sons
4. Thermal Engineering - P.L.Balaney Khanna Publisher

ME-212-F KINEMATICS OF MACHINES LAB

L	T	P
-	-	2

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

List of Experiments:

1. To study various types of Kinematic links, pairs, chains and Mechanisms.
2. To study inversions of 4 Bar Mechanisms, Single and double slider crank mechanisms.
3. To plot slider displacement, velocity and acceleration against crank rotation for single slider crank mechanism.
4. To find coefficient of friction between belt and pulley.
5. To study various type of cam and follower arrangements.
6. To plot follower displacement vs cam rotation for various Cam Follower systems.
7. To generate spur gear involute tooth profile using simulated gear shaping process.
8. To study various types of gears – Helical, cross helical worm, bevel gear.
9. To study various types of gear trains – simple, compound, reverted, epicyclic and differential.
10. To find co-efficient of friction between belt and pulley.
11. To study the working of Screw Jack and determine its efficiency.
12. Create various types of linkage mechanism in CAD and simulate for motion outputs and study the relevant effects.
13. Creation of various joints like revolute, planes, spherical, cam follower and study the degree of freedom and motion patterns available.
14. To design a cam profile by using the requirement graph using on-line engineering handbook and verify the same using a 3D mechanism on CAD.

Course Outcomes (COs):

After studying this course, students will be able:

CO 1- Understand the various practical demonstrations of mechanism.
CO 2- Knowledge of Motions in mechanism with practical demonstration.
CO 3- Learning the Special purpose machine members used in designing of a machine.
CO 4- Synthesis of working model using the various linkages.

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. However these experiments should include experiments at Sr. No. 12, 13 and 14. Remaining two experiments may either be performed from the above list or as designed & set by the concerned institution as per the scope of the syllabus.

ME- 214-F STRENGTH OF MATERIAL-I LAB

L	T	P		
-	-	2	Sessional	: 25Marks
			Theory	: 25 Marks
			Total	: 50Marks
			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 Gear of Single, Double and Triple start.
13. To determine Mechanical Advantage, Efficiency of Simple and Compound Screw Jack.
14. To find Moment of Inertia of a Fly Wheel.

Course Outcomes (COs): At the end of the course, the student shall be able to:
CO 1- Learn the principles of mechanics of solid and engineering.
CO 2- Preparation of formal laboratory reports describing the results of experiments.
CO 3- Acquire to operate basic instruments in mechanics of materials lab.
CO 4- Able to understand the concepts of stress, strain of materials and ability to interpret the
data from the experiments.

Note:

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

4. **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.**

ME-216-F FLUID MECHANICS LAB

L	T	P
-	-	2

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.
12. To verify the momentum equation.

Course Outcomes (COs):

At the end of the course, the student shall be able to:

CO 1- Understand the techniques and concept of stability.

CO 2- Learning continuity and Bernoulli's equation.

CO 3- Analyse discharge measuring devices and hydraulic coefficients.

CO 4- Knowledge of different types of pipe losses and determine the velocity profile in a pipe.

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.**

ME-218-FSTEAM & POWER GENERATION LAB

L	T	P
-	-	2

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

List of Experiments:

1. To study low pressure boilers and their accessories and mountings.
2. To study high pressure boilers and their accessories and mountings.
3. To prepare heat balance sheet for given boiler.
4. To study the working of impulse and reaction steam turbines.
5. To find dryness fraction of steam by separating and throttling calorimeter.
6. To find power out put & efficiency of a steam turbine.
7. To find the condenser efficiencies.
8. To study and find volumetric efficiency of a reciprocating air compressor.
9. To study cooling tower and find its efficiency.
10. To find calorific value of a sample of fuel using Bomb calorimeter.
11. Calibration of Thermometers and pressure gauges.

Course Outcome (COs): At the end of the course, the student shall have practical exposure of:
CO 1- vapour power cycles and find and compare different cycles based on their performance parameters and efficiencies.
CO 2- steam boilers, their types and components.
CO 3- fundamentals of flow of steam through a nozzle.
CO 4- steam turbines and can calculate their work done and efficiencies.
CO 5- types and working of condensers and compressors and
define their different types of efficiencies

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.**

GP-202-F GENERAL PROFICIENCY
(Common to CSE,IT,ECE,EE,E&I,I&C,EEE,CE,BM)

L	T	P
-	-	2

Sessional : 50 Marks
Total : 50 Marks
Duration of Exam: 3 Hrs

- Quiz & Aptitude,
- Comprehension,
- Communication for Specifics,
- Let's speak,
- Composition Skills –Formal Letter Writing based on the trends in practice in corporate culture.
- Training on etiquettes & manners should be carried further and be observed during the general classes
- Ethics in Engineering

Course Outcomes

CO1 - Student will be try to perform well not only for academic performance.

CO2 – Student will be able to participate in activities like games and other extracurricular activities

CO3 – Student will be able to write technical paper, presentation and participate in competitions.

MAHARSHI DAYANAND UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATIONS
B.Tech. 3rd YEAR MECHANICAL ENGINEERING, SEMESTER- V
Proposed "F" Scheme effective from 2011-12

Course	Course Title	Teaching schedule				Marks For class work	Marks for Examination		Total Marks	Duration of Exam
		L	T	P	Total		Theory	Practical		
ME-301-F	Dynamics Of Machines	3	1	-	4	50	100	-	150	3
ME-303-F	Mechanical Machine Design-1	3	2	-	5	50	100	-	150	4
ME-305-F	Fluid Machine	3	1	-	4	50	100	-	150	3
ME-307-F	Internal Combustion Engines & Gas Turbines	3	1	-	4	50	100	-	150	3
ME-309-F	Manufacturing Technology –II	3	1	-	4	50	100	-	150	3
ME-311-F	Applied Numerical Technique & Computing	3	-	-	3	50	100	-	150	3
ME-313-F	Dynamics Of Mechanics Lab	-	-	2	2	25	-	25	50	3
ME-315-F	Fluid Machine Lab	-	-	2	2	25	-	25	50	3
ME-317-F	Internal Combustion Engines & Gas Turbines Lab	-	-	2	2	25	-	25	50	3
ME-319-F	Manufacturing Technology –II Lab	-	-	2	2	25	-	25	50	3
ME-321-F	Applied Numerical Technique & Computing Lab	-	-	2	2	50	-	-	50	-
ME-323-F	Practical Training Viva-Voce	-	-	2	2	-	-	-	-	-
	Total	18	6	12	36	450	600	100	1150	

Note:

4. Students will be allowed to use non-programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
5. Assessment of Practical Training-I, undergone at the end of IV semester, will be based on seminar, viva-voce, report and certificate of practical training obtained by the student from the industry. According to performance letter grades A, B, C, F are to be awarded. A student who is awarded 'F' grade is required to repeat Practical Training.

ME- 301 F DYNAMICS OF MACHINES

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

Note: Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

Section A

Static and Dynamic Force Analysis : Static force analysis of planer mechanisms, dynamic force analysis including inertia and frictional forces of planer mechanisms.

Dynamics of Reciprocating Engines : engine types, indicator diagrams, gas forces, equivalent masses, inertia forces, bearing loads in a single cylinder engine, crankshaft torque, engine shaking forces.

Section B

Balancing of Rotating Components : static balance, dynamic balance, balancing of rotating masses, two plane balancing, graphical and analytical methods, balancing of rotors, balancing machines, field balancing.

Balancing of Reciprocating Parts : Balancing of single cylinder engine, balancing of multi cylinder; inline, radial and V type engines, firing order.

Section C

Governors : introduction, types of governors, characteristics of centrifugal governors, gravity controlled and spring controlled centrifugal governors, hunting of centrifugal governors, inertia governors.

Dynamometers : types of dynamometers, Prony brake, rope brake and band brake dynamometers, belt transmission dynamometer, torsion dynamometer, hydraulic dynamometer.

Section D

Gyroscope : gyroscopes, gyroscopic forces and couples, gyroscopic stabilization, ship stabilization, stability of four wheel and two wheel vehicles moving on curved paths.

Course Outcomes (COs):

At the end of the course, the student shall be able to:

CO 1- Understand the Static and Inertia Force Analysis.
CO 2- Explore the concept of Balalncing of rotating and reciprocating masses.
CO 3- Knowledge of concept of Mechanical Governor.
CO 4- Develop the concept of Gyroscope and its application.
CO 5- explore the concept of Mechanical Vibrartion.

Text Books:

5. Theory of Mechanisms and Machines: Amitabha Ghosh and Ashok kumar Mallik, Third Edition Affiliated East-West Press.
6. Theory of Machine: S.S. Rattan, McGraw Hill Higher Education.

Reference Books:

1. Mechanism and Machine Theory: J.S. Rao and R.V. Dukkipati, New age International.
3. Theory of Machines and Mechanisms: Joseph Edward Shigley and John Joseph Uicker, Jr. Second Edition Mc Graw Hill, Inc

ME- 303 F MECHANICAL MACHINE DESIGN -I

L	T	P	Sessional	: 50 Marks
3	2	-	Theory	: 100 Marks
			Total	: 150 Marks
			Duration of Exam	: 4 hrs.

Note: 1. Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

2. The paper setter will be required to mention in the note of the question paper that the use of following Design Data book is permitted:

7. Design Data Handbook (In SI and Metric Units) for Mechanical Engineers by Mahadevan
8. Design Data Book PSG College of Technology Coimbatore

Section A

Design Philosophy: Problem identification- problem statement, specifications, constraints, Feasibility study- technical feasibility, economic & financial feasibility, societal & environmental feasibility, Generation of solution field (solution variants), Brain storming, Preliminary design, Selection of best possible solution, Detailed design, Selection of Fits and tolerances and analysis of dimensional chains.

Selection of Materials: Classification of Engg. Materials, Mechanical properties of the commonly used engg. Materials, hardness, strength parameters with reference to stress-strain diagram, Factor of safety.

Section B

Mechanical Joints: ISO Metric Screw Threads, Bolted joints in tension, Eccentrically loaded bolted joints in shear and under combined stresses, Design of power screws, Design of various types of welding joints under different static load conditions.

Riveted Joints, Cotter & Knuckle Joints: Design of various types of riveted joints under different static loading conditions, eccentrically loaded riveted joints, design of cotter and knuckle joints.

Section C

Belt rope and chain drives: Design of belt drives, Flat & V-belt drives, Condition for Transmission of max. Power, Selection of belt, design of rope drives, design of chain drives with sprockets.

Keys, Couplings & Flywheel: Design of Keys – Flat, Kennedy Keys, Splines, Couplings design – Rigid & Flexible coupling, turning Moment diagram, coefficient of fluctuation of energy and speed, design of flywheel – solid disk & rimmed flywheels.

Section D

Clutches: Various types of clutches in use, Design of friction clutches – Disc. Multidisc, Cone & Centrifugal, Torque transmitting capacity.

Brakes: Various types of Brakes, Self energizing condition of brakes, Design of shoe brakes – Internal & external expanding, band brakes, Thermal Considerations in brake designing.

Course Outcomes:

At the end of the course, the student shall be able to:

CO 1- Exploration of different concepts & considerations of machine design.
CO 2- Understanding design of different types of mechanical joints.
CO 3- Learning of design of different types of keys & couplings.
CO 4- Design procedure of transmission of shafts.
CO 5- Design of different types springs.

Text Books:

3. Mechanical Engg. Design - First Metric Editions: Joseph Edward Shigley-MGH, New York.

4. Design of Machine Elements – V.B. Bhandari – Tata McGraw Hill, New Delhi.
5. PSG Design Data Book

Reference Books :

6. Engineering design – George Dieter, MGH, New York.
7. Product Design and Manufacturing , A.K.Chitale and R.C.Gupta, PHI.
8. Machine Design An Integrated Approach: Robert L.Norton, Addison Wesley.
9. Machine Design : S.G. Kulkarini - Tata MacGraw Hill.
10. Design of machine elements-C S Sharma, Kamlesh Purohit, PHI.

ME- 305 F FLUID MACHINES

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

Note: Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

Section A

Impact of free jets: Impulse – momentum principle, jet impingement - on a stationary flat plate, inclined plate and a hinged plate, at the center of a stationary vane, on a moving flat plate, inclined plate, a moving vane and a series of vanes, Jet striking tangentially at the tip of a stationary vane and moving vane(s), jet propulsion of ships. Problems

Impulse Turbines: Classification – impulse and reaction turbines, water wheels, component parts, construction, operation and governing mechanism of a Pelton wheel, work done, effective head, available head and efficiency of a Pelton wheel, design aspects, speed ratio, flow ratio, jet ratio, number of jets, number of buckets and working proportions, Performance Characteristics, governing of impulse turbines. Problems

Section B

Francis Turbines: Component parts, construction and operation of a Francis turbine, governing mechanism, work done by the turbine runner, working proportions and design parameters, slow, medium and fast runners, degree of reaction, inward/outward flow reaction turbines, Performance Characteristics, Problems.

Propeller and Kaplan turbines: Component parts, construction and operation of a Propeller, Kaplan turbine, differences between the Francis and Kaplan turbines, draft tube - its function and different forms, Performance Characteristics, Governing of reaction turbine, Introduction to new types of turbine, Deriaz (Diagonal), Bulb, Tubular turbines, Problems.

Section C

Dimensional Analysis and Model Similitude: Dimensional homogeneity, Rayleigh's method and Buckingham's π-theorem, model studies and similitude, dimensionless numbers and their significance. Unit quantities, specific speed and model relationships for turbines, scale effect, cavitations – its causes, harmful effects and prevention, Thomas cavitation factor, permissible installation height, Problems.

Centrifugal Pumps: Classification, velocity vector diagrams and work done, manometric efficiency, vane shape, head capacity relationship and pump losses, pressure rise in impeller, minimum starting speed, design considerations, multi-stage pumps. Similarity relations and specific speed, net positive suction head, cavitation and maximum suction lift, performance characteristics. Brief introduction to axial flow, mixed flow and submersible pumps, Problems.

Section D

Reciprocating Pumps: Construction and operational details, discharge coefficient, volumetric efficiency and slip, work and power input, effect of acceleration and friction on indicator diagram (pressure – stroke length plot), separation, air vessels and their utility, rate of flow into or from the air vessel, maximum speed of the rotating crank, characteristic curves, centrifugal vs reciprocating pumps, brief introduction to screw, gear, vane and radial piston pumps, Problems.

Hydraulic systems: Function, construction and operation of Hydraulic accumulator, hydraulic intensifier, hydraulic crane, hydraulic lift and hydraulic press, Fluid coupling and torque converter, Hydraulic ram, Problems.

Course Outcomes (COs):

At the end of the course, the student shall be able to:

CO 1- Application of momentum equation and its application.

CO 2- Understand the construction, working principle and design analysis of hydraulic turbines.

CO 3- Expedite construction, working principle and design analysis of pumps.

CO 4- Knowledge of the design of a prototype on the basis of dimensional analysis.

Text Books :

3. Hydraulics & Fluid Mechanics – Modi & Seth, Pub. - Standard Book House, N.Delhi
4. Hydraulic Machines – Jagdish Lal, Metropolitan

Reference Books :

5. Fluid Mechanics and Hydraulic Machines – S S Rattan, Khanna Publishers
6. Introduction to Fluid Mechanics and Fluid Machines – S K Som and G Biswas, Tata McGraw Hill
7. Fluid Mechanics and Fluid Power Engineering – D S Kumar, S K Kataria and Sons

ME- 307 F INTERNAL COMBUSTION ENGINES & GAS TURBINES

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

Note: Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

Section A

Air Standard Cycles: Internal and external combustion engines; classification of I.C. Engines, Cycles of operation in four stroke and two stroke I.C. Engines, Wankel Engines, Assumptions made in air standard cycle; Otto cycle; diesel cycle, dual combustion cycle, comparison of Otto, diesel and dual combustion cycles; sterling and Ericsson cycles; air standard efficiency, specific work output, specific weight; work ratio; mean effective pressure; deviation of actual engine cycle from ideal cycle. Problems.

Carburetion, fuel Injection and Ignition systems: Mixture requirements for various operating conditions in S.I. Engines; elementary carburetor, Requirements of a diesel injection system; types of inject systems; petrol injection, Requirements of ignition system; types of ignition systems ignition timing; spark plugs. Problems.

Section B

Combustion in I.C. Engines : S.I. engines; Ignition limits; stages of combustion in S.I. Engines; Ignition lag; velocity of flame propagation; detonation; effects of engine variables on detonation; theories of detonation; octane rating of fuels; pre-ignition; S.I. engine combustion chambers, Stages of combustion in C.I. Engines; delay period; variables affecting delay period; knock in C.I. engines, Cetane rating; C.I. engine combustion chambers. Lubrication and Cooling Systems: Functions of a lubricating system, Types of lubrication system; mist, wet sump and dry sump systems; properties of lubricating oil; SAE rating of lubricants, engine performance and lubrication, Necessity of engine cooling; disadvantages of overcooling; cooling systems; air-cooling, water cooling; radiators.

Section C

Engine Testing and Performance: Performance parameters: BHP, IHP, mechanical efficiency, brake mean effective pressure and indicative mean effective pressure, torque, volumetric efficiency; specific fuel consumption (BSFC, ISFC), thermal efficiency; heat balance; Basic engine measurements; fuel and air consumption, brake power, indicated power and friction power, heat lost to coolant and exhaust gases; performance curves. Problems. Air pollution from I.C. Engine and Its remedies: 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.

Section D

Rotary Compressors: Root and vane blowers; Static and total head values; Centrifugal compressors- Velocity diagrams, slip factor, ratio of compression, pressure coefficient, pre-whirl; Axial flow compressor- Degree of reaction, polytropic efficincy, surging, choking and stalling, performance characteristics, Problems.

Gas Turbines: Brayton cycle; Components of a gas turbine plant; open and closed types of gas turbine plants; Optimum pressure ratio; Improvements of the basic gas turbine cycle; multi stage compression with inter-cooling; multi stage expansion with reheating between stages; exhaust gas heat exchanger, Applications of gas turbines. Problems.

Course Outcomes (COs):

At the end of the course, the student shall be able to:

CO 1- Understand the Air Standard Cycles with their applications.
CO 2- Analyze carburetion, injection and ignition systems with new technologies.
CO 3- Conceptualize Combustion System of IC Engines.
CO 4- Knowledge of Lubrication and Cooling systems and fuel cells.
CO 5- Analyses the gas turbines.

Text Books:

1. Internal Combustion Engines –V. Ganesan, Pub.-Tata McGraw-Hill. 2.Gas Turbines - V. Ganesan, Pub.- Tata McGraw Hill.

3. Engineering fundamental of the I.C.Engine – Willard W. Pulkrabek Pub.-PHI,India

Reference Books:

1. Internal Combustion Engines & Air pollution- Obert E.F, Pub.-Hopper & Row Pub., New York 2.Internal Combustion Engines Fundamentals- John B. Heywood, Pub.-McGraw Hill, New York 3. Fundamentals of Internal Combustion Engines-H.N. Gupta, PHI, New Delhi

ME- 309 F MANUFACTURING TECHNOLOGY –II

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

Note: Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

Section A

Mechanism of Metal Cutting: Deformation of metal during machining, nomenclature of lathe, milling tools, mechanics of chip formation, built-up edges, mechanics of orthogonal and oblique cutting, Merchant cutting force circle and shear angle relationship in orthogonal cutting, factors affecting tool forces. Cutting speed, feed and depth of cut, surface finish. Temperature distribution at tool chip interface. Numerical on cutting forces and Merchant circle.

Cutting Tool Materials & Cutting Fluids: Characteristics of tool materials, various types of cutting tool materials, coated tools, cutting tool selection, Types of tool wear, tool life, factors governing tool life, Purpose and types of cutting fluids, basic actions of cutting fluids, effect of cutting fluid on tool life, selections of cutting fluid.

Section B

Unconventional Machining Processes: Abrasive jet machining: Principles, applications, process parameters. Ultrasonic machining: Principles, applications, analysis of process parameters. Electro-chemical machining and grinding: Principles, classifications, choice of electrolytes, applications. Electric discharge machining: Principles, selection of tools materials and dielectric fluid. Electron beam machining: Generation of electron beam, relative merits and demerits. Laser beam machining: Principles and applications.

Jigs & Fixtures: Introduction, location and location devices, clamping and clamping devises, Drill Jigs, Milling Fixtures.

Section C

Numerical Control of Machine Tools; Introduction, Numerical Control & its growth, NC Machines tools, Axes of NC Machines, Classification of NC System, CNC, DNC and Machining Centre. Machine Control unit, NC tools & Tool changer.

Manual Part Programming; coordinate, Feed, Speed & Tool, Preparation & Miscellaneous functions, Examples of two axes part programming for Turning and Milling Operations.

Section D

Group Technology; Definition and concept, Group and Family, working of group technology, Stages for Adopting Group Technology, Advantages of Group Technology.

Component Classification and Coding, Personnel and Group Technology, Planning the introduction of Group Technology, Group Technology layout.

Course Objectives (COs):

At the end of the course, the student shall be able to:

CO 1- Acquire knowledge about mechanics of chip formation and to identify the factors related to tool wear and machinability.

CO 2- Learn about different gear manufacturing and gear finishing operations.

CO 3- Select the proper cutting tool material and components of jigs and fixtures.

CO 4- Understand the basics principles of non-conventional machining processes and their applications.

CO 5- Identify and select different measuring instruments for the inspection of different components.

Text Books

4. Manufacturing Technology – Vol. - 2, P.N. Rao, T.M.H, New Delhi
5. Computer Aided Manufacturing: S Kumar & B Kant Khan, Satya Prakashan, New Delhi

Reference Books

3. Principles of Machine Tools – G.C. Sen & A. Bhattacharya, Tata McGraw Hill, New Delhi
4. Manufacturing Engg.& Tech, Kalpakian, Serope Addison -Wisly Publishing Co. New York.
5. Modern Machining Processes: P.C. Pandey & H.S. Shan, T.M.H. Company, New Delhi
6. Text Book of Production Engineering: P.C. Sharma, S.Chand & Sons.
7. Production Engineering by KC Jain & AK Chilate, PHI, New Delhi

ME – 311 F APPLIED NUMERICAL TECHNIQUES AND COMPUTING

L	T	P
3	-	-

Sessional marks	:	50
Theory marks	:	100
Total marks	:	150
Duration of exam	:	3 hrs

Note: Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

Section A

ERRORS IN NUMERICAL CALCULATIONS Introduction, Numbers and their accuracy, Absolute, relative and percentage errors and their analysis, General error formula.

INTERPOLATION AND CURVE FITTING Taylor series and calculation of functions, Introduction to interpolation, Lagrange approximation, Newton Polynomials, Chebyshev Polynomials, Least squares line, curve fitting, Interpolation by spline functions.

Section B

NUMERICAL DIFFERENTIATION AND INTEGRATION Approximating the derivative, Numerical differentiation formulas, Introduction to Numerical quadrature, Newton-Cotes formula, Gaussion Quadrature.

SOLUTION OF NONLINEAR EQUATIONS Bracketing methods for locating a root, Initial approximations and convergence criteria, Newton- Raphson and Secant methods, Solution of problems through a structural programming language such as C or Pascal.

Section C

SOLUTION OF LINEAR SYSTEMS Direct Methods, Gaussian elimination and pivoting, Matrix inversion, UV factorization, Iterative methods for linear systems, Solution of problems through a structured programming language such as C or Pascal.

EIGEN VALUE PROBLEMS Jacobi, Given's and Householder's methods for symmetric matrices, Rutishauser method for general matrices, Power and inverse power methods.

Section D

SOLUTION OF DIFFERENTIAL EQUATIONS Introduction to differential equations, Initial value problems, Euler's methods, Heun's method, Runge-Kutta methods, Taylor series method, Predictor-Corrector methods, Systems of differential equations, Boundary valve problems, Finite-difference method, Solution of problems through a structured programming language such as C or Pascal.

PARTIAL DIFFERENTIAL EQUATIONS, EIGENVALUES AND EIGENVECTORS Solution of hyperbolic, parabolic and elliptic equations, The eigenvalue problem, The power method and the Jacobi's method for eigen value problems, Solution of problems through a structural programming language such as C or Pascal.

Course Outcomes (COs):

At the end of the course, the student shall be able to:

CO 1 – Analyses of Numerical solution of partial differential equations.
CO 2 – Solution to the linear simultaneous equations.
CO 3 – Expedite Numerical solution of ordinary differential equations.
CO 4 – Conceptualizations of optimization.

Text Books:

5. Numerical Methods for Mathematics, Science and Engineering by John H.Mathews, PHI New Delhi.
6. Applied Numerical Methods – Carnahan, B.H., Luthar, H.A. and Wilkes, J.O., Pub.- J. Wiley, New York

Reference Books:

4. Numerical Solution of Differential Equations, by M.K. Jain, Published by Wiley Eastern, New York.
5. Introductory Methods of Numerical Analysis by S.D. Sastry, Published by Prentice Hall of India.
6. Numerical Methods – Hornbeck, R.W. , Pub.- Prentice Hall, Englewood Cliffs, N.J.

ME- 313 F DYNAMICS OF MACHINE LAB

L	T	P
-	-	2

Sessional : 25 Marks
Practical : 25 Marks
Total : 50Marks
Duration of Exam : 3 hrs.

List of Experiments :

9. To perform experiment on Watt and Porter Governors to prepare performance characteristic Curves, and to find stability & sensitivity.

10. To perform experiment on Proell Governor to prepare performance characteristic curves, and to find stability & sensitivity.

11. To perform experiment on Hartnell Governor to prepare performance characteristic Curves, and to find stability & sensitivity.

12. To study gyroscopic effects through models.

13. To determine gyroscopic couple on Motorized Gyroscope.

14. To perform the experiment for static balancing on static balancing machine.

15. To perform the experiment for dynamic balancing on dynamic balancing machine.

16. Determine the moment of inertial of connecting rod by compound pendulum method and tri-flair suspension pendulum.

Course Outcomes:

At the end of the course, the student shall be able to:

CO 1- Understand the various practical demonstrations of forces in mechanism.

CO 2- Knowledge of various Design features of mechanism with practical demonstration.

CO 3- Learning the Special purpose mechanism (governor, Gyroscope Cam and followers etc) used in designing of a machine

CO 4- Prepare practical model using the various linkages.

Note : 1. Ten experiments are to be performed in the Semester.

2. At least seven experiments should be performed from the above list. Remaining three experiments should be performed as designed & set by the concerned Institution as per the scope of the syllabus.

ME- 315 F FLUID MACHINES LAB.

L	T	P
-	-	2

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

List of Experiments :

1. To study the constructional details of a Pelton turbine and draw its fluid flow circuit.

3. To draw the following performance characteristics of Pelton turbine-constant head, constant-speed and constant efficiency curves.

11. To study the constructional details of a Francis turbine and draw its fluid flow circuit.

3. To draw the constant head, constant speed and constant efficiency performance characteristics of Francis turbine.

4. To study the construction details of a Kaplan turbine and draw its fluid flow circuit.

5. To draw the constant head, speed and efficiency curves for a Kaplan turbine.

6. To study the constructional details of a Centrifugal Pump and draw its characteristic curves.

To study the constructional details of a Reciprocating Pump and draw its characteristics curves.

9. To study the construction details of a Gear oil pump and its performance curves.

10. To study the constructional details of a Hydraulic Ram and determine its various efficiencies..

11. To study the constructional details of a Centrifugal compressor.

12. To study the model of Hydro power plant and draw its layout.

Course Outcomes (COs):

At the end of the course, the student shall be able to:

CO 1- Understand the concept of momentum equation.
CO 2- Knowledge of construction, working principle and performance of hydraulic turbines.
CO 3- Learn construction, working principle and performance of pumps.
CO4- Explore construction, working principle and performance of hydraulic ram.

NOTE : 1. At least ten experiments are to be performed in the Semester.

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

ME- 317 F I.C. ENGINES & GAS TURBINES LAB

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

List of Experiments :

1. To study the constructional details & working principles of two-stroke/ four stroke petrol engine.
2. To study the constructional detail & working of two-stroke/ four stroke diesel engine.
3. Analysis of exhaust gases from single cylinder/multi cylinder diesel/petrol engine by Orsat Apparatus.
4. To prepare heat balance sheet on multi-cylinder diesel engine/petrol engine.
5. To find the indicated horse power (IHP) on multi-cylinder petrol engine/diesel engine by Morse Test.
6. To prepare variable speed performance test of a multi-cylinder/single cylinder petrol engine/diesel engine and prepare the curves (i) bhp, ihp,fhp, vs speed (ii) volumetric efficiency & indicated specific specific fuel consumption vs speed.
7. To find fhp of a multi-cylinder diesel engine/petrol engine by Willian's line method & by motoring method.
8. To perform constant speed performance test on a single cylinder/multi-cylinder diesel engine & draw curves of (i) bhp vs fuel rate, air rate and A/F and (ii) bhp vs mep, mech efficiency & sfc.
9. To measure CO & Hydrocarbons in the exhaust of 2- stroke / 4-stroke petrol engine.
10. To find intensity of smoke from a single cylinder / multi-cylinder diesel engine.
11. To draw the scavenging characteristic curves of single cylinder petrol engine.
12. To study the effects of secondary air flow on bhp, sfc, Mech. Efficiency & emission of a two-stroke petrol engine.

Course Outcomes (COs):

After studying this course, students will be able:

CO 1- Understand the how to prepare the graph between bhp, ihp, fhp vs speed by using variable compression test rig.

CO 2- Knowledge of functions of 4 stroke and two stroke engines.

CO 3- Learn Combustion System of IC Engines with Lubrication and Cooling system.

CO 4- Familiarization of the pollution control system.

NOTE:

1. **At least ten experiments are to be performed in the Semester.**
2. **At least seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per**

the scope of the syllabus.

ME- 319 F MANUFACTURING TECHNOLOGY –II LAB.

L	T	P
-	-	2

Sessional marks : 25
Practical marks : 25
Total marks : 50
Duration of exam : 3 hrs

List of Experiments:

1 Study and Practice of Orthogonal & Oblique Cutting on a Lathe.

2 Machining time calculation and comparison with actual machining time while cylindrical turning on a Lathe and finding out cutting efficiency.

3 Study of Tool Life while Milling a component on the Milling Machine.

4 Study of Tool Wear of a cutting tool while Drilling on a Drilling Machine.

5 Study of Speed, Feed, Tool, Preparatory (Geometric) and Miscellaneous functions for N. C part programming.

6 Part Programming and proving on a NC lathe for:-

a. Outside Turning
b. Facing and Step Turning
c. Taper Turning
d. Drilling
e. Outside Threading

7 Part Programming and Proving on a NC Milling Machine:-

a. Point to Point Programming
b. Absolute Programming
c. Incremental Programming

8 Part Programming and Proving for Milling a Rectangular Slot.

Course Outcome (COs): At the end of the course, the student shall have practical exposure of:
CO 1- vapour power cycles and find and compare different cycles based on their performance parameters and efficiencies.
CO 2- steam boilers, their types and components.
CO 3- fundamentals of flow of steam through a nozzle.
CO 4- steam turbines and can calculate their work done and efficiencies.
CO 5- types and working of condensers and compressors and
define their different types of efficiencies

ME- 321 F APPLIED NUMERICAL TECHNIQUES AND COMPUTING LAB.

L	T	P
-	-	2

Sessional marks : 50
Practical marks : -
Total marks : -
Duration of exam : 2 hrs

The students will be required to carry out the following exercises, that are based on the theory course ME-311 Numerical Methods and Computing, with the help of MATLAB software / Pascal / C / C++ on personal computer.

1. Solution of Non-linear equation in single variable using the method of successive bisection.
2. Solution of Non-Linear equation in single variable using the Newton Raphson, Secant, Bi – Section and Modified Eualer's, method.
3. Solution of a system of simultaneous algebraic equations using the Gaussian elimination procedure.
4. Solution of a system of simultaneous algebraic equations using the Gauss-Seidel iterative method.
5. Solution of a system of simultaneous algebraic equations using the Gauss-Seidel iterative method employing the technique of successive relaxation.
6. Numerical solution of an ordinary differential equation using the Euler's method.
7. Numerical solution of an ordinary differential equation using the Runge - Kutta 4^{th} order method.
8. Numerical solution of an ordinary differential equation using the Predictor – corrector method.
9. Numerical solution of a system of two ordinary differential equation using Numerical integration.
10. Numerical solution of an elleptic boundary value problem using the method of Finite Differences.

Course Outcomes:

At the end of this course student shall be able to

CO1 – solve numerical solutions of ordinary differential equation using the Euler's method and Runge - Kutta and Predictor – corrector method.
CO2 - will be able to solve numerical solution of a system of two ordinary differential equation using Numerical integration.
CO3 - solve Non-Linear equation in single variable using the Newton Raphson, Secant, Bi – Section and Modified Eualer's, method

ME – 323 F PRACTICAL TRAINING VIVA-VOCE

At the end of fourth semester each student would undergo six weeks Practical Training in an industry/ Professional organization / Research Laboratory with the prior approval of the Director-Principal/ Principal of the concerned college and submit a written typed report along with a certificate from the organization. The report will be a evaluated during V Semester by a Board of Examiners to be appointed by the Director-Principal/ Principal of the concerned college who will award one of the following grades:

Excellent	:	A
Good	:	B
Satisfactory	:	C
Not satisfactory	:	F

A student who has been awarded 'F' grade will be required to repeat the practical training.

MAHARSHI DAYANAND UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATIONS
B.Tech. 3rd YEAR MECHANICAL ENGINEERING, SEMESTER- VI
Proposed "F" Scheme effective from 2011-12

Course	Course Title	Teaching schedule				Marks For class work	Marks for Examination		Total Marks	Duration of Exam
		L	T	P	Total		Theory	Practical		
ME-302-F	Automobile Engineering	3	1	-	4	50	100	-	150	3
ME-304-F	Mechanical Machine Design-II	3	2	-	5	50	100	-	150	4
ME-306-F	Heat Transfer	3	1	-	4	50	100	-	150	3
ME-308-F	Automatic Control	3	1	-	4	50	100	-	150	3
ME-310-F	Measurement & instrumentation	3	1	-	4	50	100	-	150	3
ME-312-F	Industrial Engineering	3	1	-	4	50	100	-	150	3
ME-314-F	Automobile Engineering Lab	-	-	2	2	25	-	25	50	3
ME-316-F	Heat Transfer Lab	-	-	2	2	25	-	25	25	3
ME-318-F	Measurement & instrumentation Lab	-	-	2	2	25	-	25	25	3
ME-320-F	General Proficiency	-	-	2	2	50	-	-	50	-
	Total	18	7	8	33	450	600	100	1050	

NOTE:

3. Students will be allowed to use non-programmable scientific calculator. However, sharing of Calculator will not be permitted in the examination.
4. Each student has to undergo practical training of 6 weeks during summer vacation and its evaluation shall be carried out in the VII semester

ME-302 F AUTOMOBILE ENGINEERING

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

Note: Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

Section A

Introduction to Automobiles : Classification, Components, Requirements of Automobile Body; Vehicle Frame, Separate Body & Frame, Unitised Body, Car Body Styles, Bus Body & Commercial Vehicle Body Types; Front Engine Rear Drive & Front Engine Front Drive Vehicles, Four Wheel Drive Vehicles, Safety considerations; Safety features of latest vehicle; Future trends in automobiles.

Clutches : Requirement of Clutches – Principle of Friction Clutch – Wet Type & Dry Types; Cone Clutch, Single Plate Clutch, Diaphragm Spring Clutch, Multi plate Clutch, Centrifugal Clutches, Electromagnetic Clutch, Over Running Clutch; Clutch Linkages.

Section B

Power Transmission: Requirements of transmission system; General Arrangement of Power Transmission system; Object of the Gear Box; Different types of Gear Boxes; Sliding Mesh, Constant Mesh, Synchro- mesh Gear Boxes; Epi-cyclic Gear Box, Freewheel Unit. Overdrive unit-Principle of Overdrive, Advantage of Overdrive, Transaxle, Transfer cases.

Drive Lines, Universal Joint, Differential and Drive Axles: Effect of driving thrust and torque reactions; Hotchkiss Drive, Torque Tube Drive and radius Rods; Propeller Shaft, Universal Joints, Slip Joint; Constant Velocity Universal Joints; Front Wheel Drive; Principle, Function, Construction & Operation of Differential; Rear Axles, Types of load coming on Rear Axles, Full Floating, Three quarter Floating and Semi Floating Rear Axles.

Section C

Suspension Systems : Need of Suspension System, Types of Suspension; factors influencing ride comfort, Suspension Spring; Constructional details and characteristics of leaf springs.

Steering System : Front Wheel geometry & Wheel alignment viz. Caster, Camber, King pin Inclination, Toe-in/Toe-out; Conditions for true rolling motions of Wheels during steering; Different types of Steering Gear Boxes; Steering linkages and layout; Power steering – Rack & Pinion Power Steering Gear, Electronics steering.

Section D

Automotive Brakes, Tyres & Wheels : Classification of Brakes; Principle and constructional details of Drum Brakes, Disc Brakes; Brake actuating systems; Mechanical, Hydraulic, Pneumatic Brakes; Factors affecting Brake performance, Power & Power Assisted Brakes; Tyres of Wheels; Types of Tyre & their constructional details, Wheel Balancing, Tyre Rotation; Types of Tyre wear & their causes.

Emission Control System & Automotive Electrical : Sources of Atmospheric Pollution from the automobile, Emission Control Systems – Construction and Operation of Positive Crank Case Ventilation (PVC) Systems, Evaporative Emission Control, Heated Air Intake System, Exhaust Gas Recirculation (ECR) Systems, Air Injection System and Catalytic Converters; Purpose construction & operation of lead acid Battery, Capacity Rating & Maintenance of Batteries; Purpose and Operation of Charging Systems, Purpose and Operations of the Starting System; Vehicle Lighting System.

Course Outcomes

CO1 - Identify the different parts of the automobile
CO2 - Explain the working of various parts like engine, transmission, clutch, brakes.
CO3 - Describe how the steering and the suspension systems operate.
CO4 - Understand the environmental implications of automobile emissions.
CO5 - Develop a strong base for understanding future developments in the

Text Books:

4. Automobile Engineering by Anil Chhikara, Satya Prakashan, New Delhi.
5. Automobile Engineering by Dr. Kirpal Singh, standard Publishers Distributors.

Reference Books:

5. Automotive Mechanics – Crouse / Anglin, TMH.
6. Automotive Technology – H.M. Sethi, TMH, New Delhi.
7. Automotive Mechanics – S.Srinivasan, TMH, New Delhi.
8. Automotive Mechanics – Joseph Heitner, EWP.
9. Motor Automotive Technology by Anthony E. Schwaller – Delmer Publishers, Inc.
10. The Motor Vehicle – Newton steeds Garrett, Butter Worths.

ME- 304 F MECHANICAL MACHINE DESIGN –II

L	T	P
3	2	-

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam : 4 hrs.

Note:

15. Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

16. The paper setter will be required to mention in the note of the question paper that the use of following Design Data book is permitted:

(i) Design Data Handbook (In SI and Metric Units) for Mechanical Engineers by Mahadevan
(ii) Design Data Book PSG College of Technology Coimbatore

Section A

Design for Production ; Erogonomic and value engineering considerations in design, Role of processing in design, Design considerations for casting, forging and machining. Variable Loading : Different types of fluctuating/ variable stresses, Fatigue strength considering stress concentration factor, surface factor, size factor, reliability factor etc., Fatigue design for finite and infinite life against combined variable stresses using Goodman and Soderberg's Criterion, Fatigue design using Miner's equation, Problems.

Section B

Shafts : Detailed design of shafts for static and dynamic loading, Rigidity and deflection consideration.

Springs : Types of Springs, Design for helical springs against tension and their uses, compression and fluctuating loads, Design of leaf springs, Surging phenomenon in springs, Design Problem.

Section C

Bearings : design of pivot and collar bearing , Selection of ball and roller bearing based on static and dynamic load carrying capacity using load-life relationship, Selection of Bearings from manufacturer's catalogue, types of lubrication – Boundary, mixed and hydrodynamic lubrication, Design of journal bearings using Raimondi and Boyd's Charts, Lubricants and their properties, Selection of suitable lubricants, Design Problems.

Section D

Gears : Classification, Selection of gears, Terminology of gears, Force analysis, Selection of material for gears, Beam & wear strength of gear tooth, Form or Lewis factor for gear tooth, Dynamic load on gear teeth -Barth equation and Buckingham equation and their comparison, Design of spur, helical, bevel & worm gear including the Consideration for maximum power transmitting capacity, Gear Lubrication, Design Problems.

Course Outcomes (COs):

At the end of the course, the student shall be able to:

CO 1- Expose the students to the Design for Production and for variable loading.
CO 2- Impart in depth knowledge of designing of screws and different types of fasteners.
CO 3- Design bearings, selection of bearings for different aspects & lubricants with their properties.
CO 4- Knowledge of gears, design of different types of gears with consideration of maximum power transmission and gear lubrication.
CO 5- Learn in depth knowledge of flywheels and their design.

Text Books:

15. Mechanical Engg. Design- Joseph Edward Shigley-Mc Graw Hill Book Co.
16. Design of Machine Elements – V.B. Bhandari – Tata McGraw Hill, New Delhi.

Reference Books :

5. Engineering design – George Dieter, McGraw Hill, New York.
6. Product Design and Manufacturing –: A.K.Chitale and R.C.Gupta, PHI, New Delhi.
7. Machine Design An Integrated Approach: Robert L.Norton,Second Edition –Addison Wisley Longman
8. Machine Design : S.G. Kulkarni , TMH , New Delhi.

ME –306 F HEAT TRANSFER

L	T	P
3	1	-

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

Note:

Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

2.The paper setter will be required to mention in the note of question paper that the use of Steam tables, Charts, Graphical plots is permitted.

Section A

Basics and Laws : Definition of Heat Transfer, Reversible and irreversible processes, Modes of heat flow, Combined heat transfer system and law of energy conservation.

Steady State Heat Conduction : Introduction, I-D heat conduction through a plane wall, long hollow cylinder, hollow sphere, Conduction equation in Cartesian, polar and spherical co-ordinate systems, Numericals.

Section B

Steady State Conduction with Heat Generation : Introduction, 1 – D heat conduction with heat sources, Extended surfaces (fins), Fin effectiveness 2-D heat conduction , Numericals.

Transient Heat Conduction : Systems with negligible internal resistance, Transient heat conduction in plane walls, cylinders, spheres with convective boundary conditions, Chart solution, Relaxation Method, Numericals.

Section C

Convection: Forced convection-Thermal and hydro-dynamic boundary layers, Equation of continuity, Momentum and energy equations, Some results for flow over a flat plate and flow through tube, Fluid friction and heat transfer (Colburn analogy), Free convection from a vertical flat plate, Empirical relations for free convection from vertical and horizontal o\planes & cylinders, Numericals.

Thermal Radiation: The Stephen-Boltzmann law, The black body radiation, Shape factors and their relationships, Heat exchange between non black bodies, Electrical network for radiative exchange in an enclosure of two or three gray bodies, Radiation shields, Numericals.

Section D

Heat Exchangers: Classification, Performance variables, Analysis of a parallel/counter flow heat exchanger, Heat exchanger effectiveness, Numericals.

Heat Transfer with Change of Phase: Laminar film condensation on a vertical plate, Drop-wise condensation, Boiling regimes, Free convective, Nucleate and film boiling, Numericals.

Course Outcome (COs):

At the end of the course, the student shall be able to:

CO 1- Understand the basic concept of conduction, convection and radiation heat transfer.

CO 2- Formulation of one dimension conduction problems.

CO 3- Application of empirical correlations for both forced and free convection for determines the value of convection heat transfer coefficient.

CO 4- Expedite basic concept of the radiation heat transfer for black and grey body.

CO 5- Learning of thermal analysis and sizing of Heat exchangers.

Text Books :

1. Heat Transfer – J.P. Holman, John Wiley & Sons, New York.
2. Fundamentals of Heat & Mass Transfer–Incropera, F.P. & Dewill, D.P –John Willey New York.
3. Heat Transfer-Principles & Applications-Binay K. Dutta, PHI, New Delhi

Reference Books :

1. Conduction of Heat in Solids – Carslow, H.S. and J.C. Jaeger – Oxford Univ. Press.
2. Conduction Heat Transfer – Arpasi, V.S. – Addison – Wesley.
3. Compact Heat Exchangers – W.M. Keys & A.L. Landon, Mc. Graw Hill.
4. Thermal Radiation Heat Transfer – Siegel, R. and J.R. Howell, Mc. Graw Hill.
5. Heat Transmission – W.M., Mc.Adams , Mc Graw Hill.

ME- 308 F AUTOMATIC CONTROLS

L	T	P
3	1	-

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

Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

Section A

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.

Section B

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; Problems.

Frequency Response Analysis: Introduction; Closed and Open Loop Transfer Function; Polar Plots; Rectangular Plots; Nichols Plots: Equivalent Unity Feed Back Systems; Problems.

Section E

Stability Of Control Systems : Introduction; Characteristic Equation; Routh's Criterion; Nyquists Criterion, Gain & Phase Margins: Problems.

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.

Section D

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; Problems.

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.

Course Outcomes (COs):

At the end of the course, the student shall be able to:

CO 1- Understand about programmable logic controllers.

CO 2- Complete understanding about communication networks for automation.

CO 3- Expedite the role of human factors in a project.

CO 4- Knowledge of various types of sensors and actuators for various applications.

CO 5- Exploration of flexible manufacturing system for making variety of components.

Text Books :

1. Theory & Applications of Automatic Controls by B.C. Nakra, Published by New Age International Pvt. Ltd. Publishers, New Delhi.
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 , New Delhi.

ME – 310 F MEASUREMENT AND INSTRUMENTATION

L	T	P
3	1	-

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

Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

Section A

Instruments and Their Representation : Introduction, Typical Applications of Instrument Systems, Functional Elements of a Measurement System, Classification of Instruments, Standards and Calibration.

Static and Dynamic characteristics of Instruments : Introduction, Accuracy, Precision, Resolution, Threshold, Sensitivity, Linearity, Hysteresis, Dead Band, Backlash, Drift, Formulation of Differential Equations for Dynamic Performance- Zero Order, First Order and Second order systems, Response of First and Second Order Systems to Step, Ramp, Impulse and Harmonic Functions.

Section B

Transducer Elements : Introduction, Analog and Digital Transducers, Electromechanical; Potentiometric, Inductive Self Generating and Non-Self Generating Types, Electromagnetic, Electrodynamic, Eddy Current, Magnetostrictive, Variable Inductance, Linearly Variable Differential Transformer, Variable Capacitance, Piezo-Electric Transducer and Associated Circuits, Unbonded and Bonded Resistance Strain Gages. Strain Gage Bridge circuits, Single Double and Four Active Arm Bridge Arrangements, Temperature Compensation, Balancing and Calibration, Ionisation Transducers, Mechano Electronic Transducers, Opto-Electrical Transducers, Photo Conductive Transducers, Photo Volatic Transducers, Digital Transducers, Frequency Domain Transducer, Vibrating String Transducer, Binary codes, Digital Encoders.

Section C

Motion, Force and Torque Measurement : Introduction, Relative motion Measuring Devices, Electromechanical, Optical, Photo Electric, Moire-Fringe, Pneumatic, Absolute Motion Devices, Seismic Devices, Spring Mass & Force Balance Type, Calibration, Hydraulic Load Cell, Pneumatic Load Cell, Elastic Force Devices, Separation of Force Components, Electro Mechanical Methods, Strain Gage, Torque Transducer, Toque Meter.

Intermediate, Indicating and Recording Elements : Introduction Amplifiers, Mechanical, Hydraulic, Pneumatic, Optical, Electrical Amplifying elements, Compensators, Differentiating and Integrating Elements,

Section D

Pressure and Flow Measurement : Pressure & Flow Measurement, Introduction : Moderate Pressure Measurement, Monometers, Elastic Transducer, Dynamic Effects of Connecting Tubing, High Pressure Transducer, Low Pressure Measurement, Calibration and Testing, Quantity Meters, Positive Displacement Meters, Flow Rate Meters, Variable Head Meters, Variable Area Meters, Rotameters, Pitot-Static Tube Meter, Drag Force Flow Meter, Turbine Flow Meter, Electronic Flow Meter, Electro Magnetic Flow meter. Hot-Wire Anemometer.

Temperature Measurement : Introduction, Measurement of Temperature, Non Electrical Methods – Solid Rod Thermometer, Bimetallic Thermometer, Liquid-in-Glass thermometer, Pressure Thermometer, Electrical Methods – Electrical Resistance Thermometers, Semiconductor Resistance Sensors (Thermistors), Thermo–Electric Sensors, Thermocouple Materials, Radiation Methods (Pyrometry), Total Radiation Pyrometer, Selective Radiation Pyrometer.

Course Outcomes

Students would be able

CO1 - To understand about the applications of measurement systems.

CO2 - To understand about the basics and working principle of pressure, temperature and flow measurement.

CO3 - Identify the different variation of measurement parameter with various input conditions.

CO4 - To analyze the primary, secondary and tertiary measurements.

CO5 - To learn about the various control devices and parts of measurement systems

Text Books :

1. Measurement systems Application and Design. Ernest O. Doebelin, Tata McGraw Hill Edition (Fourth Edition) 2002.
2. Measurement and Instrumentation in Engineering, Francis S. Tse and Ivan E. Morse, Marcel Dekker.

Reference Books :

1. Principles of Measurement and Instrumentation – Alan S. Morris Prentice Hall of India.
2. Mechanical Measurements : T.G. Beckwith, W.L. Buck and R.D. Marangoni Addison Wesley.
3. Instrumentation, Measurement and Analysis – B.C. Nakra and K.K. Chaudhary, TMH.
4. Mechanical Measurements by D. S. Kumar, Kataria & Sons.

ME- 312 F INDUSTRIAL ENGINEERING

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

Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

Section A

Definition of Industrial Engineering: Objectives, Method study, Principle of motion economy, Techniques of method study - Various charts, THERBLIGS, Work measurement - various methods, time study PMTS, determining time, Work sampling, Numericals.

Productivity & Workforce Management :Productivity - Definition, Various methods of measurement, Factors effecting productivity, Strategies for improving productivity, Various methods of Job evaluation & merit rating, Various incentive payment schemes, Behavioural aspects, Financial incentives.

Section B

Manufacturing Cost Analysis: Fixed & variable costs, Direct, indirect & overhead costs, & Job costing, Recovery of overheads, Standard costing, Cost control, Cost variance Analysis - Labour, material, overhead in volume, rate & efficiency, Break even Analysis, Marginal costing & contribution, Numericals.

Materials Management : Strategic importance of materials in manufacturing industries, Relevant costs, Inventory control models - Economic order quantity (EOQ), Economic batch quantity (EBQ) with & without shortage, Purchase discounts, Sensitivity analysis, Inventory control systems - P,Q,Ss Systems, Service level, Stock out risk, determination of order point & safety stock, Selective inventory control - ABC, FSN, SDE, VED and three dimensional, Numericals.

Section C

Quality Management: Definition of quality, Various approaches, Concept of quality assurance systems, Costs of quality, Statistical quality Control (SQC), Variables & Attributes, X, R, P & C - charts, Acceptance sampling, OC - curve, Concept of AOQL, Sampling plan - Single, Double & sequential, Introduction to TQM & ISO - 9000.

Production Planning & Control (PPC) : Introduction to Forecasting - Simple & Weighted moving average methods, Objectives & variables of PPC, Aggregate planning - Basic Concept, its relations with other decision areas, Decision options - Basic & mixed strategies, Master production schedule (MPS), Scheduling Operations Various methods for line & intermittent production systems, Gantt chart, Sequencing - Johnson algorithm for n-Jobs-2 machines, n- Jobs-3 machines, 2 Jobs n-machines, n-Jobs m-machines Various means of measuring effectiveness of PPC, Introduction to JIT, Numericals.

Section D

Management Information Systems (MIS) : What is MIS ? Importance of MIS, Organizational & information system structure, Role of MIS in decision making, Data flow diagram, Introduction to systems analysis & design, Organizing information systems.

Product Design and Development: Various Approaches, Product life cycle, Role 3S's – Standardization, Simplification, Specialization, Introduction to value engineering and analysis, Role of Ergonomics in Product Design.

Course Outcomes

Upon the completion of the course, the students will be able to

CO1 - Understand the concept of Industrial Engineering in the industrial environment.

CO2 - Manage and implement different concepts involved in methods study and understanding of work content in different situations.

CO3 - Describe different aspects of work system design and facilities design pertinent to manufacturing industries.

CO4 - Predict facility location, CPM and PERT network models.

CO5 - Interpret and solve data from aggregate output planning models.

Text Books: 1. Production & Operations Management - Chary, TMH, New Delhi.
2. Management Information Systems - Sadagopan, PHI New Delhi.
3. Modern Production Management – S.S. Buffa, Pub.- John Wiley.

Ref.Books: 1. Operations Management - Schroeder, McGraw Hill ISE.
2. Operation Management - Monks, McGraw Hill ISE.
3. Production & Operations Management - Martinich, John Wiely SE.
4. Industrial & Systems Engineering - Turner, MIZE, CHASE, Prentice Hall Pub.

ME- 314 F AUTOMOBILE ENGINEERING LAB

L	T	P
-	-	2

Sessional : 25 Marks
Practical : 25 Marks
Total : 50Marks
Duration of Exam : 3 hrs.

List of Experiments :

1. To study and prepare report on the constructional details, working principles and operation of the following Automotive Engine Systems & Sub Systems.
   (a) Multi-cylinder : Diesel and Petrol Engines.
   (b) Engine cooling & lubricating Systems.
   (c) Engine starting Systems.
   (d) Contact Point & Electronic Ignition Systems.

2. To study and prepare report on the constructional details, working principles and operation of the following Fuels supply systems:
   (a) Carburetors
   (b) Diesel Fuel Injection Systems
   (c) Gasoline Fuel Injection Systems.

3. . To study and prepare report on the constructional details, working principles and operation of the following Automotive Clutches.
   (a) Coil-Spring Clutch
   (b) Diaphragm – Spring Clutch.
   (c) Double Disk Clutch.

4. To study and prepare report on the constructional details, working principles and operation of the following Automotive Transmission systems.
   (a) Synchromesh – Four speed Range.
   (b) Transaxle with Dual Speed Range.
   (c) Four Wheel Drive and Transfer Case.
   (d) Steering Column and Floor – Shift levers.

5. To study and prepare report on the constructional details, working principles and operation of the following Automotive Drive Lines & Differentials.
   (a) Rear Wheel Drive Line.
   (b) Front Wheel Drive Line.
   (c) Differentials, Drive Axles and Four Wheel Drive Line.

6. To study and prepare report on the constructional details, working principles and operation of the following Automotive Suspension Systems.
   (a) Front Suspension System.
   (b) Rear Suspension System.
7. To study and prepare report on the constructional details, working principles and operation of the following Automotive Steering Systems.
   (a) Manual Steering Systems, e.g. Pitman –arm steering, Rack & Pinion steering.
   (b) Power steering Systems, e.g. Rack and Pinion Power Steering System.
   (c) Steering Wheels and Columns e.g. Tilt & Telescopic steering Wheels, Collapsible Steering Columns.

8. To study and prepare report on the constructional details, working principles and operation of the following Automotive Tyres & wheels.
    (a) Various Types of Bias & Radial Tyres.
    (b) Various Types of wheels.
9. To study and prepare report on the constructional details, working principles and operation of the Automotive Brake systems.
    (a) Hydraulic & Pneumatic Brake systems.
    (b) Drum Brake System.
    (c) Disk Brake System.
    (d) Antilock Brake System.
    (e) System Packing & Other Brakes.
10. To study and prepare report on the constructional details, working principles and operation of Automotive Emission / Pollution control systems.
11. Modeling of any two automotive systems on 3D CAD using educational softwares (eg. 3D modeling package/Pro Engineering/I-Deas/ Solid edge etc.)
12. Crash worthiness of the designed frame using Hypermesh and LS-Dyna solver or other software.

Course Outcomes (COs):

At the end of the course, the student shall be able to get practical exposure of :

CO 1- principle of automobiles drive and advances in automobiles.

CO 2- various types of clutch.

CO 3- various types of steering system along with merits and demerits.

CO 4- various type of hybrid vehicles.

CO 5- hydrogen based technology for pollution control

NOTE : 1. At least ten experiments are to be performed in the Semester.

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

ME- 316 FHEAT TRANSFER LAB.

L	T	P
-	-	3

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

List of Experiments :

1. To determine the thermal conductivity of a metallic rod.
2. To determine the thermal conductivity of an insulating power.
3. To determine the thermal conductivity of a solid by the guarded hot plate method.
4. To find the effectiveness of a pin fin in a rectangular duct natural convective condition and plot temperature distribution along its length.
5. To find the effectiveness of a pin fin in a rectangular duct under forced convective and plot temperature distribution along its length.
6. To determine the surface heat transfer coefficient for a heated vertical tube under natural convection and plot the variation of local heat transfer coefficient along the length of the tube. Also compare the results with those of the correlation.
7. To determine average heat transfer coefficient for a externally heated horizontal pipe under forced convection & plot Reynolds and Nusselt numbers along the length of pipe. Also compare the results with those of the correlations.
8. To measure the emmisivity of the gray body (plate) at different temperature and plot the variation of emmisivity with surface temperature.
9. To find overall heat transfer coefficient and effectiveness of a heat exchange under parallel and counter flow conditions. Also plot the temperature distribution in both the cases along the length of heat of heat exchanger.
10. To verify the Stefen-Boltzmann constant for thermal radiation.
11. To demonstrate the super thermal conducting heat pipe and compare its working with that of the best conductor i.e. copper pipe. Also plot temperature variation along the length with time or three pipes.
12. To study the two phases heat transfer unit.
13. To determine the water side overall heat transfer coefficient on a cross-flow heat exchanger.
14. Design of Heat exchanger using CAD and verification using thermal analysis package eg. I-Deas etc.

Course Outcomes (COs):

At the end of the course, the student shall be able to:

CO 1- Understanding the conduction heat transfer coefficient.
CO 2- Design and analyze heat transfer system with practical demonstration.
CO 3- Selection of equipments and their practical demonstration in heat transfer design.
CO 4- Knowledge of development about mass transfer

Note:

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

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

ME- 318 F MEASUREMENT & INSTRUMENTATION LAB.

L	T	P
-	-	2

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

List of Experiments :

1. To Study various Temperature Measuring Instruments and to Estimate their Response times.
   (a) Mercury – in glass thermometer
   (b) Thermocouple
   (c) Electrical resistance thermometer
   (d) Bio-metallic strip
2. To study the working of Bourdon Pressure Gauge and to check the calibration of the gauge in a dead-weight pressure gauge calibration set up.
3. To study a Linear Variable Differential Transformer (LVDT) and use it in a simple experimental set up to measure a small displacement.
4. To study the characteristics of a pneumatic displacement gauge.
5. To measure load (tensile/compressive) using load cell on a tutor.
6. To measure torque of a rotating shaft using torsion meter/strain gauge torque transducer.
7. To measure the speed of a motor shaft with the help of non-contact type pick-ups (magnetic or photoelectric).
8. To measure the stress & strain using strain gauges mounted on simply supported beam/cantilever beam.
9. To measure static/dynamic pressure of fluid in pipe/tube using pressure transducer/pressure cell.
10. To test experimental data for Normal Distribution using Chi Square test.
11. To learn the methodology of pictorial representation of experimental data and subsequent calculations for obtaining various measures of true value and the precision of measurement using Data acquisition system/ calculator.
12. Vibration measurement by Dual Trace Digital storage Oscilloscope.
13. To find out transmission losses by a given transmission line by applying capacitive /inductive load.
14. Process Simulator.

Note:

1. **At least ten experiments are to be performed in the Semester.**
2. **At least seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the Syllabus.**

Course Outcomes

Students would be able

CO1 - To understand about the applications of measurement systems.

CO2 - To understand about the basics and working principle of pressure, temperature and flow measurement.

CO3 - Identify the different variation of measurement parameter with various input conditions.

CO4 - To analyze the primary, secondary and tertiary measurements.

CO5 - To learn about the various control devices and parts of measurement systems

MAHARSHI DAYANAND UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATIONS
B.Tech. 4th YEAR MECHANICAL ENGINEERING, SEMESTER- VII
(Scheme-F)

EFFECTIVE FROM THE SESSION 2012-13

Course	Course Title	Teaching schedule				Marks For class work	Marks for Examination		Total Marks	Duration of Exam
		L	T	P	Total		Theory	Practical		
ME-401-F	Strength of Material-II	3	1	-	4	50	100	-	150	3
ME-403-F	Refrigeration & Air-Conditioning	3	1	-	4	50	100	-	150	3
ME-405-F	Operation Research	3	1	-	4	50	100	-	150	3
ME-407-F	Power Plant Engineering	3	1	-	4	50	100	-	150	3
ME-409-F	Mechanical Vibration	3	1	-	4	50	100	-	150	3
----------	Elective	3	1	-	4	50	100	-	150	3
ME-411-F	Refrigeration & Air-Conditioning Lab	-	-	2	2	50	-	50	100	3
ME-413-F	Advanced CAD/CAM Lab	-	-	2	2	50	-	100	150	3
ME-415-F	Practical Training-II	-	-	2	2	-	-	-	-	-
GFME-435-F	General Fitness for the Profession	-	-	-	-	-	-	50	50	3
	Total	18	6	6	30	400	600	200	1200	

LIST OF ELECTIVES

S.NO.	SUBJECT CODE	DEPTT. ELECTIVE
1.	ME-417-F	QUALITY ENGINEERING
2.	ME 419-F	FINITE ELEMENT METHODS
3.	ME-421-F	ENERGY MANAGEMENT PRINCIPLES
4.	ME- 425-F	COMPUTER INTEGRATED MANUFACTURING
5.	ME- 429-F	RELIABILITY ENGINEERING
6.	ME-431-F	SOLAR ENERGY ENGINEERING

ME- 401-F STRENGTH OF MATERIALS-II

L	T	P
3	1	-

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

Note: Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

SECTION A

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, Numericals.

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.

SECTION B

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.

SECTION C

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.

SECTION D

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.

Course Outcomes (COs):

After studying this course, students will be able:

CO 1- Apply and use energy methods to find force, stress and displacement in simple structures and springs.

CO 2- Understand and determine the stresses and strains in pressure vessels.

CO 3- Knowledge of stress functions, and calculate stresses in rotating rings, discs, and curved beams.

CO 4- Evaluate the behaviour and strength of structural elements subjected to three dimensional stress system.

Text Books:

1. Strength of Materials – G.H.Ryder, Third Edition in SI Units 1969 Macmillan, India.
2. Strength of Materials – Sadhu Singh, Khanna Publishers

Reference Books :

6. Book of Solid Mechanics – Kazmi, Tata Mc Graw Hill
7. Strength of Materials – D.S. Bedi - S. Chand & Co. Ltd.
8. Strength of Materials – U.C Jindal - Pearson India Ltd.
9.

ME-403-F REFRIGERATION & AIR CONDITIONING

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

Note: Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

SECTION A

Introduction: Definition of refrigeration & air conditioning; Necessity; Methods of refrigeration; Unit of refrigeration; Coefficient of performance (COP), Fundamentals of air-conditioning system; Refrigerants-Definition, Classification, Nomenclature, Desirable properties, Comparative study, secondary refrigerants, Introduction to eco-friendly Refrigerants; Introduction to Cryogenics.

Air Refrigeration System: Carnot refrigeration cycle. Temperature. Limitations; Brayton refrigeration or the Bell Coleman air refrigeration cycle; Necessity of cooling the aero plane; Air craft refrigeration systems, Simple cooling and Simple evaporative types, Boot strap and Boot strap evaporative types, Regenerative type and Reduced Ambient type system, Comparison of different systems, problems.

SECTION B

Vapour Compression (VC) Refrigeration Systems: (A) Simple Vapour Compression (VC) Refrigeration systems-Limitations of Reversed Carnot cycle with vapour as the refrigerant; Analysis of VC cycle considering degrees of sub cooling and superheating; VC cycle on p-v, t-s and p-h diagrams; Effects of operating conditions on COP; Comparison of VC cycle with Air Refrigeration cycle.

Multistage Ref. Systems- Necessity of compound compression, Compound VC cycle , Inter-cooling with liquid sub –cooling and / or water inter cooler: Multistage compression with flash inter-cooling and / or water inter-cooling; systems with individual or multiple expansion valves; Individual compression system with individual or multiple expansion valves; Individual compression systems with individual or multiple expansion valves but with and without intercoolers.

Other Refrigeration Systems: (A) Vapour Absorption Refrigeration Systems – Basic Systems, Actual COP of the System, Performance, Relative merits and demerits; Properties of aqua ammonia; Electrolux Refrigeration; Problems. Steam Jet Refrigerating System- Introduction, Analysis, Relative merits and demerits, Performance Applications, Problems.

SECTION C

Psychrometry of Air & Air Conditioning Processes: Properties of moist Air-Gibbs Dalton law, Specific humidity, Dew point temperature, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temp., Thermodynamics wet bulb temp., Psychrometric chart; Psychrometry of air-conditioning processes, Mixing Process, Basic processes in conditioning of air; Psychrometric processes in air washer, Problems.

Air- Conditioning Load Calculations: Outside and inside design conditions; Sources of heating load; Sources of cooling load; Heat transfer through structure, Solar radiation, Electrical applications, Infiltration and ventilation, Heat generation inside conditioned space; Apparatus selection; Comfort chart, Problems.

SECTION D

Air Conditioning Systems with Controls & Accessories: Classifications, Layout of plants; Equipment selection; Air distribution system; Duct systems Design; Filters; Refrigerant piping; Design of summer air-conditioning and Winter air conditioning systems; Temperature sensors, Pressure sensors, Humidity sensors, Actuators, Safety controls; Accessories; Problems.

Refrigeration and Air Conditioning Equipments: Type of compressors and their performance curves; Types of Condensers, Heat transfer in condensers; Types of expansion devices; types of evaporators, Cooling and Dehumidifying coils, Problems**.**

Course Outcomes (COs):

At the end of the course, the student shall be able to:

CO 1- Understand the air refrigeration, vapour compression refrigeration, vapour absorption, steam jet refrigeration systems and different type of refrigerants.

CO 2- Expedite the working of single stage, multistage and cascade refrigeration.

CO 3- Knowledge of psychrometry and different psychrometric processes. Understand and evaluate cooling and heating load and design of HVAC system.

CO 4- Develop and design RAC systems and evaluate different expansion and control devices.

Text Books :

7. Refrigeration & Air conditioning –R.C. Jordan and G.B. Priester, Prentice Hall of India.
8. Refrigeration & Air conditioning –C.P. Arora, TMH, New Delhi.

Reference Books:

4. A course in Refrigeration & Air Conditioning – Arora & Domkundwar, Dhanpat Rai & Sons.
5. Refrigeration & Air conditioning –W.F. Stocker and J.W. Jones, TMH, New Delhi.
6. Refrigeration & Air conditioning- Manohar Prasad Wiley Estern limited, New Delhi.

ME- 405-F OPERATIONS RESEARCH

L	T	P
3	1	-

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

Note: Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

SECTION A

Introduction: Definition, role of operations research in decision-making, applications in industry. Concept on O.R. model building –Types & methods.

Linear Programming (LP): Programming definition, formulation, solution- graphical, simplex Gauss-Jordan reduction process in simplex methods, BIG-M methods computational, problems.

SECTION B

Deterministic Model: Transportation model-balanced & unbalanced, north west rule, Vogel's Method, least cost or matrix minimal, Stepperg stone method, MODI methods, degeneracy, assignment, traveling salesman, problems.

Advanced Topic Of LP: Duality, PRIMAL-DUAL relations-its solution, shadow price, economic interpretation, dual-simplex, post-optimality & sensitivity analysis, problems.

SECTION C

Waiting Line Models: Introduction, queue parameters, M/M/1 queue, performance of queuing systems, applications in industries, problems.

Project Line Models: Network diagram, event, activity, defects in network, PERT & CPM, float in network, variance and probability of completion time, project cost- direct, indirect, total, optimal project cost by crashing of network, resources leveling in project, problems.

SECTION D

Simulation: Introduction, design of simulation, models & experiments, model validation, process generation, time flow mechanism, Monte Carlo methods- its applications in industries, problems.

Decision Theory: Decision process, SIMON model types of decision making environment- certainty, risk, uncertainty, decision making with utilities, problems.

Course Outcomes (COs):

At the end of the course, the student shall be able to:

CO 1- Discuss the role of operations research in decision-making, and its applications in industry and should be able to formulate and design real-world problems through models & experiments.

CO 2- Knowledge of various types of deterministic models like linear programming, transportation model etc.

CO 3- Explore various types of stochastic models like waiting line model, project line model, simulation etc.

CO 4- Deduce the relationship between a linear program and its dual and perform sensitivity analysis.

CO 5- Describe different decision making environments and apply decision making process in the real world situations

Text Books:

9. Operation Research – TAHA, PHI, New Delhi.
10. Principle of Operations Research – Ackoff, Churchaman, arnoff, Oxford IBH, Delhi.

Reference Books :

6. Operation Research- Gupta & Sharma, National Publishers, New Delhi.
7. Quantitative Techniques- Vohra, TMH, New Delhi
8. Principles of operation Research (with Applications to Managerial Decisions) by H.M.Wagher, Prentice Hall of India, New Delhi.
9. Operation Research – Sharma, Gupta, Wiley Eastern, New Delhi.
10. Operation Research – Philips, Revindran, Solgeberg, Wiley ISE.

ME- 407-F POWER PLANT ENGINEERING

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

Note: Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

SECTION-A

Introduction: Energy resources and their availability, types of power plants, selection of the plants, review of basic thermodynamic cycles used in power plants.

Hydro Electric Power Plants : Rainfall and run-off measurements and plotting of various curves for estimating stream flow and size of reservoir, power plants design, construction and operation of different components of hydro-electric power plants, site selection, comparison with other types of power plants.

SECTION-B

Steam Power Plants: Flow sheet and working of modern-thermal power plants, super critical pressure steam stations, site selection, coal storage, preparation, coal handling systems, feeding and burning of pulverized fuel, ash handling systems, dust collection-mechanical dust collector and electrostatic precipitator.

Combined Cycles: Constant pressure gas turbine power plants, Arrangements of combined plants (steam & gas turbine power plants), re-powering systems with gas production from coal, using PFBC systems, with organic fluids, parameters affecting thermodynamic efficiency of combined cycles. Problems.

SECTION-C

Nuclear Power Plants: Principles of nuclear energy, basic nuclear reactions, nuclear reactors-PWR, BWR, CANDU, Sodium graphite, fast breeder, homogeneous; gas cooled. Advantages and limitations, nuclear power station, waste disposal.

Power Plant Economics: load curve, different terms and definitions, cost of electrical energy, tariffs methods of electrical energy, performance & operating characteristics of power plants- incremental rate theory, input-out put curves, efficiency, heat rate, economic load sharing, Problems.

SECTION-D

Non-Conventional Power Generation: Solar radiation estimation, solar energy collectors, low, medium & high temperature power plants, OTEC, wind power plants, tidal power plants, geothermal power plants. Direct Energy Conversion Systems: Fuel cell, MHD power generation-principle, open & closed cycles systems, thermoelectric power generation, thermionic power generation.

Course Outcomes (CO'S): At the end of the course, the student shall be able to:

CO1 - Understand the principles of steam power plants and gas power plants.
CO2 - Utility and applications of nuclear power plant.
CO3 - Installation and commissioning of hydro-electric power plants.
CO4 - Understand various factors affecting non-conventional power plant.
CO5 - Understanding about different types of power plants

Text Books :

11. Power station Engineering and Economy by Bernhardt G.A. skrotzki and William A. Vopat – Tata Mc Graw Hill Publishing Campany Ltd., New Delhi
12. Power Plant Engineering : P.K. Nag Tata McGraw Hill second Edition 2001.

Reference Books :

1. Power Plant Engg. : M.M. El-Wakil McGraw Hill 1985.

ME -409- F MECHANICAL VIBRATIONS

L	T	P
3	1	-

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

Note: Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

SECTION A

Fundamentals : Importance of Study of Vibrations, Classifications of Vibrations, Free and Forced, Undamped and Damped, Linear and Non-linear, Deterministic and Random, Harmonic Motion, Vector and Complex Number Representations, Definitions and Terminology, Periodic Functions, Harmonic Analysis, Fourier Series Expansion.

Free and Damped Vibrations : Single Degree of Freedom system, D'Alemberts Principal, Energy Methods, Rayleighs Method, Application of these Methods, Damped Free Vibrations, Logarithmic Decrement, Under Damping, Critical and Over Damping, Coulomb Damping.

SECTION B

Harmonically Excited Vibrations : Forced Damped Harmonic Vibration of Single Degree of Freedom Systems, Rotating Unbalance, Rotor Unbalance, Critical Speeds and Whirling of Rotating Shafts, Support Motion, Vibration Isolation, Energy Dissipated by Damping, Equivalent, Viscous Camping, Structural Damping Sharpness of Resonance, Vibration Measuring Instruments.

Transient Vibrations : Impulse Excitation, Arbitrary Excitation, Response to Step Excitions, Base Excitation Solution by Laplace Transforms, Response Spectrum, Runge-Kutta Method.

SECTION C

Two Degrees of Freedom Systems : Introduction to Multi-Degree of Freedom Systems, Normal Mode Vibrations, Coordinate Coupling, Principal Coordinates, Free Vibrations in Terms of Initial Conditions, Forced Harmonic Vibrations, Vibration Absorber, Centrifugal Vibration Absorber, Vibration Damper.

Multi degrees of Freedom Systems and Numerical Methods Introduction, Influence Coefficients, Stiffness Matrix, Flexibility Matrix, Natural Frequencies and Normal Modes, Orthogonality of Normal Modes, Dunkerley's Equation, Method of Matrix Iteration, The Holzer Type Problem, Geared and Branched Systems, Beams.

SECTION D

Normal Mode Vibration of Continuous System: Vibrating String, Longitudinal Vibrations of Rod, Torsional Vibrations of Rod, Lateral Vibrations of Beam.

Course Outcomes (CO' S):

At the end of the course, the student shall be able to:

CO1 - Understand the fundamentals of mechanical vibrations leading to analysis of first degree of freedom
CO2 - To understand the concept of two degree of vibration and vibration isolation and transmissibility
CO3 - Analyse experimental methods for vibration analysis.
CO4 - Understanding the influence and stiffness coefficients.
CO5 - Analyse the concept of the non-linearity in vibrations

Text Books :

5. Theory of Vibrations with Applications W.T. Thomson, Prentice Hall of India.
6. Mechanical Vibration : G.K. Grover and S.P. Nigam, Nem Chand and Sons

Reference Books :

8. Theory and Practice of Mechanical Vibrations J.S. Rao and K. Gupta, Wiley Eastern Ltd.

9. Mechanical Vibrations S.S. Rao, Addison – Wesely Publishing Company

ME- 411- F REFRIGERATION & AIR CONDITIONING LAB.

L	T	P
-	-	2

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

List of Experiments :

6. To study the vapour compression Refrigeration System and determine its C.O.P. and draw P-H and T-S diagrams.
7. To Study the Mechanical heat pump and find its C.O.P.
8. To study the Air and Water heat pump and find its C.O.P.
9. To study the cut- sectional models of Reciprocating and Rotary Refrigerant compressor.
10. To study the various controls used in Refrigerating & Air Conditioning systems.
11. To study the Ice- plant, its working cycle and determine its C.O.P and capacity.
12. To study the humidification, heating, cooling and dehumidification processes and plot them on Psychrometric charts.
13. To determine the By-pass factor of Heating & Cooling coils and plot them on Psychrometric charts on different inlet conditions.
14. To determine sensible heat factor of Air on re-circulated air-conditioning set up.
15. To study the chilling plant and its working cycle.

Course Outcomes (COs):

At the end of the course, the student shall be able to:

CO 1- Understand the vapour compression refrigeration system and vapour absorption system.

CO 2- Application of different compressors used in refrigeration system..

CO 3- Understand functioning of various control devices

CO 4- Evaluate the COP of various refrigeration system such as vapour compression refrigeration system and vapour absorption system.

CO 5- Knowledge of how the loading condition changes the COP of the system.

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

8. At least seven experiments should be performed form the above list. Remaining three experiments may either be performed from the above list or as designed & set by the concerned institute as per the scope of the syllabus.

ME- 413- F Advanced CAD/CAM Lab

L	T	P		
-	-	2	Sessional	: 50 Marks
			Practical	: 50 Marks
			Total	: 100 Marks

The students will be required to carry out the following exercises using software packages (e.g. 3D modeling package / Pro Engineer/ I-Deas/ Solid Edge etc.)

7. CAD Modeling Assignments

Use and learn import/export techniques and customization of software.

Construction of simple machine parts and components like Coupling, Crankshaft, Pulley, Piston , Connecting rod, nuts, bolts, gears and helical springs

Assembly drawing with sectioning and bill of materials from given detailed drawings of assemblies: Lathe Tail stock, Machine vice, Pedestal bearing, Drill jigs and Milling fixture.

Make the part family/family table of a bolt.

.

2. CAM Assignments

Tool path generation, Part programming, G & M codes development for machining operations, Physical interpretation of machining features and tool geometries

Course Outcomes (CO's): At the end of the course, the student shall be able to:

CO1 - Review and train in CAD modeling.

CO2 - use parametric CAD software for geometric modeling ofmechanical designs.

CO3 - Translate production drawings to 3D CAD models.

CO4 - Evaluate a mechanical design and optimize it using CAD, CAE software.

CO5 - use 2D / 3D CAD and CAE for use in other courses and research thesis work

ME – 415- F PRACTICAL TRAINING – II

L	T	P
-	-	2

At the end of Sixth semester each student would undergo six weeks Practical Training in an industry/ Professional organization / Research Laboratory with the prior approval of the Director- Principal/ Principal of the concerned college and submit a written typed report along with a certificate from the organization. The report will be a evaluated during VII Semester by a Board of Examiners to be appointed by the Director-Principal/ Principal of the concerned college who will award one of the following grades:

Excellent: A

Good: B

Satisfactory: C

Not satisfactory: F

A student who has been awarded ‘F’ grade will be required to repeat the practical training.

ME-417-F QUALITY ENGINEERING

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

Note: Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

SECTION-A

Basic Concept Quality Costs: Fitness for Use, Quality Characteristics, Parameters of Fitness for use, Definition of quality and its meaning and importance in industry, Control and Quality control, Quality Tasks, Quality functions, The system Concept, Quality systems, quality assurance and ISO 9000 quality system standards, Quality costs concept, Quality cost categories, Examples of Quality cost studies, Securing the Cost figures, Pareto Analysis, Cost reduction Programs and economics of quality.

SECTION-B

Control charts: Statistical Tools in Quality control, The concept of variation, Tabular Summarization of Data, Frequency distribution, Graphical Summarization of Data: The Histogram, Quantitative methods of summarizing data: Numerical Indices, Probability distributions : General, The normal Probability distribution, The normal curve and Histogram Analysis, The causes of variation, statistical aspect of control charting, concept of rational sub-grouping and detecting patterns on the control charts, for variables and attributes: X and R, X and S, p, np, c and u charts; specification and tolerances, natural tolerance limits, specification limits, process capability ratio analysis and narrow limit gauging

SECTION-C

Basic statistical concepts: Descriptions of Binomial, Poisson and Normal distribution with practical examples basics of sampling distribution. Acceptance Sampling: Principle of acceptance sampling, Acceptance sampling by attributes: single multiple and sequential sampling plans, lot quality protection and average outgoing quality protection, Acceptance sampling by variables sampling plans of process parameters,

SECTION-D

Total quality Management: Basic concepts of TQM, historical review, leadership, concepts, role of senior management, quality statements, plans for process parameters, Modern Quality Management Techniques: TQM tools: Benchmarking, QFD, Taguchi quality loss function TPM, FMEA. Lean Manufacturing continuous improvement techniques, JIT systems, pareto diagrams, cause and effect diagrams, scatter diagram, run charts, affinity diagrams, inter-relationship diagram, process decision program charts

COURSE OUTCOMES:

Upon completion of this course the student will be able to:

CO1 - Attain the basic techniques of quality improvement, fundamental knowledge of statistics and probability

CO2 - Use control charts to analyze for improving the process quality.

CO3 - Describe different sampling plans

CO4 - Acquire basic knowledge of total quality management

CO5 - Understand the modern quality management techniques

TEXT BOOKS:

1. Quality planning and Analysis, Juran and Gryna, TMH, New Delhi
2. Quality Management, Kanishka Bed, Oxford University Press, New Delhi
3. Introduction to SQC, Montgomery DC, 3e, Wiley, New Delhi
4. Fundamentals of quality control and improvement, A Mitra, Mcmillan pub. Company, NY

REFERENCE BOOKS:

1. Fundamentals of Applied Statistics, Gupta and Kapoor, Sultan Chand and Sons, New Delhi.

ME 419-F FINITE ELEMENT METHODS

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

Note: Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

SECTION-A

Fundamental Concepts: Introduction; Historical Background, Stresses and Equilibrium, Boundary Conditions, Strain-displacement, Relations, Stress- strain Relations, Temperature Effects, Potential Energy and Equilibrium; The Rayleigh-Ritz Method, Galerkin's method. Saint Venant's Principle, Matrix Algebra, Gaussian Elimination. One-Dimensional Problems: Introduction; Finite Element Modeling, Coordinates and a Shape Functions, The Potential Energy Approach; The Galerkin Approach, Assembly of the Global Stiffness Matrix and Load Vector. Properties of Stiffness Matrix, The Finite Element Equations; Treatment of Boundary Conditions, Quadratic Shape Functions; Temperature effects.

SECTION-B

Two-Dimensional Problems using Constant Strain Triangles: Introduction, Finite Element Modeling, Constant Strain Triangle, Problem Modeling and Boundary conditions; Axis Symmetric Solids subjected to Axis Symmetric Loading:- Introduction, Axis Symmetric Formulation, Finite Element Modeling; Triangular Element, Problem Modeling and Boundary conditions.

Two Dimensional Isoparametric Elements and Numerical Integration: Introduction, The Four- Node quadrilateral, Numerical Integration Stress Calculations, High – Order Element; Nine-Node quadrilateral, Eight-Node Quadrilateral, Six-Node triangle, Comment on Midside Node; Problems.

SECTION-C

Beams & Frames: Introduction, Finite Element formulation, Load Vector, Boundary considerations, Shear Force and Bending Moment, Beams on Elastic supports, Plane Frames, Simple Numerical.

Three-Dimensional Problems in Stress Analysis: Introduction, Finite Element Formulation, Stress Calculations, Mesh Preparation, Hexahedral Elements and Higherorder Elements, Problem Modeling.

SECTION-D

Transfer,: Introduction One-Dimensional Heat Conduction, Heat transfer in thin Fins, Two-dimensional steady-state Heat conduction, Potential Flow, Seepage, Fluid flow in Ducts. Dynamic Considerations: Introduction, Formulation, Element Mass Matrices: Evaluation of

Eigen values and Eigenvectors, Interfacing with previous Finite Element Programs and a program for determining critical speeds of Shafts.

Course Outcomes (CO's): At the end of the course, the student shall be able to:

CO1 - Understand the theories of linear system for finite element analysis.

CO2 - Understand the theories of non-linear system for finite element analysis.

CO3 - Develop the formulation of problem for analysis.

CO4 - Analyse non-linear problem solution procedure.

CO5 - Understand modeling of system with load, displacement and boundary Conditions

Text Books :

1. Introduction to Finite Elements in Engineering Analysis by Tirupathi R. Chandruipatala and Ashok R. Belagundu. Prentice Hall
2. The Finite Element Method in Engineering by S.S.Rao, Peragamon Press, Oxford.

Reference Books:

1. Finite Element Procedures , by Klaus Jurgen Bathi, Prentice Hall.

2. Concepts and Applications of Finite Element Analysis, by Cook, Malkus and Plesha, John Wiley.
3. The Finite Element Method by Zienkiewicz published by Mc Graw Hill.
4. An Introduction to Finite Element Method by J.N. Reddy published by Mc Graw Hill.

ME-421-F ENERGY MANAGEMENT PRINCIPLES

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

Note: Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

SECTION-A

Planning for Energy Management : Initiation phase, Audit and analysis phase; Implementation phase; General methodology for building and site energy audit; Site survey, Methodology; Site survey-Electrical system, Steam & water systems; Building survey methodology; Basic energy audit instrumentation; Measurements for building surveys.

Management of Heating and Cooling General Principles : The requirements for human comfort; Description of typical systems-dual duct HVAC system, Multi zone HVAC systems, Variable an volume system, Terminal reheat system, Evaporative HVAC systems; Modeling of heating and cooling loads in buildings; Problems.

SECTION-B

Electrical load and Lighting Management : General principles; Illumination and human comfort; Basic principles of lighting system; Typical illumination system and equipment; Fundamentals of single phase and 3-phase A.C. circuits; Energy management opportunities for lighting systems, Motors and electrical heat; Electrical load analysis and their parameters; Peak, demand control.

Management of Process Energy : General Principles; Process heat; Combustion; Energy saving in condensate return, Steam generation & distribution, auto-motive fuel control, hot water and water pumping, direct & indirect fired furnaces over; Process electricity; Other process energy forms – compressed air & manufacturing processes; Problems.

SECTION-C

Economics of Efficient Energy Use : General Consideration Life Cycle Costing, Break Even Analysis, Cost of Money, Benefit / Cost Analysis, Pay Back Period Analysis, Present Worth Analysis, Equivalent Annual Cost Analysis, Capital Cost Analysis, Perspective Rate of Return.

Integrated Building System : General Principles; Environmental conformation; Passive design consideration; Building envelope design consideration; Integration of building system; Energy storage ; Problems.

SECTION-D

Use of Computer for Energy Management : Energy management; Energy management principle involving computers, Basics of computer use; Analysis – Engineering & Economic calculations, Simulation, Forecast, CAD/CAM; Controls – Microprocessor & minicomputers, Building cycling & control, Peak demand limiting & control; Industrial Power management; Problems.

Course Outcomes:

CO1 - Understanding of energy conservation and identification of energy conservation opportunities in various industrial processes

CO2 - Knowledge of various tools and components energy auditing

CO3 - Ability to evaluate the performance of industrial boilers, furnaces etc. by direct and indirect methods

Text Books :

1. Energy management Principles by Craig 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, TMH.
2. Integrated renewable energy for rural development– Proc. of natural solar energy convention, Calcutta.

ME- 425-F COMPUTER INTEGRATED MANUFACTURING

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

Note: Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

SECTION-A

Introduction : CAD/CAM Definition, Computer Technology-central processing unit (CPU), types of emory, input/output, the binary number system, computer programming languages. Automation- Types of Automation, CIM, reasons for automating, automation strategies. Conventional Numerical Control: Basic components of NC system, the NC procedure, NC coordinate systems, NC motion control system, applications of numerical control, advantages and disadvantages of NC, computer controls in NC, problems with conventional NC, NC controller technology, computer numerical control, functions of CNC, advantages of CNC, Direct numerical control, components of a DNC system, functions of DNC, advantages of DNC.

SECTION-B

NC Part Programming: Introduction, the punched tape in NC, tape coding and format, NC words, manual part programming, computer assisted part programming, the part programmer's job, the computer's job, NC part programming languages. The APT language: Geometry, statements, motion statements, post processor statements, auxiliary statements.

SECTION C

Robotics Technology : Joints and links, common robot configurations, work volume, drive systems, types of robot control, accuracy and repeatability, end effectors, sensors in robotics, applications of robots.

Automated Material Handling & FMS: The material handling function, types of material handling equipment, conveyor systems, types of conveyors, automated guided vehicle systems, applications. FMS-Components, types of systems, applying FMS technology, FMS workstation, planning.

SECTION D

Computer Aided Quality Control: Introduction, terminology in Quality Control, the computer in QC, contact and non-contact inspection methods-optical and non-optical, and computer aided testing.

Computer Integrated Manufacturing Systems: Introduction, types, machine tools and related equipments, material handling systems, computer control systems, function of the computer in a CIMS, CIMS benefits.

Course Outcome (COs):

At the end of the course, the student shall be able to:

CO 1- Understand principles and applications of oxyacetylene and electric arc welding.

CO 2- Knowledge of various types of welds testing.

CO 3- Learns concept and techniques of welding automation.

CO 4- Analyse methods of advanced and special welding processes.

CO 5- familiarisation of computer system and software for welding engineers

Text Books:

13. Automation, Production Systems and Computer Integrated Manufacturing. Groover M.P, Prentice Hall of India.

14. CAD/CAM – Groover M.P, Zimmers E.W, Prentice Hall of India.

Reference Books:

1**.** Approach to Computer Integrated Design and Manufacturing Nanua Singh, John Wiley

ME- 429-F RELIABILITY ENGINEERING

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

Note: Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

SECTION-A

Reliability: Definition; Probability Concept; Addition of Probabilities; Complimentary Events; Kolmogorov Axioms.

Failure Data Analysis: Introduction, Mean Failure Rate, Mean Time to Failure (MTTF), Mean Time between Failures (MTBF), Graphical Plots, MTTF in terms of Failure Density, MTTF in Integral Form.

SECTION-B

Hazard Models: Introduction, Constant Hazard; Linearly Increasing Hazard, The Weibull Model, Density Function and Distribution Function, Reliability Analysis, Important.

Distributions and their Choice, Standard Deviation and Variance. Conditional Probability: Introduction, Multiplication Rule, Independent Events, Vernn Diagram, Hazard Rate as conditional probability, Bayes Theorem.

SECTION-C

System Reliability: Series. Parallel and Mixed Configurations, Complex Systems, Logic Diagrams, Markov Models.

Reliability Improvement & Repairable Systems: Redundancy, Element, Unit and standby Redundancy, Optimization; Reliability – cost trade- off, Introduction to Repairable Systems, Instantaneous Repair Rate, MTTR, Reliability and Availability Functions, Important Applications.

SECTION-D

Fault-Tree Analysis and Other Techniques: Fault-tree Construction, Calculation of Reliability, Tie-set and Minimal Tie-set.

Maintainability and Availability : Introduction, Maintenance Planning, Reliability and Maintainability trade – off.

COURSE OUTCOMES:

Upon completion of this course the student will be able to:

CO1 - Attain the basic concepts of Reliability, Probability, important parameters MTTF and MTBF

CO2 - appreciate the choice of different distributions.

CO3 - Describe system reliability and improvement systems

CO4 - Acquire basic knowledge of fault tree analysis

CO5 - Understand the concepts of maintainability and availability

Text Books:

13. Reliability Engineering, L.S. Srinath, Affiliated East-West Press, New Delhi.
14. Reliability Engineering, A.K.Govil, Tata Mc-Graw Hill, New Delhi.

Reference Books:

1 Reliability Engineering, L.Balagurusamy, Tata Mc-Graw Hill, New Delhi, 1984.
1 Reliability Based Design, S. Rao, Mc-Graw Hill, 1992.
1 Reliability in Engineering Design, K.C. Kapur and L.R. Lamberson, Wiley Publications.
1 Reliability Engineering, D.J. Smith, 1972, E.W. Publications.

ME-431-F SOLAR ENERGY ENGINEERING

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

Note: Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

SECTION-A

Solar Radiation: Introduction, solar system – sun, earth and earth-sun angles, time, derived solar angles, estimation of solar radiation (direct and diffuse), measurement systems – phyrheliometers and other devices. Effect of Solar radiation upon structures: Steady state heat transmission, solar radiation properties of surfaces, shading of surfaces, periodic heat transfer through walls and roofs.

SECTION-B

Solar Collectors: Flat plate and concentrating – comparative study, design and materials, efficiency, selective coatings, heliostats.
Heating Applications of Solar Energy: Air and Water heating systems, thermal storages, solar bonds, solar pumps, solar lighting systems, solar cookers, solar drying of grains.

SECTION-C

Cooling Applications of Solar Systems: Continuous and Intermittent vapour absorption systems for cooling applications, absorbent – refrigerant combination, passive cooling systems.

SECTION-D

Solar Electric Conversion Systems: Photovoltaics, solar cells, satellite solar power systems. Effects on Environment, economic scenario, ozone layer depletion, green house effect, global warming, Remedial measures by international bodies.

COURSE OUTCOMES:

Upon completion of this course the student will be able to:

CO1 - know about solar system, solar radiation measurement system, effect of solar radiation on structures
CO2 - understand the solar collectors, solar pumps, solar lighting systems and solar cookers
CO3 - understand the cooling applications of solar systems
CO4 - know the solar electric conversion systems

Text Books:

3 Solar Energy – S P Sukhatme, Tata McGraw Hill
3 Solar Energy Process – Duffie and Bechman, John Wiley

Reference Books:

4 Applied Solar Energy – Maniel and Maniel, Addison Wiley
4 Solar Energy: Fundamentals and Applications – R P Garg and Jai Prakash, TMH.

GFME-435-F **GENERAL FITNESS FOR THE PROFESSION**

L T P
- - -

Class Work : -- Marks
Practical : 50 Marks
Total Marks : 50 Marks

At the end of each year students will be evaluated on the basis of their performance in various fields. The evaluation will be made by the panel of experts/examiners/teachers to be appointed by the rincipal/Director of the College. A specimen perform indicating the weight age to each component/ activity is given below :-

Name : _____ College Roll No. _____
Univ.Roll No._____ _____
Branch _____ Year of Admission _____._____

I. Academic Performance (15 Marks) :

(a) Performance in University Examination :-

Sem.	**Result**	**%age of Marks obtained**	**Number of Attempt in which the Sem. exam. has been cleared**
I			
II			
III			
IV			
V			
VI			
VII			

II. Extra Curricular Activities (10 Marks) :

Item	**Level of Participation**	**Remarks (Position Obtained)**
Indoor Games (Specify the Games	_____	_____
Outdoor Games (Specify the Games)	_____	
Essay Competition	_____	
Scientific Technical Exhibitions	_____	
Debate	_____	
Drama	_____	
Dance	_____	
Music	_____	
Fine Arts	_____	

Painting _____
_____
_____

Hobby Club _____
_____
_____

N.S.S. _____
_____
_____

H ostel Mgt _____
Activities _____
_____

Any other _____
activity (Please _____
Specify) _____

III. Educational tours/visits/Membership of Professional Societies (5 Marks)

6 _____
6 _____
6 _____
6 _____
6 _____
6 _____

IV. Contribution in NSS Social Welfare Floor Relief/draught relief/Adult Literacy mission/Literacy Mission/Blood Donation/Any other Social Service (5 Marks)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

V. Briefly evaluate your academic & other performance & achievements in the Institution (5 Marks)

_____
_____
_____
_____

VI. Performance in Viva voce before the committee (10 Marks)

_____
_____
_____

Course Outcomes

CO1 - Student will be try to perform well not only for academic performance.

CO2 – Student will be able to participate in activities like games and other extracurricular activities

CO3 – Student will be able to write technical paper, presentation and participate in competitions.

*Marks obtained 1.( )+II( )+III( )+IV( )+V( )+VI( ) =
**Total Marks :

Member Member Member Member Member

MAHARSHI DAYANAND UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATIONS
B.Tech. 4th YEAR MECHANICAL ENGINEERING,
SEMESTER- VIII

(Scheme -F)

EFFECTIVE FROM THE SESSION 2012-13

Sl. No.	Course No.	Subject	Internal Marks	External Marks	Total Marks
1.	**ME- 402-F**	Industrial Training/Institutional Project Work	150	150	300

Note:

The students are required to undergo Industrial Training or Institutional Project Work of duration not less than 4 months in a reputed organization or concerned institute. The students who wish to undergo industrial training, the industry chosen for undergoing the training should be at least a private limited company. The students shall submit and present the mid-term progress report at the Institute. The presentation will be attended by a committee. Alternately, the teacher may visit the Industry to get the feedback of the students.

The final viva-voce of the Industrial Training or Institutional Project Work will be conducted by an external examiner and one internal examiner appointed by the Institute. External examiner will be from the panel of examiners submitted by the concerned institute approved by the Board of Studies in Engg. & Technology. Assessment of Industrial Training or Institutional Project Work will be based on seminar, viva-voce, report and certificate of Industrial Training or Institutional Project Work obtained by the student from the industry or Institute.

The internal marks distributions for the students who have undergone Industrial Training consist of 50 marks from the industry concern and 100 marks by the committee members consisting of faculty members of concerned department of the parent institute.

The teachers engaged for Institutional Project work shall have a workload of 2 hours per group (at least 4

students) per week.

Course Outcomes:

At the end of this course the student shall be able to

CO1 have an understanding how to work in actual industry environment

CO2 utilise the technical resources

CO3 write technical/training reports

CO4 give oral presentation related to the work completed