MAHARSHI DAYANAND UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATIONS
B.Tech 2nd YEAR MECHANICAL & AUTOMATION ENGG,

(COMMON WITH MECHANICAL ENGINEERING WITH 3RD SEM)

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
Course	Course Title	L	T	P	Total		Theory	Practic	Total	Duration
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	6/7	9	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.

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.

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.

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

		Sessional	: 50 Marks
L	T	P	Theory	: 100 Marks
3	1	-	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 1st law of Thermodynamics, Internal Energy and Enthalpy, PMMFK, Steady flow energy equation, 1st 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.

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

	Sessional : 50 Marks
L T P	Theory : 100 Marks
3 1 -	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.

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.

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.

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.

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- F COMPUTER 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.

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- F ENGINEERING 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.

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.

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 (SEMESTER-IV)
MECHANICAL & AUTOMATION ENGINEERING

Course No.	Course Title	Teaching Schedule				Marks for Class work	Marks for Examination		Total Marks	Duration of Exam
		L	T	P	Total					
MAT-201-F HUM-201-F	MATH - III OR ECONOMICS	3 3	2 1	-	5 4	50	100		150	3
ME-204-F	Kinematics of Machine	3	1	-	4	50	100		150	3
ME-206-F	Strength of Materials	3	1	-	4	50	100		150	3
MAE-212-F	Manufacturing M/Cs	3	1	-	4	50	100		150	3
MAE-213-F	Microprocessor & Applications	3	1	-	4	50	100		150	3
ME-208-F	Fluid Mechanics	3	1	-	4	50	100		150	3
ME-216-F	Fluid Mechanics Lab	-	-	2	2	25	-	25	50	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
MAE-251-F	Microprocessor & Applications Lab	-	-	2	2	25	-	25	50	3
GPMAE-252	General Proficiency	-	-	2	2	50	-	-	50	-
	TOTAL	18	6/7	10	34/35		600	100	1150	

Note:

1 . Each student has to undergo Practical training of 6 weeks during summer vacation and its evaluation shall be carried out in 5th semester

2 Students will be allowed to use Non-Programmable Scientific Calculator. However sharing of calculator will not be permitted in the examination

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.

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.

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-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.

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.

MAE-212-F MANUFACTURING MACHINES

Theory : 100 Marks
Total : 150 Marks
Duration of Exam : 3 Hrs

L T P
3 1 -

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 : Classification of machine tools based on application and production rate : General purpose. Single and Special purpose machines, Classification based on types of machine tools and the processes, Generation and forming.

Elements of metal cutting processes : Elements of toll geometry, cutting tool material and applications.

SECTION B

Lathe : Various types of lathe : Centre lathe, facing lathe, gap-bed lathe, capstan and turret lathe, CNC lathe, major difference between CNC lathe and conventional lathe. Major sub-assemblies of a lathe : Bed, headstock, tail stock, carriage consisting of saddle, cross slide, toll post and apron. Work holding devices : self centering three jaw chuck, independent four jaw chuck, collets, face plates dog carriers, centers and mandrels.

SECTION C

Lathe contd… Driving mechanisms, apron mechanism, thread cutting mechanism and calculations, features of not engagement – disengagement, indexing dial mechanism. Operations on lathe : taper turning, related calculations, thread cutting, facing, under cutting, drilling, boring, parting-off, knurling, chamfering

Reciprocating Type Machine Tools : Shaper, Planer and Slotter : Constructional features, basic machines and kit and related calculations

SECTION D

Drilling Machin, multi spindle drilling machine, feed mechanism, work hold holding devices, tool holding devices. Different drilling operations: Drilling reaming, counter boring and countersinking etc. estimation of drilling time.

Milling Machines : Types of general purpose milling machine : horizontal, vertical and Universal. Types of milling cutters and their applications, different indexing. Indexing calculations and machining time calculations. Introduction to machining centers.

Grinding Machines : Different type of grinding machines : cylindrical, surface and center-less grinding machines, basic constructional features and mechanisms, specifications, different grinding operations, honing, lapping and super finishing processes.

Text Books :

1. P.N. Rao, " Manufatuiring Technology : Metal Cutting & Machine Tools ", Tata Mc Graw Hill Delhi, 2004
2. B.S. Raghuwanshi ", Workshop Technology, Vol 2, Dhanpat Rai & Sons.
3. Hazar Chandhari S.K " Elements of Workshop Technology, Vol 2, Media Promoters, 2003.

Reference Books

1. P.C Sharma " A Text Book of Production. Engineering, S. Chand, New Delhi, 2004
2. Bawa H.S " workshop Technology, Vol 2 Tata Mc Graw Hill 2004.
3. Juneja & Shekhon; Fundamental of Metal Cutting, New age publications.
4. S.F Krar Stevan F and Check A.F Technology of M/C Tools" Mc Graw Hill Book Co.1986.
5. Kibbe Richard et al "M/c Tool practices " Prentice Hall India, 2003.
6. Bangalore HMT. " Production Technology". Khanna Publishers.
7. R.K Jain " Production Technology". Khanna Publishers.
8. Gerling Heinrich " All about Machine Tools" New Age Publication. 2003.

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MAE-213-F MICROPROCESSOR & APPLICATION

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

L T P

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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 to Microprocessors And Microcontrollers : Introduction to Microprocessor and Micro controller, Number system and Binary arithmetic. Microprocessor Architecture (8085 and 8086) and Microcomputer System, memory map and addressing, memory classification, review of logic device for interfacing, Memory Interfacing, Overview of 8085 Instruction Set, stacks and Interrupts.

SECTION B

The 8051 Architecture : 8051 Microcontroller hardware oscillator and clock, Prog, Counter and Data pointer, Registers and program status word. Internal memory RAM, Stack and Stack Pointer, Special Function Registers, Internal ROM. Input/Output pins, Ports and circuits, External memory, Counters and Timers, Serial data Input and Output, Interrupts.

SECTION C

Assembly Language & Programming The 8051 : Assembly Language Programming, Programming the 8051, Moving data, Logical Operators, Arithmetic Operating, Branching Operations Interrupts.

SECTION D

Microcontroller 8051 design : Microcontroller specification and Design, External Memory and Memory space decoding, memory – mapped I/O, memory Access times, Timing Subroutines, Lookup Tables fro 8051. Special system Design.

Interfacing Peripheral Device To 8051 And Applications : Interfacing A/D Converts and D/A Converters, 8255, 8259, Application to interfacing Scanned Displays, Matrix keyboard, memory Design, data Acquisition System Design.

Text Books :

.K.J. Ayala “ The 8051 Micro controller, Architecture, Programming & Applications “ Thomsom Delmer Learning

RS Gaonkar, “ Microprocessors Architecture, Programming and Applications “ Penram International.

Reference Books :

MA. Mazidi & J.G Mazidi .” The 8051 Micro controller & Embedded System “ Pearson Education.

B. Ram “ Fundamentals of Microprocessors and Microcomputers “ Dhanpat Rai and Sons.

ME-206-F STRENGTH OF MATERIALS

L T P	SESSIONAL MARKS	: 50
3 1 0	THEORY MARKS	: 100
	TOTAL	: 150

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.

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.

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-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.

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.

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.

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.**

MAE-251-F MICROPROCESSOR AND APPLICATION LAB

L	T	P		
-	-	2	Practical	: 25 Marks
			Duration of Exam	3 hours

Sessional : 25 Marks

List of Experiments:

1. Study of 8085 Microprocessor kit.

2. Write a program using 8085 and verify for :

(a). Addition of two 8-bit numbers.
(b). Addition of two 8-bit numbers (with carry).
3. Write a program using 8085 and verify for :
(a.). 8-bit subtraction (display borrow)
(b). 16-bit subtraction (display borrow)
4. Write a program using 8085 for multiplication of two 8- bit numbers by repeated addition method. Check for minimum number of additions and test for typical data.
5. Write a program using 8085 for multiplication of two 8- bit numbers by bit rotation method and verify.
6. Write a program using 8085 for division of two 8- bit numbers by repeated subtraction method and test for typical data.
7. Write a program using 8085 for dividing two 8- bit numbers by bit rotation method and test for typical data.
8. Study of Development tools/environment for Microcontroller Programme.
9. Develop an embedded system for traffic light controller using Micro controller
10. Develop an embedded system for the automatic motion of a car (Model of car) & Subsequent display on LCD using Microcontroller..
11 Write an Assembly language Programme (ALP) to generate 10kHz square wave.
12. Write an ALP to generate 10 kHz frequency using interrupts.
13. Write an ALP to interface one Microcontroller with other wring serial/parallel communication.
14. Write an ALP for temperature & pressure measurement & to display on intelligent LCD display

NOTE:

1. 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.

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 hours

- 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

MAHARSHI DAYANAND UNIVERSITY ROHTAK

SCHEME OF STUDIES & EXAMINATIONS
B.Tech. 3RD YEAR (SEMESTER-V)
MECHANICAL & AUTOMATION ENGINEERING
Wef 2012-2013(F- Scheme)

Course No.	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 Machine (common to ME)	3	1	-	4	50	100		150	3
MAE-301-F	Mechanical Machine Design	3	2	-	5	50	100		150	4
ME-305-F	Fluid Machines (common to ME)	3	1	-	4	50	100		150	3
MAE-303-F	Theory of Metal Cutting & Forming Process	3	1	-	4	50	100		150	3
ME-307-F	Internal Combustion Engines & Gas Turbines (common to ME)	3	1	-	4	50	100		150	3
ME-311-F	Applied Numerical Techniques & Computing(common to ME)	3	-	-	3	50	100		150	3
ME-313-F	Dynamics of Machine Lab (common to ME)	-	-	2	2	25	-	25	50	3
ME-315-F	Fluid Machines Lab (common to ME)	-	-	2	2	25	-	25	50	3
MAE-315-F	Theory of Metal Cutting & Forming Process Lab	-	-	2	2	25	-	25	50	3
ME-317-F	Internal Combustion Engines & Gas Turbines Lab (common to ME)	-	-	2	2	25	-	25	50	3
ME-321-F	Applied Numerical Techniques & Computing Lab (common to ME)	-	-	2	2	50	-	-	50	3
ME-323-F	Practical Training Viva-Voce (common to ME)	-	-	2	2	-	-	-	-	-
	TOTAL	18	6	12	36	450	600	100	1150	

Note:

1) Students will be allowed to use non-programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.

2) 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.

Text Books:

1. Theory of Mechanisms and Machines: Amitabha Ghosh and Ashok kumar Mallik, Third Edition Affiliated East-West Press.
2. 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.
2 Theory of Machines and Mechanisms: Joseph Edward Shigley and John Joseph Uicker, Jr. Second Edition Mc Graw Hill, Inc

MAE - 301 - F MECHANICAL MACHINE DESIGN

L	T	P
3	1	-

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

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 B

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 differentstatic loading conditions, eccentrically loaded riveted joints, design of cotter and knuckle joints.
Shafts : Detailed design of shafts for static and dynamic loading, Rigidity and deflection consideration

Section C

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 including the Consideration for maximum power transmitting capacity, Gear Lubrication, Design Problems

Section D

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

Text Books:

1. Mechanical Engg. Design - First Metric Editions: Joseph Edward Shigley-MGH, New York.
2. Design of Machine Elements – V.B. Bhandari – Tata McGraw Hill, New Delhi.
3. PSG Design Data Book

Reference Books :

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

ME- 305 F FLUID MACHINES

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 carriesequal 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, Kaplanturbine, 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.

Text Books :

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

Reference Books :

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

MAE- 303 F THEORY OF METAL CUTTING & FORMING PROCESS

	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

MECHANISM OF CHIP FORMATION:steady of deformation, mechanism of deformation slip, twinning & dislocation, types of chips, single hear plane model and zone theory for determination of dynamic shear strain. chip formation in drilling, chip formation in milling, effect of cutting variable on chip reduction coefficients, numerical problems

MECHANISM OF CUTTING: Force system in turning, merchant circle diagram, friction and shear force, shear stress in turning, energy in cutting process, Kronenberg relation and velocity relation, chip deviation and other effect on cutting forces, force system in drilling, force system in milling(Vulf and simulated model, numerical problems.

SECTION B

DERTEMINATION OF CUTTING FORCES: Theoretical determination cutting forces-shear angle relation(Ernst & merchant, Kronenberg. Lee & Shaffer), practical determination of cutting forces-Design fundamental of tool force dynamometer. turning , milling and grinding dynamometer(mainly strain gauge type) Tool life, machinablity, metal cutting Optimisation(Gilbert Model), tool life test(mainly facing tool life test) machine surface finish.

DESIGN OF CUTTING TOOLS: Design of turning tool mainly high production tool, design of twist drills, design of form milling cutters, design of round internal broach(pull type)

SECTION C

FLOW STRESS OF METAL: True stress-strain curves, selection of stress-strain curves, determination of flow stress, compassion test, ring test and torsion test, representation of flow stress data criteria for plastic flow; Tresca and vonmises yield criteria, relation ship between tensile yield stress and shear yield stress.

SECTION D

METAL FORMING LUBRICATION: Friction at die workpiece interface, Ring compression test, lubricator mechanism, boundary lubrication, mixed lubrication, hydrodynamic lubrication.

ANALYSIS OF METAL FORMING PROCESS: drawing of rod, wire and tubes rolling or flat slab and strip forming of thin strips and circular discs.

TEXT BOOK:

1. Text metal Cutting Thory by A. bhattacharyya, New central Book Agency
2. Principles of Industrial Metal Working Proceses by Rowe
3. P.N. Rao," Manufacturing Technology",:Metal Cutting & machine Tool", Tata McGraw Hill
4. B.S. raghuwanshi." Workshop Technology:, Vol2, dhanpat Rai & sons,2003

Reference books:

1. P.C. Sharma,"A Text Book of production. Enineering", S.Chand,New Delhi,2004
2. Bawa H.S.," workshop technology" vol2 Tata McGraw Hill
3. Juneja & Shelhon."fundamental of metal cutting:, New age publications,

ME- 307 F INTERNAL COMBUSTION ENGINE AND GAS TURBINE

	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

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.

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- 311 F APPLIED NUMERICAL TECHNIQUES & COMPUTING

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

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.

Text Books:

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

Reference Books:

1. Numerical Solution of Differential Equations, by M.K. Jain, Published by Wiley Eastern, New York.
2. Introductory Methods of Numerical Analysis by S.D. Sastry, Published by Prentice Hall of India.
3. 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 :

1. To perform experiment on Watt and Porter Governors to prepare performance characteristic Curves, and to find stability & sensitivity.
2. To perform experiment on Proell Governor to prepare performance characteristic curves, and to find stability & sensitivity.
3. To perform experiment on Hartnell Governor to prepare performance characteristic Curves, and to find stability & sensitivity.
4. To study gyroscopic effects through models.
5. To determine gyroscopic couple on Motorized Gyroscope.
6. To perform the experiment for static balancing on static balancing machine.
7. To perform the experiment for dynamic balancing on dynamic balancing machine.
8. Determine the moment of inertial of connecting rod by compound pendulum method and tri-flair suspension pendulum.

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.
2. To draw the following performance characteristics of Pelton turbine-constant head, constant speed and constant efficiency curves.
3. To study the constructional details of a Francis turbine and draw its fluid flow circuit.
4. To draw the constant head, constant speed and constant efficiency performance characteristics of Francis turbine.
5. To study the construction details of a Kaplan turbine and draw its fluid flow circuit.
6. To draw the constant head, speed and efficiency curves for a Kaplan turbine.
7. To study the constructional details of a Centrifugal Pump and draw its characteristic curves.
8. 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.

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.

MAE- 315 F THEORY OF METAL CUTTING & FORMING PROCESS LAB.

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

List of Experiments :

1. To identify various angles and parameters of various single point cutting tools.
2. To identify various angles and parameters of various multipoint cutting tools.
3. To grind various angles on a single point cutting tool
4. to identify chips produced in turning of Aluminium, mild steel work piece at different speeds and feeds
5. To study wear of cutting tool in turning.
6. To study surface finish by varying cutting parameters on surface grinding machine.
7. To study chips in orthogonal cutting of Lead, Aluminium by printed grid formation method on shaper.
8. To study effect of cutting fluid on machining.
9. To study force system in milling with the help of model(VULF and Simulated model)
10. To measure cutting force in turning operation.

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

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 & 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.

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- 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 iterativemethod.
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 4th 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 intergration.
10. Numerical solution of an elleptic boundary value problem using the method of Finite Differences.

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 DirectorPrincipal/ 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 (SEMESTER-VI) (F-SCHEME)
MECHANICAL & AUTOMATION ENGINEERING

Course No.	Course Title	Teaching Schedule				Marks for Class work	Marks for Examination		Total Marks	Duration of Exam
		L	T	P	Total		theory	practical		
MAE-302-F	OPTIMIZATION TECHNIQUE FOR ENGINEERING SYSTEM	3	1	-	4	50	100		150	3
MAE-304-F	METROLOGY AND QUALITY ASSURANCE	3	1	-	4	50	100		150	3
MAE-306-F	COMPUTER AIDED MANUFAUTURING	3	1	-	4	50	100		150	3
ME-308-F	AUTOMATIC CONTROL (Common to ME)	3	1	-	4	50	100		150	3
MAE-308-F	MECHATRONICS	3	1	-	4	50	100		150	3
MAE-310-F	AUTOMATION IN MANUFACTURING	3	1	-	4	50	100		150	3
MAE-312-F	METROLOGY AND QUALITY ASSURANCE LAB	-	-	2	2	25	-	25	50	3
MAE-314-F	CAD/CAM LAB	-	-	2	2	50	-	50	100	3
MAE-316-F	MECHATRONICS LAB	-	-	2	2	25	-	25	50	3
ME-320-F	GENERAL PROFICIENCY	-	-	2	2	50	-	-	50	3
	TOTAL	18	6	8	32		600	100	1150	

Note:

1 Each student has to undergo Practical training of 6 weeks during summer vacation and its evaluation shall be carried out in 7th semester

2 Students will be allowed to use Non-Programmable Scientific Calculator. However sharing of calculator will not be permitted in the examination

MAE- 302 F OPTIMIZATION TECHNIQUE FOR ENGINEERING SYSTEM

	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

INTRODUCTION:Engineering applications, Statement of the optimal problem: classification of optimization techniques,

CLASSICAL METHODS: Single variable optimization;multivariable optimization without any constraints with equality and inequality constraints.

SECTION B

One Dimensional Minimization Method: Uni-model function;elimination method-Dichotomous search,Fibonacce and golden section methods;interpolation methods-Quadratic and cubic interpolatipon methods

UNCONSTRAINED MINIMIZATION METHOD: Univariate,conjugate directions,gradient and variable metric methods

SECTION C

Constrained minimization method:- charactersticks of a constrained problem, direct method of feasible directions:Randon search method, complex method, rosen's gradient projection method, indirect method of interior and exterior penalty function.

Geometric programming: formulation and solution of unconstrained and constrained geometric programming problems.

SECTION D

Dynamic programming; Multistage decision process, Representation of a Multistage decision process, concept of sub-optimization and the principle of optimalicy, calculate tabular and computational methods in dynamic programming, an introduction to continuous dynamic programming.

Integer programming; Gomory's cutting plane method for integer linear programming formulation and solution of integer polynimial and non linear problems.

TEXT BOOKS-

Optimization(theory and application) - S.S.RAO, Wiley eastern ltd. New Delhi.

Optimization concepts and applications in engg.- Ashok D.Belegundu andTirupathi R Chandrupatia Pearson Education.

REFERENCE BOOKS-

Optimization: Theory and practice, C.S.G Beveridge and R.S Schechter, MGH, newyork

MAE- 304 F METROLOGY AND QUALITY ASSURANCE

	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

STANDARD AND MEASUREMENTS; Need of standards, classification primary, secondary and tertiary standards tracability of standards, lenght standard, line and end standards, derivation of end standards from lline standards gauges and their calibration, wave length standards, angle standards, angle, slip gauges , precision polygons and div. circles.

LIMITS, FITS AND TOLERENCES: Concept of interchangibility , type of interchangibility, needs standards system of limits, fits and tolerences, BIS 919,1963 standrd system, selection of limits and exercise on limit, fits and tolerences, design principle for limit gauges. Taylor's principle, types of gauges , tolerences on limit gauges.

SECTION B

MEASURING AND GAUGING INSTRUMENTS; Design principle of measuring instruments,kinematics design, principle of alignment pivots and bearing , sources of error in measurement, calibration of measuring instruments,mechanical linear and angle measuring instrument, vernier callipers, micrometres, dial gauge, bevel protector, sine bar, spirit level , optical instruments, autocollimator tool room microscope, length measuring machines, comperator megnification principles, types of compoerators, mechanical optical pneumatic electrical and electronic comperator.

GEOMETRICAL METROLOGY: Concept of form error,straightness, roundness, squareness and concentricity error and their measurement.

SECTION C

SCREW THREAD AND GEAR METROLOGY; Element of screw metrology, measurement of major, minor and effective diameters of external and internal screw thraed, measurement of pitch and screw thread angel, effect of pitch error , element of gear metrology,measurement of gear tool thickness, gear profile, gear concentricity, pitch and runout for involute gears , gear rolling test.

MEASUREMENT OF SURFACE FINISH: Concept of macro and micro errors , scales, surface roughness measures, datum for surface roughness measurement, M and E system, measurement of surface roughness stylus methods using, mechanical, optical and electrical(talysurf) magnification(tomlinson testers) (foster)

SECTION D

MACHINE TOOL METROLOGY; alignment tets of machine tools, lathe, drilling machines and milling machine performance test lathe

STATISTICAL QUALITY CONTROL: Element of statistical interference, distribution of sample means, the characterstick and central limit theorem, process variation, process capability, sampling plans, single and double sampling plans, sequencial sampling plans, OC curve for sampling plans, AQL and ASN concepts, theory of control chart , change causes and assignable causes, incontrol process and out of control process, control chart for control X and R P and NP charts.
QUQLITY ASSURANCES: Sporadic process control, chronic quality problems, process tools and technic improvement, brake through management roles quality system and standardisation.
TEXT BOOKS;
metrology by R.K.JAIN, khanna publication
statistical quality control by M. MAHAJAN, dhanpat rai publication
REFERENCE BOOKS:
statistical quality control by R.S NAGARAJAN
total quality managementby dale H. Bester field publication pearson education
metrology ASTM hand book

MAE- 306 F COMPUTER AIDED MANUFACTURING

	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

INTRODUCTION : Overview of automation in industry. Type of production: continuous, mass, batch and job production, automation achievements therein, Product cycle and CAD/CAM influence on product cycle, Automation Strategies, mathematical model for employing and justifying CAD/CAM in different area of operation.

PROGRAMMED AUTOMATION AND NUMERICAL CONTROL:program controlled machine tools, punched card and punched tapes, machine tools. NUmerical control and its basis. axis Designation. NC motion control system point to point , straight cut and continuous path control system. application of NC in metal- cutting and no metal cutting areas.

SECTION B

COMPUTER NUMERICAL CONTROL : Bloch diagram of CNC operations. Nomenclature, types and future of CNC machine tools. Elements of CNC machine and systems. Machine control unit. Position control and insignificance Engineering, analysis of NC positioning system. Open loop and closed loop system. precision NC positioning system : control, resolution, accuracy and repeatability. actuators: DC servomotor, a servomotor, stepper motor. Transducer and feedback element : resolves, inductosyns optional grating and encoder.

SECTION C

PART PROGRAMMING: Process Planning and chart for part programming, Toolong system, tool nomenclature, tool geometries of modern indexable carbide tools. Tool presetting & Modular tooling. selection of tool based on machining capacity, accuracy and surface finish. Elements of programming for turning and milling . Composition of a part program programmin codes G, Miscellaneous function M, interpolation, To compensations, cycles for simplifying programming. part programming for typical component on turning machine and machining centre.

COMPUTER AIDED PROGRAMMING: APT Part programming. Introduction to computer aided programming through pro-e.

SECTION D

MODERN CNC MACHINE: CNC lathe. Turning centers, Machinin centers, Automated Pallet charger Automatic tool changer. Direct Numeric control and application. CNC machine design feature. Supportive structure. Guide ways. Ball screw and nut mechanism. Machine Spindles. Concept of rigidity and related with accuracy.

COMPUTER AIDED INSPECTION Coordinate measuring machines and their applications introduction to machine version and applications.

Text books:

1. Mikell P. groover ," Automation, Production systems and computer-integrated manufacturing",second edition pentice hall,2001
2.S.K. SINHA,"CNC Programming",galghotia publication 2003
3."HMT Machatronics",Tata mcgraw hill,2001.

Reference books:

1.Mikell P.Groover,EMORY W.Zimmers,CAD/CAM Pearson education,2001
2.P.N RAO,"CAD/CAM Principles and applications" TATA Mcgraw hill,2003

ME- 308 F AUTOMATIC CONTROL

	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

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 C

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.

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 Delh

MAE-308-F MECHATRONICS

L	T	P		
			Theory	: 100 Marks
3	1	-	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 and Basics: What is Mechatronics?; A Measurement System with its constituent elements; Open and Closed Loop Systems; Sequential Controllers; Micro-processor Based Controllers; The Mechatronic Approach.

Hardware of Measurement Systems; A review of Displacement, Position Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, Light Sensors / along with Performance Terminology; Selection of Sensors; Input Data by Switches; Signal Conditioning; Brief Review of Operational Amplifier; Protection; Filtering; Wheat Stone Bridge; Digital Signals; Multiplexers; Data Acqusition; Digital Signal Processing; Pulse Modulation; Data Presentation Systems – Displays; Data Presentation Elements; Magnetic Recording; Data Acquisition Systems; Testing & Calibration; Problems.

SECTION B

Pneumatic, Hydraulic, Mechanical and Electrical Actuation Systems: Pneumatic and Hydraulic Systems; Directional Control Valves; Valve Symbols; Pressure Control Valves; Cylinder Sequencing; Process Control Valves; Rotary Actuators; Mechanical Systems – Types of Motion, Kinematic Chains, Cams, Gear Trains, Ratchet & Pawl, Belt & Chain Drives, Bearings, Mechanical Aspect of Motor Selection; Electrical Systems; Mechanical & Solid State Switches; Solenoids; D.C. & A.C. Motors; Stepper Motors; Problems.

System Modeling and Performance: Engg. Systems; Rotational – Translational Systems; Electro-mechanical Systems; Hydraulic – Mechanical Systems; A review of modeling of First and Second Order Systems and Performance Measures; Transfer Functions for first order System, Second Order System, Systems in series & Systems with Feedback Loops; Frequency Response of First Order and Second Order Systems; Bode Plots: Performance Specifications: Stability; Problems.

SECTION C

Closed Loop Controllers: Continuous and Discrete Processes – Lag, Steady State Error; Control Modes; Two- step Mode; Proportional Mode – Electronic Proportional Controllers; Derivative Control – Proportional plus Derivative Control; Integral Control - Proportional plus Integral Control; PID Controller – Operational Amplifier PID Circuits; Digital Controllers – Implementing Control Modes; Control System Performance; Controller Tuning – Process Reaction Method & Ultimate Cycle Method; Velocity Control; Adaptative Control; Problems.

Digital Logic and Programmable Logic Controllers : A Review of Number Systems & Logic Gates; Boolean Algebra; Kanaugh Maps; Sequential Logic; Basic Structure of Programmable Logic Controllers; Input/ Output Processing; Programming; Timers, Internal Relays and Counters; Master & Jump Controls; Data Handling; Analogue Input/ Output; Selection of a PLC; Problems.

SECTION D

Microprocessors and Input/Output Systems: Control; Microcomputer Structure; Micro- controllers; Applications; Programming Languages; Instruction Sets; Assembly Language Programs; Subroutines; Why C Language ? A review of Program Structure, Branches, Loops, Arrays, Pointer; Examples of Programs; Interfacing; Input/ Output; Interface Requirements; Peripheral Interface Adaptors; Serial Communication Interface; Examples of Interfacing; Problems.

Design and Mechatronics: Design Process; Traditional and Mechatronics Design; Possible Mechatronics design solutions for Timed Switch, Wind Screen Wiper Motion, Bath Room Scale, A Pick & Place Robot, Automatic Camera, Engine Management System & Bar Code Recorder.

Text Books:

1. Mechatronics by W. Bolton, Published by Addition Wesley.
2. Mechatronics System Design – Devdas Shetty and Richard A. Kolx Brooks/ Cole 1997.

Reference Books:

1. Introduction to Mechatronics and Measuring System: david G. Alciation and Michael B. Hits and Tata McGraw Hill
2. Mechatronics – Sensing to Implementation - C.R.Venkataraman, Sapna

MAE-310-F AUTOMATION IN MANUFACTURING

L	T	P		
			Theory	: 100 Marks
3	1	-	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:

Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations, introduction to automation productivity.

Material handling systems:

Overview of Material Handling Systems- Rotary feeders, oscillating force feeder, vibratory feeder, elevator type and Centrifugal type feeders, Principles and Design Consideration, Material Transport Systems, Storage Systems.

SECTION B

Automated Manufacturing Systems:

Components, Classification and Overview of Manufacturing Systems, Manufacturing Cells, GT and Cellular Manufacturing, FMS, FMS and its Planning and Implementation, Flow lines & Transfer Mechanisms, Fundamentals and Analysis of Transfer Lines, product design for automatic assembly.

Control Technologies in Automation:

Industrial Control Systems, Process Industries Verses Discrete-Manufacturing Industries, Continuous Verses Discrete Control, Computer Process and its Forms. Sensors, Actuators and other Control System Components.

SECTION C

Evaluation of automatic production:

product manufacturability, orientation devices- active and passive devices, parts orientation and Rocapement.

Pneumatic and hydraulic components and circuits:

Boolean algebra, pneumatic sensors and amplifiers, jet destruction devices, logic devices, schimit triggering devices, developing pneumatic circuits for automatic die casting machine.

SECTION D

Modeling and Simulation for manufacturing Plant Automation: Introduction, need for system Modeling, Building Mathematical Model of a manufacturing Plant, Modern Tools- Artificial neural networks in manufacturing automation, AI in manufacturing, Fuzzy decision and control, robots and application of robots for automation.

Reference Books:

1. Handbook of design, manufacturing & Automation : R.C. Dorf, John Wiley and Sons.
2. Automation, Production Systems and Computer Integrated Manufacturing, M.P. Groover, Pearson Education.
3. Industrial Automation : W.P. David, John Wiley and Sons.
4. Computer Based Industrial Control, Krishna Kant, EEE-PHI
5. An Introduction to Automated Process Planning Systems, Tiess Chiu Chang & Richard A. Wysk
6. Manufacturing assembly Handbook:- BrunoLotter
7. Anatomy of Automation, Amber G.H & P. S. Amber, Prentice Hall.
8. Performance Modeling of Automated Manufacturing Systems, Viswanandham, PHI

ME-312- F METROLOGY AND QUALITY ASSURANCE LAB

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

List of Experiments :

1. Measurement of angle of taper using sine bar.
2. Measurement of surface roughness with digital surface roughness tester.
3. Checking the eccentricity of an eccentric shaft using (i) slip gauge (ii)dial indicator.
4. Inspection of threads with (i) thread plug gauge (ii) thread ring gauge.
5. Study of cordinate measuring machine
6. plotting of variable control chart.
7. measurement of gear papameters
8. Measurement of screw parameter.
9. Study of mechanical pneumatic comparators.
10. Experiment on Operating charaterstic curve.

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.

MAE- 314 F CAD/CAM LAB.

L	T	P		
-	-	2	Sessional	: 50 Marks
			Practical	: 50 Marks
			Total	: 100 Marks
			Duration of Exam.:	3 Hrs.

List of Experiments :

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.)

1. CAD Modeling Assignments

(i) Use and learn import/export techniques and customization of software.

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

(iii) 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.

(iv) Make the part family/family table of a bolt.

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2. CAM Assignments

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

Part Programming and proving on a CNC lathe for:-

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

Part Programming and Proving on a CNC Milling Machine:-

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

Part Programming and Proving for Milling a Rectangular Slot.

MAE-316- F MECHATRONICS LAB

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

List of Experiments :

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

2. 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.

1. To verify truth table of various gates such as AND, OR, NOR, NOT, etc.
2. To realize a logic equation Y=AB+CD.
3. Selection of sensor for a particular application from Catalogue/Internet.
4. Design a mechatronics product/system and incorporate application of mechatronics for enhancing product values
5. To study the hardwares and softwares of mechatronics kit.
6. To move a table in X-direction within the range of proximity sensors using Control-X software.
7. To rotate a table using DAC system.
8. To move a table in Y-direction within the range of proximity sensors using Control-X software.
9. To run a motor with PLC.
10. To run a conveyor with computer.
11. To study the movement of actuating cylinders and sensors.
12. To study mechatronics and their interfacing in a CNC machine.
13. Life prediction from computer programme based on mathematical model.

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

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

MAHARSHI DAYANAND UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATIONS
B.Tech. 4th YEAR MECHANICAL & AUTOMATION ENGINEERING,
SEMESTER- VII (F-SCHEME)
W.E.F 2013-14

Course	Course Title	Teaching schedule				Marks For class work	Marks for Examination		Total Marks	Duration of Exam
		L	T	P	Total		Theory	Practical		
MAE-401-F	NETWORKING SYSTEM	3	1	-	4	50	100	-	150	3
MAE-403-F	COMPUTER INTEGARTED MANUFACTURING	3	1	-	4	50	100	-	150	3
MAE-405-F	ROBOTICS ENGINEERING	3	1	-	4	50	100	-	150	3
ME-403-F	REFRIGERATION AND AIR CONDITIONING (Common to ME)	3	1	-	4	50	100	-	150	3
ME-409-F	MECHANICAL VIBRATION Common to ME)	3	1	-	4	50	100	-	150	3
----------	DEPTT ELECTIVE	3	1	-	4	50	100	-	150	3
ME-411-F	RAC LAB	3	1	-	4	50		50	100	3
MAE-411-F	ROBOTICS ENGINEERING LAB	-	-	2	2	50	-	50	100	3
ME-415-F	PT-II	-	-	2	2	-	-	-	-	-
	Total	18	6	6	30	400	600	100	1100	

LIST OF DEPARTMENTAL 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-423-F**	**ENGINEERING DESIGN**
5.	**ME-427-F**	**MANUFACTURING MANAGEMENT**
6.	**ME- 429-F**	**RELIABILITY ENGINEERING**
7.	**ME-431-F**	**SOLAR ENERGY ENGINEERING**
8.	**ME- 433-F**	**VALUE ENGINEERING**

MAE-401-F NETWORKING SYSTEM

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 to computer networks, reference models: OSI model, TCP/IP model, Evaluation of internet

SECTION B

Fundamental of MAC layer, Data link, Transmission medias: Guided and Unguided, Twisted pair cable(STP & UTP), coaxial cable, fiber optic cable, radio wave, infrared, microwave links.

SECTION C

LAN Technologies: Traditional Ethernet(concept of CSMA/CD), Fast Ethernet, Giga bit Ethernet IEEE 802.4(token bus) , IEEE802.5(token ring) IEEE802.11(Wireless lan), Working of a repeater, hub bridge and switch. Network layer concepts and routing algorithms, IPV6 and IPV4, subnetting and subnet masksing, working of router in LAN concepts of virtual LAN.

SECTION D,

Introduction to encryption and compression of data, network security issues, working of dial up connection, role of internet service provider(ISP) and working of ISDN and broadband connection etc., Application layer protocol DNS,HTTP,FTP,telnet.

Text book:

B.A. faoruzan," Data communication and networking", tata Mcgraw hill,4th edition 2001

A.S. Tanenbaun," Computer network",Prentice Hall india 3rd edition 2002

Reference Books:

W. stalling," Computer communication network", Prentice hall india 5th edition 2001

Micheal A. Miller,"Data and Network communication", Vikas publications 2001

MAE-403-F COM PUTER 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 memory, 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.

Text Books:

1. Automation, Production Systems and Computer Integrated Manufacturing. Groover M.P, Prentice Hall of India.
2. 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

MAE-405-F ROBOTICS 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

Robotic manipulation: Automation and robots; Robot classification - Drive , Technilogies, work-envelope Geometries, motion control method, Applications; Robot Specification- No. of axis, capacity and speed, reach and stroke. tool orientation, Repeatability, precision, accuracy, operation environment, An example; Rhino X-3

DIRECT KINEMATIC: The arm equation homogenous co-ordinate- frames, translation and rotation, composite homogenous transformation; screw transformation; link Co-ordinates; the arm equation: A five axis Articulated robot: A four axis scara robot, A six axis articulated robot

SECTION B

INVERSE KINEMATIC: solving the arm equation: the inverse kinematic problem; general properties of solution; tool confugration; inverse kinematic of a five axis articulated robot, four axis scara robot, A six axis articulated robot and three axis planner articulated robot; a robotic workcell; problems

WORKSPACE ANALYSIS AND TRAJECTORY PLANNING: work space analysis; work envelope of a five axis articulated robot; work envelope of a four axis scara robot, work space fixture, the pick and place operation, continoues path motion; interpolated motion, straight line motion; problems

SECTION C

Differential motion and statics: The tool configuration jacobian matrix; joint- space sinularties; generalized inverse, resolved-motion rate control;n>6; rate control of redundant robot: n>6; rate control using (I)inverse;the manipulator jacobian; induced joint torques and forces ; problems

manipulater dynamic: Lagrange's equation; Kinetic and potential energy; generalized force; lagrange-euler dynamic model; Dynamic model of a two axis planer articulated robot and a three axis scara robot; direct and inverse dynamic; Recuresive newton- euler formulation, Dynamic model of a one axis robot; problems

SECTION D

Robot control: the control problem; state equation; constant solution; linear feedback system;sinle axis PID control; PD- gravity control; computed - torque control; variable structure control;impedance control; problem

Text books

1. Fundamental of robotics(analysis and control) by robert J. Schilling published by PHI

2. introduction to robotics (mechanism and control) by John J. Craig, published by Addition wesley.

reference book

A robotic engg text book-Mohsen shahinpur, harper & low, publishing new york

ME- 403 F REFRIGERATION & AIR-CONDITIONING

	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

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**.**

Text Books :

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

Reference Books:

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

ME- 409 F MECHANICAL VIBRATION

	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

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.

Text Books :

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

Reference Books :

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

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 :

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

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

2. 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.

MAE- 411- F ROBOTICS ENGG LAB**.**

L	T	P
-	-	2

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

List of Experiments :

1. To get Knowledge of various safety points in CNC Lab.
2. To get Knowledge of various safety points in Robotics Lab.
3. To cut an intricate shape on wire cut- CNC Machine.
4. To machine steel component (involving milling, drilling & reaming operations) on a VMC.
5. To machine a steel component (turning, facing & threading operation) in a CNC turning center.
6. To teach robotic arm a point in space by using teach pendant.
7. To draw a triangle in particular frame by using KR-16 robotic arm.
8. To draw the above triangle in different frame with the same programme.
9. To construct an array of 3*3 by using robotic arm.
10. To make a complicate shape involving arcs and circles by using teach pendant.

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

2. 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 – 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

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.

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.

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-423-F ENGINEERING DESIGN

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

Design Philosophy : Definition of Design, Difference between Science, Engineering and Technology, Morphology of Design, Definition of Product Design, Design by Evolution, Design by Innovation, Invention and Brainstorming.Considerations Dictating Mechanical Design : Basic Considerations- Convenience of Use,Maintenance Cost and Appearance; Operational Considerations: Operational Requirements -Strength (Volume & Surface), Rigidity (proper and contact), Vibration, ThermalResistance etc.; Design for Strength, Design for Rigidity. Design for Stability (buckling) with Illustrations; Functional Requirements – Conformiting (among various components), Concept of Synthesis and Assembly, Role of Fits, Tolerance and Process Capability.

SECTION B

Human Engineering : Human factors in Engineering Design, Man-machine Systems, Human Physical Activities and Human Control of Systems, Visual Displays of Static and Dynamic Information, Work Environment – Illumination, Atmospheric Conditions, Noise etc.

Ingenuity in Design : Tips to increase Strength and Rigidity of m/c components, Concept of Standardization. Simplification (Preferred numbers or Renard series). Concept of Slim Design – Use of Reinforcement, Ribs, Corrugations, Laminations etc. – their Design Analysis; Designation of different types of Fits, Design of Interference Fit Joints, Cumulative Fatigue Failure & Minor's Equation.

SECTION C

Modeling, Analogy & Simulation : Types of Models and their uses with emphasis on Mathematical Modeling, Importance of Analogy in Design, Electrical – Mechanical Analogy, Membrane Analogy. Similitude and Scale Models.

Material Selection: Spectrum of material properties: Performance Characteristics of materials, Evaluation Methods for material selection – Cost vs Performance Relations, Weighted- property Index, Value Analysis – Illustrations.

SECTION-D

Interactions of Materials, Processing and Design : Role of processing in design, Economics of Manufacturing, Design for Casting, Design for Machining, Design for Welding, Design for Powder Metallurgy, Design for Assembly.

Cost Analysis: Objectives, Costs Classification, Cost Estimate Methods, Labour Costs, Product Pricing.

Text Books :

1. Product Design and Manufacturing – A.Kale & R.C. Gupta, P H I, New Delhi.
2. Engineering Design–A material & Processing Approach – George Dietor, McGraw Hill

Reference Books :

1. Machine Elements - C.B. Rovoloky et.al., MIR Punleshan, Moscow.
3. Mechanical Engg. Design – Joseph Shigley Published by MGH.
4. Engineering Design Process : Yousef Haik, Books/Cole 2003.

ME-427-F MANUFACTURING MANAGEMENT

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

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

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

SECTION-B

New Product Development (NPD): Product Development, Customer Need, Strategies for New Product Development, Product life cycle, Product status. Corporate Design Strategies, Japanese Approach to NPD. PUGH total Design approach, PAHL & BEITZ Approach, Project Approach, Cross functional

Integration –Design, manufacturing, Marketing, Concurrent Engineering, Modular Design, Standardization Value Engineering & Analysis.

Manufacturing Planning & Control Systems: Overview of Aggregate Planning Models, Linear Decision Rules, Management Coefficient, Direct Search Methods, Master Production Schedule, Modular Bill and Materials, Capacity planning & control, language, medium range, short range capacity planning, Justin

Time (JIT), Manufacturing –Philosophy, Elements, KANBAK, effects on layout, workers & vendors, optimized production technology (OPT).

SECTION-C

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

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

SECTION-D

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

Text Books:

1. Operations Management – SCHOROEDER, MGH, New York.
2. Production Operations Management – CHARY, TMH, New Delhi.

Reference Books:

1. Production Operations Management – ADAM & EBERT, PHL, New Delhi
2. Operational Management –MONKS, McGraw Hill, Int.
3. Production & Operations Management – I. Hill, Prentice Hall, Int.
4. Production Planning & Inventory Control – NARASIMHAM etal, PHL, New Delhi
5. Production & Operation Management- Panneerselvam, PHI, New Delhi
6. Managing for total Quality-LOGOTHETIS, PHI, New Delhi
7. Concept of Reliability Engineering –L.S. Srinath, Affiliated East West.
8. Revolutionizing Product Development – WHEELWRIGHT & CLARK, Free Press.

9. Management in Engineering – FREEMAN-BALL & BALKWILL, PHI, New Delhi.

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.

Text Books:

2. Reliability Engineering, L.S. Srinath, Affiliated East-West Press, New Delhi.
3. 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.
2. Reliability Based Design, S. Rao, Mc-Graw Hill, 1992.
3. Reliability in Engineering Design, K.C. Kapur and L.R. Lamberson, Wiley Publications.
4. 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.

Text Books:

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

Reference Books:

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

ME- 433-F VALUE 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

Introduction: Value Engineering concepts, Advantages, Applications, Problem recognition, and role in productivity criteria for comparison, element of choice.

SECTION-B

Organisation: Level of VE in the organization, Size and skill of VE staff, small plant VE activity. Unique and quantitative evaluation of ideas.

SECTION-C

Analysis Of Function: Anatomy of the function, Use esteem and exchange values, Basic vs secondary vs. unnecessary functions.

SECTION-D

Value Engineering Techniques: Selecting products and operation for VE action, VE programmes, determining and evaluating function(s) assigning rupee equivalents, developing alternate means to
required functions, decision making for optimum alternative, Use of decision matrix, Queuing theory and Monte Carlo method, make or buy, Measuring profits, Reporting results, Follow up, Use of advanced technique like FAST (Function Analysis System) Tech.

Reference and Text Books:

1. Techniques of Value analysis and engineering – Miles, Pub.- McGraw Hill.
2. Value Management – Heller Pub.- Addison Wesley.
3. Value Analysis and Value – Oughson, Pub.- Pitman.

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

W.E.F 2013-14

Sl. No.	Course No.	Subject	Internal Marks	External Marks	Total Marks
1.	**MAE- 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.