B.Tech Syllabus – II, III & IV Year

Mechanical Engineering

M.D.UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATION
B.Tech 2nd YEAR (MECHANICAL ENGINEERING)
SEMESTER-III
Proposed 'F' Scheme w.e.f 2010-11

Course No.	Course Title	Teaching Schedule				Marks For Class Work	Marks for Examination		Total Marks	Duration of Exam
		L	T	P	Total		Theory	Practical		
MATH-201-F HUM-201-F	Mathematics – III or Engineering Economics	3 2	2 1	- -	5 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	4	-	4	50	100	-	150	3
EE-209-F	Machine Drawing	1	-	3	4	50	-	50	100	4
ME-211-F	Computer Aided Design Lab	-	-	2	2	25	-	25	50	3
EE-213-F	Engineering Mechanics Lab	-	-	2	2	25	-	25	50	3
ME-215-F	Material Science Lab	-	-	2	2	25	-	25	50	3
	TOTAL	**19**	**6**	**10**	**34/35**	**425**	**600**	**125**	**1150**	

M.D.UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATION
B.Tech 2nd YEAR (MECHANICAL ENGINEERING)
SEMESTER-IV
Proposed 'F' Scheme w.e.f 2010-11

Course No.	Course Title	Teaching Schedule				Marks for Class work	Marks for Examination		Total Marks	Duration of Exam
		L	T	P	Total		Theory	Practical		
MATH-201-F HUM-201-F	Mathematics – III or Engineering Economics	3 2	2 1	- -	5 4	50	100	-	150	3
ME-202-F	Manufacturing Technology-I	3	1	-	4	50	100	-	150	3
ME-204-F	Kinematics of Machine	3	1	-	4	50	100	-	150	3
ME-206-F	Strength of Materials – I	3	1	-	4	50	100	-	150	3
ME-208-F	Fluid Mechanics	3	1	-	4	50	100	-	150	3
ME-210-F	Steam & Power Generation	3	1	-	4	50	100	-	150	3
ME-212-F	Kinematics of Machine Lab	-	-	2	2	25	-	25	50	3
ME-216-F	Fluid Mechanics Lab	-	-	2	2	25	-	25	50	3
ME-214-F	Strength of Materials Lab	-	-	2	2	25	-	25	50	3
ME-218-F	Steam & Power Generation Lab	-	-	2	2	25	-	25	50	3
GPME-202-F	General Proficiency	-		2	2	50	-	-	50	-
	TOTAL	**18**	**6**	**9**	**34/35**	**450**	**600**	**100**	**1150**	

M.D.UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATION
BACHELOR OF Technology (MECHANICAL ENGINEERING)
SEMESTER–V
Modified 'F' Scheme effective from 2011-12

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 Machines	3	1	-	4	50	100	-	150	3
ME-303-F	Mechanical Machine Design-I	3	2	-	5	50	100	-	150	4
ME-305-F	Fluid Machines	3	1	-	4	50	100	-	150	3
ME-307-F	Internal Combustion Engines & Gas Turbines	3	1	-	4	50	100	-	150	3
ME-309-F	Manufacturing Technology-II	3	1	-	4	50	100	-	150	3
ME-311-F	Applied Numerical Techniques & Computing (ME, AE)	3	-	-	3	50	100	-	150	3
ME-313-F	Dynamics of Machines Lab	-	-	2	2	25	-	25	50	3
ME-315-F	Fluid Machines Lab	-	-	2	2	25	-	25	50	3
ME-317-F	Internal Combustion Engines & Gas Turbines Lab.	-	-	2	2	25	-	25	50	3
ME-319-F	Manufacturing Technology Lab-II	-	-	2	2	25	-	25	50	3
ME-321-F	Applied Numerical Techniques & Computing Lab. (ME, AE)	-	-	2	2	50	-	-	50	-
ME-323-F	Practical Training Viva-Voce	-	-	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.**

Course No.	Course Title	Teaching schedule				Marks for class work	Marks for Examination			Duration of Exam.
		L	T	P	Total		Theory	Practical	Total Marks	
ME-302-F	Automobile Engineering	3	1	-	4	50	100	-	150	3
ME-304-F	Mechanical Machine Design – II	3	2	-	5	50	100	-	150	4
ME-306-F	Heat Transfer (ME, AE)	3	1	-	4	50	100	-	150	3
ME-308-F	Automatic Controls	3	1	-	4	50	100	-	150	3
ME-310-F	Measurements & Instrumentation (ME, AE)	3	1	-	4	50	100	-	150	3
ME-312-F	Industrial Engineering (ME, AE)	3	1	-	4	50	100	-	150	3
ME-314-F	Automobile Engineering Lab	-	-	2	2	25	-	25	50	3
ME-316-F	Heat Transfer Lab	-	-	2	2	25	-	25	25	3
ME-318-F	Measurements & Instrumentation Lab. (ME, AE)	-	-	2	2	25	-	25	25	3
ME-320-F	General Proficiency	-	-	2	2	50	-	-	50	-
	Total	**18**	**7**	**8**	**33**	**450**	**600**	**100**	**1050**	**-**

Note:
1. **Students will be allowed to use non-programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.**
2. **Each student has to undergo practical training of 6 weeks during wummer cacaiton and its evaluation shall be carried out in the VII Semester.**

M.D.UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATION
BACHELOR OF ENGINEERING (MECHANICAL ENGINEERING)
SEMESTER-VII
Modified 'E' Scheme effective from 2006-07

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-401 E	Automobile Engg.	3	1	-	4	50	100	-	150	3
ME-403 E	Ref. & Air-conditioning	3	1	-	4	50	100	-	150	3
ME-405 E	Operations Research	3	1	-	4	50	100	-	150	3
	Open Elective*	3	1	-	4	50	100	-	150	3
ME-407E	Mechanical Vibration	3	1	-	4	50	100	-	150	3
ME-409E	Automobile Engg. Lab	-	-	2	2	25	-	25	50	3
ME-411 E	R. A. C. Lab.	-	-	3	3	50	-	50	100	3
ME-413 E	Project	-	-	4	4	50	-	-	50	3
ME-415 E	Practical Training – II	-	-	2	2	-	-	-	-	-
	Total	**15**	**5**	**11**	**31**	**375**	**500**	**75**	**950**	

List of Open Electives

1	HUM-451-E	Language Skills for Engineers	8	CSE-451-E	Artificial Intelligence & Expert Systems
2	HUM-453-E	Human Resource Management	9	CSE-303-E	Computer Graphics
3	HUM-457-E	Business Communication	10	IC-455-E	Intelligent Instrumentation for Engineers
4	HUM-455-E	Entrepreneurship	11	IC-403-E	Embedded Systems
5	PHY-451-E	Nano technology	12	CH-453-E	Pollution & Control
6	PHY-453-E	Laser Technology	13	IT-471-E	Management Information System
7	ME-451-E	Mechatronics Systems	14	IT-204-E	Multimedia Technologies

Notes:
1. **Students will be permitted to opt for any one elective run by the other departments. However, the departments will offer only those electives for which they have expertise The choice of the students for any elective shall not be a binding for the department to offer, if the department does not have expertise.**
2. **Project load will be treated as 2 hrs. per week for Project co-ordinator and 1 hr. for each participating teacher. Project will commence in VIIth semester where the students will identify the Project problem, complete the design/procure the material/start the fabrication/complete the survey etc., depending upon the nature of the problem. Project will continue in VIIIth semester.**
3. **Assessment of Practical Training-II, carried out at the end of VI semester, will be based on seminar, viva-voce and project report of 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.**
4. **Students will be allowed to use the non-programmable scientific calculator. However, sharing of calculator will not be permitted.**

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-402 E	Computer Aided Design	3	1	-	4	50	100	-	150	3
ME-404 E	Power Plant Engg.	3	1	-	4	50	100	-	150	3
ME-	Deptt. Elective-I	4	-	-	4	50	100	-	150	3
ME-	Deptt. Elective-II	4	-	-	4	50	100	-	150	3
ME-406 E	CAD Lab.	-	-	3	3	50	-	50	100	3
ME-408 E	Independent Study Seminar	-	-	4	4	50	-	-	50	-
ME-413 E	Project	-	-	8	8	50	-	100	150	3
GFME-402 E	General Fitness for the Profession*	-	-	-	-	50	-	100	150	3
	Total	**14**	**2**	**15**	**31**	**400**	**400**	**250**	**1050**	

Deptt. Electives - I

1. ME- 432 E   Optimization Methods for Engineering Systems
2. ME- 434 E   Computer Aided Vehicle Design
3. ME- 436 E   Mechatronics
4. ME- 438 E   Flexible Manufacturing System

Deptt. Electives - II

1. ME-442 E   Robotics Engineering
2. ME-444 E   Ergonomics and Work Place Design
3. ME-446 E   Modern Manufacturing Processes
4. ME-448 E   Emerging Automotive Technologies

Note :
1. **Project load will be treated as 2 hrs. per week for the project coordinator and 1 hour for each participating teacher. Project involving design, fabrication, testing, computer simulation, case studies etc., which has been commenced by students in VIIth semester will be completed in VIIIth Semester.**
2. **For the subject ME-408 E, a student will select a topic from emerging areas of Mech. Engg. and study it thoroughly and independently. Later he will give a seminar talk on the topic.**
3. **The evaluation of the student for his/her General Fitness for the Profession shall be carried out by a team consisting of Principal / Director, HOD of concerned department and external examiner appointed by University.**
4. **Students will be allowed to use the non-programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.**
5. ***The subject GFME-420-E (General Proficiency) code has been changed to GFME-402-E and will be effective from 2006-07.**

Math-201-F **MATHEMATICS-III**
(Common for All Branches)

L	T	P
3	2	–

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

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 for All Branches)

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

Definition of Economics - various definitions, Nature of Economic problem, Production possibility curve conomic 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)

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

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

L	T	P			
3	1	–	Class Work	:	50 Marks
			Exam	:	100 Marks
			Total	:	150 Marks
			Duration of Exam. :		3Hours

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 coefficientt & 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

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

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

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	**Class Work : 50 Marks**
3 1 –	**Exam : 100 Marks**
	Total : 150 Marks
	Duration of Exam. : 3Hours

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, NewDelhi
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**		**Class Work**	:	50 Marks
1	–	3		**Exam**	:	50 Marks
				Total	:	100 Marks
				Duration of Exam.	:	4Hours

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				

Class Work   **:**   25 Marks
Exam   **:**   25 Marks
Total   **:**   50 Marks
Duration of Exam. :   3 Hours

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			

Class Work   **:**   25 Marks
Exam   **:**   25 Marks
Total   **:**   50 Marks
Duration of Exam. :   3 Hours

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 horizontall 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	**Class Work**	**:** 25 Marks
– – 2	**Exam**	**:** 25 Marks
	Total	**:** 50 Marks
	Duration of Exam. : 3 Hours

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.**

MATH-201-F   MATHEMATICS-III

L   T   P
3   2   –

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

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
Exam	:	100 Marks
Total	:	150 Marks
Duration of Exam.	:	3Hours

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-202-F   **MANUFACTURING TECHNOLOGY-I**

L	T	P				
3	2	–	**Class Work**	:	50 Marks	
			Exam	:	100 Marks	
			Total	:	150 Marks	
			Duration of Exam.	:	3Hours	

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

Section-A

Metal Cutting & Tool Life: Introduction, basic tool geometry, single point tool nomenclature, chips types and their characters tics, mechanics of chips formation, theoretical and experimental determination of shear angle, orthogonal and oblique metalcutting, metal cutting theories, relationship of velocity, forces, and power consumption, cutting speed, feed and depth of cut, coolant, temperature profile in cutting, tool life relationship, tailor equation of tool life, tool material and mechanism Economics of Metal Machining: Introduction, elements of machining cost, tooling economics, machining, economics and optimization, geometry of twist, drills and power calculation in drills.

Section-B

Metal forming Jigs and Fixtures: Introduction, Metal blow condition, theories of plasticity, conditions of plane strains, friction, conditions in metal working, wire drawing, theory of forging, rolling theory, no slip angle, and foreword slip, types of tools, principles of locations, locating and clamping devices, jigs bushes, drilling jigs, milling fixtures, turning fixtures, boring and broaching fixtures, welding fixtures, different materials, for jigs and fixtures, economics of jigs and fixtures.
Metrology: Measurement, linear and angular simple measuring instruments, various clampers, screw gauge, sine bar, auto-collimator, comparator- mechanical, electrical, optical, surface finish and its measurements, micro and macro deviation, factors influencing surface finish and evaluation of surface finish.

Section-C

Machine tools: Introduction, constructional features, specialization, operations and devices of basic machine tools such as lathe, shaper, planner, drilling machining, and milling machine, indexing in milling operation, working principles of capstan and turret lathes.
Metal Casting Process: Introduction, Foundry: Introduction to Casting Processes, Basic Steps in Casting Processes. Pattern: Types of Pattern and Allowances. Sand Casting: Sand Properties, Constituents and Preparation. Mould & Core making with assembly and its Types. Gating System. Melting of Metal, Furnaces and Cupola, Metal Pouring, Fettling. Casting Treatment, Inspection and Quality Control, Sand Casting Defects & Remedies.

Section-D

Welding: Introduction to Welding, Classification of Welding Processes, Gas Welding: Oxy-Acetylene Welding, Resistance Welding; Spot and Seam Welding, Arc Welding: Metal Arc, TIG & MIG Welding, Submerged arc welding (SAW), resistance welding principles, electrode types and selection, thermit welding, electro slag welding, electron beam welding, laser beam welding, forge welding, friction welding, Welding Defects and remedies, brazing & soldering.
Forming Processes: Basic Principle of Hot & Cold Working, Hot & Cold Working Processes, Rolling, Extrusion, Forging, Drawing, Wire Drawing and Spinning. Sheet Metal Operations: Measuring, Layout marking, Shearing, Punching, Blanking, Piercing, Forming, Bending and Joining.

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

ME-204-F   **KINEMATICS OF MACHINE**

L	**T**	**P**			
3	1	–	**Class Work**	:	50 Marks
			Exam	:	100 Marks
			Total	:	150 Marks
			Duration of Exam. :		3Hours

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.

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

ME-206-F   **STRENGHT OF MATERIALS-I**

L T P		**Class Work**	**:**	50 Marks
3 1 –		**Exam**	**:**	100 Marks
		Total	**:**	150 Marks
		Duration of Exam. :		3Hours

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	–	**Class Work**	:	50 Marks
			Exam	:	100 Marks
			Total	:	150 Marks
			Duration of Exam. :		3Hours

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

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

ME-210-F   **STEAM & POWER GENERATION**

L	**T**	**P**	
3	1	–	

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

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

Section-A

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

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

Section-B

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

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

Section-C

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

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

Section-D

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

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

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

ME-212-F   **KINEMATICS OF MACHINES LAB**

L	**T**	**P**		**Class Work**	**:**	25 Marks
–	–	2		**Exam**	**:**	25 Marks
				Total	**:**	50 Marks
				Duration of Exam. :		3Hours

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			

Class Work   :   25 Marks
Exam   :   25 Marks
Total   :   50 Marks
Duration of Exam. :   3Hours

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:
   1. **At least ten experiments are to be performed in the semester.**
   2. **At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or designed & set by the concerned institute as per the scope of the syllabus.**

ME-216-F   **FLUID MECHANICS LAB**

L	**T**	**P**			
–	–	2			

Class Work : 25 Marks
Exam : 25 Marks
Total : 50 Marks
Duration of Exam. : 3Hours

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.**

ME-218-F   **STEAM & POWER GENERATION LAB**

L T P   **Class Work   :   25 Marks**
– – 2   **Exam   :   25 Marks**
                                          Total   :   50 Marks
                                          Duration of Exam. :   3Hours

List of Experiments:

1. To study low pressure boilers and their accessories and mountings.

2. To study high pressure boilers and their accessories and mountings.

3. To prepare heat balance sheet for given boiler.

4. To study the working of impulse and reaction steam turbines.

5. To find dryness fraction of steam by separating and throttling calorimeter.

6. To find power out put & efficiency of a steam turbine.

7. To find the condenser efficiencies.

8. To study and find volumetric efficiency of a reciprocating air compressor.

9. To study cooling tower and find its efficiency.

10. To find calorific value of a sample of fuel using Bomb calorimeter.

11. Calibration of Thermometers and pressure gauges.

Note:
1. **At least ten experiments are to be performed in the semester.**
2. **At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or designed & set by the concerned institute as per the scope of the syllabus.**

ME-218-F   STEAM & POWER GENERATION LAB

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

L   T   P   **Class Work   :**   50 Marks
–   –   2   **Total   :**   50 Marks
                            Duration of Exam. :   3Hours

• 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

ME-301-F   DYNAMICS OF MACHINES

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

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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

ME-303-F   MECHANICAL MACHINE DESIGN-I

L	T	P
3	1	–

Class Work	:	50 Marks
Exam	:	100 Marks
Total	:	150 Marks
Duration of Exam	:	4 Hrs.

Note:
1. Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.
2. The paper setter will be required to mention in the note of the question paper that the use of following Design Data book is permitted:
   (i) Design Data Handbook (In SI and Metric Units) for Mechanical Engineers by Mahadevan
   (ii) Design Data Book PSG College of Technology Coimbatore

Section A
Design Philosophy: Problem identification- problem statement, specifications, constraints, Feasibility studytechnical feasibility, economic & financial feasibility, societal & environmental feasibility, Generation of solution field (solution variants), Brain storming, Preliminary design, Selection of best possible solution, Detailed design, Selection of Fits and tolerances and analysis of dimensional chains.
Selection of Materials: Classification of Engg. Materials, Mechanical properties of the commonly used engg. Materials, hardness, strength parameters with reference to stress-strain diagram, Factor of safety.

Section B
Mechanical Joints: ISO Metric Screw Threads, Bolted joints in tension, Eccentrically loaded bolted joints in shear and under combined stresses, Design of power screws, Design of various types of welding joints under different static load conditions.
Riveted Joints, Cotter & Knuckle Joints: Design of various types of riveted joints under different static loading conditions, eccentrically loaded riveted joints, design of cotter and knuckle joints.

Section C
Belt rope and chain drives: Design of belt drives, Flat & V-belt drives, Condition for Transmission of max. Power, Selection of belt, design of rope drives, design of chain drives with sprockets.
Keys, Couplings & Flywheel: Design of Keys – Flat, Kennedy Keys, Splines, Couplings design – Rigid &
Flexible coupling, turning Moment diagram, coefficient of fluctuation of energy and speed, design of flywheel – solid disk & rimmed flywheels.

Section D
Clutches: Various types of clutches in use, Design of friction clutches – Disc. Multidisc, Cone & Centrifugal, Torque transmitting capacity.
Brakes: Various types of Brakes, Self energizing condition of brakes, Design of shoe brakes – Internal & external expanding, band brakes, Thermal Considerations in brake designing.

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

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

Section A

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

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

Section B

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

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

Section C

Dimensional Analysis and Model Similitude: Dimensional homogeneity, Rayleigh's method and Buckingham's _-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 :
1. Hydraulics & Fluid Mechanics – Modi & Seth, Pub. - Standard Book House, N.Delhi
2. Hydraulic Machines – Jagdish Lal, Metropolitan

Reference Books :
1. Fluid Mechanics and Hydraulic Machines – S S Rattan, Khanna Publishers
2. Introduction to Fluid Mechanics and Fluid Machines – S K Som and G Biswas, Tata McGraw Hill
3. Fluid Mechanics and Fluid Power Engineering – D S Kumar, S K Kataria and Sons

ME-307-F INTERNAL COMBUSTION ENGINES & GAS TURBINES

L	T	P			
3	1	–	**Class Work**	:	50 Marks
			Exam	:	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

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-309-F   MANUFACTURING TECHNOLOGY-II

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

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

Section A
Mechanism of Metal Cutting: Deformation of metal during machining, nomenclature of lathe, milling tools, mechanics of chip formation, built-up edges, mechanics of orthogonal and oblique cutting, Merchant cutting force circle and shear angle relationship in orthogonal cutting, factors affecting tool forces. Cutting speed, feed and depth of cut, surface finish. Temperature distribution at tool chip interface. Numerical on cutting forces and Merchant circle.
Cutting Tool Materials & Cutting Fluids: Characteristics of tool materials, various types of cutting tool materials, coated tools, cutting tool selection, Types of tool wear, tool life, factors governing tool life, Purpose and types of cutting fluids, basic actions of cutting fluids, effect of cutting fluid on tool life, selections of cutting fluid.

Section B
Unconventional Machining Processes: Abrasive jet machining: Principles, applications, process parameters. Ultrasonic machining: Principles, applications, analysis of process parameters. Electro-chemical machining and grinding: Principles, classifications, choice of electrolytes, applications.
Electric discharge machining: Principles, selection of tools materials and dielectric fluid. Electron beam machining: Generation of electron beam, relative merits and demerits. Laser beam machining: Principles and applications. Jigs & Fixtures: Introduction, location and location devices, clamping and clamping devises, Drill Jigs, Milling Fixtures.

Section C
Numerical Control of Machine Tools; Introduction, Numerical Control & its growth, NC Machines tools, Axes of NC Machines, Classification of NC System, CNC, DNC and Machining Centre. Machine Control unit, NC tools & Tool changer.
Manual Part Programming; coordinate, Feed, Speed & Tool, Preparation & Miscellaneous functions, Examples of two axes part programming for Turning and Milling Operations.

Section D
Group Technology; Definition and concept, Group and Family, working of group technology, Stages for Adopting Group Technology, Advantages of Group Technology. Component Classification and Coding, Personnel and Group Technology, Planning the introduction of Group Technology, Group Technology layout.

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

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

ME-311-F APPLIED NUMERICAL TECHNIQUES AND COMPUTING

L	T	P			
3	–	–	**Class Work**	:	50 Marks
			Exam	:	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   **DYNAICS OF MACHINE LAB**

L	T	P			
–	–	2	**Class Work**	:	25 Marks
			Exam	:	25 Marks
			Total	:	50 Marks
			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	**Class Work**	:	25 Marks
			Exam	:	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, constantspeed 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.**

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

L	T	P
–	–	2

Class Work   : 25 Marks
Exam   : 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-319-F   MANUFACTURING TECHNOLOGY-II LAB

L	T	P			
–	–	2	**Class Work**	:	25 Marks
			Exam	:	25 Marks
			Total	:	50 Marks
			Duration of Exam	:	3 Hrs.

List of Experiments:

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

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

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

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

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

6. Part Programming and proving on a NC lathe for:-
   a. Outside Turning
   b. Facing and Step Turning
   c. Taper Turning
   d. Drilling
   e. Outside Threading

7. Part Programming and Proving on a NC Milling Machine:-
   a. Point to Point Programming
   b. Absolute Programming
   c. Incremental Programming

8. Part Programming and Proving for Milling a Rectangular Slot.

ME-321-F APPLIED NUMERICAL TECHNIQUES AND COMPUING LAB

L	T	P
–	–	2

Class Work	:	50 Marks
Exam	:	
Total	:	50 Marks
Duration of Exam	:	2 Hrs.

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

1. Solution of Non-linear equation in single variable using the method of successive bisection.

2. Solution of Non-Linear equation in single variable using the Newton Raphson, Secant, Bi – Section and Modified Eualer's, method.

3. Solution of a system of simultaneous algebraic equations using the Gaussian elimination procedure.

4. Solution of a system of simultaneous algebraic equations using the Gauss-Seidel iterative method.

5. Solution of a system of simultaneous algebraic equations using the Gauss-Seidel iterative method employing the technique of successive relaxation.

6. Numerical solution of an ordinary differential equation using the Euler's method.

7. Numerical solution of an ordinary differential equation using the Runge - Kutta 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 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-302-F   AUTOMOBILE ENGINEERING

L	T	P			
3	1	–	**Class Work**	:	50 Marks
			Exam	:	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 Automobiles : Classification, Components, Requirements of Automobile Body; Vehicle Frame, Separate Body & Frame, Unitised Body, Car Body Styles, Bus Body & Commercial Vehicle Body Types; Front Engine Rear Drive & Front Engine Front Drive Vehicles, Four Wheel Drive Vehicles, Safety considerations; Safety features of latest vehicle; Future trends in automobiles.

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

Section B

Power Transmission: Requirements of transmission system; General Arrangement of Power Transmission system; Object of the Gear Box; Different types of Gear Boxes; Sliding Mesh, Constant Mesh, Synchro- mesh Gear Boxes; Epi-cyclic Gear Box, Freewheel Unit. Overdrive unit-Principle of Overdrive, Advantage of Overdrive, Transaxle, Transfer cases. Drive Lines, Universal Joint, Differential and Drive Axles: Effect of driving thrust and torque reactions; Hotchkiss Drive, Torque Tube Drive and radius Rods; Propeller Shaft, Universal Joints, Slip Joint; Constant Velocity Universal Joints; Front Wheel Drive; Principle, Function, Construction & Operation of Differential; Rear Axles, Types of load coming on Rear Axles, Full Floating, Three quarter Floating and Semi Floating Rear Axles.

Section C

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

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

Section D

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

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

Text Books:
1. Automobile Engineering by Anil Chhikara, Satya Prakashan, New Delhi.
2. Automobile Engineering by Dr. Kirpal Singh, standard Publishers Distributors.

Reference Books:
1. Automotive Mechanics – Crouse / Anglin, TMH.
2. Automotive Technology – H.M. Sethi, TMH, New Delhi.
3. Automotive Mechanics – S.Srinivasan, TMH, New Delhi.
4. Automotive Mechanics – Joseph Heitner, EWP.
5. Motor Automotive Technology by Anthony E. Schwaller – Delmer Publishers, Inc.
6. The Motor Vehicle – Newton steeds Garrett, Butter Worths.

ME-304-F   **MECHANICAL MACHINE DESIGN-II**

L	**T**	**P**		**Class Work**	**:**	50 Marks
3	2	–		**Exam**	**:**	100 Marks
				Total	**:**	150 Marks
				Duration of Exam	**:**	4 Hrs.

Note:
1. Examiner will set 9 questions in total, two questions from each section and one question covering all sectionswhich 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 DesignData book is permitted:
   (i) Design Data Handbook (In SI and Metric Units) for Mechanical Engineers by Mahadevan
   (ii) Design Data Book PSG College of Technology Coimbatore

Section A

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

Section B

Shafts : Detailed design of shafts for static and dynamic loading, Rigidity and deflection consideration.
Springs : Types of Springs, Design for helical springs against tension and their uses, compression and fluctuating loads, Design of leaf springs, Surging phenomenon in springs, Design Problem.

Section C

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

Section D

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

Text Books:
1. Mechanical Engg. Design- Joseph Edward Shigley-Mc Graw Hill Book Co.
2. Design of Machine Elements – V.B. Bhandari – Tata McGraw Hill, New Delhi.

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

ME-306-F HEAT TRANSFER

L	T	P			
3	1	–	Class Work	:	50 Marks
			Exam	:	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 question paper that the use of Steam tables, Charts, Graphical plots is permitted.**

Section A

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

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

Section B

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

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

Section C

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

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

Section D

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

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

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

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

ME-308-F   AUTOMATIC CONTROL

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

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

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

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

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

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

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

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

ME-304-F   **MECHANICAL MACHINE DESIGN-II**

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

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

Section A

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

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

Section B

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

Section C

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

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

Section D

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

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

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

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

ME-312-F   INDUSTRIAL ENGINEERING

L	T	P
3	2	–

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

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

Section A
Definition of Industrial Engineering: Objectives, Method study, Principle of motion economy, Techniques of method study - Various charts, THERBLIGS, Work measurement - various methods, time study PMTS, determining time, Work sampling, Numericals. Productivity & Workforce Management :Productivity - Definition, Various methods of measurement, Factors effecting productivity, Strategies for improving productivity, Various methods of Job evaluation & merit rating, Various incentive payment schemes, Behavioural aspects, Financial incentives.

Section B
Manufacturing Cost Analysis: Fixed & variable costs, Direct, indirect & overhead costs, & Job costing, Recovery of overheads, Standard costing, Cost control, Cost variance Analysis - Labour, material, overhead in volume, rate & efficiency, Break even Analysis, Marginal costing & contribution, Numericals.
Materials Management : Strategic importance of materials in manufacturing industries, Relevant costs, Inventory control models - Economic order quantity (EOQ), Economic batch quantity (EBQ) with & without shortage, Purchase discounts, Sensitivity analysis, Inventory control systems - P,Q,Ss Systems, Service level, Stock out risk, determination of order point & safety stock, Selective inventory control - ABC, FSN, SDE, VED and three dimensional, Numericals.

Section C
Quality Management: Definition of quality, Various approaches, Concept of quality assurance systems, Costs of quality, Statistical quality Control (SQC), Variables & Attributes, X, R, P & C - charts, Acceptance sampling, OC - curve, Concept of AOQL, Sampling plan - Single, Double & sequential, Introduction to TQM & ISO - 9000.
Production Planning & Control (PPC) : Introduction to Forecasting - Simple & Weighted moving average methods, Objectives & variables of PPC, Aggregate planning - Basic Concept, its relations with other decision areas, Decision options - Basic & mixed strategies, Master production schedule (MPS), Scheduling Operations Various methods for line & intermittent production systems, Gantt chart, Sequencing – Johnson algorithm for n-Jobs-2 machines, n- Jobs-3 machines, 2 Jobs n-machines, n-Jobs m-machines Various means of measuring effectiveness of PPC, Introduction to JIT, Numericals.

Section D
Management Information Systems (MIS) : What is MIS ? Importance of MIS, Organizational & information system structure, Role of MIS in decision making, Data flow diagram, Introduction to systems analysis & design, Organizing information systems.
Product Design and Development: Various Approaches, Product life cycle, Role 3S's – Standardization, Simplification, Specialization, Introduction to value engineering and analysis, Role of Ergonomics in Product Design.

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

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

ME-314-F **AUTOMOBILE ENGINEERING LAB**

L	T	P
–	–	2

Class Work   **:** 25 Marks
Exam   **:** 25 Marks
Total   **:** 50 Marks
Duration of Exam **:** 3 Hrs.

List of Experiments :

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

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

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

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

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

6. To study and prepare report on the constructional details, working principles and operation of the following Automotive Suspension Systems.
   a. Front Suspension System.
   b. Rear Suspension System.

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

8. To study and prepare report on the constructional details, working principles and operation of the following Automotive Tyres & wheels.
   a. Various Types of Bias & Radial Tyres.
   b. Various Types of wheels.

9. To study and prepare report on the constructional details, working principles and operation of the Automotive Brake systems.
   a. Hydraulic & Pneumatic Brake systems.
   b. Drum Brake System.
   c. Disk Brake System.
   d. Antilock Brake System.
   e. System Packing & Other Brakes.

10. To study and prepare report on the constructional details, working principles and operation of Automotive Emission / Pollution control systems.

11. Modeling of any two automotive systems on 3D CAD using educational softwares (eg. 3D modeling package/Pro Engineering/I-Deas/ Solid edge etc.)

12. Crash worthiness of the designed frame using Hypermesh and LS-Dyna solver or other software.

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

ME-316-F   **HEAT TRANSFER LAB**

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

List of Experiments:

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

Note:

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

ME-318-F   MEASUREMENTS & INTERMENTATION LAB

L	T	P			
–	–	2	**Class Work**	:	25 Marks
			Exam	:	25 Marks
			Total	:	50 Marks
			Duration of Exam	:	3 Hrs.

List of Experiments:

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

Note:

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

ME-401-E   **Automobile Engineering**


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L  T  P                      Class Work        :    50 Marks
3  1  –                      Exam              :   100 Marks
                             Total             :   150 Marks
                             Duration of Exam. :     3 Hours
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Unit I Introduction to Automobiles : Classification, Components, Requirements of Automobile Body; Vehicle Frame, Separate Body & Frame, Unitised Body, Car Body Styles, Bus Body & Commercial Vehicle Body Types; Front Engine Rear Drive & Front Engine Front Drive Vehicles, Four Wheel Drive Vehicles, Safety considerations; Safety features of latest vehicle; Future trends in automobiles.

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

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

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

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

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

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

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

Text Books:
1. Automobile Engineering by Anil Chhikara, Satya Prakashan, New Delhi.
2. Automobile Engineering by Dr. Kirpal Singh, standard Publishers Distributors.

Reference Books:
1. Automotive Mechanics – Crouse / Anglin, TMH.
2. Automotive Technology – H.M. Sethi, TMH, New Delhi.
3. Automotive Mechanics – S.Srinivasan, TMH, New Delhi.
4. Automotive Mechanics – Joseph Heitner, EWP.
5. Motor Automotive Technology by Anthony E. Schwaller – Delmer Publishers, Inc.
6. The Motor Vehicle – Newton steeds Garrett, Butter Worths.

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

ME-403-E   Refrigeration & Air Conditioning

L	T	P			
3	1	–	**Class Work**	:	50 Marks
			Exam	:	100 Marks
			Total	:	150 Marks
			Duration of Exam. :		3 Hours

Unit I 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.

Unit II 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.

Unit III 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.

(B) 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.

Unit IV 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.

(B) Steam Jet Refrigerating System- Introduction, Analysis, Relative merits and demerits, Performance Applications, Problems.

(C) Cascade Refrigerating Systems-Necessity Selection of Pairs of refrigerants for the system, Concept of cascade temperature, Analysis, Multistaging, Comparison with V.C. systems, Applications, Problems.

Unit V 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.

Unit VI 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.

Unit VII 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.

Unit VIII 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.

Note :

In the semester examination the examiner will set eight questions in all one question from each unit. The students will be required to attempt only 5 questions.

ME-405-E **Operations Research**

L	T	P			
3	1	–	**Class Work**	:	50 Marks
			Exam	:	100 Marks
			Total	:	150 Marks
			Duration of Exam. :		3 Hours

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

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

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

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

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

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

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

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

Text Books:
1. Operation Research – TAHA, PHI, New Delhi.
2. Principle of Operations Research – Ackoff, Churchaman, arnoff, Oxford IBH, Delhi.

Reference Books :
1. Operation Research- Gupta & Sharma, National Publishers, New Delhi.
2. Quantitative Techniques- Vohra, TMH, New Delhi
3. Principles of operation Research (with Applications to Managerial Decisions) by H.M.Wagher, Prentice Hall of India, New Delhi.
4. Operation Research – Sharma, Gupta, Wiley Eastern, New Delhi.
5. Operation Research – Philips, Revindran, Solgeberg, Wiley ISE.

Note:
Paper setter will set eight questions, at least one from each unit. Students are required to answer five questions.

ME-407-E   **Mechanical Vibrations**

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

Unit I 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.

Unit II 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.

Unit III 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.

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

Unit V 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.

Unit VI 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.

Unit VII 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.
2.   Mechanical Vibrations S.S. Rao, Addison – Wesely Publishing Company

Note :

In the semester examination, the examiner will set eight questions in all, at least one question from each unit & students will be required to attempt only 5 questions**.**

ME-409-E   **Automobile Engineering Lab**

```
L  T  P                        Class Work      :   25 Marks
-  -  2                        Exam            :   25 Marks
                               Total           :   50 Marks
                               Duration of Exam. :  3 Hours
```

List of Experiments :

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

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

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

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

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

6. To study and prepare report on the constructional details, working principles and operation of the following Automotive Suspension Systems.
   - (a) Front Suspension System.
   - (b) Rear Suspension System.

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

8. To study and prepare report on the constructional details, working principles and operation of the following Automotive Tyres & wheels.
   - (a) Various Types of Bias & Radial Tyres.   (b) Various Types of wheels.

9. To study and prepare report on the constructional details, working principles and operation of the Automotive Brake systems.
   - (a) Hydraulic & Pneumatic Brake systems.
   - (b) Drum Brake System.
   - (c) Disk Brake System.
   - (d) Antilock Brake System.
   - (e) System Packing & Other Brakes.

10. To study and prepare report on the constructional details, working principles and operation of Automotive Emission / Pollution control systems.

11. Modeling of any two automotive systems on 3D CAD using educational softwares (eg. 3D modeling package/Pro Engineering/I-Deas/ Solid edge etc.)

12. Crash worthiness of the designed frame using Hypermesh and LS-Dyna solver or other software.

Note :

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

ME-411-E   Refrigeration & Air Conditioning Lab

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

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.

ME-413-E   **Project**

L   T   P   **Class Work   :   100 Marks**
–   –   6   **Exam   :   100 Marks**
                                                 Total   :   200 Marks
                                                 Duration of Exam. :   3 Hours

Project involving design/ fabrication/ testing computer simulation/ case studies etc. which is commenced in VIIth Semester, will be completed in VIIIth Semester and will be evaluated through a panel of examiners consisting of HOD of the concerned department, project coordinator and one external examiner to be appointed by the University.

The student will be required to submit three copies of his/her project report to the office of the concerned department for record (one copy each for the deptt. Office, participating teacher and college library).

Project coordinator will be assigned the project load of 2 hrs., per week while the participating teachers will be assigned 1 hr. load for the same.

ME-415-E   Practical Training - II

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.

Open Electives

HUM-451 E   **Language Skills for Engineers**

```
L  T  P                        Class Work      :    50 Marks
4  -  -                        Exam            :    80 Marks
                               Pract./Presen   :    20 Marks
                               Total           :   150 Marks
                               Duration of exam. :   3 Hours
```

The real challenge before the students starts when they cross the threshold of the college after completing   their degree. They, all of a sudden, find themselves competing for job/ P.G. Degrees, through various entrance tests and interviews. Verbal ability forms a major portion of these tests. Without sound language skills and its semantic-syntactic know-how, the students with engineering background find themselves almost under- prepared for such tests. With this difficulty of students in mind, this course is proposed to make them technically proficient in handling the language skills required in competitive exams. The course would expose students to almost all variety of items, the common run of such tests as CAT, GMAT etc. And in the context of LPG, this cutting edge competence becomes imperative, and no professional education can afford to overlook this aspect.

Course Content:
Unit I
Remedial English: Parts of speech; Gerunds, participles and infinitives; Clauses; Sentence-constructions (unity; avoidance of choppy and rambling sentences, logic and consistency, conciseness, sequencing of ideas); Sentence errors - agreement between verb and subject, pronoun and antecedents, sequence of tenses, problems involving modifiers (dangling and misplaced modifiers); Shifts in point of view - consistency of number and person, tense, mood, voice and subject; Parallelism; Omissions and mixed constructions.

Unit II
Vocabulary: Methods of building vocabulary - etymological roots, prefixes and suffixes; Commonly used foreign words and phrases; spelling; words often confused; synonyms and homonyms; one word substitutes; verbal idioms.

Unit III
 Punctuation and Mechanics: End Punctuation; Internal Punctuation; Word Punctuation.

Unit IV
Comprehension: Abstracting; Summarising; Observations, Findings and Conclusions; Illustration and Inductive Logic; Deduction and Analogy.

Unit V
Presentation: Oral presentation - Extempore, discussion on topics of contemporary relevance, interviews.

Suggested Reading:

1. *Working with Words* by R.Gairns and S.Redman, Cambridge University Press, London.
2. *Meanings into Words – Upper Intermediate Students Book,* Doff/jones, Foundation Books (Cambridge university Press), Delhi.
3. *A Practical English Grammar* by A.J. Thomson and A.V. Martinet, OUP, Delhi.
4. *Examine your English* by Margaret M. Maison, Orient Longman, New Delhi.
5. *A Practical Guide to Colloquial Idiom* by W.J. Ball, Longman.
6. *A guide to Correct English* by L.A. Hill, Oxford.
7. *Structural Essentials of English* by H. Whitehall, Longman.
8. *Advanced English Practice* by B.D. Graver, OUP. Delhi.
9. *Public Speaking*, Sudha Publication Pvt. Ltd., New Delhi.
10. *Group Discussion*, Sudha Publication Pvt. Ltd., New Delhi.

Scheme of Examination:

(A) Theoretical:
The pattern of the exam would be more or less like the pattern of the competitive exams. (i.e., OBJECTIVE TYPE) like CAT G-MAT etc., as far as the units I, II, III and IV are concerned.

Unit-I, II, III: (30, 20, 10 Marks respectively)
The first section of the question paper will have 110 objective type questions with no choice at all. These 110(60+40+10) questions will cover all the first three units (I, II, III) of the syllabus and would carry 30,20 and 10 marks respectively. The questions may be in the form of multiple choices, fill-in-the-blank, supply the right word/choice, choose the right alternative, do as directed etc.

Unit-IV: 20 Marks
The question from this unit will test comprehension competence (in the form of various elements mentioned in the unit) of the text given.

(B) Practical (Presentation):
There will be an oral test carrying **20 marks**. The presentation part of the section i.e. Unit-V will be covered in this test. Hence, there is no need to include this unit in theory exam.

Three hours for a group of 15 students are required for this test. Test can be in the form of any of the activities mentioned in the Unit-V.

A panel of examiners appointed by the University will evaluate the presentation.

CSE-303-E   **Computer Graphics**

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L   T   P                         Class Work      :   50 Marks
3   1   -                         Exam            :  100 Marks
                                  Total           :  150 Marks
                                  Duration of exam. :  3 Hours
```

Unit-1: Introduction to Computer Graphics: What is Computer Graphics, Computer Graphics Applications, Computer Graphics Hardware and software, Two dimensional Graphics Primitives: Points and Lines, Line drawing algorithms: DDA, Bresenham's; Circle drawing algorithms: Using polar coordinates, Bresenham's circle drawing, mid point circle drawing algorithm; Filled area algorithms: Scanline: Polygon filling algorithm, boundary filled algorithm.

Unit-2: Two/Three Dimensional Viewing: The 2-D viewing pipeline, windows, viewports, window to view port mapping; Clipping: point, clipping line (algorithms):- 4 bit code algorithm, Sutherland-cohen algorithm, parametric line clipping algorithm (Cyrus Beck).

Polygon clipping algorithm: Sutherland-Hodgeman polygon clipping algorithm. Two dimensional transformations: transformations, translation, scaling, rotation, reflection, composite transformation.

Three dimensional transformations: Three dimensional graphics concept, Matrix representation of 3-D Transformations, Composition of 3-D transformation.

Unit-3: Viewing in 3D: Projections, types of projections, the mathematics of planner geometric projections, coordinate systems.

Unit-4: Hidden surface removal: Introduction to hidden surface removal. The Z- buffer algorithm, scanline algorithm, area sub-division algorithm.

Unit-5: Representing Curves and Surfaces: Parametric representation of curves: Bezier curves, B-Spline curves. Parametric representation of surfaces; Interpolation method.

Unit-6: Illumination, shading, image manipulation: Illumination models, shading models for polygons, shadows, transparency. What is an image? Filtering, image processing, geometric transformation of images.

Text Books:
- Computer Graphics Principles and Practices second edition by James D. Foley, Andeies van Dam, Stevan K. Feiner and Johb F. Hughes, 2000, Addision Wesley.
- Computer Graphics by Donald Hearn and M.Pauline Baker, 2nd Edition, 1999, PHI

Reference Books:
- Procedural Elements for Computer Graphics – David F. Rogers, 2001, T.M.H Second Edition
- Fundamentals of 3Dimensional Computer Graphics by Alan Watt, 1999, Addision Wesley.
- Computer Graphics: Secrets and Solutions by Corrign John, BPB
- Graphics, GUI, Games & Multimedia Projects in C by Pilania & Mahendra, Standard Publ.
- Computer Graphics Secrets and solutions by Corrign John, 1994, BPV
- Introduction to Computer Graphics By N. Krishanmurthy T.M.H 2002

Note: Eight questions will be set in all by the examiners taking at least one question from each unit. Students will be required to attempt five questions in all.

HUM-455-E   **Entrepreneurship**

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L  T  P                              Class Work     :    50 Marks
3  1  –                              Exam           :   100 Marks
                                     Total          :   150 Marks
                                     Duration of exam. :  3 Hours
```

Unit-I : Promotion of Entrepreneurship

Meaning, definition and functions of an entrepreneur, qualities of a good entrepreneur; Role of Entrepreneur in economic development; Government measures for the promotion of small scale industries with special reference to Haryana; Cultural factors in developing entrepreneurship.

Unit -II : Ownership and Location of Industrial Units

Different forms of Industrial Organisation.
Theories of Industrial location. Process of preparing project reports.

Unit -III : Size of Firm and Pricing

Concept of optimum firm, factors determining
Optimum size. Technical, Managerial, Marketing Uncertainties and risk.
Pricing Methods, Policies and procedures.

Unit -IV : Financing of Small Industries

Importance and need : Commercial Banks and term lending in India; Banks and under-writing of capital issues; Brief description about the role of other financial agencies viz; Industrial Finance Corporation of India. State Financial Corporation, Industrial Development Bank of India; Unit Trust of India.

Unit -V : Problems Faced by Small Enterprises

Problems connected with Marketing, Management of New Products; Power; Finance; Raw Material; Under-utilization of capacity; Causes of under – utilization; Rehabilitation of Sick Mills.

Unit -VI : Government and Business

(a)   Highlights of Industrial Policy and Licensing Policy.
(b)   International Marketing with special reference to export documentation.

Recommended Books :

1.   Entrepreneurship of Small Scale Industries – Deshpande Manohar D. (Asian Publishers, New Delhi)
2.   Environment and Entrepreneur – Tandon B.C. (Asian Publishers, New Delhi).
3.   The Industrial Economy of India – Kuchhal S.C. (Chaitanya, Allahabad).
4.   Emerging Trends in Entrepreneurship Development Theories & Practices – Singh P.Narendra (International Founder, New Delhi)
5.   Entrepreneur, Banker & Small Scale Industries – Bhattacharya Hrisnikes.
6.   Entrepreneurship & Growth of Enterprise in Industrial Estates – Rao Gangadhara N.

Note:

Eight questions are to be set atleast one question from each unit and the students will have to attempt five questions in all.

HUM-452-E   **Business Communication**

```
L  T  P                        Class Work        :    50 Marks
4  -  -                        Exam              :   100 Marks
                               Total             :   150 Marks
                               Duration of exam. :     3 Hours
```

The course proposes to help students develop business and technical communication competence. It focuses on writing skills and strategies for specific purposes. The inevitability of introducing this course to Engineering students is embodied in that it has comparatively a high concentration of certain complex writing techniques and procedures.

Course Content:
Unit-I

Business correspondence: Characteristics and Formats of Business letter; Quotations, Orders, Tenders, Sales letters, claim and adjustment letters, Credit and Collection letters, Application Letters for vacant situations with emphasis on Resumes and Curriculum Vitae; E-mail and Netiquette – format, style and tone.

Unit-II

Business Reports and Proposals: Importance, Function, Pattern and formats of Reports, Typical Business Reports, Report Organisation and Presentation, and Formal Reports; Proposal Formats, Writing problem-Solving Proposals, Executive Summary Proposals and project Proposals.

Unit-III

Meetings: Writing of Memorandum, Notes, Agenda and Minutes of Meeting.

Unit-IV

Public Relations and Advertising Documents: Press Releases, Public Service Announcements, Advertising Strategy and its objective, Designing of Classified and Display Advertising copies.

Suggested Reading:

1. *Business Communication: Process & Product* by Hary Ellen Guffey, IV Edition, South-Western College Publishing, Cincinnati.
2. *Business Correspondence and Report Writing* by R.C. Sharma & Krishna Mohan, Tata Macgraw Hill Publication, New Delhi.
3. *Effective Business English and Correspondence* by M.S. Ramesh and C.C. Pattanshetti, R. Chand & Co., New Delhi.
4. *Effective Letters in Business by Robert* by C. Shruter, Tata Macgraw Hill, New Delhi.
5. *English Business Letters* by F.W. Wing & D. Anncree, Orient Longman.
6. *Written Communication in English* by Sarah Freeman, Orient Longman.
7. *International Business English* by Leo Jones & Richard Alexander, Cambridge University Press.
8. *General and Business English* by Sweet Stephen, Sir Issac Pitman & Sons Ltd., London.
9. How to Write and Present Technical Information, Charles H. Sides, Cambridge University Press, U.K.
10. Strategies for Engineering communication, Susan Stevenson/Steve Whitmore, John Wiley and Sons, Inc. Printed in India by Replika Press Pvt. Ltd., Delhi.

Scheme Of Examination:

There will be six questions in all, covering all the units. All questions will be compulsory and will have enough internal choice.

Unit-I: 30 Marks

There will be two questions from this unit. One question will cover the theoretical aspect of business letter writing and will carry 10 marks. The other question will be on writing the letter in a proper format on a subject given and will be of 20 marks. There will be enough choice taking care of the justice to be given to both the aspects of the letter writing.

Unit-II: 35 Marks

There will be two questions from this unit. One question will cover the theoretical aspect of report/proposal writing and will carry 15 marks. The other question will be on preparing the report/proposal on a topic/subject given and will be of 20 marks. There will be enough choice taking care of the justice to be given to both the aspects of the report writing.

Unit-III: 15 Marks

There will be a question on theoretical aspects of the various items of this unit or students can be asked to draft a specimen of any of these from the material given in the exam. The question can be split into parts.

Unit-IV: 20 Marks

There will be one question having two parts. One part will be on theory and will be of 5marks and the other will require the drafting an advertisement copy of a product or service or a public announcement and will carry 15 marks.

PHY-453-E   **Laser Technology**

L	**T**	**P**			
4	–	–			

Class Work   :   50 Marks
Exam   :   100 Marks
Total   :   150 Marks
Duration of exam. :   3 Hours

Conditions for Producing Laser, Concept of coherence – Special and temporal, Population Inversions, Einstein coefficient, Gain and Gain saturation, Saturation intensity, Development and Growth of a Laser Beam, Exponential Growth factor, Threshold Requirement for a Laser.

Inversions and two-level systems, steady-state inversions and three and four-level systems. Transient Population Inversions, Factors effecting population inversion, Laser Amplifiers.

Excitation or Pumping Threshold Requirements, Pumping Pathways, Specific Excitation Parameters Associated with Optical and particle Pumping.

Helium-Neon Laser, CO_2 Laser, Ruby Laser, Semiconductor Diode Laser.

Recommended Books:

1.   Laser Fundamentals by William T. Silfvast Cambridge University, Press.
2.   Introductory University Optics by John Beynon, (PHI)
3.   Laser – B.B. Laud.
4.   Optics – A.K. Ghatak (TMH)

Note :
Eight questions will be set and students will be required to attempt any five questions in all. All questions will carry equal marks.

IC-403-E   **Embedded System Design**

```
L  T  P                        Class Work      :    50 Marks
3  1  –                        Exam            :   100 Marks
                               Total           :   150 Marks
                               Duration of exam. :   3 Hours
```

Unit 1 : Introduction:

Different types of microcontrollers: Embedded microcontrollers, External memory microcontrollers; Processor Architectures: Harvard V/S Princeton , CISC V/S RISC; microcontrollers memory types; microcontrollers features : clocking, i/o pins, interrupts, timers, peripherals.

Unit 2 : Microcontroller Architecture:

Introduction to PIC microcontrollers, Architecture and pipelining, program memory considerations, Addressing modes, CPU registers, Instruction set, simple operations.

Unit 3 : Interrupts And I/O Ports:

Interrupt logic, Timer2 scalar initialization, IntService Interrupt service routine, loop time subroutine, External interrupts and timers, Synchronous serial port module, Serial pheriphal device, O/p port Expansion, I/p port expansion, UART.

Unit 4 : Software:

Development tools/ environments, Assembly language programming style, Interpreters, High level languages, Intel hex format object files, Debugging.

Unit 5 : Programming With Microcontrollers:

Arithmetic operations, Bit addressing, Loop control, Stack operation, Subroutines, RAM direct addressing, state machines, Oscillators, Timer Interrupts, Memory mapped I/O.

Unit 6 : Desining Using Microcontrollers:

Music box, Mouse wheel turning, PWM motor control, Aircraft Demonstration, ultra sonic distance measuring, Temperature Sensor, Pressure Sensor, Magnetic Field Sensor.

Text Book:

1. Design with PIC Microcontrollers by John B. Peatman , Pearson.

Reference Books :

1.   Programming and Customizing the 8051 Microcontroller : Predko ; TMH.
2.   Designing Embedded Hardware : John Catsoulis ;SHROFF PUB. & DISTR. ND.
3.   Programming Embedded Systems in C and C++ : Michael Barr; SHROFF PUB. & DISTR. ND.

HUM-452-E   **Business Communication**

```
L  T  P                          Class Work        :    50 Marks
4  -  -                          Exam              :   100 Marks
                                 Total             :   150 Marks
                                 Duration of Exam. :     3 Hours
```

The course proposes to help students develop business and technical communication competence. It focuses on writing skills and strategies for specific purposes. The inevitability of introducing this course to Engineering students is embodied in that it has comparatively a high concentration of certain complex writing techniques and procedures.

Course Content:
Unit-I
Business correspondence: Characteristics and Formats of Business letter; Quotations, Orders, Tenders, Sales letters, claim and adjustment letters, Credit and Collection letters, Application Letters for vacant situations with emphasis on Resumes and Curriculum Vitae; E-mail and Netiquette – format, style and tone.

Unit-II
Business Reports and Proposals: Importance, Function, Pattern and formats of Reports, Typical Business Reports, Report Organisation and Presentation, and Formal Reports; Proposal Formats, Writing problem-Solving Proposals, Executive Summary Proposals and project Proposals.

Unit-III
Meetings: Writing of Memorandum, Notes, Agenda and Minutes of Meeting.

Unit-IV
Public Relations and Advertising Documents: Press Releases, Public Service Announcements, Advertising Strategy and its objective, Designing of Classified and Display Advertising copies.

Suggested Reading:
1. *Business Communication: Process & Product* by Hary Ellen Guffey, IV Edition, South-Western College Publishing, Cincinnati.
2. *Business Correspondence and Report Writing* by R.C. Sharma & Krishna Mohan, Tata Macgraw Hill Publication, New Delhi.
3. *Effective Business English and Correspondence* by M.S. Ramesh and C.C. Pattanshetti, R. Chand & Co., New Delhi.
4. *Effective Letters in Business by Robert* by C. Shruter, Tata Macgraw Hill, New Delhi.
5. *English Business Letters* by F.W. Wing & D. Anncree, Orient Longman.
6. *Written Communication in English* by Sarah Freeman, Orient Longman.
7. *International Business English* by Leo Jones & Richard Alexander, Cambridge University Press.
8. *General and Business English* by Sweet Stephen, Sir Issac Pitman & Sons Ltd., London.
9. How to Write and Present Technical Information, Charles H. Sides, Cambridge University Press, U.K.
10. Strategies for Engineering communication, Susan Stevenson/Steve Whitmore, John Wiley and Sons, Inc. Printed in India by Replika Press Pvt. Ltd., Delhi.

Scheme Of Examination:

There will be six questions in all, covering all the units. All questions will be compulsory and will have enough internal choice.

Unit-I: 30 Marks

There will be two questions from this unit. One question will cover the theoretical aspect of business letter writing and will carry 10 marks. The other question will be on writing the letter in a proper format on a subject given and will be of 20 marks. There will be enough choice taking care of the justice to be given to both the aspects of the letter writing.

Unit-II: 35 Marks

There will be two questions from this unit. One question will cover the theoretical aspect of report/proposal writing and will carry 15 marks. The other question will be on preparing the report/proposal on a topic/subject given and will be of 20 marks. There will be enough choice taking care of the justice to be given to both the aspects of the report writing.

Unit-III: 15 Marks

There will be a question on theoretical aspects of the various items of this unit or students can be asked to draft a specimen of any of these from the material given in the exam. The question can be split into parts.

Unit-IV: 20 Marks

There will be one question having two parts. One part will be on theory and will be of 5marks and the other will require the drafting an advertisement copy of a product or service or a public announcement and will carry 15 marks.

CSE-451-E   **AI and Expert System**

L	**T**	**P**			
3	1	–	**Class Work**	:	50 Marks
			Exam	:	100 Marks
			Total	:	150 Marks
			Duration of exam. :		3 Hours

Contents

1. Introduction to Artificial intelligence: Scope, history & applications: AI as representation and search the predicate calculus inference rules. Logic based financial advisor, structures and strategies for state space search graph theory, strategies for space search, using state space to represent reasoning with the predicate calculus.

2. Heuristic Search: An algorithm for heuristic search, admissibility monotonicity and informed ness heuristics in games, complexity issues, control and implementation of state space search recursion based search, pattern directed search. Production systems, predicate calculus and planning the black board architecture for problems solving.

3. LISP and PROLOG: Knowledge representation languages issues in knowledge representation, network representation language, structured representations, introduction to LISP, Search in LISP: a functional approach to the farmer, Wolf, Goat and cabbage problem, higher order functions & procedural abstraction, search strategies in LIPS.

4. Expert systems: Introduction, History basic concepts, structure of expert systems, the human element in ES how ES works, problem areas addressed by ES, ES success factors, types of expert systems, ES and the internet interacts web, knowledge engineering, scope of knowledge, difficulties, in knowledge acquisition methods of knowledge acquisition, machine learning, intelligent agents, selecting an appropriate knowledge acquisition method, knowledge acquisition form multiple experts validation and verification of the knowledge base, analyzing coding, documenting & diagramming.

5. Expert systems- II, societal impacts reasoning in artificial intelligence, inference with rules, with frames: model based reasoning, case based rezoning, explanation & meta knowledge inference with uncertainty representing uncertainty probabilities and related approaches, theory of certainty (certainty factors) Qualitative reasoning, the development life cycle, phases I, II, III, IV, V, VI the future of expert system development process societal impacts.

Text

1. Efrain Turban and Jay E Aranson: Decision support systems & intelligent systems (5th Edn.) Prentice hall, 1998.

2. Donald A Waterman: A Guide to expert Systems, Addison -Wesley 1995

3. G.F. Luger & W.A Stubble Field -Artificial Intelligence structures and Strategies for complex problem solving, 3 rd Edn. Addision Wesley 1998.

4. E.Rich and Knight, Artificial Intelligence, Second Edn, Tata Mc. Graw Hill Publishing, 1981.

IC-455-E INTELLIGNET INSTRUMENTATION FOR ENGINEERS

L T P		**Class Work**	:	50 Marks
3 1 –		**Exam**	:	100 Marks
		Total	:	150 Marks
		Duration of exam.	:	3 Hours

Introduction:
Intelligence, features characterizing intelligence, intelligent instrumentation system; features of intelligent instrumentation; components of intelligent instrumentation system. Block diagram of an intelligent instrumentation system.

Signal Processing, Manipulation And Transmission
Signal amplification & attenuation (OP-AMP based); Instrumentation Amplifier (circuit diagram, high CMRR& other features); Signal Linearization (different types such as Diode resistor combination, OP-AMP based, etc.(; Bias Removal, Signal filtering (outputs from ideal filters, outputs form constant-k filters, matching of filter sections, active analog filters);OP-AMP based Voltage-to-current converter, Current-to-voltage conversions, Signal integration, Voltage follower (pre amplifier); voltage comparator, Phase –Locked loop, Signal addition, Signal multiplication, Signal Transmission (Signal amplification, Shielding , Current loop transmission, Voltage-to-frequency conversion, Fiber optic transmission(; Description of Spike Filter (software based)

Smart Sensors
Primary sensors; Excitation; Compensation (Nonlinearity: look up table method, polygon interpolation, polynomial interpolation, cubic spline interpolation, Approximation & regression: Noise & interference; Response time: Drift; Cross-sensitivity); information coding/Processing; Data Communication; Standards for smart sensor interface…

Interfacing Instruments & Computers
Address decoding; Data transfer control; A/D converter; D/A converter; Sample & hold circuit; others interface considerations.

Recent Trends In Sensor Technologies
Introduction; Film sensors (Thick film sensors, this film sensor) Semiconductor IC Technology- Standard methods; Micro electro- mechanical systems (Micro-machining, some application examples); Nono-Sensors.

Text Book
1. Barney, G.C., Intelligent instruments. Hemel Hempsteao: Prentice Hall, 1985.
2. ALAN S. Morris, Principles of Measurement s Instrumentation. New. Delhi: PHI Pvt. Ltd. 1999.

Reference Book:
1. D.Patranabis, Sensors s Transducers. New .Delhi: PHI, 2003.
2. Roman Kuc, Introduction to Digital Signal Processing. New York: McGraw-Hill Pub. Co.

Notes
1. In the sessional exam. The examiner will set 8 questions in all covering the Entire syllabus. Students will be required to attempt any five questions.
2. Use of scientific calculator will be allowed in the Exam. However, pager, Programmable calculator s cellular phone etc. will nit be allowed.

PHY-453-E   **LASER TECHNOLOGY**

L	T	P
4	–	–

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

Conditions for Producing Laser, Concept of coherence – Special and temporal, Population Inversions, Einstein coefficient, Gain and Gain saturation, Saturation intensity, Development and Growth of a Laser Beam, Exponential Growth factor, Threshold Requirement for a Laser.

Inversions and two-level systems, steady-state inversions and three and four-level systems. Transient Population Inversions, Factors effecting population inversion, Laser Amplifiers.

Excitation or Pumping Threshold Requirements, Pumping Pathways, Specific Excitation Parameters Associated with Optical and particle Pumping.

Helium-Neon Laser, Co_2 Laser, Ruby Laser, Semiconductor Diode Laser.

Recommended Books:
1.   Laser Fundamentals by William T. Silfvast Cambridge University, Press.
2.   Introductory University Optics by John Beynon, (PHI)
3.   Laser – B.B. Laud.
4.   Optics – A.K. Ghatak (TMH)

Note :
Eight questions will be set and students will be required to attempt any five questions in all. All questions will carry equal marks.

PHY-451-E   **NANO TECHNOLOGY**

L T P	**Class Work** :	50 Marks
4 - -	**Exam** :	100 Marks
	Total :	150 Marks
	Duration of Exam:	3 Hours

Unit-I Introduction To Nanotech
Crystalline noncrystalline materials, fundamental of Nano Technology & Nano-materials in metals, other materials & Biosystem molecular recognition, quantum mechanics and quantum idea in nanotechnology,semiconductor nano particles.

Unit-II Preparation And Characterization Of Nanoparticles
Nanoscale lithography,dip pen lithography,e-beam lithography,nanosphere life off,lithography,molecular synthesis,nanocrystal growth,polymerization nanobricks & building block: tool for measuring nanostructures-scanning probe instrument,spectroscopy,electrochemistry, electronmicroscopy tools to make nanostructure.

Unit-III Properties & Application Of Nano Crystalline Materials
Application in sensors, nanoscale biostructure electronics, magnets, optics, fabrication medical application, smart materials self healling structures, heterogeneous nano structure & composites encapsulation carbon nanotubes.

Unit-IV
Synthesis of semiconductor nanocluster,processing of nanomaterials,nanobusiness-boom,bust & nanotechnology,nanoethics

References
1. Camarata. R.C. Nanomaterials synthesis, properties and application Institute of Physics Publication.
2. Madou. Fundamentals of microfabrication, Mcgraw Hill.
3. Sibelia, J.P. A Guide to material characterization, Prentice Hall.
4. Mark Ratner, Deniel Ratner – Nano Technology – A gentle Introduction to the Next Big Idea.

Note
The question paper will contain 8 questions in all. The students will be required to answer any five. At the most one question will be set from each section.

L	T	P
4	–	–

Class Work : 50 Marks
Exam : 100 Marks
Total : 150 Marks
Duration of Exam: 3 Hours

I. Waster Water & its treatment Processes:-

Waster-water characteristics, effiuent standards, primary treatment, secondary treatment – aerobic (Activated sludge, aerated lagoons, trickling filter, roughing filter, rotating biological contractor) anaerobic (contact process, UASB)

II. Air Pollution

Classification of air pollutants

Particulates: Physical characteristics, mode of formation, setting properties, control measures.

Hydrocarbons: Nature, sources, control

Carbon Monoxide : Source harmful effects on human health, control measure.

Axides of sulphur and Nitrogen Sources, effects on human health and platns. Control measure.

III. Solid Waste:

Types, sources and properties of solid waste, aoilid waste management-generation, collection and techniques for ultimate disposal, elementary discussion on resource and energy recovery.

IV. Elementary treatment of nuclear pollution, metal pollution, noise pollution their effects & control.

Books Suggested:

1. Environmental Engg. By Howard s. peeavy & others, MGH international.
2. Metacaf-EDDY-Waste-Water engineering revised by George Teholonobus (TMH)
3. Environmental Chemistry By B.K Sharma, Goel Publishin Meerut.
4. Environmental Chemistry, A.K DE, Wiley Eastern.
5. Air Pollution: H.C. perking-Mc Graw Hill

Note :

Eight questions will be set and students will be required to attempt five questions in all.

HUM-453-E   **HUMAN RESOURCES MANAGEMENT**

L	T	P			
4	–	–	**Class Work :**	50 Marks	

Class Work :   50 Marks
Exam   :   100 Marks
Total   :   150 Marks
Duration of Exam: 3 Hours

Unit-I : Understanding Organizational Behaviour
Definition, Goals of Orgamisational behaviour. Key forces affecting organizational Behaviour. Fundamental Concepts of organizational behaviour.

Unit-II : Motivation
Meaning, objectives and importance of motivation. Theories of Motivation, Maslow's theory, Mc Greger's Theory Herzberg's theory.

Morale : Meaning, Factors affecting morale, types of morale morale and productivity, Evaluation of morale, improving morale.

Unit-III : Communication
Definition & importance of Communication; Formal & informal communication, Barriers in communication.

Unit-IV : Leadership
Definition & importance, nature of leadership various approaches to leadership styles.

Unit-V :
Importance of human resources in industry, Definition of human resource management, mechanical approach towards personnel, Paternalism, Social system approach.

Unit-VI
Need for human resource planning, process of human resource planning, methods of recruitment, Psychological tests and interviewing, Meaning and importance of placement, meaning and techniques of induction. Training and development : Concepts of training and development, Importance of training and development, Management development its nature, purpose and method.

Unit-VII
Significant factors affecting compensation, Methods of wage payment, Wage differentials, Causes of difference in Wages, Types of wage differentials, Wage incentives, Meaning, objectives, types of incentive plans.

Recommended Books:

Text Books:
1. Human Resources and Personal Management-K . Aswathappa-Tata McGraw Hill Publishing Company Ltd.
2. Personnel Management : C.B. Mamoria, Himalaya Publishing House.
3. Organisational Behaviour – Dr. L.M Prasad (Sultan Chand & Sons)

Reference Books:
1. Personnel Management & Industrial Relations : Dr. T.N. Bhagoliwal : Sahitya Bhawan Agra.
2. Personnel Management : V.G. Karnik, Jaico Publishing House.
3. Personnel Management & Industrial Relation: Tripathi: Sultan, Chand & Sons.
4. Personnel Management – Arun Monappa & Mirza Saiyadain – Tata McGraw Hill Publishing Co. Ltd.
5. Personnel Management and Industrial Relations – D.C. Sharma & R.C. Sharma S.J. Publication.
6. Principles of Personnel Management – Edwin B. Flippo (McGraw Hill)
7. Organisational Behaviour – K. Adwathappa.
8. Organisational Behaviour – John W. Newsstorn & Keith Davis, Tata McGraw – Hill Publishing Company Limited, New Delhi.

Note :
Eight questions are to be set at least one question from each unit and the students will have to attempt five questions in all.

ME-402-E   **Computer Aided Design**

L	**T**	**P**	**Class Work**	**:** 50 Marks
3	1	–	**Exam**	**:** 100 Marks
			Total	**:** 150 Marks
			Duration of Exam.	**:** 3 Hours

UNIT – I Introduction: Introduction to CAD/CAM, Historical developments, Industrial look at CAD/CAM, Introduction to CIM; Basics of geometric and solid modeling, explicit, implicit, intrinsic and parametric equations, coordinate systems.

UNIT – II 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, orthographic and perspective projections, reconstruction of 3-D objects.

UNIT – III Curves: Algebraic and geometric forms, tangents and normal, blending functions reparametrization, straight lines, conics, cubic splines, Bezier curves and B-spline curves.

UNIT – IV Surfaces: Algebraic and geometric forms, tangents and normal, blending functions, reparametrization, sixteen point form, four curve form, plane surface, ruled surface, surface of revolution, tabulated cylinder, bi-cubic surface, bezier surface, B-spline surface.

UNIT – V Solids: Solid models and representation scheme, boundary representation, constructive solid geometry, sweep representation, cell decomposition, spatial occupancy enumeration.

UNIT – VI   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.

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

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

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.

Note :

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

ME-404-E   **Power Plant Engineering**

L	**T**	**P**	**Class Work** :	50 Marks
3	1	–	**Exam** :	100 Marks
			Total :	150 Marks
			Duration of Exam. :	3 Hours

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

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

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

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

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

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

Unit VII Non-Conventional Power Generation: Solar radiation estimation, solar energy collectors, low, medium & high temperature power plants, OTEC, wind power plants, tidal power plants, geothermal power plants.

Unit VIII Direct Energy Conversion Systems: Fuel cell, MHD power generation-principle, open & closed cycles systems, thermoelectric power generation, thermionic power generation.

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

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

Note :

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

ME-406-E   **Computer Aided Design Lab**

L T P	**Class Work** :	50 Marks
– – 3	**Exam** :	50 Marks
	Total :	100 Marks
	Duration of Exam. :	3 Hours

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.   Implement simple programmes for the graphics representation of

   (i)   Transformation and projections.

   (ii)   Conic Sections, cubic splines, and B-splines.

   (iii)   Surfaces- Bilinear, Bicubic surface patch and Bezier surface.

2.   CAD Modelling Assignments.

   (i)   Construction of simple machine parts and components.

   (ii)   Modelling of machine components.

   - Surface of a Diffuser section, Propeller.

   - Gear blank and other mechanical parts.

   - Mechanical assembly of parts.

ME-408-E   **Independent Study Seminar**

```
L   T   P                    Class Work   :   50 Marks
-   -   4                    Total        :   50 Marks
```

The student will select a topic in emerging areas of Mech. Engg. and study independently. He will give a seminar talk on the same before the committee constituted by the head of the dept. The committee should comprise of at least three faculty members from Thermal, Production & Design specializations.

GPME-402-E   General Fitness For the Profession

L	**T**	**P**
–	–	8

Class Work : 50 Marks
Exam : 100 Marks
Total : 150 Marks

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

Name : _____ **College Roll No.** _____

Univ.Roll No. _____ **Branch** _____

Year of Admission _____

I. Academic Performance (15 Marks) :
   (a) Performance in University Examination :-

S.No.	Semseter	Result % age of Marks in which the Sem Obtained	Number of Attempt Exam has been Cleared
1	I		
2	II		
3	III		
4	IV		
5	V		
6	VI		
7	VII		

II. Extra Curricular Activities (10 Marks) :

Item	Level of Participation	Remarks (Position Obtained)

Indoor Games (Specify the Games

Outdoor Games (Specify the Games)

Essay Competition

Scientific Technical Exhibitions

Debate

Drama

Dance

Music

Fine Arts _____
_____
_____

Painting _____
_____
_____

Hobby Club _____
_____
_____

N.S.S. _____
_____
_____

Hostel Management _____
Activities _____
_____

Any other _____
activity (Please _____
Specify) _____

III. Educational tours/visits/Membership of Professional Societies (5 Marks)
1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

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

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

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

*Marks obtained I.(   )+II(   )+III(   )+IV(   )+V(   )+VI(   ) =

**Total Marks :

Member   Member   Member   Member   Member

MDU B.Tech Syllabus (ME) – IV Year

ME-432-E Optimization Methods for Engineering Systems

```
L  T  P
4  -  -
```

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

Unit I Introduction: Engineering Applications; Statement of the Optimal Problem: Classification; Optimization Techniques.

Unit II Classical Methods: Single Variable Optimization; Multivariable Optimization without any Constraints with Equality and Inequality Constraints.

Unit III One-Dimensional Minimization Methods: Uni-model Function; Elimination Methods – Dichotomous Search, Fibonacce and Golden Section Methods; Interpolation Methods – Quadratic and Cubic Interpolation Methods.

Unit IV Unconstrained Minimization Methods: Univariate, Conjugate Directions, Gradient and Variable Metric Methods.

Unit V Constrained Minimization Methods: Characteristics of a constrained problem; Direct Methods of feasible directions; Indirect Methods of interior and exterior penalty functions.

Unit VI Geometric Programming : Formulation and Solutions of Unconstrained and Constrained geometric programming problems.

Unit VII Dynamic Programming: Concept of Sub-optimization and the principle of optimality; Calculus, Tabular and Computational Methods in Dynamic Programming; An Introduction to Continuous Dynamic Programming.

Unit VIII Integer Programming : Gomory's Cutting Plane Method for Integer Linear Programming; Formulation & Solution of Integer Polynomial and Non-linear problems.

Text Books :
1. Optimization (Theory & Applications) – S.S. Rao, Wiley Eastern Ltd., New Delhi.
2. Optimization Concepts and Applications in Engineering - Ashok D.Belegundu and Tirupathi R Chandrupatla -- Pearson Education.

Reference Books :
1. Optimization: Theory and Practice, C.S.G. Beveridge and R.S. Schechter, MGH, New York.

Note :
In the semester examination, the examiner will set eight questions, at least one question from each unit. The students will be required to attempt only 5 questions

ME-434-E   Computer Aided Vehicle Design

L T P	**Class Work :**	50 Marks
4 - -	**Exam :**	100 Marks
	Total :	150 Marks
	Duration of Exam. :	3 Hours

PART-A

Unit I Vehicle Frame and Suspension: Study of Loads-Moments and Stresses on Frame Members. Computer Aided Design of Frame for Passenger and Commercial Vehicles. Computer Aided Design of Leaf Springs-Coil Springs and Torsion Bar Springs.

Unit II Front Axle and Steering Systems: Analysis of Loads-Moments and Stresses at different sections of Front Axle. Determination of Bearing Loads at Kingpin Bearings. Wheel Spindle Bearings. Choice of Bearings. Determination of Optimum Dimension and Proportions for Steering Linkages ensuring minimum error in Steering.

Unit III Drive Line and Read Axle : Computer Aided Design of Propeller Shaft. Design of Final Drive Gearing. Design details of Full-floating., Semi-floating and Three Quarter Floating, Rear Axle Shafts and Rear Axle Housings.

PART-B

Unit IV Clutch: Torque capacity of Clutch. Computer Aided Design of Clutch Components. Design details of Roller and Sprag Type of Clutches.

Unit V Gear Box : Computer Aided Design of Three Speed and Four Speed Gear Boxes.

Note : Use of Software Packages for Analysis and Design of Mechanical Systems may be used for Design Problem.

Text Books :
1. Dean Averns,Automobile Chassis Design, llliffe Books
2. Heldt, P.M., Automotive Chassis, Chilton Co., New York

Reference Books:
1. Steeds.W., Mechanics of Road Vehicles, llliffee Books Ltd., London
2. Giles, J.G. Steering, Suspension and Tyres, llliffee Books Ltd., London,.
3. Newton, Steeds & Garret, Motor Vehicle, llliffee Books Ltd., London,.
4. Heldt, P.M. Torque Converter, Chilton Book Co., New York,

Note :
In the semester examination, the examiner will set eight questions in all, taking two questions each from Units I, II, III & one question each from Units IV & V. The students will be required to attempt 3 questions from PART-A & two questions compulsorily from Part-B .

ME-436-E   Mechatronics

```
L   T   P                          Class Work    :    50 Marks
4   -   -                          Exam          :    100 Marks
                                   Total         :    150 Marks
                                   Duration of Exam. :    3 Hours
```

Unit I 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.

Unit II Hardware of Measurement Systems; A review of Displacement, Position Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, Light Sensors / alongwith Performance Terminology; Selection of Sensors; Input Data by Switches; Signal Conditioning; Brief Review of Operational Amplifier; Protection; Fitering; 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.

Unit III 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.

Unit IV 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.

Unit V 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.

Unit VI 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.

Unit VII 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.

Unit VIII Design and Mechatronics: Design Process; Traditional and Mechantronics 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. Hist and Tata McGraw Hill
2. Mechtronics – Sensing to Implementation - C.R.Venkataraman, Sapna

Note :
In the semester examination, the examiner will set eight questions, at least one question from each unit. The students will be required to attempt only 5 questions.

ME-438-E   **Flexible Manufacturing System**

L T P	**Class Work**	**:**	50 Marks
4 - -	**Exam**	**:**	100 Marks
	Total	**:**	150 Marks
	Duration of Exam. :		3 Hours

Unit I Automation: Types of automation, reasons for automating, automation strategies, Detroit-type automation: Automated flow lines, methods of work part transport, Transfer mechanisms, buffer storage, automation for machining operations.

Unit II Automated assembly systems: Design for automated assembly, types of automated   assembly systems, part feeding devices, quantitative analysis of the delivery system   operation, analysis of a single-station assembly machine, numericals.

Unit III Group Technology: Part families, parts classification and coding, types of classification and coding systems. Machine cell design: The composite part concept, types of cell designs, determining the best machine arrangement, benefits of group technology.

Unit IV Flexible Manufacturing Systems: Components of an FMS, types of systems, where   to apply FMS technology, FMS work stations. Material handling and storage system: Functions of the handling system, FMS layout configurations. Material handling equipment. Computer control system: Computer function, FMS data file, system reports. Planning the FMS, analysis methods for FMS, applications and benefits.

Unit V Robotic technology: Joints and links, common robot configurations, work volume, types of robot control, accuracy and repeatability, other specifications, end effectors, sensors in robotics.

Unit VI Robot programming: Types of programming, lead through programming, motion Programming, interlocks, advantages and disadvantages. Robot languages: Motion   programming, simulation and off-line programming, work cell control.

Unit VII Robot applications: Characteristics of robot applications, robot cell design, types of robot applications: Material handling, processing operations, assembly and inspection.

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 and Sons, 1998.
2. Production Management Systems: A CIM Perspective
     Browne J, Harhen J, Shivnan J, Addison Wesley, 2nd Ed. 1996.

Note :

In the semester examination the examiner will set 8 questions, at least one   question from each unit. Students will be required to attempt five questions.

ME-442-E   **Robotics Engineering**

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L   T   P                          Class Work    :    50 Marks
4   -   -                          Exam          :   100 Marks
                                   Total         :   150 Marks
                                   Duration of Exam. :   3 Hours
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Unit I Robotic Manipulation: Automation and Robots; Robot Classification – Drive Technologies, Work-Envelope Geometries, Motion Control Methods, Applications; Robot Specifications – No. of Axes, Capacity and Speed, Reach and Stroke, Tool Orientation, Repeatability, Precision, Accuracy, Operating Environment, An Example; Rhino X-3.

Unit II Direct Kinematics: The Arm Equation Homogenous Co-ordinates – Frames, Translations and Rotations, Composite Homogenous Transformations; Screw Transformations; Link Co-ordinates;   The Arm Equation; A Five-Axis Articulated Robot; A Four-Axis Scara Robot; A Six-Axis Articulated Robot; Problems.

Unit III Inverse Kinematics: Solving the Arm Equation: The Inverse Kinematics Problem; General Properties of Solutions; Tool Configuration; Inverse Kinematics of a Five-Axis Articulated Robot, Four-Axis Scara Robot, Six-Axis Articulated Robot and Three-Axis Planer Articulated Robot; A Robotic Work Cell; Problems.

Unit IV Work Space Analysis and Trajectory Planning : Work Space Analysis; Work Envelope of a Five-Axis Articulated Robot; Work Envelope of a Four Axis Scrara Robot; Work Space Fixtures; The Pick and Place Operation; Continuous Path Motion; Interpolated Motion; Straight Line Motion; Problems.

Unit V Differential Motion and Statics : The Tool Configuration Jacobian Matrix; Joint – Space Singularties; Generalised Inverses; Resolved – Motion Rate Control; $n > 6$; Rate Control of Reduntant Rebots : $n > 6$; Rate Control using (1) – Inverses; The Manipulator Jacobian; Induced Joint Torques and Forces; Problems.

Unit VI Manipulator Dynamics : Lagrange's Equation; Kinetic & Potential Energy; Generalised Force; Lagrange – Euler Dynamic Model; Dynamic Models of a Two-Axis Planer Articulated Robot and A Three-Axis SCARA Robot; Direct & Inverse Dynamics; Recuresive Newton - Euler Formulation; Dynamic Model of a One-Axis Robot; Problems.

Unit VII Robot Control : The Control Problems; State Equations; Constant Solutions; Linear Feedback Systems; Single-Axis PID Control; PD-Gravity Control; Computed –Torque Control; Variable-structure Control; Impedance Control; Problems.

Text Books:
1.   Fundamental of Robotics (Analysis & Control) by Robert J.Schilling, Published by PHI, Pvt. Ltd., New Delhi.
2.   Introduction to Robotics (Mechanics & Control) by John J. Craig, Published by Addition Wesley (Intl. Student Edition).

Reference Books:
1.   Analysical Robotics & Mechatronics by Wolfram Stadler, Published by Mc-Graw Hill, Inc., New Delhi.
2.   Industrial Robotics - Technology, Programming & Applications by Mikell P. Grover, Weiss, Nagel and Ordef , Published by Mc-Graw Hill International Edition.
3.   A Robot Engg. Test Book - Mohsen Shahinpoor, Harper & Low, Publishing New York.
4.   Robotic Engineering – An Integrated Approach : Richard D.Klafter, Thomas A. Chmielewski and Michael Negin PHI 1989.
5.   Foundations of Robotics Analysis and Control - Tsuneo Yashikawa MIT Press 1990, Indian Reprint 1998.
6.   Robots and Control - R.K.Mittal and I.J.Nagrath - Tata McGraw Hill 2003.

Note:

In the semester examination, the examiner will set eight questions, at least one question from each unit. The students will be required to attempt only 5 questions.

ME-444-E   **Ergonomics and Work Place Design**

L T P   **Class Work   :   50 Marks**
4 – –   **Exam   :   100 Marks**
                                          Total   :   150 Marks
                                          Duration of Exam. :   3 Hours

Unit I Basic Principles of Ergonomics, Anthropometry, Posture and Health; Anthropometry Practical; Displays, Controls and HMI; Tools and Equipment Design; Workplace Design and Assessment; Task Analysis; Questionnaire and Interview Design; Product Design and Evaluation; Designing for manufacture and maintenance; Health and Safety Legislation and Ergonomics.

Unit II Application of Ergonomics Principles, Cognitive Ergonomics, Human Information Processing; Memory; Reading; Perception; Navigation; Problem Solving; Decision Making, Human-Computer Interaction, Input/Output Technology, Usability; Evaluation; Health problems.

Unit III Future Systems, Job Design, Scientific Management, Enrichment, Enlargement, Rotation, Cells, Shift work, Management Style and Job Design, Change Management. New Technology, Unemployment, Deskilling, Introducing new technology. Questionaire design and assessment. Task analysis techniques. Measurement of human error and risk. Use of simulation and prototypes. Product Evaluation. Experimental Design.

Unit IV Case Studies: A set of case studies will be used to demonstrate how ergnomics has lead to changes in work activity, safety and product design. Case studies will include advanced computer applicatons, workplace assessment and re-design, accident analysis and industrial inspection, and in manufacturing. Students will be required to apply the principles to a real life ergonomic design as applied to a product, service or computer application.

Text Books:

1.   Work Design: Industrial Ergonomics – Knoz, Stephan A., Johnson, Steven, Holcomb Hathaway, Scottsdale, AZ.
2.   Human factors in   engineering and design – Sanders, M.S. &   McCormick, E.J., 6th ed., McGraw-Hill, New York.

Reference Books:

1. Ergonomics: Man in his working environment- Murrell, K.F.H, Champan & Hall, London.
2. Man – Machine Engineering – Chapanis A: Wordsworth Publishing Co.
3. The Practice and Management of Industrial Ergonomics – Alexander, D.C., Prentice-Hall, Englewood Cliffs, NJ.
4. Textbook of Work Physiology – Astrand, P.O. & Rhodahl, K.– McGraw-Hill, New York.
5. Human Factors in Lighting – Boyce, P.R. Macmillan, New York.
6. The Ergonomics of Workspaces and Machines : A design manual – Clark, T.S. & Corlett, E.N. Taylor & Francis, London.
7. Ergonomics at work. Oborne, D Wiley, London.
8. Bodyspace–Anthropometry, Ergonomics and Design. – Pheasant, S. Taylor & Francis,.

Note:

In the semester examination, the examiner will set eight questionsin all , taking at least two question from each unit. The students have to attempt 5 questions.

ME-446-E   Modern Manufacturing processes

L T P
4 - -

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

Unit I Mechanical Processes: Ultrasonic Machining- Elements of process, cutting tool system design, effect of parameters, economic considerations, applications, limitations of the process, advantages and disadvantages. Abrasive Jet Machining- Variables in AJM, metal removal rate in AJM. Water Jet Machining- Jet cutting equipments, process details, advantages and applications.

Unit II Electrochemical and Chemical Metal Removal Processes: Electrochemical Machining-Elements of ECM process, tool work gap, chemistry of the process, metal removal rate, accuracy, surface finish and other work material characteristics, economics, advantages, applications, limitations. Electrochemical Grinding - Material removal, surface finish, accuracy, advantages, applications.

Unit III Thermal Metal Removal Processes: Electric Discharge Machining (EDM) or spark erosion machining processes, mechanism of metal removal, spark erosion generators, electrode feed control, dielectric fluids, flushing, electrodes for spark erosion, selection of electrode material, tool electrode design, surface finish, machining accuracy, machine tool selection, applications. Wire cut EDM. Laser beam machining (LBM)-Apparatus, material removal, cutting speed and accuracy of cut, metallurgical effects, advantages and limitations.

Unit IV Plasma Arc Machining (PAM): Plasma, non thermal generation of plasma, mechanism of metal removal, PAM parameters, equipments for D.C. plasma torch unit, safety precautions, economics, other applications of plasma jets. Electron Beam Machining (EBM) - Generation and control of electron beam, theory of electron beam machining, process capabilities and limitations.

Text Books :
1. Modern Machining Processes – P.C.Pandey, H.S.Shan, Tata McGraw Hill
2. Machining Science- Ghosh and Malik, Affiliated East-West Press

Reference Books :
1. Non Traditional Manufacturing Processes- Benedict G.F, Marcel Dekker
2. Advanced Methods of Machining- Mc Geongh J.A, Chapman and Hall

Note:

In the semester examination, the examiner will set eight questions in all , taking at least 2 questions from each unit. The students will be required to attempt only five questions.

ME-448-E   Emerging Automotive Technologies

L	T	P			
4	–	–	**Class Work**	:	50 Marks
			Exam	:	100 Marks
			Total	:	150 Marks
			Duration of Exam. :		3 Hours

UNIT I The Future Of The Automotive Industry : Challenges and Concepts for the 21st century. Crucial issues facing the industry and approaches to meet these challenges.

UNIT II Fuel Cell Technology For Vehicles : What is fuel cell, Type of fuel cell, Advantages of fuel cell. Current state of the technology. Potential and challenges. Advantages and disadvantages of hydrogen fuel.

UNIT III Latest Engine Technology Features : Advances in diesel engine technology. Direct fuel injection Gasoline engine. Diesel particulate emission control. Throttling by wire. Variable Valve Timing, Method used to effect variable Valve Timing. Electromagnetic Valves, Camless engine actuation.

UNIT IV 42 Volt System : Need, benefits, potentials and challenges. Technology Implications for the Automotive Industry. Technological evolution that will occur as a result of the adoption of 42 volt systems.

UNIT V Electrical And Hybrid Vehicles : Types of hybrid systems, Objective and Advantages of hybrid systems. Current status, Future developments and Prospects of Hybrid Vehicles

UNIT VI Integrated Starter Alternator: Starts stop operation, Power Assist, Regenerative Braking. Advanced lead acid batteries, Alkaline batteries, Lithium batteries, Development of new energy storage systems, Deep discharge and rapid charging ultra capacitors.

UNIT VII X-By Wire Technology : What is X-By Wire, Advantage over hydraulic systems. Use of Automotive micro controllers. Types of censors. Use of actuators in an automobile environment.

UNIT VIII   Vehicles Systems : Constantly Variable Transmission, Benefits, Brake by wire, Advantages over power Braking System. Electrical assist steering, Steering by wire, Advantages of Steering by wire. Semi-active and fully-active suspension system. Advantages of fully active suspension system.

Text & Reference Books :
1. Advanced Vehicle Technologies by Heinz Heisler-SAE International Publication.
2. Electric and Hybrid Electric vehicles by Ronald K. Jurgen.- SAE International Publication
3. .Electronic Braking, Traction and Stability control-SAE Hardbound papers.
1. Electronics steering and suspension systems- SAE Hardbound papers.
2. 42 Volt system by Daniel J. Holt- SAE International Publication
3. Diesel Particulate Emission by J.H. Johnson- SAE Hardbound papers.
7. Fuel Cell Technologies for vehicles by Richard Stobart- SAE Hardbound papers.

Note :

In the semester examination the examiner will set 8 questions, at least one question from each unit. Students will be required to attempt five questions.