MAHARSHI DAYANAND UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATIONS
B.E 2nd YEAR (SEMESTER – III) MECHANICAL ENGINEERING
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		
MATH-201 E	Mathematics – III (Common with all Branches)	3	1	-	4	50	100	-	150	3
HUM- 201 E	Economics (Common with all Branches)	3	1	-	4	50	100	-	150	3
ME-201 E	Thermodynamics (ME, AE)	3	1	-	4	50	100	-	150	3
ME-203 E	Strength of Materials-I (ME,AE)	3	1	-	4	50	100	-	150	3
ME-205 E	Engineering Mechanics (ME, AE)	3	1	-	4	50	100	-	150	3
ME-207 E	Machine Drawing	1	-	4	5	50	-	-	50	-
EE-213 E	Electronics Engg. (ME, CHE)	3	1	-	4	50	100	-	150	3
ME-209 E	Strength of Materials -I Lab (ME, AE)	-	-	2	2	25	-	25	50	3
EE-219 E	Electronics Engg. Lab. (ME, CHE)	-	-	2	2	25	-	25	50	3
ME-211E	Computer Aided Drafting Lab.	-	-	2	2	50	-	50	100	4
	TOTAL	19	6	10	35	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. **The university examination in the ME-207E (Machine Drawing) shall not be conducted w.e.f. the session 2006-07. Thus the total marks of the subject shall be 50 only.**

3. **The marks for class work as well as practical examination in the subject ME-211E (Computer Aided Drafting Lab.) has been increased from 25 each to 50 each. Thus the total marks for the subject shall be 100 in place of 50 from the session 2006-07.**

4. **The grand total of semester marks shall be 1150 in-place of 1200 marks.**

MAHARSHI DAYANAND UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATIONS
B.E 2nd YEAR (SEMESTER – IV) MECHANICAL ENGINEERING
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		
HUM-202 E	Fundamentals of Management EE, EL, EI, IC,ME,CHE)	3	1	-	4	50	100	-	150	3
ME-202 E	Manufacturing Technology	3	1	-	4	50	100	-	150	3
ME-204 E	Material Science	3	1	-	4	50	100	-	150	3
ME-206 E	Strength of Materials – II (ME, AE)	3	1	-	4	50	100	-	150	3
ME-208 E	Fluid Mechanics	3	1	-	4	50	100	-	150	3
ME-210 E	Energy Conversion	3	1	-	4	50	100	-	150	3
ME-212 E	Material Science Lab	-	-	2	2	25	-	25	50	3
ME-214 E	Fluid Mechanics Lab	-	-	2	2	25	-	25	50	3
ME-216 E	Energy Conversion Lab	-	-	2	2	25	-	25	50	3
ME-218 E	Manufacturing Practice	-	-	3	3	25	-	25	50	3
GPME-202 E	General Proficiency	-		-	-	50	-	-	50	-
	TOTAL	18	6	9	33	450	600	100	1150	

Note:

0. **Each student has to undergo Practical training of 6 weeks during summer vacation and its evaluation in 5th semester w.e.f. the session 2006-07**
0. **Students will be allowed to use Non-Programmable Scientific Calculator. However, sharing of calculator will not be permitted in the examination.**
0. **The subject GPME-220-E (General Proficiency) code has been changed to GPME-202-E and will be effective from 2006-07.**

MAHARSHI DAYANAND UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATIONS
B.E 3rd YEAR (SEMESTER – V) MECHANICAL ENGINEERING
Modified 'E' Scheme Effective from 2007-08

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 E	Kinematics of Machines	3	1	-	4	50	100	-	150	3
ME-303 E	Machine Design-I	3	2	-	5	50	100	-	150	4
ME-305 E	Fluid Machines	3	1	-	4	50	100	-	150	3
ME-307 E	Internal Combustion Engines & Gas Turbines	3	1	-	4	50	100	-	150	3
ME-309 E	Manufacturing Science	3	1	-	4	50	100	-	150	3
ME-311 E	Applied Numerical Techniques & Computing (ME, AE)	3	1	-	4	50	100	-	150	3
ME-313 E	Kinematics of Machines Lab	-	-	2	2	25	-	25	50	3
ME-315 E	Fluid Machines Lab	-	-	2	2	25	-	25	50	3
ME-317 E	Internal Combustion Engines & Gas Turbines Lab.	-	-	2	2	25	-	25	50	3
ME-319 E	Applied Numerical Techniques & Computing Lab. (ME, AE)	-	-	2	2	25	-	25	50	3
ME-321 E	Practical Training - I	-	-	2	2	-	-	-	-	-
	Total	18	7	10	35	400	600	100	1100	

Note:

0. **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.**
0. **Students will be allowed to use Non-Programmable Scientific Calculator. However, sharing of calculator will not be permitted in the examination.**

MAHARSHI DAYANAND UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATIONS
B.E 3rd YEAR (SEMESTER – VI) MECHANICAL ENGINEERING
Modified 'E' Scheme Effective from 2007-08

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-302 E	Dynamics of Machines	3	1	-	4	50	100	-	150	3
ME-304 E	Machine Design - II	3	2	-	5	50	100	-	150	4
ME-306 E	Heat Transfer (ME, AE)	3	1	-	4	50	100	-	150	3
ME-308 E	Automatic Controls	3	1	-	4	50	100	-	150	3
ME-310 E	Measurements & Instrumentation (ME, AE)	3	1	-	4	50	100	-	150	3
ME-312 E	Industrial Engineering (ME, AE)	3	1	-	4	50	100	-	150	3
ME-314 E	Dynamics of Machines lab	-	-	2	2	25	-	25	50	3
ME-316 E	Heat Transfer Lab	-	-	3	3	50	-	50	100	3
ME-318 E	Measurements & Instrumentation Lab. (ME, AE)	-	-	2	2	25	-	25	50	3
GPME-302 E	General Proficiency	-	-	-	-	50	-	-	50	3
	Total	18	7	7	32	450	600	100	1150	

Note:

0. **Each student has to undergo Practical training of 6- weeks during summer vacation and its evaluation shall be carried out in the VIIth Semester.**
0. **Students will be allowed to use Non-Programmable Scientific Calculator. However, sharing of calculator will not be permitted in the examination.**
0. **The practical hours for the subject ME-316E (Heat Transfer Lab.) have been increased from 2 hours to 3 hours. The marks for the class work and practical examination in the subject have also been increased from 25 each to 50 each. Thus the total marks of the subject shall be 100 in place of 50 marks w.e.f the session 2007-08.**
0. **The grand total of the semester marks shall be 1150 in-place of 1100 marks from the session 2007-08.**
0. ***The subject GPME-320-E (General Proficiency) code has been changed to GPME-302-E and will be effective from 2007-08.**

MAHARSHI DAYANAND UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATIONS
B.E 4th YEAR 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 & Design
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:

0. **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.**

0. **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.**

0. **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.**

0. **Students will be allowed to use the non-programmable scientific calculator. However, sharing of calculator will not be permitted.**

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

0. **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.**
0. **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.**
0. **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.**
0. **Students will be allowed to use the non-programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.**
0. ***The subject GFME-420-E (General Proficiency) code has been changed to GFME-402-E and will be effective from 2006-07.**

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MATH-201-E : MATHEMATICS-III

L	T	P
3	1	-

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

Part-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 consine 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.

Part-B

Functions of Complex Variable : Definition, Exponential function, Trignometric and Hyperbolic functions, Logrithmic functions. Limit and Continuity of a function, Differnetiability 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 fourmula.

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).

Part-C

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.

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. Advanced Engg. Mathematics : F Kreyszig.
2. 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.

Note: Examiner will set eight questions, taking two from Part-A, three from Part-B and three from Part-C. Students will be required to attempt five question taking atleast one from each part.

HUM-201-E ECONOMICS

L	T	P
3	1	-

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

COURSE OBJECTIVE : The purpose of this course is to :

1. Acquaint the student in the basic economic concepts and their operational significance and
2 .Stimulate him to think systematically and objectively about contemporary economic problems.

UNIT-I

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

UNIT-II

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

UNIT-III

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.

UNIT-IV

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

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.

UNIT-V

Meaning of Market, Types of Market - Perfect Competition, Monopoly, Oligoply, Monoplistic Competition (Main features of these markets)

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

UNIT-VI

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

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

ME- 201 E THERMODYNAMICS

L	T	P
3	1	-

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

Unit I 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.

Unit II 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.

Unit III 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.

Unit IV 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.

Unit V 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.

Unit VI 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.

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

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. Engineering Thermodynamics – P K Nag, Tata McGraw Hill

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

ME- 203 E STRENGTH OF MATERIALS –I

L	T	P	Sessional	: 50 Marks
3	1	-	Theory	: 100 Marks
			Total	: 150 Marks

Duration of Exam. : 3 Hrs.

Unit 1 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.

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

Unit III 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.

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

Unit V 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.

Unit VI 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.

Unit VII 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.

Unit VIII 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

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

ME 205 E ENGINEERING MECHANICS

L	T	P
3	1	-

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

Unit-I Review of Basic Force Systems: Dimensions and units of mechanics, idealization of mechanics, laws of mechanics, vector algebra review, moment of a force about a point and axis, the couple and couple moment, addition and subtraction of couples, moment of a couple about a line, translation of a force to a parallel position, resultant of a force system, Problems (vector method).

Unit-II Equilibrium: Introduction, free body diagram, control volumes, general equations of equilibrium, two point equivalent loading, static in-determinacy, simple truss, method of joints, method of sections, co-planer cable-loading a function of x, coplanar cables- loading the weight of the cable itself. Problems.

Unit-III Properties of Surfaces & Moments and Products of inertia : First moment of an area and the centroid, principal axes, formal definition of inertia quantities, relation between mass-inertia terms and area-inertia terms, translation of coordinate axes, transportation properties of the inertia terms, a brief introduction to tensors, the inertia of ellipsoid and principal moments of inertia, Problems (vector method).

Unit-IV Kinematics of Particles and Rigid Bodies: Velocity and acceleration in path and cylindrical coordinates, motion of a particle relative to a pair of translating axes, translation and rotation of rigid bodies, Chasles theorem, moving references, velocity and acceleration for different references, inertia and coriolis forces. Problems(vector method).

Unit-V Particle Dynamics, Energy Methods & Momentum Methods: Newton's law for rectangular coordinates & cylindrical coordinates, rectifier translation, central force motion, Newton's law for path variables, work energy equations, work energy equations for a systems of particles, linear and angular momentum equations for a systems of particles. Problems(vector method).

Unit-VI Variational Mechanics: Hamiton principle, Lagrange equations, principle of virtual work, methods of minimum potential energy, stability.

Text Book:

1. Engineering Mechanics - Statics & Dynamics by I.H. Shames, PHI, New Delhi.
2. Engineering Mechanics – Timoschenko.

Reference Books :

1. Statics & Dynamics by J.L. Meriam, JohnWiley & Sons (P) Ltd. New York.
2. Statics & Dynamics by Beer & Johnson, MGH, New Delhi.

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

ME- 207 E MACHINE DRAWING

L	T	P		
1	-	4	Theory	: -
			Sessional	: 50 Marks
			Total	: 50 Marks

PART-A

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

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

PART-B

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

PART-C

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

NOTE : (1) In the semester examination , the examiner will set total six questions in all, taking two questions from each part. The students will be required to attempt three questions in all, taking one question from each part

(2) The questions from Part-A and Part-B will carry 20 marks each. Question from Part-C will carry 60 marks.

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.

EE-213-E ELECTRONICS ENGINEERING

L	T	P
3	1	-

Class Work : 50
Exam : 100
Total : 150
Duration of Exam : 3hrs

UNIT – I : DIODES :

P-N junction, P-N junction as a rectifier, V-I characteristics, Breakdown diodes, Light emitting diodes, Load – Line concept, Clipping, Clamping, Rectifiers.

UNIT – II : TRANSISTORS :

Operation and Characteristics of a Transistor, Common Emitter, Common Collector and Common Base Configurations of a transistor, Biosing and Transistor as an amplifier and oscilletor..

UNIT – III : OP-AMPS :

Basic Characteristics of an OP-AMP, Applications of OP-AMP (Inverter, Non-Inverter, Integrator, Differentiator, Logarithmic amplifier, Square wave generator).

UNIT – IV : POWER AMPLIFIERS :

Class A, Class B and Class C Amplifiers.

UNIT – V : STABILISED POWER SUPPLIES :

Regulated power supply, series voltage regulator.

UNIT – VI : DIGITAL GATES :

Binary numbers, OR, AND, NAND, NOR, NOT, EX-OR Gates.

TEXT BOOK : Integrated Electronics Milman & Halkias (MGH).

REFERENCE BOOKS :

1. Digital Electronics by R.P.Jain (MGH).
2. Microelectronics – Ramana (MGH).
3. Electronics Principles Malvino, TMH.

NOTE : 1. Five out of eight questions are to be attempted.
2. At least one question should be set from each unit.

ME- 209 E STRENGTH OF MATERIAL-I LAB

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

List of Experiments :

1. To study the Brinell hardness testing machine & perform the Brinell hardness test.
2. To study the Rockwell hardness testing machine & perform the Rockwell hardness test.
3. To study the Vickers hardness testing machine & perform the Vickers hardness test.
4. To study the Erichsen sheet metal testing machine & perform the Erichsen sheet metal test.
5. To study the Impact testing machine and perform the Impact tests (Izod & Charpy).
6. To study the Universal testing machine and perform the tensile test.
7. To perform compression & bending tests on UTM.
8. To perform the sheer test on UTM.
9. To study the torsion testing machine and perform the torsion test.
10. To draw shear Force, Bending Moment Diagrams for a simply Supported Beam under Point and Distributed Loads.
11. To determine Mechanical Advantage and Efficiency of Single and Double Purchase Winch Crab.
12. To determine Mechanical Advantage and Efficiency of Worm and Worm Gear of Single, Double and Triple start.
13. To determine Mechanical Advantage, Efficiency of Simple and Compound Screw Jack.
14. To find Moment of Inertia of a Fly Wheel.

Note:

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.

EE-219-E ELECTRONICS ENGINEERING LAB

L	T	P
0	0	2

Class Work : 25
Exam : 25
Total : 50
Duration of Exam : 3hrs

LIST OF EXPERIMENTS :

1. Study of V-I Characteristics of Diode.
2. Study of a Clipping and Clamping circuits.
3. Study of a Half wave rectifier.
4. Study of a Full wave rectifier.
5. Study and Analysis of a Transistor in Common Emitter Configuration.
6. Study of OP-AMP as Inverter and Comparator.
7. Study of OP-AMP as Differentiator.
8. Study of OP-AMP as Integrator.
9. Study of OP-AMP as Square wave generator.
10. Realization of Truth Tables of AND, OR, NOT Gates.
11. Realization of Truth Tables of NAND, NOR and EX-OR Gates.

Note : At least seven experiments should be performed from 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 – 211 E COMPUTER AIDED DRAFTING LAB.

L	T	P
-	-	2

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

The students will be required to carry out the following exercises using educational soft-wares (AutoCad-2002, 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.

HUM-202-E **FUNDAMENTALS OF MANAGEMENT**

L	T	P
3	1	-

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

UNIT-I

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.

UNIT-II

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.

UNIT-III

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.

UNIT-IV

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.

UNIT-V

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.

BOOKS RECOMMENDED :

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.

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

ME-202 E MANUFACTURING TECHNOLOGY

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

Unit I Metal Casting Processes: Advantages and limitations, sand mold making procedure. Patterns and Cores: Pattern materials, pattern allowances, types of pattern, color coding. Molding materials: Molding sand composition, sand preparation, sand properties and testing, Sand molding processes

Unit II Cores: Types of cores, core prints, chaplets, and chills. Gating systems: Gates and gating systems risers**.** Melting practice: Cupola, charge calculations. Casting cleaning and casting defects, Fettling, defects in castings and their remedies, methods of testing of castings for their soundness.

Unit III Special Casting Processes: Shell molding, precision investment casting, permanent mold casting, die casting, centrifugal casting, continuous casting,

Unit IV Metal Forming Processes: Nature of plastic deformation, hot working and cold working .Principles of rolling, roll passes, roll pass sequences. Forging: Forging operations, smith forging, drop forging, press forging, forging defects.

Unit V Extrusion and other processes: Extrusion principle, hot extrusion, cold extrusion, wire drawing, swaging, tube making**.** Sheet metal operations: Press tools operations, hearing action, drawing dies, spinning, bending, stretch forming, embossing and coining.

Unit VI Gas and Arc Welding: Classification: oxy- acetylene welding equipment and techniques. Electric arc welding: Electrodes, manual metal arc welding, inert gas shielded arc welding, tungsten inert gas welding (TIG), metal inert gas welding(MIG), submerged arcwelding (SAW).

Unit VII Resistance Welding: Principles, resistance spot welding, resistance seam welding, upset welding, flash welding,

Unit VIII Other Welding Processes: Introduction thermit welding, electro slag welding, electron beam welding, forge welding, friction welding, diffusion welding, brazing and soldering.

Text Books:

1. Principles of Manufacturing Materials & Processes – Campbell J. S., Publisher – Mc Graw Hill.
2. Manufacturing Science - Ghosh A; Mallik A.K. Affiliated East-West Press Pvt. Ltd., New Delhi

Reference Books:

1. Foundry Technology - K.P. Sinha, D.B. Goel, Roorkee Publishing House.
2. Welding and Welding Technology, Richard L. Little Tata McGraw Hill Ltd.
3. Principle of Metal casting - Rosenthal, Tata McGraw Hill, New Delhi
4. Manufacturing Processes and Systems: Ostwald Phillip F., Munoz Jairo, John Wiley & Sons
5. Manufacturing Technology-Foundry, Forming and Welding - P.N. Rao, Tata McGraw Hill
6. Elements of Manufacturing Processes – B.S. Nagendra Parasher, RK Mittal, PHI N. Delhi

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

ME- 204 E MATERIAL SCIENCE

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

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

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

Unit III 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.

Unit IV Heat Treatment: Principles, purpose, classification of heat treatment processes, annealing, normalizing, stress relieving, hardening, tempering, carburizing, nitriding, cyaniding, flame and induction hardening. Allotropic transformation of iron and steel, Properties of austenite, ferrite, pearlite, martensite.

Unit V 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.

Unit VI Failures of metals: Failure analysis, fracture, process of fracture, types of fracture, fatigue, characteristics of fatigue, fatigue limit, mechanism of fatigue, factors affecting fatigue.

Unit VII 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.

Unit VIII Plastic, Composite and Ceramics: Polymers, formation of polymers, polymer structure and crystallinity, polymers to plastics types, reinforced particles-strengthened and dispersion strengthened composites. Ceramic materials: Types of ceramics, properties of ceramic, ceramic forming techniques, mechanical behavior of ceramic.

Text Books:

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

Reference Books:

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

Note: In the semester examination the examiner will set 8 questions, at least one question from each unit. Students will be required to attempt 5 questions.

ME- 206 E STRENGTH OF MATERIALS-II

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

Unit I Strain Energy & Impact Loading: Definitions, expressions for strain energy stored in a body when load is applied (i) gradually, (ii) suddenly and (iii) with impact, strain energy of beams in bending, beam deflections, strain energy of shafts in twisting, energy methods in determining spring deflection, Castigliano's & Maxwell's theorems, Numericals.

Unit II Theories of Elastic Failure: Various theories of elastic failures with derivations and graphical representations, applications to problems of 2- dimensional stress system with (i) Combined direct loading and bending, and (ii) combined torsional and direct loading, Numericals.

Unit III Unsymmetrical Bending: Properties of beam cross section, product of inertia, ellipse of inertia, slope of the neutral axis, stresses & deflections, shear center and the flexural axis Numericals.

Unit IV Thin Walled Vessels : Hoop & Longitudinal stresses & strains in cylindrical & spherical vessels & their derivations under internal pressure, wire would cylinders, Numericals.

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

Unit VI Rotating Rims & Discs: Stresses in uniform rotating rings & discs, rotating discs of uniform strength, stresses in (I) rotating rims, neglecting the effect of spokes, (ii) rotating cylinders, hollow cylinders & solids cylinders. Numericals.

Unit VII Bending of Curved Bars : Stresses in bars of initial large radius of curvature, bars of initial small radius of curvature, stresses in crane hooks, rings of circular & trapezoidal sections, deflection of curved bars & rings, deflection of rings by Castigliano's theorem stresses in simple chain link, deflection of simple chain links, Problems.

Unit VIII Springs: Stresses in open coiled helical spring subjected to axial loads and twisting couples, leaf springs, flat spiral springs, concentric springs, Numericals.

Text Books:

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

Reference Books :

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

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

ME- 208 E FLUID MECHANICS

L	T	P
3	1	-

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

Unit I Fluid Properties and Fluid Statics: Concept of fluid and flow, ideal and real fluids, continuum concept, properties of fluids, Newtonian and non-Newtonian fluids. Pascal's law, hydrostatic equation, hydrostatic forces on plane and curved surfaces, stability of floating and submerged bodies, relative equilibrium. Problems.

Unit II Fluid Kinematics: Eulerian and Lagrangian description of fluid flow; stream, streak and path lines; types of flows, flow rate and continuity equation, differential equation of continuity in cylindrical and polar coordinates, rotation, vorticity and circulation, stream and potential functions, flow net. Problems.

Unit III 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.

Unit IV Potential Flow: Uniform and vortex flow, flow past a Rankin half body, source, sink, source-sink pair and doublet, flow past a cylinder with and without circulation. Problems.

Unit V Viscous Flow: Flow regimes and Reynold's number, Relationship between shear stress and pressure gradient, uni-directional flow between stationary and moving parallel plates, movement of piston in a dashpot, power absorbed in bearings. Problems.

Unit VI Flow Through Pipes: Major and minor losses in pipes, Hagen-Poiseuilli law, hydraulic gradient and total energy lines, series and parallel connection of pipes, branched pipes; equivalent pipe, power transmission through pipes. Problems.

Unit VII 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.

Unit VIII Turbulent Flow: Shear stress in turbulent flow, Prandtl mixing length hypothesis, hydraulically smooth and rough pipes, velocity distribution in pipes, friction coefficients for smooth and rough pipes. Problems.

Text Books:

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

References Books:

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

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

ME- 210 E ENERGY CONVERSION

L	T	P
3	1	-

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

Unit I **Fuels and Combustion**: Classification of fuels- solid, liquid & gaseous fuels, Combustion equations, Stochiometric air-fuel ratio, Excess air, Exhaust gas analysis, Orsat apparatus. Enthalpy and internal energy of combustion, Enthalpy of formation, Adiabatic flame temperature, Gibb's and Helmholtz functions, Calorific values of fuel, Problems.

Unit II **Steam Boilers and Draft:** Classification, comparison between fire and water tube boilers, Essentials of a good boiler, Constructional and operational details of Locomotive& Lancashire Boilers, High pressure boilers- Benson, Lamont, Loeffler and Velox boilers, Boiler mountings and accessories, Boiler performance, Natural& Artificial drafts, Chimney height, Maximum draft and chimney efficiency, Boiler heat balance sheet, Problems.

Unit III **Vapour Power Cycles:** Carnot and Rankine vapour cycles, effect of operating conditions on thermal efficiency of Rankine cycle, Rankine cycle with superheat, reheat and regeneration, Binary vapour cycle, Problems..

Unit IV **Flow Through Nozzles:** Velocity and heat drop, mass discharge through a nozzle, critical pressure ratio and its significance, effect of friction and nozzle efficiency, supersaturated flow, design pressure ratio, Problems.

Unit V **Steam Turbines:** Classification, Impulse Turbine- Flow through blades, velocity diagram, power output and efficiency, maximum blade efficiency of single stage impulse turbine, blade friction, compounding of impulse turbine. Reaction Turbine-Flow through impulse reaction blades, degree of reaction, velocity diagram, power output, efficiency and blade height, comparison of impulse and impulse reaction turbines. Losses in steam turbines, stage efficiency, overall efficiency and reheat factor. Governing of steam turbines, Problems.

Unit VI **Steam Condensers:** Elements of a condensing plant, types of condensers, comparison of jet and surface condensers. Condenser vacuum, sources of air leakage & its disadvantages, vacuum efficiency and condenser efficiency, Problems.

Unit VII **Air Compressors:** Working of a single stage reciprocating air compressor; calculation of work input; Volumetric efficiency; Isothermal efficiency; Advantages of multi stage compression; Two stage compressor with Inter-cooling; Perfect Inter cooling; Optimum intercooler pressure, Problems.

Text Books :

1. Thermal Engineering – P L Ballaney, Khanna Publishers
2. Thermodynamics and Heat Engines vol. II – R Yadav, Central Publishing House

Reference Books :

1. Applied Thermodynamics for Engineering Technologists – T D Eastop and A McConkey, Pearson Education
2. Heat Engineering – V P Vasandani and D S Kumar, Metropolitan Book Co Pvt Ltd

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

ME- 212 E MATERIAL SCIENCE LAB.

L	T	P
-	-	2

Sessional : 25 Marks
Theory : 25 Marks
Total : 50 Marks
Duration of Exam: 3 Hrs

List of Experiments:

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

Note:

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

ME- 214 E FLUID MECHANICS LAB

L	T	P
-	-	2

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

List of Experiments:

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

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 E ENERGY CONVERSION LAB

L	T	P
-	-	2

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

List of Experiments:

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

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 E MANUFACTURING PRACTICE

L	T	P
-	-	3

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

List of Experiments:

1. To make a pattern for a given casting with all the necessary allowances, parting line, running system details. Prepare the mold and make the casting. Investigate the casting defects and suggest the remedial measures.

2. To make a component involving horizontal and vertical welding and study the welding defects and suggests their remedies.

3. To prepare a job on surface grinder/cylindrical grinder and measure the various parameters of the finished piece.

4. To cut external threads on a lathe.

5. Manufacture and assembly of a unit consisting of 2 to 3 components to have the concept of tolerances and fits (shaft and bush assembly or shaft, key and bush assembly or any suitable assembly).

6. Leveling of machine tools and testing their accuracy.

7. Disassembly and assembly of small assemblies such as tail stock, bench vice, screw jack etc.

8. Development and manufacture of complex sheet-metal components such as funnel etc.

9. Multi slot cutting on milling machine by indexing.

10. Drilling and boring of a bush.

11. Modeling of 3D runner system and creation of drawing for manufacturing of the casting patterns.

12. Development of blank size for complex sheet metal components using CAD/CAE software and compare results with manual calculation method.

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 including exercises 11 and 12. 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.

GPME-202- E GENERAL FITNESS FOR THE PROFESSION

L	T	P
-	-	8

Class Work : 50 Marks
Practical : 100 Marks
Total Marks : 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 :-

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

II. Extra Curricular Activities (10 Marks) :

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

Music _____
_____
_____

Fine Arts _____
_____
_____

Painting _____
_____
_____

Hobby Club _____
_____
_____

N.S.S. _____
_____
_____

Hostel Mgt 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 1.( )+II( )+III( )+IV( )+V( )+VI( ) =

**Total Marks :

Member Member Member Member Member

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ME-301 E KINEMATICS OF MACHINES

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

Unit I Introduction: mechanism and machines, kinematic links, kinematic pairs, kinematic chains, plane and space mechanism, kinematic inversion, equivalent linkages, four link planar mechanisms, mobility and range of movement, straight line mechanisms, steering mechanisms, pantograph, problems.

Unit II Kinematic Analysis of Plane Mechanisms: displacement analysis, general plane motion, instantaneous center of velocity, graphical and analytical methods of velocity and acceleration analysis, problems.

Unit III 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 and analytical approaches, cams with specified contours, tangent and circular are cams, problems.

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

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

Unit VI Kinematic synthesis of Mechanisms. Type, number and dimensional synthesis, function generation, path generation and body guidance two and three position synthesis of four bar and slider crank mechanisms by graphical and analytical methods, Freudenstein's equation, precision positions, structural error; Chebychev spacing, transmission angle, problems.

Unit VII Kinematics of Spatial Mechanisms: introduction, link coordinate system, homogeneous transformation matrix, loop closure equation, kinematics of robotic manipulators, problems.

Text Books :

1. Theory of Mechanisms and Machines: Amitabha Ghosh and Ashok kumar Mallik, 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.

Note: In the semester examination the examiner will set 8 questions, at least one question from each unit. Students will be required to attempt 5 questions.

ME- 303 E MACHINE DESIGN -I

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

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

Unit II 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.

Unit III 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.

Unit IV 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.

Unit V 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.

Unit VI 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.

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

Unit VIII 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.

Note: 1. In the semester examination the examiner will set 8 questions, at least one question from each unit. Students will be required to attempt 5 questions.

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

ME- 305 E FLUID MACHINES

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

Unit I 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

Unit II 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

Unit III 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.

Unit IV 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.

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

Unit VI 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.

Unit VII 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.

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

Text Books :

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

Reference Books :

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

Note: 1. In the semester examination the examiner will set 8 questions, at least one question from each unit. Students will be required to attempt 5 questions.

ME- 307 E INTERNAL COMBUSTION ENGINES & GAS TURBINES

L	T	P
3	1	-

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

UNIT – I **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.

UNIT – II **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.

UNIT – III **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.

UNIT – IV **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.

UNIT – V **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.

UNIT – VI **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.

UNIT – VII **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.

UNIT – VIII **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

Note: In the semester examination the examiner will set 8 questions, at least one question from each unit. Students will be required to attempt 5 questions.

ME- 309 E MANUFACTURING SCIENCE

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

Unit I 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. Numericals on cutting forces and Merchant circle.

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

Unit III Tool Wear and Machinability: Types of tool wear, tool life, factors governing tool life, Machinability: Definition and evaluation. Economics of machining. Numericals on tool life.

Unit IV Gear Manufacturing: Introduction, methods of manufacture. Gear generation and forming: Gear cutting by milling, single point form tool, gear hobbing and shaping. Gear finishing operations: Gear shaving, gear burnishing, gear grinding, lapping.

Unit V 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.

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

Unit VII Manufacturing Accuracy: Product cycle in manufacturing, part print analysis, location principles, tolerance stacking, accuracy of machining, operation selection, tolerance analysis.

Unit VIII Metrology & Machine Tools Testing: Tolerances, limits and fits, methods of linear measurement and angular measurement, Go and No Go gauges. Introduction to Machine tools testing**,** measuring instruments used for testing, test procedures, acceptance tests of machine tools.

Text Books

1. Manufacturing Technology – Metal cutting and machine Tools: P.N. Rao, T.M.H, New Delhi
2. Introduction to Jig and Tool Design: Kempster M.H.A, Hodder & Stoughton, England

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.

Note: In the semester examination the examiner will set 8 questions, at least one question from each unit. Students will be required to attempt 5 questions.

ME – 311 E APPLIED NUMERICAL TECHNIQUES AND COMPUTING

L	T	P			
3	1	-	Sessional marks	:	50
			Theory marks	:	100
			Total marks	:	150
			Duration of exam	:	3 hrs

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

UNIT – II 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.

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

UNIT – IV 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.

UNIT – V 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.

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

UNIT – VII 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.

UNIT – VIII 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.

Note :
1. **Programming exercises may be done in MATLAB.**
2. **The Instructor of the course may cover the use of software MATHEMATICA in the tutorial class.**
3. **In the semester examination, the examiner will set eight questions, at least one question from each unit. The students will be required to attend only 5 questions.**

ME- 313 E KINEMATICS OF MACHINES LAB

L	T	P
-	-	2

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

List of Experiments :

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

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

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

ME- 315 E FLUID MACHINES LAB.

L	T	P
-	-	2

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

List of Experiments :

1. To study the constructional details of a Pelton turbine and draw its fluid flow circuit.
2. To draw the following performance characteristics of Pelton turbine-constant head, constant-speed and constant efficiency curves.
3. To study the constructional details of a Francis turbine and draw its fluid flow circuit.
4. To draw the constant head, constant speed and constant efficiency performance characteristics of Francis turbine.
5. To study the construction details of a Kaplan turbine and draw its fluid flow circuit.
6. To draw the constant head, speed and efficiency curves for a Kaplan turbine.
7. To study the constructional details of a Centrifugal Pump and draw its characteristic curves.
8. To study the constructional details of a Reciprocating Pump and draw its characteristics curves.
9. To study the construction details of a Gear oil pump and its performance curves.
10. To study the constructional details of a Hydraulic Ram and determine its various efficiencies..
11. To study the constructional details of a Centrifugal compressor.
12. To study the model of Hydro power plant and draw its layout.

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

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

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

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

L	T	P
-	-	2

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 E APPLIED NUMERICAL TECHNIQUES AND COMPUTING LAB.

L	T	P
-	-	2

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

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

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

ME – 321 E PRACTICAL TRAINING – I

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 E DYNAMICS OF MACHINES

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

L T P
3 1 -

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

Unit II 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.

Unit III 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.

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

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

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

Unit VII 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 Machines and Mechanisms : Joseph Edward Shigley and John Joseph Uicker, Jr. Second Edition Mc Graw Hill, Inc

Reference Books:

1. Mechanism and Machine Theory : J.S. Rao and R.V. Dukkipati, New age International.
2. Theory and Machine (S I units) S.S. Rattan, Tata McGrawHill.

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- 304 E MACHINE DESIGN –II

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

Unit I 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.

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

Unit III 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.

Unit IV 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.

Unit V 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.

Note : 1. 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.

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

ME –306E HEAT TRANSFER

L	T	P
3	1	-

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

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

UNIT II 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.

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

UNIT IV 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.

UNIT V 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.

UNIT VI 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.

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

UNIT VIII 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.

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.

NOTE : 1. 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.

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.

ME- 308 E AUTOMATIC CONTROLS

L	T	P
3	1	-

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

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

Unit II Types of Controllers : Introduction : Types of Control Action; Hydraulic Controllers; Electronic Controllers; Pneumatic Controllers; Problems.

Unit III 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.

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

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

Unit VI Root Locus Method : Introduction; Root Ioci of a Second Order System; General Case; Rules for Drawing Forms of Root Ioci; Relation between Root Locus Locations and Transient Response; Parametric Variation; Problems.

Unit VII 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.

Unit VIII 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.

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 – 310 E MEASUREMENTS AND INSTRUMENTATION

L	T	P
3	1	-

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

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

Unit II 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.

Unit III 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.

Unit IV Intermediate, Indicating and Recording Elements : Introduction Amplifiers, Mechanical, Hydraulic, Pneumatic, Optical, Electrical Amplifying elements, Compensators, Differentiating and Integrating Elements, Filters, Classification of Filters, A-D and D-A Converters, Digital Voltmeters (DVMs), Cathode Ray Oscillo scopes (CROs), Galvanometric Recorders, Magnetic Tape recorders, Data Acquisition Systems, Data Display and Storage.

Unit V 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.

Unit VI 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.

Unit VII 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.

Unit VIII Basic Statistical Concepts : Types of Measured Quantities (Discrete and Continuous), Central Tendency of Data, Mode, Median, Arithmetic Mean, Best Estimate of true Value of Data, Measures of Dispersion, Range, Mean Deviation, Variance, Standard Deviation, Normal Distribution, Central Limit Theorem, Significance Test, Method of Least Squares, Graphical Representation and Curve Fitting of Data.

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.

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- 312 E INDUSTRIAL ENGINEERING

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

UNIT - I

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.

UNIT - II

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.

UNIT - III

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.

UNIT - IV

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.

UNIT - V

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.

UNIT - VI

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.

UNIT - VII

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.

UNIT – VIII

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.

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- 314 E DYNAMICS OF MACHINE LAB

L	T	P
-	-	2

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

List of Experiments :

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

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

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

ME- 316 E HEAT TRANSFER LAB.

L	T	P
-	-	3

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

List of Experiments :

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

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 E MEASUREMENTS & INSTRUMENTATION LAB.

L	T	P
-	-	2

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

List of Experiments :

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

Note:

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

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

GPME-302- E GENERAL FITNESS FOR THE PROFESSION

L	T	P
-	-	8

Class Work : 50 Marks
Practical : 100 Marks
Total Marks : 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 :-

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

II. Extra Curricular Activities (10 Marks) :

Item	**Level of Participation**	**Remarks (Position Obtained)**
Indoor Games (Specify the Games	_____ _____ _____	_____ _____
Outdoor Games (Specify the Games)	_____ _____ _____	
Essay Competition	_____ _____ _____	
Scientific Technical	_____ _____	

Exhibitions _____

Debate _____
_____
_____

Drama _____
_____
_____

Dance _____
_____
_____

Music _____
_____
_____

Fine Arts _____
_____
_____

Painting _____
_____
_____

Hobby Club _____
_____
_____

N.S.S. _____
_____
_____

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 1.( )+II( )+III( )+IV( )+V( )+VI( ) =

**Total Marks :

Member Member Member Member Member

ME- 401 E AUTOMOBILE ENGINEERING

L	T	P
3	1	-

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

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

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

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
3	1	-

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

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
-	-	2

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

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.

L	T	P
-	-	3

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

List of Experiments :

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

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

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

ME- 413- E PROJECT

L	T	P
-	-	6

Sessional : 100 Marks
Practical : 100 Marks
Total : 200 Marks
Duration of Exam : 3Hrs.

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.

ME- 451 E FINITE ELEMENT METHODS

L	T	P
3	1	-

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

Unit I Fundamental Concepts : Introduction; Historical Background, Stresses and Equilibrium, Boundary Conditions, Strain-displacement, Relations, Stress- strain Relations, Temperature Effects, Potential Energy and Equilibrium; The Rayleigh-Ritz Method, Galerkin's method. Saint Venant's Principle, Matrix Algebra, Gaussian Elimination.

Unit II One-Dimensional Problems: Introduction; Finite Element Modeling, Coordinates and a Shape Functions, The Potential Energy Approach; The Galerkin Approach, Assembly of the Global Stiffness Matrix and Load Vector. Properties of Stiffness Matrix, The Finite Element Equations; Treatment of Boundary Conditions, Quadratic Shape Functions; Temperature effects.

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

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

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

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

Unit VII Scalar Field Problems : Introduction, Steady-state Heat Transfer,: Introduction One-Dimensional Heat Conduction, Heat transfer in thin Fins, Two-dimensional steady-state Heat conduction, Potential Flow, Seepage, Fluid flow in Ducts.

Unit VIII Dynamic Considerations: Introduction, Formulation, Element Mass Matrices: Evaluation of Eigen values and Eigenvectors, Interfacing with previous Finite Element Programs and a program for determining critical speeds of Shafts.

Text Books :

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

Reference Books:

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

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– 453 E ENERGY MANAGEMENT PRINCIPLES

L	T	P
3	1	-

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

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

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

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

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

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

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

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

Text Books :

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

Reference Books :

1. Energy – resources, demand and conservation with reference to India – Chaman Kashkari, TMH.
2. Integrated renewable energy for rural development– Proc. of natural solar energy convention, Calcutta.

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- 455 E ENGINEERING DESIGN

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

Unit I Design Philosophy : Definition of Design, Difference between Science, Engineering and Technology, Morphology of Design, Definition of Product Design, Design by Evolution, Design by Innovation, Invention and Brainstorming.

Unit II Considerations Dictating Mechanical Design : Basic Considerations- Convenience of Use, Maintenance Cost and Appearance; Operational Considerations: Operational Requirements - Strength (Volume & Surface), Rigidity (proper and contact), Vibration, Thermal Resistance etc.; Design for Strength, Design for Rigidity. Design for Stability (buckling) with Illustrations; Functional Requirements – Conformiting (among various components), Concept of Synthesis and Assembly, Role of Fits, Tolerance and Process Capability.

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

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

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

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

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

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

Text Books :

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

Reference Books :

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

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- 457 E COMPUTER INTEGRATED MANUFACTURING

L	T	P
3	1	-

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

Unit I Introduction : CAD/CAM Definition, Computer Technology-central processing unit (CPU), types of memory, input/output, the binary number system, computer programming languages. Automation- Types of automation, CIM, reasons for automating, automation strategies.

Unit II Conventional Numerical Control: Basic components of NC system, the NC procedure, NC coordinate systems, NC motion control system, applications of numerical control, advantages and disadvantages of NC, computer controls in NC, problems with conventional NC, NC controller technology, computer numerical control, functions of CNC, advantages of CNC, Direct numerical control, components of a DNC system, functions of DNC, advantages of DNC.

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

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

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

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

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

Text Books:

1. Automation, Production Systems and Computer Integrated Manufacturing. Groover M.P, Prentice Hall of India.
2. CAD/CAM – Groover M.P, Zimmers E.W, Prentice Hall of India.

Reference Books:

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

Note : The paper setter will set 8 questions taking at least one question from each unit . Students will be required to answer only five.

ME 459 E MANUFACTURING MANAGEMENT

L	T	P
3	1	-

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

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

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

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

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

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

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

Unit VII Maintenance & Reliability: Concept of preventive & breakdown maintenance, maintenance cost, optimal preventive maintenance simple replacement models-individual and group replacement, MAPI - methods, reliability definitions, failure analysis and curve, systems reliability- series parallel, redundancy, methods of

improving reliability, MTBF, MTTR, Maintainability, availability, brief concept of tero-technology.

Text Books:

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

Reference Books:

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

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- 461 E RELIABILITY ENGINEERING

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

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

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

Unit III Hazard Models: Introduction, Constant Hazard; Linearly Increasing Hazard, The Weibull Model, Density Function and Distribution Function, Reliability Analysis, Important Distributions and their Choice, Standard Deviation and Variance.

Unit IV Conditional Probability: Introduction, Multiplication Rule, Independent Events, Vernn Diagram, Hazard Rate as conditional probability, Bayes Theorem.

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

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

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

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

Text Books:

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

Reference Books:

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

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- 463 E SOLAR ENERGY ENGINEERING

L	T	P
3	1	-

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

Unit I Solar Radiation: Introduction, solar system – sun, earth and earth-sun angles, time, derived solar angles, estimation of solar radiation (direct and diffuse), measurement systems – phyrheliometers and other devices.

Unit II Effect of Solar radiation upon structures: Steady state heat transmission, solar radiation properties of surfaces, shading of surfaces, periodic heat transfer through walls and roofs.

Unit III Solar Collectors: Flat plate and concentrating – comparative study, design and materials, efficiency, selective coatings, heliostats.

Unit IV Heating Applications of Solar Energy: Air and Water heating systems, thermal storages, solar bonds, solar pumps, solar lighting systems, solar cookers, solar drying of grains.

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

Unit VI Solar Electric Conversion Systems: Photovoltaics, solar cells, satellite solar power systems.

Unit VII Effects on Environment, economic scenario, ozone layer depletion, green house effect, global warming, Remedial measures by international bodies.

Text Books:

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

Reference Books:

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

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- 465 E DESIGN OF HEAT EXCHANGERS

L	T	P
3	1	-

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

UNIT I Classification of Heat exchangers: Introduction ; Recuperation and regeneration, Transfer processors, Geometry of construction–tubular heat exchangers, plate heat exchangers, extended surface heat exchanges, Heat transfer mechanisms, Flow arrangements, Selection of heat exchangers.

UNIT II Basic Design Methods of Heat Exchanges: Introduction, Arrangement of flow path in heat exchangers , Basic equations in design, Overall heat transfer coefficient , Log mean temperature difference method for heat exchanger analysis , The $\in$-NTU method for heat exchanger analysis, Heat exchanger design calculation, Variable overall heat transfer coefficient , Heat exchanger design methodology.

UNIT III Design Correlations for Condensers and Evaporators :Introduction, Condensation, Film condensation on a single horizontal tube-laminar film condensation, forced convection, Film condensation in tube bundles-effect of condensate inundation, effect of vapor shear, Combined effects of inundation and vapor shear, Condensation inside tubes-condensation in vertical tubes, Flow boiling-sub-cooled boiling, flow pattern, flow boiling correlations.

UNIT IV Shell and Tube Heat Exchangers: Introduction, Basic components-shell types, tube bundle types, tubes and tube passes, tube layout, baffle type and geometry, allocation of streams, Basic design procedure of a heat exchanger-preliminary estimation of unit size, rating of preliminary design, Shell-slide heat transfer and pressure drop-shell-side heat transfer coefficient, shell-side pressure drop, tube-side pressure drop, Bell-Delaware method.

UNIV V Compact Heat Exchangers: Introduction, Plate-fin heat exchangers, tube-fin heat exchangers, Heat transfer and pressure drop-heat transfer, pressure drop for finned-tube exchangers, pressure drop for plate-fin exchangers.

UNIT VI Gasketed Plate Heat Exchangers: Introduction, Mechanical features-plate pack and frame, plate types, Operational characteristics-main advantages, performance limits, Passes and flow arrangements, Application-corrosion, maintenance, Heat transfer and pressure drop calculations-heat transfer area, mean flow channel gap, channel equivalent diameter, heat transfer coefficient, channel pressure drop, port pressure drop, overall heat transfer coefficient, heat transfer surface area, performance analysis, Thermal performance.

UNIT VII Condensers and Evaporators: Introduction, Shell-and-tube condensers-horizontal shell-side condensers, vertical shell-side condensers, vertical tube-side condensers, horizontal in-tube condensers, Steam turbine exhaust condensers, Plate condensers, Air-cooled condensers, Direct contact condensers, Thermal design of shell-and-tube condensers, Design and operational considerations, Condensers for refrigeration and air-conditioning-water cooled condensers, air-cooled condensers, evaporative condensers, Evaporative for

refrigeration and air-conditioning-water-cooling evaporators (chillers), air-cooling evaporators (air coolers), Thermal analysis-shah correlation, Kandlikar correlation, Gungor and Winterton correlation, Standards for evaporators and condensers.

UNIT VIII Regenerators: Classifications-fixed bed regenerators, rotary regenerators, basic design method, Influence of fluid bypass carry-over, Pressure drop evaluation, The rating problem, surface geometrical properties, Pressure drop, Sizing problem.

Text Books:

1. Heat Exchangers, Sadik Kakac, Hongtan Hiu , CRC Press.
2. Principles of Heat Transfer, F.Krieth & M.S. Bohn, Asian Books Pvt. Ltd., Delhi.

Reference Books:

1. Heat exchangers, Design and Theory Source Book, N.H. Afgan and Schliinder MGH.
2. Compact Heat Exchanger, W.M. Kays & A.L. London, MGH.

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- 467 E VALUE ENGINEERIN

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

PART- A

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

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

PART- B

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

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

Reference and Text Books:

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

Note: In the semester examination, the examiner will set eight questions in all, taking two questions from each unit. The students will be required to attempt 5 questions in all, taking at least two questions from each Part.

ME- 402 E COMPUTER AIDED DESIGN

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

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

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 **C**ombined 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
-	-	3

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

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		
-	-	4	Sessional	: 50 Marks
			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
Practical : 100 Marks
Total Marks : 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 :-

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

II. Extra Curricular Activities (10 Marks) :

Item	**Level of Participation**	**Remarks (Position Obtained)**
Indoor Games (Specify the Games	_____ _____ _____	_____ _____
Outdoor Games (Specify the Games)	_____ _____ _____	
Essay Competition	_____ _____ _____	
Scientific	_____	

Technical Exhibitions _____

Debate _____

Drama _____

Dance _____

Music _____

Fine Arts _____

Painting _____

Hobby Club _____

N.S.S. _____

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 1.( )+II( )+III( )+IV( )+V( )+VI( ) =

**Total Marks :

Member Member Member Member Member

ME- 432- E OPTIMIZATION METHODS FOR ENGINEERING SYSTEMS

L	T	P
4	-	-

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

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

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

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 SYSTEMS

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

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.

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ME- 442- E ROBOTICS ENGINEERING

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

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

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

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

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.