UNIVERSITY OF KERALA

B. TECH DEGREE COURSE

2008 SCHEME

MECHANICAL ENGINEERING

I to VIII SEMESTER

REGULATION, SCHEME AND SYLLABUS

APPROVED BY

BOARD OF STUDIES IN ENGINEERING AND

FACULTY OF ENGINEERING AND TECHNOLOGY

UNIVERSITY OF KERALA

B.Tech Degree Course – 2008 Scheme

REGULATIONS

1. Conditions for Admission

Candidates for admission to the B.Tech degree course shall be required to have passed the Higher Secondary Examination, Kerala or 12th Standard V.H.S.E., C.B.S.E., I.S.C. or any examination accepted by the university as equivalent thereto obtaining not less than 50% in Mathematics and 50% in Mathematics, Physics and Chemistry/ Bio- technology/ Computer Science/ Biology put together, or a diploma in Engineering awarded by the Board of Technical Education, Kerala or an examination recognized as equivalent thereto after undergoing an institutional course of at least three years securing a minimum of 50 % marks in the final diploma examination subject to the usual concessions allowed for backward classes and other communities as specified from time to time.

2. Duration of the course

i) The course for the B.Tech Degree shall extend over a period of four academic years comprising of eight semesters. The first and second semester shall be combined and each semester from third semester onwards shall cover the groups of subjects as given in the curriculum and scheme of examination
ii) Each semester shall ordinarily comprise of not less than 400 working periods each of 60 minutes duration
iii) A candidate who could not complete the programme and pass all examinations within Ten (10) years since his first admission to the B.Tech programme will not be allowed to continue and he has to quit the Programme. However he can be readmitted to the first year of the programme if he/she satisfies the eligibility norms applicable to the regular candidates prevailing at the time of readmission.

3. Eligibility for the Degree

Candidates for admission to the degree of bachelor of technology shall be required to have undergone the prescribed course of study in an institution maintained by or affiliated to the University of Kerala for a period of not less than four academic years and to have passed all the examinations specified in the scheme of study

4. Subjects of Study

The subjects of study shall be in accordance with the scheme and syllabi prescribed

5. Evaluation
Candidates in each semester will be evaluated both by continuous assessment and end semester University examination. The individual maximum marks allotted for continuous assessment and University examination for each subject is as prescribed by the scheme of study.

5.1 Continuous Assessment (C.A)
The marks awarded for the continuous assessment will be on the basis of the day-to-day work, periodic tests (minimum two in a semester) and assignments (minimum of three – one each from each module). The faculty member concerned will do the continuous assessment for each semester. The C.A. marks for the individual subjects shall be computed by giving weight age to the following parameters.

Subject	Attendance	Tests	Assignments/ Class Work
Theory Subjects	20%	50%	30%
Drawing	20%	40%	40%
Practical	20%	40%	40%
Project Work	Work Assessed by Guide – 50% Assessed by a three member committee out of which one member is the guide – 50%		

The C.A. marks for the attendance (20%) for each theory, practical and drawing shall be awarded in full only if the candidate has secured 90% attendance or above in the subject. Proportionate reduction shall be made in the case of subjects in which he/she gets below 90% of the attendance for a subject. The CA marks obtained by the student for all subjects in a semester is to be published at least 5 days before the commencement of the University examinations. Anomalies if any may be scrutinized by the department committee and the final CA marks are forwarded to the university within the stipulated time.

5.2. End Semester University Examinations

i) There will be University examinations at the end of the first academic year and at the end of every semester from third semester onwards in subjects as prescribed under the respective scheme of examinations. Semester classes shall be completed at least 10 working days before the commencement of the University examination.

ii) The examination will be held twice in an year – April/May session (for even semester) and October/November session (for odd semester). The combined 1st and 2nd semester is reckoned as equivalent to an even semester for the purpose of conduct of examination and the University examination will be held during April/May. However VII and VIII Semester examination will be conducted in both the sessions. This schedule will not be changed

iii) A student will be permitted to appear for the university examination only if he/she satisfies the following requirements

a. He/she must secure not less than 75% attendance in the total number of working periods during the first year and in each semester thereafter and shall be physically present for a minimum of 60% of the total working periods. In addition, he/she also shall be physically present in at least 50% of total working periods for each subject
b. He must earn a progress certificate from the head of the institution of having satisfactorily completed the course of study in the semester as prescribed by these regulations
c. It shall be open to the Vice-Chancellor to grant condonation of shortage of attendance on the recommendation of the head of the institution in accordance with the following norms
d. The attendance shall not be less than 60% of the total working periods
e. He/she shall be physically present for a minimum of 50% of the total working periods
f. The shortage shall not be condoned more than twice during the entire course
g. The condonation shall be granted subject to the rules and procedures prescribed by the university from time to time.
h. The condonation for combined 1st and 2nd semesters will be reckoned as a single condonation for attendance purposes.

iv) A student who is not permitted to appear for the University examinations for a particular semester due to the shortage of attendance and not permitted by the authorities for condonation of shortage of attendance shall repeat the semester when it is offered again. This provision is allowed only once for a semester.

v) The university will conduct examinations for all subjects (Theory, Drawing & Practical)

vi) The scheme of valuation will be decided by the chief examiner for theory / drawing subjects

vii) For practical examinations, the examiners together will decide the marks to be awarded. The student shall produce the certified record of the work done in the

laboratory during the examination. The evaluation of the candidate should be as per the guidelines given in the syllabus for the practical subject.

6. Letter Grades

For each subject in a semester, based on the total marks obtained by the student in the University examination and Continuous assessment put together a letter grade (S,A+, A, B+, B, C+, C, D, E and F) will be awarded. ***All letter grades except 'F' will be awarded if the marks for the University examination is 40 % or above and the total mark (C.A marks + University Exam mark) is 50 % or above***. No absolute mark will be indicated in the grade card. Letter grade corresponding to total marks (C.A marks+ University Exam mark) and the corresponding grade point in a ten-point scale is described below.

% of Total marks ***(C.A marks + University Exam mark)***	**Letter Grade**	**Grade Point (G.P)**	**Remarks**
90 % and above	S	10	Excellent
85 % and above but less than 90%	A+	9	
80 % and above but less than 85%	A	8.5	
75 % and above but less than 80%	B+	8	
70 % and above but less than 75%	B	7.5	
65 % and above but less than 70%	C+	7	
60 % and above but less than 65%	C	6.5	
55 % and above but less than 60%	D	6	
50 % and above but less than 55%	E	5.5	
Below 50% (C.A + U.E) or below 40 % for U.E only	F	0	Failed

7. Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA)
Grade point average is the semester wise average points obtained by each student in a 10-point scale. GPA for a particular semester is calculated as per the calculation shown below.

$$GPA = \frac{\sum Credit \times \text{GP obtained for the subject}}{\sum \text{credit for subject}}$$

Cumulative Grade point Average (CGPA) is the average grade points obtained by the students till the end of any particular semester. CGPA is calculated in a 10-point scale as shown below.

$$\text{CGPA} = \frac{\sum \text{Credits for semester} \times \text{GPA obtained for the semester}}{\sum \text{credits for the semester}}$$

GPA and CGPA shall be rounded to two decimal points. The Grade card issued to the students shall contain subject number and subject name, credits for the subject, letter grades obtained, GPA for the semester and CGPA up to that particular semester. In addition to the grade cards for each semester all successful candidate shall also be issued a consolidated statement grades. On specific request from a candidate and after remitting the prescribed fees the University shall issue detailed mark to the individual candidate.

8. Minimum for a pass

a) A candidate shall be declared to have passed a semester examination in full in the first appearance if he/she secures not less than 5.5 GPA with a minimum of 'E' grade for the all individual subject in that semester.

b) A candidate shall be declared to have passed in an individual subject of a semester examination if he/she secures grade 'E' or above.

c) A candidate who does not secure a full pass in a semester examination as per clause (a) above will have to pass in all the subjects of the semester examination as per clause (b) above before he is declared to have passed in that semester examination in full.

9. Improvement of Grades

i) A candidate shall be allowed to re-appear for a maximum of two subjects of a semester examination in order to improve the marks and hence the grades already obtained subject to the following conditions
   a) The candidate shall be permitted to improve the examination only along with next available chance.
   b) The candidate shall not be allowed to appear for an improvement examination for the subjects of the VII & VIII semesters
   c) The grades obtained by the candidate for each subject in the improvement chance he has appeared for or the already existing grades – whichever is better will be reckoned as the grades secured.
   d) First & Second semester will be counted as a single chance and they can improve a maximum of three subjects

ii) A candidate shall be allowed to repeat the course work in one or more semesters in order to better the C.A. marks already obtained, subject to the following conditions
   a) He/she shall repeat the course work in a particular semester only once and that too at the earliest opportunity offered to him/her.
   b) He/she shall not combine this course work with his/her regular course work
   c) He/she shall not be allowed to repeat the course work of any semester if he has already passed that semester examination in full
   d) The C.A marks obtained by the repetition of the course work will be considered for all purposes

iii) A candidate shall be allowed to withdraw from the whole examination of a semester in accordance with the rules for cancellation of examination of the University of Kerala.

10. Classification of Successful candidates

i) A candidate who qualifies for the degree passing all the subjects of the eight semesters within five academic years (ten consecutive semesters after the commencement of his/her course of study) and secures not less than 8 CGPA up to and including eighth semester (overall CGPA) shall be declared to have passed the B.Tech degree examination in FIRST CLASS WITH DISTINCTION
ii) A candidate who qualifies for the degree passing all the subjects of the eight semesters within five academic years (ten consecutive semesters after the commencement of his/her course of study) and secures less than 8 CGPA but not less than 6.5 CGPA up to and including eighth semester shall be declared to have passed the B.Tech degree examination in FIRST CLASS.
iii) All other successful candidates shall be declared to have passed the B.Tech Degree examination in SECOND CLASS
iv) Successful candidates who complete the examination in four academic years (Eight consecutive semesters after the commencement of the course of study shall be ranked branch-wise on the basis of the CGPA in all eight semesters put together. In the case of a tie in the CGPA the total marks of the students who have got same CGPA shall be considered for finalizing the rank. Students who pass the examination in supplementary examination are also covered under this clause

11. Educational Tour

a) The students may undertake one educational tour preferably after fourth semester of the course and submit a tour report
b) The tour may be conducted during the vacation / holidays taking not more than 5 working days, combined with the vacation / holidays if required. Total number of Tour days shall not exceed 15 days.
c) The tour period shall be considered as part of the working periods of a semester

12. Revision of Regulations

The university may from time to time revise, amend or change the regulations, curriculum, scheme of examinations and syllabi. These changes unless specified otherwise, will have effect from the beginning of the academic year / semester following the notification of the University

SCHEME AND SYLLABUS

MECHANICAL ENGINEERING

Combined I and II Semesters, 2008 scheme
(Common for all branches)

Course No	Name of subject	Weekly load, hours			Max sessional marks	Exam Dur Hrs	Exam max marks	Credits
		L	**T**	**D/P**				
08.101	Engineering Mathematics	2	1	0	50	3	100	6
08.102	Engineering Physics	2	1	0	50	3	100	6
08.103	Engineering Chemistry	2	1	0	50	3	100	6
08.104	Engineering Graphics	1	0	2	50	3	100	6
08.105	Engineering Mechanics	2	1	0	50	3	100	6
08.106	Basic Civil Engineering	2	1	0	50	3	100	6
08.107	Basic Mechanical Engineering	2	1	0	50	3	100	6
08.108	Basic Electrical and Electronics Engineering	2	1	0	50	3	100	6
08.109	Basic Communication and Information Engineering	2	1	0	50	3	100	6
08.110	Engineering Workshops	0	0	2	50	3	100	4
	Total	**17**	**8**	**4**	**500**		**1000**	**58**

The subject 08.109 will be handled by the Department of Electronics and Communication Engineering,

Semester III

Course No	Name of subject	Weekly load, hours			Max sessional marks	Exam Dur Hrs	Exam max marks	Credits
		L	**T**	**D/P**				
08.301	Engineering. Mathematics – II (CMPUNERFHBTA)	3	1	-	50	3	100	4
08.302	Humanities (MPUE)	3	0	-	50	3	100	3
08.303	Fluid Mechanics and Machines(MPU)	4	1	-	50	3	100	5
08.304	Mechanics of Solids (MPU)	3	1	-	50	3	100	4
08.305	Thermodynamics	3	1	-	50	3	100	4
08.306	Engineering Drawing (MPU) Part A: Machine Drawing Part B : Civil Engg. Drawing & Estimation	 0 1	 0 	 2 2	 25 25	4	100 (50+50)	5
08.307	Civil Engineering Lab (MPU)	0	0	2	50	3	100	2
08.308	Computer Aided Drafting and Modeling Lab	0	0	2	50	3	100	2
	Total	17	4	8	400		800	29

Semester IV

Course No	Name of subject	Weekly load, hours			Max sessional marks	Exam Dur. Hrs	Exam max marks	Credits
		L	T	D/P				
08.401	Engineering Mathematics – III (CMPUNERFHB)	3	1	-	50	3	100	4
08.402	Computer programming and numerical methods (MNPU)	3	1	-	50	3	100	4
08.403	Metallurgy & Material science(MP)	3	1	-	50	3	100	4
08.404	Manufacturing Process (MN)	3	1	-	50	3	100	4
08.405	Thermal Engineering (MU)	3	1	0	50	3	100	4
08.406	Machine Drawing	0	0	3	50	4	100	3
08.407	Fluid Mechanics & Machines Lab. (MN)	0	0	3	50	3	100	3
08.408	IC Engines Lab	0	0	3	50	3	100	3
	Total	15	5	9	400		800	29

Semester V

Course No	Name of subject	Weekly load, hours			Max sessional marks	Exam Dur Hrs	Exam max marks	Credits
		L	T	D/P				
08.501	Engineering Mathematics IV,(CMPU)	3	1	-	50	3	100	4
08.502	Electrical Technology.(MPU)	3	1	-	50	3	100	4
08.503	Theory of Machines (MP)	3	1	-	50	3	100	4
08.504	Industrial Electronics(MP)	2	1	-	50	3	100	3
08.505	Machine Tools(MN)	3	1	-	50	3	100	4
08.506	Elective I	3	1	-	50	3	100	4
08.507	Production Engineering Lab	0	0	3	50	3	100	3
08.508	Electrical & Electronics Lab (MPU)	0	0	3	50	3	100	3
	Total	17	6	6	400		800	29

The subject 08.504 will be handled by the Department of Electronics and Communication Engineering,

Semester VI

Course No	Name of subject	Weekly load, hours			Max sessional marks	Exam Dur Hrs	Exam max marks	Credits
		L	T	D/P				
08.601	Metrology &Instrumentation(MP)	3	1	-	50	3	100	4
08.602	Dynamics of Machinery (MP)	3	1	-	50	3	100	4
08.603	Computer Aided Design (MPU)	2	1	-	50	3	100	3
08.604	Heat & Mass Transfer (MU)	3	1	-	50	3	100	4
08.605	Design of Machine Elements - I	3	1	-	50	3	100	4
08.606	Elective – II	3	1	-	50	3	100	4
08.607	CAD Analysis Lab	0	0	3	50	3	100	3
08.608	Machine Tools Lab	0	0	3	50	3	100	3
	Total	17	6	6	400		800	29

Semester VII

Course No	Name of subject	Weekly load, hours			Max sessional marks	Exam Dur Hrs	Exam max marks	Credits
		L	T	D/P				
08.701	Principles of Management and Decision modeling (MPU)	2	1	-	50	3	100	3
08.702	Mechatronics (MPU)	3	1	-	50	3	100	4
08.703	Gas Dynamics	3	1	-	50	3	100	4
08.704	Refrigeration & Air conditioning	3	1	-	50	3	100	4
08.705	Design of Machine Elements II	3	1	-	50	3	100	4
08.706	Elective III	3	1	-	50	3	100	4
08.707	Thermal Engineering Lab	0	0	2	50	3	100	2
08.708	Mechanical Engineering Lab	0	0	2	50	3	100	2
08.709	Project & Seminar (MPU)	0	0	2	100			2
	Total	17	6	6	500		800	29

Semester VIII

Course No	Name of subject	Weekly load, hours			Max sessional marks	Exam Dur Hrs	Exam max marks	Credits
		L	T	D/P				
08.801	Energy Management(MPU)	2	1	-	50	3	100	3
08.802	Industrial Engineering (MPU)	2	1	-	50	3	100	3
08.803	Automobile Engineering	3	1	-	50	3	100	4
08.804	Computer Integrated Manufacturing (MU)	3	1		50	3	100	4
08.805	Elective IV	3	1	-	50	3	100	4
08.806	Elective V	3	1	-	50	3	100	4
08.807	Industrial Seminar (MPU)	0	0	2	50			2
08.808	Project & Viva voce (MPU)	0	0	5	150		100	5
	Total	16	6	7	500		700	29

ELECTIVE SECTION

LIST OF ELECTIVES

(Electives are common to Mechanical, Production and Automobile Engineering branches unless otherwise specified in the title)

08. 506 Elective I

1. Communicative English and technical writing
2. Human aspects of management
3. Disaster Management
4. Glimpses of world thought
5. Professional ethics and human values
6. Environmental Science
7. Advanced Welding technology
8. Foundry Technology
9. Environmental Pollution Control
10. Advanced Fluid Mechanics
11. Composite Materials Technology
12. Internet Technologies
13. Non Destructive Testing
14. Powder Metallurgy
15. Vehicle Transport & Fleet Management
16. Automotive Airconditioning
17. Two And Three Wheeled Vehicles

08.606 Elective II	08.706 Elective III
1. Advanced mechanics of solids	1. Computer Graphics
2. New Energy systems	2. Advanced Thermodynamics
3. Object Oriented Programming	3. Industrial Heat Transfer
4. Nuclear Engineering	4. Plant Engg & Maintenance
5. Mechanical working Methods	5. Fracture Mechanics
6. Artificial Intelligence Systems	6. Marketing Management.
7.System Modeling & Simulation	7. Entrepreneurship Development
8. Instrumentation and control	8. Industrial Hydraulics
9. Materials Handling	9. Finite Element Methods
10. Agro Machinery	10. Metal Forming
11. Total Quality Management	11. Machine tool Technology
12. Precision Engineering	12.Non-conventional Machining Techniques
13 Advanced Manufacturing Processes	13. Turbo Machines
14. Material Characterisation	14 Experimental Methods in Engineering
15. Micromachining Methods	15. Mech. Vibration & Noise Control
16. Tool Engineering (MU)	16. Failure Analysis
17Vehicle Body Engineering	17. Theory of Machining (MU)
18. Vehicle Performance And Testing	18. Bio Materials
19. Automotive Fuels & Alternate Fuels	19. Concurrent Engineering
	20. Industrial Automation
	21. Alternate Energy Sources
	22. Automotive Pollution and Control
	23. Creativity, Innovation and New Product Development

08. 805 Elective IV	08. 806 Elective V
1. Experimental Stress Analysis Techniques 2. Aerospace Engineering 3. Facilities Planning 4. Advanced Decision Modeling 5. Non linear Dynamics and Chaos 6. Design of jigs and fixtures 7. Multiphase flow 8. Controls in Machine tools 9. Design of Pressure Vessels & Piping 10. Tribology 11. Value Engineering. 12. Software Engineering 13. Cryogenic Engineering 14. Bio Medical Engineering. 15. Thermal Management of Electronic Systems 16. Continuum Mechanics 17. Product and brand management 18. Research Methodology 19. Nanotechnology 20. Automotive Technology (P) 21. High Temperature Materials 22. Industrial Safety Engineering 23. Engineering Design 24. Tractors & Farm Equipments 25. Embedded System In Automobiles 26. Computer Aided Vehicle Design	1. Propulsion Engineering 2. Industrial Refrigeration 3. Industrial Quality Control 4. Design of Heat transfer equipment 5. Creativity& Product Development 6. Computerized Materials Management 7. Random vibrations 8. Advanced Kinematics of Machines 9. Financial Management 10. Flexible Manufacturing Methods 11. Computational Fluid Dynamics 12. Technology Forecasting 13. Management Information Systems 14. Production & Operations Management 15. Project Management 16. Design of IC Engines 17. Robotics 18. Logistics and Supply Chain Management 19. Rapid Prototyping 20. Surface Engineering 21. Design of Cellular Manufacturing 22. Heating Ventilation and Air Conditioning Design 23. Automotive Aerodynamics 24. Off- Road Vehicles 25. Computer Simulation of IC Engine Processes.

08.103 ENGINEERING MATHEMATICS- I

L-T-P: 2-1-0 **Credit: 6**

MODULE- 1

Applications of differentiation:– Definition of Hyperbolic functions and their derivatives- Successive differentiation- Leibnitz' Theorem(without proof)- Curvature- Radius of curvature- centre of curvature- Evolute (Cartesian ,polar and parametric forms)

Partial differentiation and applications:- Partial derivatives- Euler's theorem on homogeneous functions- Total derivatives- Jacobians- Errors and approximations- Taylor's series (one and two variables) - Maxima and minima of functions of two variables - Lagrange's method- Leibnitz rule on differentiation under integral sign.

Vector differentiation and applications :- Scalar and vector functions- differentiation of vector functions-Velocity and acceleration- Scalar and vector fields- Operator ∇ - Gradient- Physical interpretation of gradient- Directional derivative- Divergence- Curl- Identities involving ∇ (no proof) - Irrotational and solenoidal fields – Scalar potential.

MODULE-II

Laplace transforms:- Transforms of elementary functions - shifting property- Inverse transforms- Transforms of derivatives and integrals- Transform functions multiplied by t and divided by t - Convolution theorem(without proof)-Transforms of unit step function, unit impulse function and periodic functions-second shifiting theorem- Solution of ordinary differential equations with constant coefficients using Laplace transforms.

Differential Equations and Applications:- Linear differential equations with constant coefficients- Method of variation of parameters - Cauchy and Legendre equations –Simultaneous linear equations with constant coefficients- Application to orthogonal trajectories (cartisian form only).

MODULE-III

Matrices:-Rank of a matrix- Elementary transformations- Equivalent matrices- Inverse of a matrix by gauss-Jordan method- Echelon form and normal form- Linear dependence and independence of vectors- Consistency- Solution of a system linear equations-Non homogeneous and homogeneous equations- Eigen values and eigen vectors – Properties of eigen values and eigen vectors- Cayley Hamilton theorem(no proof)- Diagonalisation- Quadratic forms- Reduction to canonical forms-Nature of quadratic forms-Definiteness, rank, signature and index.

REFERENCES

1. Kreyszig; *Advanced Engineering Mathematics*, 8th edition, Wiley Eastern.
2. Peter O' Neil ; *Advanced Engineering Mathematics,* Thomson
3. B.S.Grewal ; *Higher Engineering Mathematics,* Khanna Publishers
4. B.V.Ramana*; Higher Engineering Mathematics,* Tata Mc Graw Hill, 2006
5. Michel D Greenberg; *Advanced Engineering Mathematics,*Pearson International
6. Sureshan J, Nazarudeen and Royson; *Engineering Mathematics I*, Zenith Publications

08.102 ENGINEERING PHYSICS

L-T-P: 2-1-0 **Credit: 6**

MODULE-I

Oscillations and Waves: Basic ideas of harmonic oscillations – Differential equation of a SHM and its solution. Theory of damped harmonic oscillations. Quality factor. Theory of forced harmonic oscillations and resonance. Types of waves. One dimensional waves – Differential Equation. Harmonic waves. Three dimensional waves - Differential Equation and solution. Plane waves and spherical waves. Energy in wave motion. Velocity of transverse waves along a stretched string.

Electromagnetic Theory: Del operator – grad, div, curl and their physical significance. Concept of displacement current. Deduction of Maxwell's equations. Prediction of electromagnetic waves. Transverse nature of electromagnetic waves. **E** and **H** are at right angles. Poynting's theorem (qualitative only)

Physics of Solids: Space lattice. Unit cell and lattice parameters. Crystal systems. Co-ordination number and packing factor with reference to simple cubic, body centered cubic and face centered cubic crystals. Directions and planes. Miller indices. Interplanar spacing in terms of Miller indices. Super conductivity - Meissner effect. Type-I and Type-II superconductors. BCS theory (qualitative). High temperature superconductors. Applications of superconductors. Introduction to new materials (qualitative) -Metallic glasses, Nano materials, Shape memory alloys, Bio materials.

MODULE- II

Interference of Light: Concept of temporal and spatial coherence. Interference in thin films and wedge shaped films. Newton's rings. Michelson's interferometer. Determination of wave length and thickness. Interference filters. Antireflection coating.

Diffraction of Light: Fresnel and Fraunhofer diffraction. Fraunhofer diffraction at a single slit. Fraunhofer diffraction at a circular aperture (qualitative). Rayleigh's criterion for resolution. Resolving power of telescope and microscope. Plane transmission grating. Resolving power of grating. Grating equation. X-ray diffraction. Bragg's law.

Polarization of Light: Types of polarized light. Double refraction. Nicol Prism. Retardation plates. Theory of plane, circular and elliptically polarized light. Production and analysis of circularly and elliptically polarized light. Polaroids. Induced birefringence. Photo elasticity – isoclinic and isochromatic fringes – photo elastic bench

Special Theory of Relativity: Michelson-Morley experiment. Einstein's postulates. Lorentz transformation equations (no derivation). Simultaneity. Length contraction. Time dilation. Velocity addition. Relativistic mass. Mass energy relation. Mass less particle.

MODULE – III

Quantum Mechanics: Dual nature of matter. Wave function. Uncertainty principle. Energy and momentum operators. Eigen values and functions. Expectation values. Time Dependent and Time Independent Schrodinger equations. Particle in one dimensional box. Tunnelling (qualitative).

Statistical Mechanics: Macrostates and Microstates. Phase space. Basic postulates of Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics. Distribution equations in the three cases (no derivation). Bosons and Fermions. Density of states. Derivation of Planck's formula. Free electrons in a metal as a Fermi gas. Fermi energy.

Laser: Einstein's coefficients. Population inversion and stimulated emission. Optical resonant cavity. Ruby Laser, Helium-Neon Laser, Carbon dioxide Laser (qualitative). Semiconductor Laser (qualitative). Holography. Fiber Optics - Numerical Aperture and acceptance angle. Types of optical fibers. Applications.

REFERENCE:

1. Sears & Zemansky ; *University Physics. XI Edn.,; Pearson*
2. Frank & Leno; *Introduction to Optics. III Edn., , Pearson*
3. J.C. Upadhyaya*; Mechanics., Ram Prasad & Sons*
4. David J Griffiths*; Introduction to Electrodynamics, III Edn, , Pearson*
5. M Ali Omar*; Elementary Solid State Physics., Pearson*
6. S O Pillai*; Solid State Physics., New Age International Publishers*
7. John R Taylor, Chris D Zafiratos & Michael A Dubson*; Modern Physics for Scientists and Engineers. II Edn, Prentice Hall of India*
8. Eugene Hecht*; Optics. IV Edn, Pearson*
9. Robert Resnick ; *Introduction to Special Relativity., John Willey and Sons*
10. Richard L Libboff*; Introduction to Quantum Mechanics. IV Edn, Pearson*
11. Donald A Mcquarrie*; Statistical Mechanics., Vivo Books*
12. Mark Ratner& Daniel Ratner*; Nanotechnology.*
13. T.A. Hassan et al; A Text Book of Engineering Physics.*, Aswathy Publishers, Trivandrum*
14. B. Premlet*; Advanced Engineering Physics , Phasor Books, Kollam.*

LIST OF DEMONSTRATION EXPERIMENTS

1. Newton's Rings – Determination of wave length.
2. Air Wedge – Diameter of a thin wire
3. Spectrometer – Plane transmission grating – wavelength of light.
4. Spectrometer – Refractive indices of calcite for the ordinary and extraordinary rays.
5. Laser – Diffraction at a narrow slit.
6. Laser – Diffraction at a straight wire or circular aperture.
7. Michelson's interferometer – Wavelength of light.
8. Michelson's interferometer – Thickness of thin transparent film.
9. Polarization by reflection – Brewster's law.
10. Computer stimulation – superposition of waves.
11. Computer stimulation – study of **E** & **H**. (Gauss' law & Ampere's law)

Pattern of Question Paper

*University examination is for a maximum of **100 marks**, in **3 hour** duration. The syllabus is spread in 3 modules. The question paper will consist of two parts (A and B).*

***Part A** contains short answer questions for **40 marks**. This part contains 10 questions without any choice, **each of 4 marks** (uniformly taken from all modules).*

***Part B** contains long answer questions for **60 marks**. From each module, this part contains 3 questions out of which 2 are to be answered, **each of 10 marks.** Long answer questions from all the 3 modules will form 60 marks.*

08.103 ENGINEERING CHEMISTRY

L-T-P: 2-1-0 **Credit: 6**

MODULE-1

Electrochemistry - Electrodes- Electrode potential- Origin of electrode potential- Helmotz double layer- Nernst equation and application- Reference electrodes- Standared hydrogen electrode- Saturated calomel electrode- Quinhydron electrode-Determination of P^H using these electrodes- Concentration cells- Fuel cells- Secondary cells- Lead acid cell- Nickel cadmium cell- Lithium-ion cell. - Coductometric and Potentiometric titrations (acid base, oxidation reduction and precipitation titrations). **(12hrs)**

Corrosion and its control- Theories of corrosion (chemical corrosion and electrochemical corrosion)- Galvanic series- Types of corrosion (Concentration cell corrosion, Stress corrosion, Galvanic corrosion) - Factors affecting corrosion (nature of metal and nature of environment) and different methods of corrosion control (corrosion inhibitors, cathodic protection). **(5hrs)**

Protective coatings- Metallic coatings- Chemical conversion coatings- paint **(4hrs)**

Nano materials- Introduction-Classification-preparation (laser abrasion technique and sputtering technique)- Chemical method (reduction)-Properties and Applications of nano materials-Nano tubes-Nano wires. **(4hrs)**

MODULE-2

Water treatment- Types of hardness- Degree of hardness- Related problems- Estimation of hardness- by EDTA method- Sludge and scales in boilers- Priming and foaming- Boiler corrosion-Water softening methods, Lime-soda process, Ion exchange methods-Internal treatments (colloidal, carbonate, phosphate and calgon conditioning)- Domestic water treatment- Methods of disinfection of water-Desalination process (Reverse osmosis, electro dialysis- Distillation). **(12hrs)**

Envirnmental damages and prevention- Air pollution- CFCs and ozone depletion-Alternative refrigerents-Green house effect-Water pollution- BOD and COD- Waste water treatment- Aerobic - Anaerobic and USAB processes. **(3hrs)**

Thermal methods of analysis-Basic principles involved in Thermo gravimetry, Differential thermal analysis and applications. **(2hrs)**

Spectroscopy- Molecular energy levels-Types of molecular spectra- Electronic spectra (Classification of electronic transitions- Beer Lamberts law, Vibrational spectra (mechanism of interaction and application), Rotational spectra (Determination of bond length and application). NMR spectra (Basic principle, chemical shift, spin-spin splitting) **(6hrs)**

Chromatography- General principles- High performance liquid chromatography- Gas chromatography. **(2hrs)**

MODULE-3

Polymers- Classifications- Mechanism of polymarisation (Addition, free radical, cationic, anionic and coordination polymarisation)- Thermoplastics and thermosetting plastics-Compounding of plastics-Moulding techniques of plastics (Compression, Injection, Transfer and Extrusion moulding)-Preparation, properties and uses of PVC, PVA, PMMA, Nylon, PET, Bakelite, Urea formaldehyde resin- Silicon polymers- Biodegradable plastics. Elastomers-structure of natural rubber- vulcanisation- synthetic rubbers (Buna-S, Butyl rubber and Neoprene) **(12hrs)**

Organo electronic compounds -Super conducting and conducting organic materials like Polyaniline, polyacetylene and [polypyrrol and its applications. **(2hrs)**

Fuels- Calorific value- HCV and LCV-Experimental determination of calorific value-Theoretical calculation of calorific value by Dulongs formula - Bio fuels -Bio hydrogen and Bio-diesel **(5hrs)**

Lubricants- Introduction-Mechanism of lubrication- solid and liquid lubricant- Properties of lubricants-Viscosity index- flash and fire point- cloud and pour point- aniline value. **(4hrs)**

Cement- Manufacture of Portland cement- Theory of setting and hardening of cement **(2hrs)**

LAB-EXPERIMENTS (DEMONSTRATION ONLY)

1. Estimation of total hardness in water using EDTA.
2. Estimation of chloride ions in domestic water.
3. Estimation of dissolved oxygen.
4. Estimation of COD in sewage water.
5. Estimation of available chlorine in bleaching powder.
6. Estimation of copper in brass.
7. Estimation of iron in a sample of heamatite.
8. Determination of flash and fire point of a lubricating oil by Pensky Marten's apparatus.
9. Potentiometric titrations.
10. Preparation of buffers and standardisation of P^H meter.
11. Determination of molarity of HCl solution P^H-metrically.
12. Determinations of PH using glass electrode and quinhydron electrode.

REFERENCES

1. H.A. Willard, L.L. Merrit and J.A. Dean ; *Instrumental methods of analysis*
2. A.K. De ; *Environmental Chemistry*
3. K.J.Klauhunde; *Nanoscale materials in chemistry*
4. B.R. Gowariker ; *Polymer science*
5. B.W.Gonser ; *Modern materials*
6. V.Raghavan; *Material Science and engineering. A first course*
7. L.H. Van Vlack ; *Elements of Material science and Engineering*
8. J.W.Goodby ; *Chemistry of liquid crystals*
9. S.Glasstone ; *A text book of physical chemistry*
10. P.C. Jain; *Engineering Chemistry*
11. Juhaina Ahad ; *Engineering Chemistry*
12. Shashi Chawla ; *A text book of Engineering Chemistry*
13. R. Gopalan, D.Venkappayya & S. Nagarajan ; *Engineering Chemistry*
14. J.C. Kuriakose and J. Rajaram ; *Chemistry of Engineering and Technology Vol. I & II*
15. R.N Goyal and Harmendra Goeal; *Engineering Chemistry*, Ane Students Edition, Thiruvananthapuram

08.104 ENGINEERING GRAPHICS

L-T-P: 1-0-2 **Credit: 6**

INTRODUCTION: Introduction to technical drawing and its language. Lines, lettering, dimensioning, scaling of figures, symbols and drawing instruments. (1 sheet practice)

MODULE I

PLAIN CURVES: Conic sections by eccentricity method. Construction of ellipse: (i) Arc of circles method (ii) Rectangle method (ii) Concentric circles method. Construction of parabola (i) Rectangle method (ii) Tangent method. Construction of hyperbola (i) Arc of circles method (ii) given ordinate, abscissa and the transverse axis (iii) given the asymptotes and a point on the curve. Construction of Tangent and Normal at any point on these curves

MISCELLANEOUS CURVES: Construction of Cycloid, Epicycloid and Hypocycloid, Involute of a circle. Archimedian spiral, Logarithmic spiral and Helix. Construction of Tangent and Normal at any point on these curves

PROJECTION OF POINTS AND LINES: Types of projections, Principles of Orthographic projection. Projections of points and lines. Determination of true length, inclination with planes of projection and traces of lines.

MODULE II

PROJECTION OF SOLIDS: Projection of simple solids such as prisms, pyramids, cone, cylinder, tetrahedron, octahedron, sphere and their auxiliary projections.

SECTIONS OF SOLIDS: Types of cutting planes, section of simple solids cut by parallel, perpendicular and inclined cutting planes. Their projections and true shape of cut sections.

DEVELOPMENT OF SURFACES: Development of surfaces of (i) simple solids like prisms, pyramids, cylinder and cone (ii) Cut regular solids.

MODULE III

ISOMETRIC PROJECTION: Isometric scale, Isometric view and projections of simple solids like prisms, pyramids, cylinder, cone sphere, frustum of solids and also their combinations.

INTERSECTION OF SURFACES: Intersection of surfaces of two solids as given below.

(i) Cylinder and cylinder
(ii)Prism and prism.
(iii) Cone and Cylinder

(Only cases where the axes are perpendicular to each other and intersecting with or without offset.)

PERSPECTIVE PROJECTION: Principles of perspective projection, definition of perspective terminology. Perspective projection of simple solids like prisms and pyramids in simple positions.

CAD: Introduction to CAD systems, Benefits of CAD, Various Soft wares for CAD, Demonstration of any one CAD software.

General Note:

(i) First angle projection to be followed

(ii) Question paper shall contain 3 questions from each module, except from CAD. Students are required to answer any two questions from each module.

(iii) Distribution of marks

Module -I 2 x 16 = 32
Module -II 2 x 17 = 34
Module III 2 x 17 = 34

100

REFERENCES

1. Luzadder and Duff ; *Fundamentals of Engineering Drawing*
2. N. D. Bhatt ; *Engineering Drawing*
3. K. Venugopal *; Engineering Drawing and Graphics*
4. P.S. Gill; *Engineering Graphics*
5. P.I. Varghese; *Engineering Graphics*
6. K.R. Gopalakrishnan*; Engineering Drawing*
7. Thamaraselvi; *Engineering Drawing*
8. K.C. John; *Engineering Graphics*
9. K.N. Anil Kumar; *Engineering Graphics*

08.105 ENGINEERING MECHANICS

L-T-P: 2-1-0 **Credit: 6**

MODULE I (20 HRS)

Idealizations of Mechanics- Elements of vector algebra

Statics of rigid bodies-Classification of force systems- principle of transmissibility of a force-composition and resolution- Resultant and Equilibrant of coplanar concurrent force systems-various analytical methods- - Lami's theorem, method of resolution- Conditions of equilibrium-

Moment of a force, couple, properties of couple- Varignon's theorem- Resultant and equilibrant of coplanar non-concurrent force systems- Conditions of equilibrium. Equilibrium of rigid bodies-free body diagrams.(simple problems)

Types of supports - types of beams - types of loading- Support reactions of simply supported and overhanging beams under different types of loading.

Forces in space, equations of equilibrium, Vector approach.

Friction-Laws of friction-angle of friction- cone of friction- ladder friction- wedge friction.

MODULE II (20 HRS)

Properties of surfaces- centroid of composite areas- Theorems of Pappus-Gouldinus-Moment of inertia of areas, Parallel and perpendicular axes theorems- Radius of Gyration-moment of inertia of composite areas.

Dynamics: Kinematics-Combined motion of translation and rotation-instantaneous centre, motion of link, motion of connecting rod and piston, wheel rolling without slipping.

Relative velocity - basic concepts-analysis of different types of problems

Kinetics- Newton's laws of translatory motion- D'Alembert's principle- Motion of lift- Motion of connected bodies.

MODULE III (20 HRS)

Work, Power and Energy - Work-Energy principle-Impulse, Momentum.

Collision of elastic bodies-Law of conservation of momentum-Direct and oblique impact between elastic bodies and impact with fixed plane.

Curvilinear motion- D'Alembert's principle in curvilinear motion- Mass moment of inertia of rings, solid discs and solid spheres (no derivations required)Angular momentum-Angular impulse.

Kinetics of rigid bodies under combined translatory and rotational motion – work – energy principle for rigid bodies.

Centrifugal and centripetal forces – motion of vehicles on curved paths in horizontal and vertical planes – super elevation – stability of vehicles moving in curved paths (qualitative ideas only).

Simple harmonic motion – vibration of mechanical systems - basic elements of a vibrating system – spring mass model – undamped free vibrations – angular free vibration – simple pendulum.

REFERENCES:

1. Beer & Johnston, "*Vector Mechanics for Engineers – Statics and Dynamics"*, Tata Mc-Graw Hill Publishing Company Limited, New Delhi, 2005.
2. Irving. H. Shames, "*Engineering Mechanics*", Prentice Hall Book Company, 1966.
3. Timoshenko S. & Young D. H., "*Engineering Mechanics*", Mc-Graw Hill –International Edition
4. Popov, "*Mechanics of Solids*", Pearson Education,2007
5. Kumar K.L., "*Engineering Mechanics*", Tata Mc-Graw Hill Publishing Company Limited, New Delhi, 1998.
6. Rajasekaran S. & Sankarasubramanian G., "*Engineering Mechanics*", Vikas Publishing House Private Limited, New Delhi, 2003.
7. Tayal A K, "*Engineering Mechanics- Statics and Dynamics*" , Umesh Publications, Delhi,2004
8. Benjamin J., "*Engineering Mechanics",* Pentex Book Publishers and Distributors, Kollam, 2008

Note

Question For University Examination:- Part A – 8 compulsory questions covering entire syllabus, 5 marks each. (5 x 8 = 40) Part B – Three questions of 10 marks from each module, out of which two should be answered (10 x 2 x 3 = 60).

08.106 BASIC CIVIL ENGINEERING

L-T-P: 2-1-0 **Credit: 6**

MODULE I

Surveying: Object and Principles of Surveying.
Linear Measurements: Direct measurements - Tape & chain only - Ranging out survey lines-Taking measurements of sloping ground - Errors - Tape correction (problems).
Levelling: Levelling instruments - Level (Dumpy Level, Tilting Level) Levelling Staff. Measurements in levelling - Temporary adjustments of a level, holding the staff, reading the staff - Principles of leveling - recording measurements in the field book - reduction of level - height of collimation method only (simple examples).
Contour maps (Brief description only). Computation of areas - Mid ordinate rule, average ordinate rule, Trapezoidal rule, Simpson's rule (examples)- Introduction to Distomat, Total Station & GPS (Brief description only)

MODULE II

Building construction*:* Selection of site for buildings - types of buildings - Components of buildings.
Foundation: Different types - Spread footing, Isolated footing, Combined footing, Mat foundation¸ Pile foundation (description only).
Safe Bearing Capacity of Soil: Importance of determination of the Safe Bearing Capacity of Soil (brief description only).

Super structure: *Masonry - stone masonry, brick masonry –Types- desirable qualities of stone and brick.*

Partition: Materials used for making partition - plywood, particle boards & glass.
Doors, windows & ventilators : Types - materials used for the construction of doors and windows - wood, steel & Aluminium.
Plastering: Mortar – properties - Preparation of Cement mortar
Painting: Preparation of surfaces for painting - plastered, wood and steel surfaces- Types of paint - enamel, emulsion & distemper. Flooring: Types - mosaic tiles, ceramic tiles, marble, granite and synthetic materials. Roofing: Selection of type of roof -flat roof, sloping roof -Concrete roof, tiled roof. Selection of roof covering materials. GI Sheet , AC Sheet, PVC Sheet

MODULE III

Concrete: Ingredients- cement, aggregate, and water. Qualities of ingredients (brief description only).
Tests on Cement - consistency, initial and final setting times. Compressive strength - IS Specifications.
Aggregates – desirable qualities of fine and coarse aggregates
Plain Cement Concrete (PCC): preparation-proportioning-mixing of concrete.
Steel-common types used in construction- Mild Steel, HYSD Steel and their properties.
Reinforced Cement Concrete (RCC)-advantages of RCC over Plain Cement Concrete.
Elementary ideas on pre-cast and pre-stressed concrete constructions.
Building services – vertical transportation – stairs – types, escalators and elevators, ramps (brief description only). Plumbing services- brief description of water supply and sewage disposal arrangements for residential buildings.

REFERENCES:

1. Adler R., *Vertical Transportation for Buildings*, American Elsevier Publishing Company, New York.1970
2. B.C Punmia, "*Surveying & Leveling" Vol*. – I, Laxmi publications(P) Ltd,N.Delhi, 2004
3. Rangwala., *Building Materials,*Charotar publishing house, 2001
4. Rangwala, "*Building Construction*" , Charotar Publishing House., 2004
5. S.K. Roy, "*Fundamentals of Surveying*" Prentice-Hall of India, New Delhi.2004
6. Rangwala.,"*Water Supply and Sanitary Engineering*", Charotar Publishing House. 1990
7. Moorthy, "*Building Construction*", Modern Publishing House distributor., 1957
8. Jha and Sinha, "*Construction and Technology*"
9. Narayanan and Lalu Mangal ,"*Introduction to Civil Engineering*"Phasor Books,Kollam.
10. Santha Minu, "*Basic Civil Engineering*" Karunya Publications,Trivandrum

Note: *The question paper will consists of two parts. Part I and part II..*

Part I is Compulsory covering the entire syllabus, for 40 marks. It contains 8 questions of 5 marks each.
Part II is to cover 3 modules. There will be two questions (20 marks each) from each module out of which one from each module is to be answered. (20 X 3 = 60)

08.107 BASIC MECHANICAL ENGINEERING

L-T-P: 2-1-0 **Credit: 6**

MODULE I

Thermodynamics : Basic concepts and definitions of Zeroth law, First law, Second law of thermodynamics- concept of reversibility and entropy. p-v and T-s diagrams
Air cycles: Carnot, Otto and Diesel cycles-Air standard efficiency (simple problems)
IC Engines: Working and comparison of two stroke and four stroke petrol and diesel engines - general description of various systems using block diagrams – air system, fuel system, ignition system and governing system. A brief description of CRDI, MPFI, GDI and Hybrid Vehicles
Steam boilers: Classification – Cochran boiler, Babcock and Wilcox boiler, Benson boiler- fluidized bed combustion,

MODULE II

Principles and fields of application of - compressors - reciprocating and centrifugal, blower, pumps- reciprocating, centrifugal and jet pumps, steam and hydraulic turbines- impulse and reaction, gas turbine cycles- open and closed
Elementary ideas of hydro electric, thermal and nuclear power plants
Refrigeration & Air Conditioning: Refrigerants, CFC free refrigerants. Vapor compression refrigeration system, Comfort and Industrial air conditioning-typical window air conditioning unit (general description only).

MODULE III

Mechanical Power transmission systems: Belt, rope and gear drives-types, comparison and fields of application-velocity ratio-slip (simple problems) friction disc, single plate clutch, gear trains (no derivations).
Manufacturing processes: Elementary ideas of casting, forging, rolling, welding, soldering and brazing
Machining processes- turning, taper turning, thread cutting, shaping, drilling, grinding, milling (simple sketches and short notes).
Non conventional machining - Electro discharge machining (EDM) and Electro chemical machining (ECM)
Principle, application and advantages of C N C machine

REFERENCES

1. Spalding and Cole, "*Engineering Thermodynamics*"
2. Gill, Smith and Zuirys, "*Fundamentals of IC Engines*"
3. Amstead, Ostwald and Begeman, "*Manufacturing processes*"
4. Crouse, "*Automobile Engineering*"
5. Roy and Choudhary, "*Elements of Mechanical Engineering*"
6. Hajra Choudhary, "*Workshop Technology*"
7. R K Bensal, "*Fluid mechanics and machines*"
8. J Benjamin, "*Basic Mechanical Engineering*"

Note: Lectures are to be supplemented by demonstration in laboratories.

Note: *The question paper will consist of two parts. Part I is to be compulsory for 40 marks. This may contain 10 questions of 4 marks each. Part II is to cover 3 modules. There can be 3 questions from each module (10 marks each) out of which 2 are to be answered.*

08.108 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

L – T – P: 2-1-0 **Credits: 6**

MODULE – I

Elementary concepts - Kirchoffs laws - Magnetic Circuits - MMF, field strength, flux density, reluctance – problems in series magnetic circuits. Review of electromagnetic induction - Faradays laws, Lenz's law - statically induced and dynamically induced emf - self and mutual induction - inductance.

Alternating current fundamentals - generation of alternating currents – waveforms - frequency - period - average and rms values - form factor. Phasor representation of alternating quantities - rectangular polar and exponential forms.

Analysis of simple ac circuits – concept of impedance and admittance - phasor representation - *j* notation - power and power factor in ac circuits - active and reactive components. Solution of RL, RC and RLC series circuits.

Three phase systems - generation of three phase voltage - star and delta connection - relation between phase and line values of voltage and current - phasor representation - three wire and four wire systems.

Measurement of power in three phase circuits (two wattmeter method). Measurement of energy – working of 1-phase energy meter.

MODULE – II

Transformers - Principle of operation - EMF equation - constructional details of single phase and three phase transformers

Methods of bulk generation of electric power. Block schematic of layout of generating stations - hydroelectric, thermal and nuclear power plants. Renewable energy sources - solar, wind, tidal, wave and geothermal energy.

Bulk transmission of electric power - typical electrical power transmission scheme - need for high transmission voltage - substations - substation equipments. Primary and secondary transmission and distribution systems

Different methods of wiring for LT installations. Schematic layout of LT switchboards. Earthing of installations - necessity of earthing - plate and pipe earthing. Protective fuses, MCBs, ELCBs and switches.

Working of incandescent lamps, -fluorescent lamps, energy efficient lamps

MODULE – III

Diodes - PN junction diodes,. V-I characteristics, dynamic & static resistance, principle of working and V-I characteristics of Zener diode, principle of Photo diode, Solar cell, & LED. Rectifiers & power supplies - block diagram description of a dc power supply, circuit diagram & working of half-wave & full wave rectifier, final equations of Vrms, Vdc, ripple factor and peak inverse voltage in each case, principle of working of series inductor and shunt capacitor filters. Working of simple zener voltage regulator. Power devices – V – I characteristics and applications of SCR and Triac Working principle of UPS and SMPS. Transducers – Resistance strain guage, thermistor, LVDT

REFERENCES

1. V.N. Mitlle, "*Basic Electrical Engineering*", Tata McGraw Hill, 1990.
2. DP Kothari, LJ Nagrath, "*Theory and Problems of Basic Electrical Engineering*", Prentice Hall of India, 2000.
3. B.L. Thereja, "*A Text Book of Electrical Technology*", Volume I, S Chand & Co, New Delhi, 1992.
4. Francis M Fernandez, "*A Basic Course in Electrical Engineering*", Rajath Publishers, Ernakulam.
5. TP Imthias Ahmed, B. Premlet, "*Introduction to Electrical Engineering*", Phaser Books, Kollam
6. Gopakumar, "*Introduction To Electronics and Communications*", .Phasor Books, Kollam
7. Millman and Halkias, "*Integrated Electronics: Analog and digital circuits and systems*", McGraw-Hill Book Co
8. Edward Hughes, "*Electrical and Electronic Technology*", Pearson Education, 2002.
9. ML Soni, PU Guptha, US Bhatnagar and A Chakrabarthy, "*A Text Book on Power System Engineering*", Dhanpath Rai & Sons, New Delhi 1997
10. N.N.Bhargava, "*Basic Electronics and Linear Circuits*", Tata McGraw Hill
11. Rangan C.S., Sarma G.R., and Mani V.S.V., "*Instrumentation Devices and Systems*", Tata McGraw Hill, 1992.
12. Muhammad H. Rashid, "*Power Electronic Circuits, Devices and Applications*", Pearson education, Asia 2003.

Note : *The question paper will consist of two parts. Part – A is to be compulsory for 40 marks (10 questions of 4 marks each). Part-B is to cover 3 modules for 60 marks. (50% choice- One out of two or two out of four from each module).*

08.109 BASIC COMMUNICATION AND INFORMATION ENGINEERING

L – T – P: 2-1-0 **Credits: 6**

MODULE 1(Qualitative Treatment)

(a) Bipolar junction transistors: NPN & PNP transistors, structure, typical doping, working of NPN transistor, concepts of common base, common emitter & common collector configurations, current gain of each, input & output characteristics of common emitter configuration, comparison of three configurations with reference to voltage & current gain, input & output resistances and applications. (6 hrs)
(b) Field effect Transistors : basic principles of JFET, MESFET and MOSFET, comparison with BJT. (3 hrs)
(c) Amplifiers & Oscillators: circuit diagram & working of common emitter amplifier, function of each component in the circuit, need of proper biasing, frequency response, voltage gain and 3dB bandwidth, concepts of class A, B, AB and Class C power amplifiers, circuit diagram & working of push pull amplifiers, concepts of feedback, working principles of oscillators, circuit diagram & working of RC phase shift oscillator (7 hrs)
(d) Integrated circuits: advantages of ICs, analog and digital ICs, functional block diagram of operational amplifier, ideal operational amplifier,use as inverting amplifier, non inverting amplifier, summing amplifier, integrator and comparator. (4 hrs)
(e) Digital ICs:logic gates, realization of logic functions, principle of combinational and sequential logic circuits, flip flop (JK), logic families: TTL and CMOS Logic (No internal diagram) (4 hrs)
(f) IC fabrication: purification of silicon, crystal growth, wafer preparation. unit process: oxidation, diffusion, ion implantation, epitaxy, deposition, photolithography. (4 hrs)

MODULE 2 (Qualitative Treatment)

(a) Measurements: principle and block diagram of analog and digital multimeter, working principle of CRT, block diagram of CRO, measurements using CRO, principle of digital storage oscilloscope, principle and block diagram of function generator. (5hrs)

(b) Radio communication: principle of AM & FM, wave forms, bandwidths, block diagrams of AM & FM transmitters, principle of AM &FM demodulation, comparison of AM & FM,principle &block diagram of super heterodyne receiver. (4 hrs)

(c) Color television: TV Standards,interlaced scanning, block diagram of PAL TV transmitter & receiver, basic principles of cableTV, CCTV system, basic principles of HDTV, basic principles of LCD & Plasma displays. (5 hrs)

(d) Radar and navigation: principle of radar and radar equation, block schematics of pulsed radar, factors affecting range, applications of radar in measurements and navigation. (4 hrs)

(e) Satellite communication: microwave frequency bands, concept of geo-stationary satellite, frequency bands used, satellite transponder, block diagram of earth station transmitter & receiver, advantages of satellite communication, principle of Global Positioning System(GPS).
(3 hrs)
(f) Optical communication: block diagram of the optical communication system, principle of light transmission through fiber, concepts of Single Mode and Multi Mode optical fiber, working principle of source (semiconductor Laser) & detector (PIN,APD), advantages of optical communication. (5 hrs)

MODULE 3 (Qualitative Treatment)

(a) Computer Architecture: functional units: basic concept of ALU- data path and control, memory hierarchy, caches, main memory, virtual memory, operating systems, microprocessors - functional block diagram of 8085 (9 hrs)
(b) Data communication: overview, analog and digital data transmission, transmission media, digitization of wave forms, PCM , digital modulation techniques- ASK, PSK, FSK, basic concepts of error detection , parity checking. (6hrs)
(c) Mobile communication: basic principles of cellular communications, concepts of cells, frequency reuse, principle and block diagram of GSM,principle of CDMA, WLL & GPRS technologies. (4hrs)
(d) Internet Technology: concepts of networking: client - server computing, IP addresses, domain names, network interface unit - modem, switching technologies- circuit switching and packet switching, LAN,MAN,WAN &World wide web, network topologies, communication protocols- TCP/IP, Introduction to web languages-HTML ,XML, internetworking concepts, network devices- basic principles of router, bridge, switch, network security- Firewall. (7 hrs)

REFERENCES

1. Santiram Kal, *Basic Electronics – Devices, Circuits and IT fundamentals*, PHI
2. Louis.E.Frenzel, *Principles of Electronic Communication Systems*, TMH
3. William Stallings, *Wireless Communications and Networks*, Pearson Education.
4. M.Moris Mano, *Computer Architecture*, PHI
5. Neil H E Weste,Kamran Eshraghian, *Principles of CMOS VLSI design – A system perspective*, Pearson Education [Module 1(f)]
6. David A. Bell, *Electronic Instrumentation and Measurements*, PHI .[Module 2(a)]
7. N N Bhargava,D C Kulshreshtha,S C Gupta, *Basic Electronics & Linear Circuits*, TMH
8. ITL Education Solution Ltd., *Introduction to Information Technology*, Pearson Education, 5th edition, 2008
9. R.R. Gulati, *Monochrome and Colour Television*, New Age International [Module 2 (c)]
10. K Gopakumar, *Introduction to Electronics & Communication* , 3rd edition, 2008,Phasor Publisher's,Kollam

This subject shall be handled by faculty of Dept.of Electronics and Communication in the Colleges.

Question Paper

The question paper shall consist of two parts. Part I is to cover the entire syllabus, and carries 40 marks. This shall contain 10 compulsory questions of 4 marks each. Part II is to cover 3 modules, and carries 60 marks. There shall be 3 questions from each module (10 marks each) out of which 2 are to be answered.

08.110 ENGINEERING WORKSHOPS

L-T-P/D; 0-0-2 **Credits: 6**

A. Carpentry: Study of tools and joints. Practice in planning, chiseling, marking and sawing. Joints – Cross joint, T joint, Dove tail joint.

B. Fitting: Study of tools, Practice in filing, cutting, drilling and tapping. Male and female joints, Stepped joints.

C: Sheet Metal Work: Study of tools. Selection of different gauge GI sheets for jobs. Practice on riveted joints. Preparing tube joints, frustums, trays and containers.

D. Plumbing: Study of tools. Details of plumbing work in domestic and industrial applications. Study of pipe joints, cutting, threading and laying of pipes with different fittings using PVC pipes. Use of special tools in plumbing work.

E: Foundry: Study of tools. Preparation of sand, moulding practice and demonstration of casting.

F. Welding: Study of welding machines. Straight line practices, Making of Butt joint, T joint and Lap joint.

G: Smithy: Study of tools. Demonstration on forging of square prism, hexagonal bolt, T bolt and Eye bolt.

H: Machine Tools: Study and demonstration on working of machine tools. Lathe and Drilling machine.

NOTE: For the university examination the student shall be examined in sections A, B, C, D and E only.

SEMESTER III

08. 301 ENGINEERING MATHEMATICS II
(CMPUNERFHBTA)

L-T-P/D; 3-1-0 **Credits 4**

Module I

Multiple Integrals: Double Integrals (Cartisian only).Change of order of integration. Area enclosed by plane curves. Triple integrals. Volume of solids.
Vector integration: Line and surface and volume integrals. Greens theorem in the plane. Stokes theorem and Gauss divergence theorem (no proof).

Module II

Fourier series: Fourier series of periodic functions of period **2π** and **2*l***. Dirichlet's condition for convergence. Odd and even functions. Half range expansions.
Fourier Transforms: Fourier integral theorem(no proof)-Fourier transforms-Fourier sine and cosine transforms , inverse Fourier transforms, properties

Module III

Partial differential equations: Formation of PDE. Solution of Lagranges linear equation. First order nonlinear equations-standard forms -Homogeneous PDE with constant coefficients.
Application of PDE: Derivation of one dimensional Wave and Heat equations. solution by seperation of variables. Boundary value problems in one dimensional Wave and Heat equations.

References

1. Kreyszig, Advanced Engineering Mathematics, 8th Wiley Eastern.
2. Peter O Neil, Advanced Engineering Mathematics.
3. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers.
4. B.V.Ramana, Higher Engineering Mathematics, Tata Mc Graw Hill.
5. Michel D Greenberg, Advanced Engineering Mathematics, Pearson

University Examination

The question paper shall contain two parts. Part A and Part B. Part A shall contain 10 compulsory questions of 4 marks each covering the entire syllabus (10 x 4 = 40).Part B shall contain 2 questions of 20 marks each from module I, II and III. One full question from each module has to be answered (3 x 20 = 60)

08. 302 HUMANITIES (MPEU)

L-T-P/D; 3-0-0 **Credits 3**

PART I

ECONOMICS (2 periods per week)

MODULE – I

Definition of Economics – Basic Concepts Goods – Choice of techniques – Production possibility curve National Income concepts - GNP – GDP – NNP – Per Capita Income – Three Sectors of the Economy – Primary – Secondary, Tertiary Sector – Significance of Money.

Meaning of Demand and Supply – Types of demand – Determinants of Demand – Demand forecasting

Production function – Law of Variable proportion – Returns to scale - Least cost combination of inputs – Cost concepts – Cost output relationship

Module II

Inflation – causes of inflation – measures to control inflation – Demand – Pull inflation – cost push inflation – effects of Inflation – effects of inflations comparison between inflation and deflation

India's Economic crisis in 1991 – New economic policy – Global Financial meltdown in 2008 – Applicability of Keynesian Theory to UDC'S.

Stock Market and present scenario – Industrial sector past and present – Industry Analysis – Electronics – Chemical – Automobile – FMCG Industry.

Environment and Development – Basic Issues – Sustainable Development and Environmental Accounting – Population – Resources and the Environment – Poverty and the Environment – Growth versus the Environment – The Global Environment .

PART II

Module III

ACCOUNTANCY (1 Period per week)

Book- Keeping and Accountancy -Elements of Double Entry -Book- Keeping- rules for journalizing -Ledger accounts –Cash book-Banking transactions – Trial Balance- Method of Balancing accounts- the journal proper (simple problems).

Final accounts: Preparation of trading and profit and loss Account- Balance sheet (with simple problems) - Introduction to Accounting packages (Description only)

References :

1. K.K Dewett, Modern Economic theory
2. Michael – Todaro, Economic Development Addison Wesley Longman Ltd.
3. Mohinder Kumar Sharma _ Business Environment in India
4. D.M. Mithani-Money, Banking, International Trade and Public Finance, Himalaya publishing House, New Delhi.
5. Rudder Dutt and K.P.M Sundaran – Indian Economy
6. Hal R. Varian – Intermediate Micro Economics
7. Koutsiannis (second Edition) Micro Economics
8. Double Entry book Keeping – Batliboi
9. A Systematic approach to Accounting: Dr K.G. Chandrasekharan Nair

University question

Note: Part I and Part II to be answered in separate answer books.

Part – I Economics

Part A – 30 Marks (short answers) covering entire syllabus (3x10=30)

Part B – 40 marks (50% choice one out of two or two out of four from each module)

Part – II Accountancy

Three questions covering entire syllabus out of which two questions has to be answered (2x15=30)

08.303 FLUID MECHANICS AND MACHINES (MPU)

L-T-D: 4-1-0 **Credits : 5**

Module – I

Properties of fluid - Density, Specific weight, viscosity, surface tension, bulk modulus, compressibility, velocity, rate of shear strain, Newton's law of viscosity, Newtonian and non- Newtonian fluids, real and ideal fluids, incompressible and compressible fluids. Atmospheric pressure, Gauge pressure and Absolute pressure. Pressure at a point in a fluid, Pascal's Law. Measurement of pressure - Piezo meter, manometers, pressure gauges.

Energies in flowing fluid, head - pressure, dynamic, static and total head, Continuity equation, Eulers equation, Bernoulli's equation, Practical applications: Flow rate measurements- Venturi and Orifce meters, Notches and Weirs (description only for notches and weirs).Velocity measurements- Pitot tube and Pitot –static tube.

Flow through pipes: Reynolds experiment, Reynolds number, Laminar and Turbulent flow, Hagen- Poiseuille equation, Turbulent flow through pipes, head loss due to friction, friction factor, Mody's chart, Darcy- weisbach equation, Chezy's formula - Losses at entry, exit, sudden expansion and sudden contractions, Compound pipes, branching of pipes, siphon effect, water hammer Transmission of power through pipes (simple problems)

Module – II

Impact of jets: Stationary and moving vanes – Flat and curved vanes – Series of vanes - work done and efficiency.

Hydraulic Turbines : Impulse and Reaction Turbines – Pelton Wheel – Constructional features - Velocity triangles – Euler's equation – Speed ratio, jet ratio & work done , losses and efficiencies, design of Pelton wheel – Inward and outward flow reaction turbines- Francis Turbine – Constructional features – Velocity triangles, workdone and efficiencies – Axial flow turbine (Kaplan) Constructional features – Velocity triangles- work done and efficiencies – Characteristic curves of turbines – theory of draft tubes – surge tanks – Cavitation in turbines – Governing of turbines – Specific speed of turbine , similarity and model testing-selection of water turbines for power plants. Type Number– Characteristic curves, scale Laws – Unit speed – Unit discharge and unit power

Module –III

Positive displacement pumps- reciprocating pump – air vessels and their purposes – separation and cavitation - slip negative slip and work required and efficiency- indicator diagram- effect of acceleration and friction on indicator diagram – multi cylinder pumps.

Rotary motion of liquids – free, forced and spiral vortex flows- rotodynamic pumps- centrifugal pump impeller, casings –manometric head- work, efficiency and losses, priming, specific speed. Performance characteristics- multistage pumps-selection of pumps-pumping devices-hydraulic ram jet pumps, gear pumps, vane pump and lobe pump.

Dimensional analysis : Rayleigh method, Buckingham π theorem – Dimensionless numbers - Similarity Laws – Shape numbers – Impeller shapes based on shape numbers

References :

1. J. F. Douglas, Fluid Mechanics, Pearson education.
2. Robert W. Fox, Introduction to fluid dynamics, John Wiley and sons
3. K. Subrahmanya, Theory and applications of fluid mechanics, (TMH)
4. Shames. I. H, Mechanics of fluids
5. Jagadish Lal, Fluid mechanics and Hydraulic machines
6. R K Bansal, Hydraulic Machines
7 R.K.Rajput, Hydraulic Machines
8. D S Kumar, Hydraulics & Hydraulic Machines
9. Modi & Seth, Fluid Mechanics & Machines , Standard Publishers.
10. N. S Govinda Rao, Fluid flow mechanics
11. Yunus A Cengel, John M Cimbala, Fluid Mechanics, Tata McGraw-Hill

University Examination

The question paper shall contain two parts. Part A and Part B. Part A shall contain 10 compulsory questions of 4 marks each covering the entire syllabus (10 x 4 = 40).Part B shall contain 2 questions of 20 marks each from module I, II and III. One full question from each module has to be answered (3 x 20 = 60)

08.304 MECHANICS OF SOLIDS (MPU)

L-T-D: 3-1-0 **Credits : 4**

Module I

Concept of stress – normal stress and shear stress, concept of strain, normal strain and shear strain, constitutive relation, Hooke's law, modulus of elasticity, modulus of rigidity, deformation of axially loaded bars, members with varying cross section, principle of superposition, composite bars, thermal stress.

Saint-Venant's Principle and stress concentration, lateral strain, Poisson's ratio, volumetric strain, bulk modulus of elasticity, relationship between elastic constants.

Concept of stress and strain tensor, generalised Hooke's law, definition of plane stress, plane strain and examples. Stress transformation (2D only) principal stress and Mohr's circle, Strain energy due to axial loads- gradually and suddenly applied impact loads.

Module II

Shear force and bending moment diagrams– cantilever, simply supported and over hanging beams-concentrated and UD loads, Theory of simple bending-bending stress and shear stress distribution-rectangular, circular and I sections.

Slope and deflection of beams, load- deflection differential equation, computation of slope and deflection of simply supported and cantilever beams- Macaulay's method.

Module III

Torsion of circular shafts-solid and hollow shafts-power transmitted by shafts.

Thin cylinders and shells subjected to internal and external pressures – thick cylinders and spherical shells- Lame's equation – compound cylinders.

Direct and bending stress – short columns – core of section Crippling load-Eulers equation

Analysis of pin-jointed plane perfect frames by the method of joints.

References :

1 S.B.Junarkar, Mechanics of structures Vol I & II
2 Egor P Popov, Engineering Mechanics of solids,PHI
3 Timoshenko, Strength of Materials
4 Timoshenko S.P. and J.M. Gere, Mechanics of Materials, CBS Publishers & Distributors, New Delhi.
5 Singh G. D., Strength of materials, Ane Books India, New Delhi.
6 L.S. Srinath, Advanced Mechanics of Solids, Tata McGraw-Hill

Note: University question paper consists of two parts

Part A – 40 Marks (8 compulsory questions of 5 marks each to cover the entire syllabus)

Part B – 60 marks (50% Choice, One out of Two from each module)

08. 305 THERMODYNAMICS

L-T-D: 3-1-0 **Credits : 4**

Module I

Basic concepts and definitions, microscopic and macroscopic approaches , definitions of heat and work, zeroth law of thermodynamics, measurement of temperature , temperature scales, ideal gas thermometer , first law of thermodynamics, Applications of first law to processes:- Control Mass and control volume Analyses, Analysis of Steady and Unsteady flow processes, limitations of first law. Properties of Pure Substances: Pure Substance, phases of a Pure Substance, Phase Change processes of Pure Substances, Property diagrams for phase change processes, The ideal Gas Equation and other Equations of State, Compressibility Factor, law of Corresponding states.

Module II

Second Law of Thermodynamics , Kelvin – Planck and Clausius statements. Equivalence of the above Statements – Reversible Processes and Cycles. The Carnot cycle – corollaries of the Second Law. Absolute thermodynamic temperature Scale , International Temperature Scale (ITS). Entropy, Inequality of Clausius, Causes of Entropy Change, Entropy changes in various thermodynamic processes, principle of increase of entropy, Available and Unavailable energy, Availability function, Availability and irreversibility open and closed systems. Practical consideration with Availability. Third Law of Thermodynamics.

Module III

General Thermodynamic Relations – Combined First and Second law equations – Helmholtz and Gibb's functions - Maxwell's Relations, equations for internal energy , enthalpy and entropy, ideal and real gases. The Clapeyron Equation, Throttling process, Joule Thomson Coefficient, inversion curve. Properties of Gas Mixtures : composition of a gas mixture – Mass and Mole Fraction, Dalton's law, Gibbs – Daltons Law, equivalent molecular weight and gas constant, Properties of gas mixtures – Specific Heats, Internal energy, enthalpy and Entropy , .Introduction to Mixtures of Gases and a Vapors, Introduction to real gas mixtures.

References:

1. J.P.Holman, Thermodynamics, McGraw – Hill Book Company.
2. P.K.Nag, Engineering Thermodynamics, Tata McGraw-Hill.
3. E.Rathakrishnan, Fundamentals of Engineering Thermodynamics
4. Gordon J.Van Wylen, Richard E Sonnttag, Fundamentals of Classical Thermodynamics
5. H.W.Zemansky, Heat and Thermodynamics,
6. M.Achuthan, Engineering Thermodynamics
7. Michael A Spaldling, Thermodynamics
8. Y.V.C.Rao, An Introduction to Thermodynamics
9. Gordon Rogers & Y.O.N Maghew, Engineering Thermodynamics: Work & Heat Transfer , Pearson Eduction.
10. Yunus A, Cengal Michael A. Boles, Thermodynamics, Tata McGraw-Hill

University Examination

The question paper shall contain two parts. Part A and Part B. Part A shall contain 10 compulsory questions of 4 marks each covering the entire syllabus (10 x 4 = 40).Part B shall contain 2 questions of 20 marks each from module I, II and III. One full question from each module has to be answered (3 x 20 = 60)

08. 306 ENGINEERING DRAWING (MPU)

L-T-D: 1-0-4 **Credits : 5**

PART - A Machine Drawing 0-0-2

Conversion of pictorial views into Orthographic views – Sectional views, types of sectional views, Conventions-Dimensioning techniques, BIS standards

Module-I

Free hand sketching: Screw thread forms and conventional representations, lock nuts, foundation bolts, forms of rivet heads, Riveted Joints – Lap (chain and zigzag with multiple rows), butt joints (chain and zigzag with multiple rows, single strap and double strap), different types of keys, Pipe joint-socket and spigot.

Module-II

Dimensioned drawing: Hexagonal and square headed bolt with nut, Sectional drawings of Socket and spigot joint, Knuckle Joint, Rigid flange couplings, Bushed Pin flexible coupling, Plummer block, Single plate clutch and Cone friction clutch. Pipe joints: Sectional drawings of Cast Iron Flanged joint, Hydraulic joint and Union Joint.

References:

1. N.D. Bhatt, Machine Drawing
2. P.I.Varghese, Machine Drawing,
3. P.S.Gill, Machine Drawing
4. Parkinson, Machine Drawing

PART – B Civil Engg. Drawing & Estimation 1-0-2

Module I

Drawing : Principles of building drawing, preparation of drawing of buildings such as office building, residential building (RCC and tiled roof, single storied and two storied), factory building with steel trusses for small scale industries.

Module II

Estimating: Principles of estimation, quantity estimation and cost estimation of building such as residential building and factory buildings.

References:

1. Balagopal.R.S.Prabhu ,Vincent Paul, Building drawing and detailing.
2. Dutta B.N., Estimating and Costing in Civil Engineering.
3. Chakrabarti M., Estimating and Costing in Civil Engineering.

University examination

Duration – 4 hours

Part A and Part B are to be answered in separate answer books

Part A (50 marks) The question paper shall contain 2 questions. The first question is from module-1 which carries 20 marks. It contains 3 sub divisions and any 2 has to be answered, (2x10=20 marks). The second question is from Module 2, Dimensioned drawing which is a compulsory question and carries 30 marks.

Part B (50 marks) The question paper shall contain 2 questions from each module and one has to be answered from each. Module I carries 30 marks and module II carries 20 marks.

08.307 CIVIL ENGINEERING LAB (MPU)

L-T-D: 0-0-2 **Credits : 2**

Experiments

1. Test on Mild Steel, High carbon steel and Cast Iron specimens
2. Shear test on MS Rod
3. Torsion test on MS Rod
4. Torsion test using Torsion Pendulum on MS, Aluminium and Brass wire
5. Izod and Charpy Impact tests
6. Hardness test (Brinell Hardness & Rockwell Hardness)
7. Spring test (Open and closed coiled)
8. Bending test on Wood
9. Determination of Moment of Inertia of Rotating Bodies
10. Chain Surveying and Levelling (4hrs only.)

Scheme of Examination:-

Exam. Duration: 3 hrs.

No examination for chain surveying and levelling, but viva shall be asked.

08.308 Computer Aided Drafting and Modelling Lab

L-T-D: 0-0-2 **Credits : 2**

(i) Introduction to computer aided drafting and solid modeling: software and hardware.

(ii) Understand basic 2D geometric construction techniques.

a. Cartesian and polar coordinate systems: locating points, coordinate entry methods, units and limits.
b. Object generation: lines, arcs, polylines, and multilines; rectangles, circles, polygons, and ellipses.
c. Transformations: move, copy, rotate, scale, mirror, offset and array; trim, extend, fillet, chamfer
d. Layers: creation, naming, properties manager.
e. Blocks: create, edit, import and explode.
f. Text: creating and editing, formatting, text styles.
g. Dimensions: creating and editing, dimension styles.

(iii) Exercise on basic drafting principles to create technical drawings.

a. Create orthographic views of machine parts from pictorial views.
b. Create isometric views of machine parts from orthographic views
c. Create hatched sectional views of machine parts.

(iv) Understanding basic solid modeling techniques

a. Creation of solid primitives
b. Boolean operations
c. Extrude, Revolve operations
d. 3D Views

(v) Exercise on basic modeling to create machine parts

Create solid models from pictorial views

UNniversity Examination:

Question paper may contain two parts. Part A shall contain 2D drafting which carries 40% marks, Part B shall contain 3D drafting which carries 40% marks and 20% marks is for viva voce conducted during the exam.

SEMESTER IV

08.401 ENGINEERING MATHEMATICS III (CMPUNERFHB)

L-T-P/D; 3-1-0 **Credits 4**

Module I

Complex Differentiation: Limits ,continuity and differentiation of complex functions. Analytic functions-Cauchy Reimann equations in Cartesian form (proof of necessary part only) properties of analytic functions-harmonic functions. Milne Thomson method

Conformal mapping: The Transformations $w=1/z$, $w=z^2$, $w=z+1/z$, $w=\sin z$,$w=\cos z$,Bilinear transformation

Module II

Complex Integration:Line integral- Cauchy's integral theorem-Cauchy's integral formula. Power series-radius of convergence-Taylors and Laurents series-zeros and singularities –Residues and residue theorem. Evaluation of real definite integrals-

2π

$\int_0 f(\sin\theta, \cos\theta)\, d\theta$, $\int_{-\infty}^{\infty} f(x)\, dx$ with no poles of $f(z)$

on the real axis (proof of theorems not required)

Module III

Numerical Techniques:Errors in numerical computation-solution of algebraic and transcendental equations by bisection method, regula false method,Newton- Raphson method. Solution linear systems by Gauss elimination and Gauss-Seidal method. Newtons forward and backward interpolation formula. Lagranges interpolation formula.Numerical integration. Trapezoidal and Simpson's rule.Numerical solutionof ODE Taylor series method,

Eulers method,Runge Kutta methods(derivation of formulae not required for the above methods.)

References:

1. Peter v. O'neil, Advanced Engineering Mathematics, Thomson Pub.
2. Erwin Kreizig, Advanced Engineering Mathematics, Weiley Eastern.
3. Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. B.V Ramana, Higher Engineering Mathematics, Tata Mc Graw hill.
6. C T.Veerarajan and T.Ramachandran, Numerical Methods with programming.
7. S.S.Sastry, Introductory methods of numerical analysis.

University Examination

The question paper shall contain two parts. Part A and Part B. Part A shall contain 10 compulsory questions of 4 marks each covering the entire syllabus (10 x 4 = 40).Part B shall contain 2 questions of 20 marks each from module I, II and III. One full question from each module has to be answered (3 x 20 = 60)

08.402 COMPUTER PROGRAMMING & NUMERICAL METHODS (MNPU)

L-T-P/D; 3-1-0 **Credits 4**

Module – I

Introduction to Computer programming concept - Algorithm and flow chart, Basics of procedure oriented and object oriented programming.

Introduction to C++: Structure of C++ program; Key words; Identifiers; Data types – integer, real, character, string, boolean, enumeration, array and pointer; Constant and Variables; Escape sequences; Operators – assignment, arithmetic, relational, logical, increment & decrement, conditional, size of, comma and bitwise operators; Statements – simple & compound, declaration statements, Control statements -if, if-else, switch, for loop, while, do-while, break and continue statements, Input and output streams, Arrays – one dimensional & two dimensional; Functions- inline functions, function over loading, Functions with default arguments, recursion, pointers. Simple programs using above features.

Module –II

Introduction to Class and Object- definition, data members, member function, private & public member function, member access, friend declaration, class objects, predefined classes, initialization, constructor and destructor; Operator overloading, Inheritance- base class and derived class; Input/output stream libray - ifstream, ofstream , fstream, class flies. Simple problems using the above features.

Module-III

Errors and approximations – floating point arithmetic – sources of errors – control of errors – propagation of errors – condition and stability – Rate of convergence. Interpolation – Newton's Divided difference, Lagrange, Aitken, Hermite and Spline techniques- Inverse interpolation. Curve fitting – method of least squares – non-linear relationships – Correlation and Regression – Linear correlation – measures of correlation – Standard error of estimate – coefficient of correlation. Solution of Partial differential equations – classification – Laplace equation – Finite difference methods – relaxation methods. Stability and convergence of solution. Numerical problems and preparation of computer programs for the above methods

References :

1. Ashok M. Kamthane, Object oriented Programming with ANSI & Turbo C++, Pearson Education.
2. Nagler, Learning C++, A Hands on Approach, Jaico publications.
3. Stanley B. Lippman and Josee Lajoie, C++ Primer, Pearson Education.
4. Balaguruswamy, Object Oriented Programming with C++, TataMcgraw Hill.
5. Nabajyothi barkakati, Object Oriented Programming in C++ , Prentice Hall.
6. Balaguruswamy, Numerical Methods, E. TataMcgraw Hill.
7. C.F. Gerald and P.O.Wheatley, Applied Numerical Analysis , Pearson Education.

University Examination

The question paper shall contain two parts. Part A and Part B. Part A shall contain 10 compulsory questions of 4 marks each covering the entire syllabus (10 x 4 = 40).Part B shall contain 2 questions of 20 marks each from module I, II and III. One full question from each module has to be answered (3 x 20 = 60)

08. 403 METALLURGY AND MATERIAL SCIENCE (MP)

L-T-P/D : 3-1-0 **Credits : 4**

Module I

Classification of engineering materials-selection of materials with reference to properties, service and economic considerations. Thermal, Physical Mechanical, Electrical, Magnetic, Dielectric properties, Super conductivity and Super plasticity of materials. Metallic bonds, crystal structure, space lattice, types of unit cells, Miller indices, co-ordination number, atomic packing factor, allotropy and polymorphism, imperfections in crystals. Elastic and Plastic deformation of metals, Factors affecting plastic deformation, deformation temperature. Slip, Twinning, Dislocation, Critical shear stress, Frank-Read source, Strain hardening, De-lamination theory.

Module II

Diffusion mechanism, Fick's Laws. Theory of alloys, Gibb'phase rule, Solid solutions. Hume Rothery's rule. Equilibrium diagrams-Construction and uses-Equilibrium diagram of binary alloys: Eutectic, Eutectoid, Peritectic and peritectoid reactions. Iron-Carbon Equilibrium diagram, Isothermal TTT diagrams, Critical cooling rate. Heat treatment processes, Hardenability tests. Surface treatments, Case Hardening, Carburising, Nitriding, Cynading,Induction hardening, Precipitation hardening, CVD, PVD, Thermal spraying, Plasma spraying, D-Gun spraying, Recovery, Recrystalisation and Grain Growth.

Module III

Testing of materials-Tensile and Compression test, Impact test, Significance of fracture mechanics, Brittle fracture, Griffith's crack theory, Energy balance approach, Ductile fracture, Factors leading to crack formation, Ductile-brittle transition in steels, Fatigue mechanism, Fatigue crack growth, Creep mechanism. Properties, composition and uses of various types of Cast Iron and Steels - Effect of various alloying elements. Properties, composition and uses of Copper, Aluminum, Titanium and its alloys, Effects of various alloying elements. Introduction to Ceramics, Composites, Smart materials, Nuclear, Nano materials.

References :

1. L.W.Van Wlanck, Elements of Materials Science.
2. Wulff-Series, Material Science Vol-I,II,III,IV.
3. B.K.Agrawal, Introduction of Engineering materials, Tata McGraw Hill.
4. C.W.Richards, Engineering Material Science.
5. R.K.Rajput,S.K.Kataria &Sons, Material Science and Engineering.
6. Y.Lakhtin, Engg Physical Metallurgy.
7. Dieter, Mechanical Metallurgy.
8. Serope Kalpakjain *et al*., Manufacuring Engg and Technology.
9. R.K.Dogra & A.K.Sharma, Advanced Material Science.
10. William D.Callister, Indroduction to Material Science., John Wiley.

University Examination

The question paper shall contain two parts. Part A and Part B. Part A shall contain 10 compulsory questions of 4 marks each covering the entire syllabus (10 x 4 = 40).Part B shall contain 2 questions of 20 marks each from module I, II and III. One full question from each module has to be answered (3 x 20 = 60)

08. 404 MANUFACTURING PROCESS (MN)

L-T-P/D : 3-1-0 **Credits : 4**

Module I

Foundry – basic requirements of casting processes. Patterns – types, materials, allowances. Moulding Sand – Properties, testing, Sand Muller, Types of mould – Green Sand Mould, Dry Sand Mould, Sodium Silicate – Carbon Dioxide Moulding, Shell Moulding, Ceramic Mould Casting , Plaster mould casting. Cores – Core Sand, Core Types, Core Prints , Core Baking, Principles of gating and Risering – Riser location and Direction Solidification, Blind riser, Chills-Internal and External chills and Chaplets. Internal, external chills. Pressurised and Unpressurised Gating systems. Gravity die casting Pressure die casting-Hot and Cold chamber type, Centrifugal casting, Semi centrifugal casting Centrifuging, Continuous Casting. Sodification of Castings – Cleaning and Inspection of castings, Casting defects.

Module II

Welding- classification, Weldability, Metallurgy of welding, structure of weld, HAZ. Gas welding, types of flames. Arc welding- Carbon arc welding, Shielded metal arc welding, Submerged arc welding, TIG, MIG. Resistance welding- Spot welding, Seam welding, Projection welding, Butt welding, Flash butt welding, Percussion welding. Solid phase welding-forge welding, friction welding, explosive welding, ultrasonic welding. Thermit welding, Atomic hydrogen welding, Electron beam welding. Weld defects and inspection.

Module III

Forming-plastic deformation and yield criteria-relation between tensile and shear yield stress-Rolling-cold, hot rolling-Types of rolling mills-Rolling of channels, I and rail sections. Rolling of tubes, wheels and axles. Defects in rolled products. Forging- open and closed die forging, press forging, roll forging, types of forging presses. Defects in forging. Extrusion-hot and cold extrusion-Wire drawing-Rotary piercing-Rotary swaging, Cold forming-thread rolling, metal spinning. Introduction to powder metallurgy process – Compacting and sintering.

References :

1. Serope Kalpakjian and Steven R Schmid, Manufacturing Engineering and Technology, (Fourth Edition), Pearson Education, Asia.
2. Amitabh Ghosh and Amitkumar Mallik, Manufacturing Science, Affiliated East West press(p) Ltd, NewDelhi, 2002
3. H.F.Taylor, M.C.Flemmings and John Wulff, Foundry Engineering, Wiley Eastern Pvt. Ltd.
4. Campbell, Principles of Manufacturing materials and processes – TMH
5. Paul dE Grarmo , J.T.Black and RA.K Kosher, Materials and process in Manufacturing , PHI.

University Examination

The question paper shall contain two parts. Part A and Part B. Part A shall contain 10 compulsory questions of 4 marks each covering the entire syllabus (10 x 4 = 40).Part B shall contain 2 questions of 20 marks each from module I, II and III. One full question from each module has to be answered (3 x 20 = 60)

08. 405 THERMAL ENGINEERING (MU)

L-T-P/D : 3-1-0 **Credits : 4**

Module I

Steam engineering, T- S diagram, Mollier chart, Rankine cycle, Modified Rankine cycle, Binary vapor cycle

Boilers:- High pressure boilers:- Benson boiler,LaMont boiler, Loeffler boiler, Velox boiler, Schmidt Hartman boiler,

Steam nozzle:- effect of friction, super saturated flow. Steam turbine: classification, velocity diagrams, condition for maximum efficiency, multistage turbines, condition line, stage efficiency, reheat factor, degree of reaction, cycles with reheating and regenerative heating, governing of turbines,

Module II

Fuels and combustion, types of fuels, Properties of fuels. Calculation of air fuel ratio and equivalence ratio- volumetric and gravimetric analysis, Adiabatic flame temperature.

IC engines:- combustion in CI and SI engines, Normal combustion and flame front propagation, Abnormal combustion, factors affecting auto ignition, preignition, detonation, octane and cetane numbers, Anti knocking agents, combustion chambers for SI and CI engines, Alternate fuels for IC engines. Introduction to HCCI combustion.

Gas turbines:- classification, simple cycle, isentropic efficiency and mechanical efficiency, simple cycle with regeneration, intercooling and reheating, cycle efficiency and work output., types of combustion chambers

Module III

Compressors- classification of compressors, reciprocating compressor-single stage compressor, equation for work with and without clearance volume, efficiencies, multistage compressor, intercooler, free air delivered (FAD)

Rotary compressors- classification, centrifugal compressor-working, velocity diagram, work done, power required, width of blades of impeller and diffuser, isentropic efficiency, slip factor and pressure coefficient, effect of impeller blade shape on performance, compressor characteristics, surging and chocking, performance.

Axial flow compressors:- working, velocity diagram, degree of reaction, performance. Roots blower, vane compressor, screw compressor

References :

1. P.L.Ballaney, Thermal Engineering, Khanna publishers.
2. R.K.Rajput, Thermal Engineering, Laxmi publications.
3. Gill and Smith, Internal combustion engines.
4. J.B.Heywood, I.C engine fundamentals.
5. T.D. Eastop and A McConkay, Applied thermodynamics for engineering technology, Pearson education.
6. V. Ganesan, Fundamentals of IC engines, Tata McGraw-Hill.

University Examination

The question paper shall contain two parts. Part A and Part B. Part A shall contain 10 compulsory questions of 4 marks each covering the entire syllabus (10 x 4 = 40).Part B shall contain 2 questions of 20 marks each from module I, II and III. One full question from each module has to be answered (3 x 20 = 60)

08.406 MACHINE DRAWING

L-T-P/D : 0-0-3 **Credits : 3**

Module-1

Information to be furnished in drawings: Fits and Tolerances, form tolerance and position tolerance, Geometric tolerance and its indications on drawing, Surface texture- indication of surface roughness, indication of production method, surface treatment, IS specifications.

Module-2

Assembly and working drawing (Part drawing): Shaft bearing and supports – Pedestal bearings, Plummer block and foot step bearing, I.C. Engine parts – Piston, Connecting Rod, fuel pump for a diesel engine and fuel injection nozzle, Valves - Stop valve for boilers, feed check valve, Ramsbottom safety valve and dead weight safety valve, Machine parts- Lathe tail stock, Lathe tool post and screw jack.

References :

1. N.D. Bhatt, Machine Drawing.
2. P.I.Varghese, Machine Drawing.
3. P.S.Gill, Machine Drawing.
4. Parkinson, Machine Drawing.

University examination:

D*uration will be 4 hours. The question paper shall contain 2 questions. The first question is from module-1 and shall contain 3 sub divisions out of which 2 has to be answered (2x10=20marks). The second question is from module-2 carrying 80 marks and is a compulsory question.*

08. 407 FLUID MECHANICS & MACHINES LAB (MN)

L-T-D: 0-0-3 **Credits : 3**

Study of meters, gauges and valves - pressure gauge, vacuum gauge, manometers, flow measuring equipments-water meters-venturi meter-orifice meter-current meter, stop valve, gate valve and foot valve
Study of pumps- Centrifugal – Reciprocating – Rotary - Jet. Study of Turbines- impact and reaction types. Study of Hydraulic ram, accumulator etc.

Experiments

1. Determination of Coefficient of discharge and calibration of Notches, Orifice meter, Nozzle and Venturimeter.
2. Determination of Chezy's constant and Darcy's coefficient on pipe friction apparatus
3. Determination of Hydraulic coefficients of orifices
4. Determination of Metacentric Height and Radius of gyration of floating bodies.
5. Performance test on Rotodynamic and Positive displacement pumps
6. Performance test on Impulse and Reaction turbines
7. Speed variation test on Impulse turbine
8. Determination of best guide vane opening for Reaction turbine
9. Performance test on variable speed pump and plotting iso-efficiency curves

08. 408 IC ENGINES LAB

L-T-P/D : 0-0-3 **Credits : 3**

1. Study of I.C engines :-
    a) Diesel engines - all systems and parts
    b) Petrol engines - all systems and parts
2. Determination of flash and fire points of petroleum products
3. Determination of viscosity of lubricating oil using Redwood Viscometer
4. Determination of calorific value of solid, liquid and gaseous fuels using Bonb calorimeter and Gas Calorimeter
5. Experiment on I C Engines
    a) Performance test on IC Engines (Petrol and Diesel)
    b) Heat Balance test
    i) Heat exchanger method
    ii) Flue gas analysis method
    iii) Volumetric efficiency method
    c) Valve timing diagram
    d) Economic speed test
    e) Best cooling water Temperature test
    f) Retardation test
    g) Volumetric efficiency and Air-fuel ratio test
6. Morse test on petrol engine.

SEMESTER V

08.501 ENGINEERING MATHS IV (CMPU)

L-T-D: 3-1-0 **Credits : 4**

Module I

Discrete and continuous random variables and their probability distributions - Probability distribution (density) functions - Distribution functions - Mean and Variance - Simple problems. - Binomial, Poisson, uniform and exponential distributions - Mean and Variance of the above distributions - Normal distribution - Properties of normal distribution - Computing probabilities using Binomial, Poisson, uniform, exponential and normal distributions

Module II

Curve fitting - Principle of least squares - Fitting a straight line - Fitting a parabola - Linear correlation and regression - Karl Pearson's coefficient of correlation - Sampling distributions - Standard error - Estimation - Interval estimation of population mean and proportions (small and large samples) - Testing of Hypothesis - Hypothesis concerning a mean, Equality of means - Hypothesis concerning one proportion, difference of two proportions.

Module III

Linear programming - Formation of LPP - graphical solution - General linear programming problem - Slack and surplus variables - Standard form - Solution of LPP - basic solution - Basic feasible solution - Degenerate and non-degenerate solutions - Optimal solution - Solution by simplex method - Artificial variables - Big-M method - Canonical form of LPP Duality in LPP - Properties of primal and dual optimal solutions - solution using duality

Reference

1. T. Veerarajan*, Probability and Random Processes*, TMH
2. Richard A. Johnson, *Probability and statistics for engineers,* Pearson
3. G. Hadly, *Linear Programming,* Addison Wesley
4. Ravindran, Philips, Solberg, *Operations Research,* Wiley

University Examination:

The question paper shall consist of two parts. PartA (40 marks) shall contain 10 compulsory questions of 4 marks each. PartB (60 marks) will have 3 modules . There shall be 2 questions from each module (20 marks each) out of which one is to be answered

08.502 ELECTRICAL TECHNOLOGY (MPU)

L-T-D: 3-1-0 **Credits : 4**

Module 1

DC Machines-principle of operation-emf equation-types of excitations. Separately excited, shunt and series excited DC generators, compound generators. General idea of armature reaction, occ and load characteristics-simple numerical problems.

Principles of dc motors-torque and speed equations-torque speed characteristics- variations of speed, torque and power with motor current. Applications of dc shunt series and compound motors. Principles of starting, losses and efficiency – load test- simple numerical problems.

ModuleII

Transformers – principles of operations – emf equation- vector diagrams-losses and efficiency – OC and SC tests. Equivalent circuits- efficiency calculations- maximum efficiency – all day efficiency – simple numerical problems. Auto transformers constant voltage transformer- instrument transformers.

Three phase induction motors- slip ring and squirrel cage types- principles of operation – rotating magnetic field- torque slip characteristics- no load and blocked rotor tests. Circle diagrams- methods of starting – direct online – auto transformer – star delta and rotor resistance starting

ModuleIII

Single phase motors- principle of operation of single phase induction motor – split phase motor – capacitor start motor- stepper motor- universal motor

Synchronous machines- types – emf equation of alternator – regulation of alternator by emf method. Principles of operation of synchronous motors-methods of starting- V curves- synchronous condenser.

Electric traction – systems of power supply – functional schematic of ac electric locomotives- types of motors used in traction systems. Methods of speed control – methods of braking.

Referemces:

1. B. L. Theraja & A.K. Theraja, A text book of electrical technology.
2. Partab, Art and utilization of electric energy.
3. V.K. Metha, Principles of electrical and electronics.
4. Guptha .B.R & Vandana Singal, Fundamentals of electric machines.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.503 THEORY OF MACHINES (MP)

L-T-D: 3-1-0 **Credits : 4**

Module – I

Introduction:

Terminology – definitions and assumptions. Degrees of freedom – Kutzbach criterion – Grashof's Law – Kinematic inversions – Concepts of mechanical advantage. Transmission angle. Coupler curve. Introduction to graphical and vector approaches. Straight line mechanisms – Watt mechanism – Peaucellier mechanism – Harts mechanism. Steering mechanisms – Quick return mechanisms – Intermittent motion mechanisms – Geneva mechanism. Rachet and pawl mechanisms. **Synthesis:** Introduction to kinematic synthesis – types, number and dimensional synthesis – function generation – chebyshev spacing – Three position synthesis – graphical methods – Analytical methods- Freudensteins equations. **Velocity analysis of mechanisms:** Velocity analysis – Instantaneous center of velocity. Aronhold & Kennedy's theorem – locating instantaneous centers (upto 6 link mechanisms) – Velocity analysis using instantaneous method – Centrodes velocity analysis – analytical method. (Slider crank mechasim only)

Module – II

Velocity and acceleration analysis of mechanisms: Relative velocity method - Relative acceleration method –Graphical method - Velocity and acceleration diagrams – Vector methods - Coriolis component of acceleration Klien's Construction

Belt – Rope –Chain Drives: Introduction – Open and ccross belt drive – length of belt – ratio of belt tensions – centrifugal tensions- initial tensions- V belt drive-Rope drive – Power tramsmitted **Friction Clutches** Plate clutches – Conical clutches – power tramsmitted

Brakes and Dynamometers. Types of brakes: Analysis of shoe , band , band and block brakes-internal expanding shoe brakes. Dynamometers- Description of Absorption and Transmission type dynamometers

Module – III

Gears: Types of gears –Terminology- law of gearing – gear tooth profiles.- interference and under cutting,- calculation of minimum number of teeth, contact ratio, path of contact, arc of contact,- effect of friction in gears.

Gear trains: Types of gear trains-compound, reverted and epicyclic. Torque in epicyclic gear trains. **Cams**: Classification of cams and followers-Terminology - graphical layout of cam profiles,-standard follower motions– Disc cam with reciprocating or pivoted type knife edge, flat faced or roller followers-. Description of Tangent cam and circular arc cams (No problems).

References

1. Shigley and Uicker, Theory of Machines and Mechanisms,McGraw Hill
2. Rao and Dukkipatti, Mechanism and Machine theory,Wiley Eastern
3. P.L. Ballaney, Theory of Machines and Mechanisms
4. S.S. Rattan, Theory of machines, THM
5. Amithabha Ghosh and Malik - Theory of Machines and Mechanisms
6. V. Ramamoorthi, Mechanics of Machinery, Narosa
7. Myzka, Kinematics of Machines, Pearson Education
8. Charles E Wilson and J Peter Sadler , Kinematics and Dynamics of Machinery 3rd ed, Pearson Education

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.504 INDUSTRIAL ELECTRONICS (MP)

L-T-D: 2-1-0 **Credits : 3**

Module I

Thyristors-Working and characteristics of SCR,TRIAC. Structure and working of power BJT. Working and characteristics of UJT and IGBT. Converters-Single phase half wave and Bridge converters. Dielectric heating and Induction heating - Principle and applications. Resistance welding-sequence timer. Photoelectric devices- principle of operations of APD, Photo transister and Photovoltaic cell. Applications for industrial measurement and control.

Module II

Data acquisition system-block diagram and explanation of each block. Transducers – LED,Laser diode and Thermistors .Actuators. Micro controllers – Intel 8051 – Architecture, memory organization, register banks, special function registers, addressing modes. Instruction set of 8051 – Programming examples (addition, subtraction, 8 bit multiplication and 8 bit division, interfacing with 7-segment LED display only). Application of 8051 - microcontroller based temperature control system. ADC , DAC.

Module III

Control systems: Open loop and closed loop control systems, Transfer function-electrical system, mechanical system. Second order systems - response to step input, time domain specifications-rise time, delay time, peak time, peak overshoot and falling time. Frequency response -frequency domain specifications-bandwidth and resonant peak. Stability of a system-definition-stability analysis using Routh hurwitz criterion. Stability analysis in frequency domain using Bode plot. Principle of PD, PI and PID controllers.

References

1. Harish C. Rai, *Industrial and power electronics*, PHI
2. Ayala, *The 8051 Microcontroller* 3rd Edn., Thomson India edition
3. Muhammad H Rashid, *Power Electronics*, 2nd Edn., PHI
4. Ned Mohan, *Power Electronics; Converters, application and Design*, 2nd Edn., John Wiley and sons
5. Benjamin C. Kuo, *Automatic cotrol system*, 6th Edn, PHI, New Delhi

This subject shall be handled by faculty of Dept. of Electronics and Communications in the colleges.

University Examination

The question paper shall contain two parts. Part A and Part B. Part A shall contain 10 compulsory questions of 4 marks each covering the entire syllabus (10 x 4 = 40).Part B shall contain 2 questions of 20 marks each from module I, II and III. One full question from each module has to be answered (3 x 20 = 60)

08.505 MACHINE TOOLS (MN)

L-T-D: 3-1-0 **Credits : 4**

Module – I

Introduction to Metal cutting, Orthogonal and Oblique cutting, Chip formation, Types of chips, Tool Signature – Tool Geometry – Machinability – Tool Wear and wear measurement – Factors affecting tool life – Analysis of cutting forces in orthogonal cutting - Merchants theory (simple problems), Work done. Economic of Machining – Cutting Tools for different materials and cutting speeds. Characteristics of Tool materials, Measurement of cutting forces. Tool dynamo meters, Cutting Fluids. Ceramic tools and inserts.

Module II

General Purpose Machine Tools – Principle of operation of Lathe – Types of lathes and size specification, Work holding parts of lathes and their functions – Main operations – attachments – Feeding Mechanisms, Apron mechanism, Shaper mechanism – Calculation of cutting speed – Shaper operation and tools used, Milling Machine – Types – Principal parts – Types of milling cutters – Elements of plain milling cutters – Up milling, Down milling and face milling operations – Indexing – Simple Indexing – Differential indexing. Grinding Machines – Classification – Operations – Surface, Cylinderical and Centreless grinding, Specification of grinding wheels - Glazing and Loading of wheels.-Dressing and Truing of Grinding wheels.

Module III

Semi – automatic Machine Tools – Turret and Capstan Lathes. Automatic Machine Tools – Single Spindle and Multi-spindle machines , Transfer machines, unconventional machining process – EDM, WEDM, ECM, LBM,USM, AJM, EBM and Chemical Machining, High energy rate forming process –Explosive forming , Hydro forming,
Electromagnetic forming. Powder Metallurgy-basic concepts and advantages.

Reference:

1. Kalpakjian, Manufacturing Engineering & Technology ,Addison Wesley
2. Poul De Garmo, J.T.Black, R.A.Kosher, Materials and Processes in Manufacturing , Printice Hall of India.Pvt. Ltd. 1997.
3. G.R.Nagpal, Tool Engineering & Design, Khanna Pub.
4. Chernov, Machine Tools, Mir Publishers
5. R.K.Jain, Production Technology, Khanna Publishers
6. R.K.Gupta, Production Technology, Sathya Prakashan
7. Ghosh A and Malic A.K, Manufacturing Science, Affiliated East West Press.
8. Production Technology , HMT, TMH.
9. Hajra Choudary et.al., Elements of workshop technology, Vol II, Media promoters and publishers, pvt. Ltd.
10. P.N. Rao, Manufacturing Technology, vol2, TMH

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.506 ELECTIVE I

Refer Elective Section:

08.507 PRODUCTION ENGINEERING LAB

L-T-D: 0-0-3 **Credits : 3**

General study of Lathe and Accessories, Tools used for different operations. Exercises involving plane turning, Groove cutting, form turning, taper turing, facing and thread cutting.
Study of shaping and slotting machines, and planning machines, exercises involving production of flat surfaces, grooves and key ways.

08.508 ELECTRICAL AND ELECTRONICS LAB (MPU)

L-T-D: 0-0-3 **Credits : 3**

1. OCC on a DC shunt generator- determination of critical resistance , critical speed, additional resistance required in the field circuit.
2. Load characteristics of a dc shunt generator.
3. Load characteristics of DC compound generator
4. Load test on DC series motor
5. Load test on DC shunt motor
6. Load test on single phase transformer
7. Starting of three phase squirrel cage induction motor by star delta switch, load test on three phase squirrel cage induction motor
8. Load test on three phase slip ring induction motor
9. V-I characteristics of diodes and zener diode
10. Input and output characteristics of CE and CB configurations of BJTs. Determination of β, input resistance and output resistance
11. Drain and transfer characteristics of JFET
12. Static V-I characteristics of SCR
13. Half wave and full wave rectifiers with and with out filters- observe the waveforms on CRO

SEMESTER VI

08.601 METROLOGY AND INSTRUMENTATION (MP)

L-T-D: 3-1-0 **Credits : 4**

Module-I

General Principles of Measurement: Introduction Concept of Precision, accuracy, sensitivity, calibration. Basic standards of length- Line standard and End standards – slip gauges, Angular measurements using bevel protractors, spirit levels, clino-meters, sine bar, Angle gauges, optical dividing head.

Limits and Fits:- Systems of limits and fits. Interchangeability & selective assembly. Tolerance- Allowance- Deviation as per BIS (simple problems).

Taylor's principles- Limit gauges design. Considerations- gauges materials- Gauges tolerance and wear allowance.

Classification of Limit gauge- plug, ring, taper, Gap, Snap gauges, position gauges etc – merits and demerits.

Module II

Comparator:- Mechanical, Optical, Pneumatic, Electrical and Electronic comparators.

Optical Measuring Instruments:- Principle of Interferometry – Optical flat – Interferometers – angle dekkor Autocollimators, Tool makers- Microscope. Co-ordinate measuring machine.

Concepts of machine Vision system – CCD, CID cameras.

Surface Finish- Surface Texture – Evaluation of surface roughness- Simple problems.

Surface roughness measuring instruments – Different types.

Measurement of major elements of Screw threads and Gears.

Module III

Transducers:- Classification- Static and Dynamic characteristics of Transducers and Dynamometers.

Stress- Strain Measurement: Types of strain gauges- Strain measurements by using resistance strain gauges and Mechanical strain gauges-types, application.

Basic concept in static and dynamic measurements: Analysis of Experimental errors Gaussian and normal error Distribution- methods of Least Squares- Simple problems.

Reference :

1. Ernest O Doebelin , Measurement system (Application and Design).
2. R. K. Jain, Mechanical and Industrial measurements.
3. R. K. Jain, Engineering Metrology.
4. R. C. Gupta, Engineering Precision Metrology.
5. I. C. Gupta, A text book of Engineering Metrology.
6. ASME, Hand book of Industrial Metrology.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.602 DYNAMICS OF MACHINERY (MP)

L-T-D: 3-1-0 **Credits : 4**

Module – I

Force analysis: Static force analysis Graphical and vector method- Free body diagrams-Conditions for equilibrium- two and three force members,- four force members, Analysis of mechanisms without considering friction, -Analysis with sliding and pin friction- Method of virtual work- Principal of super position

Dynamic force analysis: Inertia force and inertia torque. D'Alemberts principle, -Analysis of mechanisms, Equivalent dynamical systems. Shaking forces and moments. Flywheel analysis: Fly wheel- Turning moment diagrams,- fly wheel in different applications like IC engines, -Punching press – Dimensions of the fly wheel rim – Size of fly wheel.

Module II

Governors: Types of governors – Watt ,Porter, Proell and Hartnell governors – Sensitiveness – Hunting – Isocronism – Stability – Effort and power of governor – Controlling force. **Gyroscopes :** Principle, -analysis of gyroscopic action on vehicles-two wheelers, four wheelers, air planes and ships. Stability of an automobile – stability of a two wheel vehicle –Stabilization of ship.

Balancing : Static and Dynamic balancing - Balancing of revolving masses in different planes – Balancing of reciprocating mass – single cylinder engine – multi cylinder engine – V engines - Balancing machines.

Module III

Vibration Analysis:

Types of vibrations – Basic elements of a vibrating system - Undamped force vibrations, different methods of analysis,- Free vibrations with viscous damping,- logarithmic decrement, -forced vibrations,- vibration isolation and transmissibility- Force due to unbalance - Force due to support motion – Vibration measuring instruments - vibrometers – accelerometers. Transverse vibration – string, beam.

Natural frequency - Dunkerley's method – Whirling of shafts – critical speed.

Torsional vibrations Free torsional vibrations – Single rotor - Two rotor, - three rotor systems – Torsionally equivalent shaft - geared systems.

References

1. Holowenko, Dynamics of Machinery, John Wiley
2. Shigley and Uicker, Theory of Machines and Mechanisms, Mcgrawhill
3. Charles E Wilson and J Peter Sadler , Kinematics and Dynamics of Machinery 3rd ed, Pearson Education
4. Ballaney P.L. , Theory of Machines
5. V. Ramamoorthi, Mechanics of Machinery, Narosa
6. S S Rattan, Theory of Machines,TMH
7. Rao and Dukkipati, Mechanisms and Machine theory
8. Amithabha Ghosh and Malik, Theory of Machines and Mechanisms
9. Lasithan, Elementary Mechanical Vibration and Noise Control

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.603 COMPUTER AIDED DESIGN (MPU)

L-T-D: 2-1-0 **Credits : 3**

Module –I

Computer Aided Design – Definition, Necessity for CAD, Benefits of CAD
Design process – Application of computers in Design- Geometric modeling, Engineering analysis, design review and evaluation, Automated drafting. Design for Manufacture. Hardware in CAD- components, Data communications, Design workstation, Interactive display devices- CRT, directed beam refresh, DVST and raster scan displays, LCD and plasma discharge displays. User interaction devices, Design Database, graphic Standards, Data Exchange Formats. Virtual Reality: Introduction, Hardware and software for Virtual Reality environment, Applications of Virtual Reality in product design.

Module II

Computer graphics. Computer graphics software, functions of CG packages. Methods of defining points, lines,arcs - Bresenhams algorithm. 2D and 3D Transformations– translation, scaling, rotation, mirroring, concatenation of transformations. Windowing and Clipping- Cohen Sutherland line clipping algorithm. Hidden surface removal algorithms – z-buffer algorithm, scan line algorithm. 3D modeling: types of models- wire frame - surface and solid models, CSG and B-REP Techniques - Features of Soild Modeling Packages - Parametric and features - Interfaces to drafting, Design Analysis.

Module III

Introduction to finite element analysis-steps involved in FEM- Preprocessing phase-discretisation-types of elements selection of interpolation functions- Formulation of stiffness matrix - formulation of load vector- Transformation of coordinates- assembly of global equations-solution procedure, post processing phase. Simple problems with Axial element - beam element, CST element. Isoparametric formulation. Solution of 1D and 2D structural and solid mechanics problems - linear static analysis. Dynamic analysis.

References:

1. Mikell P Groover, CAD/CAM, Prentice Hall
2. D.F. Rogers and J.A.Adams, " Mathematical Elements in Computer Graphics ", McGraw-Hill Book Company, New York
3. Hearn and Baker, Computer Graphics, Prentice Hall
4. Ibrahim Zeid, "CAD - CAM Theory and Practice", TMH Pub. Co.
6. Grigore Burdea, Philippe Coiffet, Virtual Reality Technology, John Wiley and sons
5. P.Radhakrishnan and S.Subramanyan, " CAD / CAM / CIM ", New Age Int. Ltd
6. Sadhu Singh, " Computer Aided Design and Manufacturing ", Khanna Publishers, New Delhi, 1998
7. Abbott, M. B. and Basco, D. R., “Computational fluid dynamics: An introduction for engineers,” Harlow, Essex, England: Longman Scientific & Technical; NY.
8. Anderson, J.D., Jr., *Computational Fluid Dynamics: The Basics with Applications*, McGraw- Hill, Inc., New York,
9. Daryl Logan, A First course in Finite Element Method, Thomson Learning
10. Thirupathi R Chandrupatla and Ashok D. Belagundu, Introduction to Finite Elements in Engineering, Pearson Education.
11. David V Hutton, Fundamentals of Finite Element Analysis, THM.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.604 HEAT AND MASS TRANSFER

L-T-D: 3-1-0 **Credits : 4**

Module I

Modes of Heat Transfer: Conduction: Fourier law of heat conduction-Thermal conductivity of solids, liquids and gases-Factors affecting thermal conductivity- Most general heat conduction equation in Cartesian, cylindrical and spherical coordinates-One dimensional steady state conduction with and without heat generation-conduction through plane walls, cylinders and spheres-variable thermal conductivity-conduction shape factor- heat transfer through corners and edges. Transient heat conduction-lumped heat capacity method

Module II

Convection heat transfer: Newton's law of cooling-Dimensional analysis-Buckingham's Pi theorem- Application of dimensional analysis to free and forced convection- empirical relations- problems using empirical relations Elementary ideas of hydrodynamics and thermal boundary layers. Combined conduction and convection heat transfer - overall heat transfer coefficient - critical radius of insulation. Fins: Types of fins - Heat transfer from fins of uniform cross sectional area- Fin efficiency and effectiveness. Heat exchangers: Types of heat exchangers-LMTD method- effectiveness- NTU method. Boiling and condensation heat transfer (elementary ideas only). Introduction to heat pipe

Module III

Radiation- Nature of thermal radiation-definitions and concepts- monochromatic and total emissive power-Intensity of radiation- solid angle- absorptivity, reflectivity and transmissivity-Concept of black body- Planck' law- Kirchoff's law- Wein's displacement law-Stefan Boltzmann's law- black, gray and real surfaces-Configuration factor (derivation for simple geometries only)- Electrical analogy- Heat exchange between black/gray surfaces- infinite parallel plates, equal and parallel opposite plates-perpendicular rectangles having common edge- parallel discs (simple problems using charts and tables). Radiation shields(no derivation). Mass Transfer : Mass transfer by molecular diffusion- Fick's law of diffusion- diffusion coefficient-Steady state diffusion of gases and liquids through solid- equimolar diffusion-Isothermal evaporation of water through air- simple problems-Convective mass transfer- Mass transfer through boundary layer- evaluation of mass transfer coefficient- empirical relations- simple problems- analogy between heat and mass transfer.

Data book: Heat and Mass Transfer data book: C.P,Kothandaraman, S, Subramanya, New age International publishers

References:

1. Yunus A Cengel, Heat Transfer: A Practical Approach, Tata McGraw Hill Inc., New York
2. Holman J P, Heat Transfer, McGraw Hill Inc., New York,
3. Frank P. Incropera and David P. Dewitt, Heat and Mass Transfer. John Wiley and sons
4. R.K.Rajput. Heat and mass transfer , S.Chand & Co.
5. Kothandaraman C P, Fundamentals of Heat and Mass Transfer, Second Edition, New Age International Publishers,
6. Sachdeva R C, Fundamentals of Engineering Heat and Mass Transfer,
7. Nag P K., Heat and Mass Transfer, Tata McGraw Hill Publishing Company.
8. S.P.Venketashan, Heat Transfer, Ane books

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.605 DESIGN OF MACHINE ELEMENTS I

L-T-D: 3-1-0 **Credits : 4**

Module I

Introduction to design - steps in design process - design factors - tolerances and fits - principles of standardisation – Materials and their properties- Elastic and plastic behaviour of metals- ductile and brittle behaiour-true stress and true strain- stress strain curves- Selection of materials – stresses in machine parts- tension,compression, shear, bending, and torsional stresses, combined stress- stress concentration – stress intensity factor- Fracture toughness-factor of safety- margin of safety-variable stress-endurance limit-fatigue factor-theories of failure – combined steady and variable stress-Gerber, Goodman, Soderberg method- impact load - fatigue loading - consideration of creep and thermal stresses in design

Module II

Design of Pins, keys, splines and cotters. Thread standards - stresses in screw threads, Power screw- analysis of power screws.

Design of bolted joints - preloading of bolts- shaft couplings, - stresses in couplings - design of couplings. Welded joints - types of welded joints - stresses in butt and fillet welds - torsion and bending in welded joints - welds subjected to fluctuating loads - design of welded machine parts and structural joints

Module III

Pressure vessels, thin cylinders, Thick cylinder equation, Hydraulic accumulators. Compound Cylinders. Springs: classification and use of springs- spring materials- stresses in helical springs - deflection of helical springs - extension, compression and torsion springs - design of helical springs for static and fatigue loading - critical frequency of helical springs - design of leaf springs.

Power shafting - stresses in shafts - design for static loads - reversed bending and steady torsion - design for strength and deflection - design for fatigue loading

Design Data hand books

Prof. Narayana Iyengar B. R. & Dr Lingaiah K., *Machine Design Data Handbook,* Vol. I &II

P.S.G., Tech., *Machine Design Data Handbook*

Design data Book -K. Mahadevan – C.B.S Pub.

References

1. Shigley J.E., *Mechanical Engineering Design*, McGraw Hill Book Company
2. Siegel, Maleev & Hartman, *Mechanical Design of Machines*, International Book Company
3. Phelan R.M., *Fundamentals of Mechanical Design,* TMH, Ltd.
4. Doughtie V.L., & Vallance A.V., *Design of Machine Elements*, McGraw Hill Book Company
5. Juvinall R.C. & Marshek K.M., *Fundamentals of Machine Component Design,* John Wiley
6. Machine Design Robert L Norton , Prentice Hall India
7. Design of machine elements M.F.Spotts, Prentice Hall India
8. Machine Design – Wentzell, Thomson Learning
9. Kulkarni S.G, Machine Design, THM
10. Ganesh Babu, Srithar, Design of Machine Elements, THM. Ganesh Babu, Srithar, Design of Machine Elements, THM.
11. Shigley et al., Mechanical Engineering Design, THM

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

Use of Design Data hand books allowed for reference during examinations

08.606 ELECTIVE II

Refer Elective Section:

08.607 CAD ANALYSIS LAB

L-T-D: 0-0-3 **Credits : 3**

I. Introduction to solid modeling and Finite Element Analysis softwares.
II. Exercises on modeling and assembly.
   a. Creation of higher end 3D solid models.
   b. Creation of assembled views of riveted joints, cotter joints and shaft couplings.

III. Exercises on the application of Finite Element Method to engineering systems:-
   a. Structural analysis.
   b. Thermal analysis.
   c. Fluid flow analysis.

University exam pattern:

Duration – 3 hrs.
The question paper shall consist of two parts .
Part A – 40 marks from modeling.
Part B – 40 marks from Assembly and/or Analysis.
Viva Voce – 20 marks

08.608 MACHINE TOOLS LAB

L-T-D: 0-0-3 **Credits : 3**

Study of Milling Machines and Milling Cutters
Study of Grinding machines, Surface and Cylindrical grinding machines –
Study of Drilling machines
Study of CNC machines and Manual part programming

Exercises on Milling machines-face milling, end milling – spur and helical gear cutting – milling of keyways
Exercise on Grinding and Drilling Machines.
Exercises on CNC lathe : Turning, Taper turning, Thread cutting, Ball and cup turning.
Exercises on CNC Milling machine: Surface milling, Pocket milling, Contour milling and Drilling.

SEMESTER VII

08.701 PRINCIPLES OF MANAGEMENT AND DECISION MODELLING (MPU)

L-T-D: 2-1-0 **Credits : 3**

Module- I

Evolution of Scientific management :- Principles and functions of scientific management, Concept of pre modern, modern and post modern management, Levels and skills of management.

Organisational structure:- Authority, responsibility and span of control - system concept of management – Line, Line and staff, project and matrix organization.

Formation of companies:- Proprietary Partnership and joint stock companies – private limited, public limited companies, cooperative organizations and Government organizations.

Module- II

Facilities planning:-Selection of site- factors to be considered – plant layout, different types, process, product, fixed group technology layout. Layout planning, computerized planning techniques.

Personal management:- objectives and function-recruitment, selection, orientation and training of workers – Industrial safety and health-Labour welfare –Industrial psychology –Labour legislation.

Sales management:- Objectives and function - forecasting of demand-different methods (simple problems). Marketing: Concepts, marketing environment, -Market segmentation-marketing mix-product life cycle.

Module III

Quantitative techniques in management:- linear programming and its application in management, transportation and assignment problems - Decision making : statistical decision theory, decision tree, Game theory and its applications. Queing theory: Single server models- network theory – CPM – crashing of networks, PERT – probability of completion.

References:

1. T N Chabra, Principles & Practice of Management, Dhanpat Rai Pub.
2. M. Mahajan Industrial Engineering & Production Management, Dhanpat Rai Pub.
3. O P Khanna, Industrial engineering and management.
4. Hillier and Lieberman, Fundamentals of operation research.
5. C.R. Basu, Business Organisation & Management, Tata Mc Graw Hill.
6. Tripathi & Reddy, Principles of Management, Tata McGraw Hill.
7. Fraidoon Mazda, Engineering Management, Pearson Edn. Asia.
8. Bernaud W Taylor III, Introduction to management science, Pearson Edn.,Asia.
9. Koontz & Weihrich, Essentials of Management, THM.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.702 MECHATRONICS (MPU)

L-T-D: 3-1-0 **Credits : 4**

Module I

Introduction to Mechatronics – Sensors and transducers: characteristics. Displacement and position sensors. Resolvers and synchros. Velocity and motion sensors. Principle and types of force, temperature, vibration and acoustic emission sensors. Pneumatic, hydraulic and mechanical actuation systems used for mechatronics devices.

Micro Electro Mechanical Systems (MEMS): Fabrication methods - Working and applications of MEMS based accelerometer, pressure sensor and gyroscope

Module II

Design of modern Computer Numerical Control (CNC) machines and mechatronics elements - Machine structure: guide ways, drives. Bearings: anti-friction bearings, hydrostatic bearing and hydrodynamic bearing. Roller and ball screws. Measuring system for NC machines: direct and indirect measuring system.

System modeling - Mathematical models and basic building blocks of general mechanical, electrical, fluid and thermal systems.

Adaptive control of machine tools. Programmable Logic Controllers (PLC) – Architecture, input/output processing, development of simple ladder diagrams.

Module III

Mechatronics in Robotics-Electrical drives: DC, AC, brushless, servo and stepper motors. Harmonic drive. Force and pressure sensors: piezoelectric sensor and strain gauge. Tactile sensor. Proximity sensors: Magnetic, optical, ultrasonic, inductive, capacitive and eddy current methods. Range finders: ultrasonic and light based range finders. Robotic vision - Image acquisition: Vidicom and charge coupled device (CCD) cameras. Image processing techniques: histogram analysis, thresholding and connectivity method..

Case studies of mechatronics systems: Pick and place robot, automatic car park barrier system, automobile engine management system.

References

1. W. Bolton, *Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering*, Person Education Limited, New Delhi 2007.
2. HMT, *Mechatronics*, Tata McGraw-Hill Publishing Company Ltd., New Delhi 2004.
3. K.P. Ramachandran, G.K. Vijayaraghavan, M.S. Balasundaram. *Mechatronics: Integrated Mechanical Electronic Systems*. Wiley India Pvt. Ltd., New Delhi 2008.
4. David G. Aldatore, Michael B. Histand, *Introduction to Mechatronics and Measurement Systems*, McGraw-Hill Inc., USA 2003.
5. Vijay K. Varadan, K. J. Vinoy, S. Gopalakrishnan, *Smart Material Systems and MEMS: Design and Development Methodologies*, John Wiley & Sons Ltd., England 2006.
6. Saeed B. Niku, *Introduction to Robotics: Analysis, Systems, Applications*, Person Education, Inc., New Delhi 2006.
7. Gordon M. Mair, *Industrial Robotics*, Prentice Hall International, UK 1998.

University Examination

The question paper shall contain two parts. Part A and Part B. Part A shall contain 10 compulsory questions of 4 marks each, covering the entire syllabus (10 x 4 = 40).Part B shall contain 2 questions of 20 marks each from module I, II and III. One full question from each module has to be answered (3 x 20 = 60)

08.703 GAS DYNAMICS

L-T-D: 3-1-0 **Credits : 4**

Module I

Introductory Concepts to Compressible Flow- Concept of continuum-system and control volume approach- conservation of mass, momentum and energy- stagnation state- compressibility

Wave propagation- Acoustic velocity-Mach number-effect of Mach number on compressibility- Pressure coefficient-physical difference between incompressible, subsonic and supersonic flows- Mach cone-sonic boom-reference velocities-Impulse function-adiabatic energy equation-representation of various flow regimes on steady flow adiabatic ellipse.

One dimensional steady isentropic flow- Adiabatic and isentropic flow of a perfect gas- basic equations- Area-Velocity relation using 1D approximation-nozzle and diffuser-mass flow rate-chocking in isentropic flow-flow coefficients and efficiency of nozzle and diffuser- working tables-charts and tables for isentropic flow.

Module II

Flow in a constant area duct with friction (Fanno Flow) – Governing Equations- Fanno line on h-s and P-v diagram- Fanno relation for a perfect gas- Chocking due to friction-Isothermal flow(elementary treatment only)-working tables for Fanno flow.

Flow through constant area duct with heat transfer (Rayleigh Flow)-governing equations- Rayleigh line in h-s and P-v diagram-Rayleigh relation for perfect gas- maximum possible heat addition-location of maximum enthalpy point- thermal chocking- working tables for Rayleigh flow.

Model III

Irreversible discontinuity in supersonic flow- one dimensional shock wave- stationary normal shock- governing equations- Prandtl- Meyer relations- Shock strength- Rankine- Hugoniot Relation- Normal Shock on Fanno, Rayleigh curves- working formula- curves and tables-moving normal shock (elementary treatment only)- operation of nozzle under varying pressure ratios- two dimensional shock waves- Oblique shock waves-supersonic flow over a compression and expansion corner (basic idea only).

Compressible flow field visualization and measurement- shadowgraph-Schlieren technique- interferometer- subsonic compressible flow field measurement (Pressure, Velocity and Temperature) - compressibility correction factor- hot wire anemometer- supersonic flow measurement-Rayleigh Pitot tube- wedge probe- stagnation temperature probe- temperature recovery factor.

References

1. Shapiro, Dynamics and Thermodynamics of Compressible flow – Vol 1.
2. S.M. Yahya, Fundamentals of compressible flow.
3. P. Balachandran, Fundamentals of compressible fluid dynamics.
4. E. Rathakrishnan, Gas Dynamics.
5. S M Yahya, Gas Tables.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.704 REFRIGERATION AND AIR CONDITIONING

L-T-D: 3-1-0 **Credits : 4**

Module I

Introduction – Brief history and applications of refrigeration.. Thermodynamics of refrigeration- reversed Carnot cycle- heat pump and refrigeration machines. Unit of refrigeration- Air refrigeration systems- Limitations of reversed Carnot cycle, Reversed Joule cycle, Air craft refrigeration systems, simple bootstrap- Regenerative and reduced ambient system- Vortex tube refrigeration-Very low temperature refrigeration systems (concept only). Adiabatic demagnetization of paramagnetic salts. Vapour compression systems-simple cycle - representation on T- s and P- h Diagrams. COP- Effect of operating parameters on COP – methods of improving COP of simple cycle- super- heating , under cooling, Liquid suction heat exchanger-actual cycle. Multi pressure systems - multi compression and multi evaporator systems. Inter cooling - flash inter cooling and flash gas removal- Different combinations of evaporator and compressor for different applications, Cascade system

Module II

Vapour absorption systems - Ammonia – water system - simple system- drawbacks-Lithium Bromide water system- Electrolux- comparison with vapour compression system- steam jet refrigeration. Refrigerants and their properties-Eco-friendly Refrigerants, mixed refrigerants, selection of refrigerants for different applications. Application of refrigeration- domestic refrigerators- water coolers- ice plants. Cold storages- food preservation methods- plate freezing , quick-freezing. Refrigeration system components- Compressors, condensers, expansion devices, evaporators. Cooling towers- Different types and their application fields- Refrigerant leakage and detection – charging of refrigerant – system controls.

Module III

Air conditioning – meaning and utility, comfort and industrial air conditioning. Psychometric properties- saturated and unsaturated air, dry, wet and dew point temperature – humidity, specific humidity, absolute humidity, relative humidity and degree of saturation- thermodynamic equations- enthalpy of moisture- adiabatic saturation process -psychrometers. Thermodynamic wet bulb temperature-psychometric chart- Psychometric processes- adiabatic mixing- sensible heating and cooling- humidifying and dehumidifying, air washer – bypass factor- sensible heat factor-RSHF and GSHF line- Design condition- Apparent dew point temperature – Choice of supply condition, state and mass rate of dehumidified air quantity – Fresh air supplied –air refrigeration. Comfort air conditioning- factors affecting human comfort. Effective temperature – comfort chart. Summer air conditioning- factors affecting-cooling load estimation . Air conditioning systems- room air conditioner- split system-packaged system-all air system-chilled water system. Winter air conditioning – factors affecting heating system, humidifiers . Year round air conditioning AC system controls-thermostat and humidistat. Air distribution systems- duct system and design- Air conditioning of restaurants, hospitals, retail outlets, computer center, cinema theatre, and other place of amusement . Industrial applications of air conditioning .

References :

1. W.F. Stoecker, Refrigeration and air-conditioning.
2. C. P. Arora, Refrigeration and air-conditioning.
3. S. C. Arora and Domkundwar, Refrigeration and air-conditioning.
4. Manohar Prasad, Refrigeration and air-conditioning.
5. Dossat. R. J , Principles of Refrigeration.
6. P. L. Ballaney, Refrigeration and air-conditioning.
7. ASHRAE Handbook

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60

08.705 DESIGN OF MACHINE ELEMENTS II

L-T-D: 3-1-0 **Credits : 4**

Module I

Design of gears- nomenclature – spur, helical, bevel and worm gears - gear materials -tooth loads - design stresses -basic tooth stresses - stress concentration - service factor - velocity factor - bending strength of gear teeth - Lewis equation and Lewis form factor. Working stress in gear teeth- Dynamic load and wear load on gear teeth- Buckingham's equation for dynamic load - surface strength and durability - heat dissipation - design for strength and wear, Design of spur gear, Helical gear, bevel gear and worm gear-AGMA standards.

Module II

Bearing and Lubrication-Journal bearing-Introduction to lubrication – types of lubrication and lubricants - viscosity - Hydrodynamic bearings-Sommerfield Number, L/D ratio, Clearance ratio- Minimum film thickness-bearing materials-Hydrostatic bearings. Rolling contact bearings - bearing types - Ball & roller bearings- Static and Dynamic load capacity- Equivalent dynamic load-Bearing life- Stribeck's equations, selection of bearings.

Module III

Design of I.C engine parts-cylinder, piston connecting rod, Crankshaft, Flywheel. Friction and power loss in pivots and collars, clutches-dog clutch-selection of single plate ,multiple plate and cone clutches, centrifugal clutch.

Design Data hand books

1. Prof. Narayana Iyengar B.R. & Dr Lingaiah K., Machine Design Data Handbook
2. P.S.G., Tech., *Machine Design Data Handbook*
3. K. Mahadevan, Design data Book, C.B.S Pub.

References:

1. M.F Spotts, Design of Machine Elements, Prentice Hall of India,
2. J.E. Shigley, Machine Design, Mc Graw Hill Book Co.
3. Sadhu Singh, Machine Design, Khanna Pub.
4. P.C Sharma and DK Aggarwal, Machine Design, S.K/Kataria & sons.
5. R.S. Kurmi & J.K. Gupta, A Textbook of machine design, Eurasia Pub.
6. Rajendra Karwa, A Textbook of machine design, Lakshmi Pub.
7. John F. Harry, Design of pressure vessels.
8. Phelan R.M, Fundamentals of Mechanical Design, Tata McGraw Hill Pub. Co. Ltd
9. Juvinall R.C. & Marshek K.M, Fundamentals of Machine Component Design.
10. Wentzell, Machine Design Thomson Learning.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

Use of Design Data hand books allowed for reference during examinations

08.706 ELECTIVE III

Refer Elective Section:

08.707 THERMAL ENGINEERING LAB

L-T-D: 0-0-2 **Credits : 2**

2. Performance analysis of parallel flow, Counter flow and cross flow heat exchangers.
3. Determination of heat transfer coefficients using forced and free convection apparatus.
4. Conduction heat transfer analysis of
    a) Plane composite walls
    b) Cylindrical composite walls
5. Determination of emissivity
6. Study and Performance Analysis of
    a) Reciprocating compressor
    b) Rotary compressor
    c) Blowers
7. Test on refrigeration and air conditioning equipment.
8. Calibration of Thermocouples
9. Calibration of Pressure gauge
10. Velocity profile using pitot tube.
11. Determination of Stefan Boltzman constant
12. Determination of Thermal conductivity of liquids
13. Experiment on Heat pipe

08.708 MECHANICAL ENGINEERING LAB

L-T-D: 0-0-2 **Credits : 2**

Metallurgy:

1. Study of Metallurgical Microscope and Polishing Machines
2. Microstructure study of Mild steel, Cast iron, , Brass and Aluminium and heat treated steel.

Metrology:

1. Study and experiment using profile projector
2. Study of various measuring instruments like micrometers and calipers
3. Experiment to test flatness
4. Experiment to test roundness
5. Measurement of angle using sine bar
6. Experiment on Autocollimator
7. Study and Experiment on Tool Maker's microscope
8. Experiment on LVDT
9. Experiment on Acceptance sampling

CIM

1. Study and testing using Tool Dynamometer
2. Experiment on Robotics (Robot Programming)
3. Experiment on PLC

08.709 PROJECT AND SEMINAR (MPU)

L-T-D: 0-0-2 **Credits : 2**

The Students shall do a project work, which can be the preliminary work of final project, and submit a report at the end of semester.
The students shall present a seminar on a topic which is of high relevance to Mechanical Engineering. A report on seminar also shall be submitted at the end of the semester. 25% credit should be given for Project , and 75% credit for Seminar.

SEMESTER VIII

08.801 ENERGY MANAGEMENT (MPU)

L-T-D: 2-1-0 **Credits : 3**

Module I

Energy conversion processes and devices – Energy conversion plants – Conventional (Thermal, Hydro, Nuclear fission) and Non – conventional (Biomass, Fuel cells and Magneto Hydrodynamics) – Energy storage and Distribution – Electrical energy route – Load curves – Energy conversion plants for Base load , Intermediate load, Peak load and Energy displacement – Energy storage plants, Energy from waste, Energy plantation.

Module II

Energy Management – Definitions and significance – objectives – Characterising of energy usage – Energy Management program – Energy strategies and energy planning – Energy Audit – Types and Procedure – Optimum performance of existing facilities – Energy management control systems – Energy policy in India – Computer applications in Energy management

Module III

Energy conservation – Principles – Energy economics – Energy conservation technologies – cogeneration – Waste heat recovery – Combined cycle power generation – Heat Recuperators – Heat regenerators – Heat pipes – Heat pumps – Pinch Technology

Energy Conservation Opportunities – Electrical ECOs – Thermodynamic ECOs in chemical process industry – ECOs in residential and commercial buildings – Energy Conservation Measures.

References:

1. T.D.Eastop and D.R. Croft, Energy Efficiency for Engineers & Technologists, Longman Group Ltd.
2. Albert Thumann, P.E, C.E.M and WIliam.J.Younger, C E.M, Handbook of Energy Audits, Fairmont Press Ltd.
3. Wayne.C.Turner , Energy Management Hand book, Fairmont Press Ltd.
4. S.Rao and Dr.B.B.Parulekar, Energy Technology, Khanna Publishers.
5. G.D. Rai, Non – conventional Energy Sources, Khanna Publishers.
6. P.K. Nag, Power Plant Engineering, TMH.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.802 INDUSTRIAL ENGINEERING (MPU)

L-T-D: 2-1-0 **Credits : 3**

Module I

Introduction to Industrial Engineering – Evolution of modern Concepts in Industrial Engineering – Functions of Industrial Engineering – Field of application of Industrial Engineering Product Development and research- Design function – Objectives of design, - Manufacturing vs purchase- Economic aspects C-V-P analysis - Development of designs- prototype, production and testing – Selection of materials and processes- Human factors in design- Value Engineering, Job plan. Introduction to Flexible manufacturing systems, Plant layout and Material handling- principles of material handling, Types of material handling equipments, Selection and application. Preventive and break- down maintenance - Replacement of equipments- Method of providing for depreciation- Determination of economic life - Simple problems.

Module II

Methods engineering: Analysis of work methods using different types of process chart and flow diagrams- Critical examination- Micro motion study and therbligs- SIMO chart- Principles of motion economy – determination of allowances and standard time. - Job evaluation and merit rating – Objectives and principles of job evaluation- merit incentive plan – Merit rating plans.

Wages and Incentives- Primary wage systems- Time rate and piece rate system of wage payment- Incentive plans- essentials of a good wage incentive plan- Non monitory incentives.

Industrial relations- Psychological attitudes to work and working conditions - fatigue- Methods of eliminating fatigue- Effect of Communication in Industry, causes effects of industrial disputes- Collective bargaining- Trade union – Workers participation in management.

Module III

Production planning and control- Importance of planning – job, batch and mass production- Determination of economic lot size in batch production- Functions of production control – Routing , Scheduling, dispatching and follow up- Gantt charts. Inventory Control, Inventory models -Determination of EOQ and reorder level, selective inventory control techniques.

Quality control and Inspection- Destructive and non-destructive testing methods- process capability- Statistical quality control and control charts for X and R. (Simple problems without using SQC table)

Acceptance sampling and operation characteristic curves- System reliability- life testing-Bath tub curve.

Introduction to concepts of Bench marking, TQM, ISO, Six Sigma and Quality circles (Brief description only).

References:

1. O. P. Khanna, Industrial Engineering and Management.
2. Ralph and Barien, Time and Motion Study
3. Grant and Ieven Worth, Statistical Quality Control.
4. E. S. Buffa, Modern Production management.
5. M Mahajan, Industrial Engineering & Production Management, Dhanpat Rai Pub.
6. Martand Telsang, Industrial Engineering & Production Management, S. Chand.
7. B. Kumar, Industrial Engineering Khanna Pub.
8. Introduction to work study - ILO

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.803 AUTOMOBILE ENGINEERING

L-T-D: 3-1-0 **Credits : 4**

Module I

Automobiles- History and Classification of Automobiles- different types of power units. Constructional details of reciprocating type power unit- multi cylinder engines: Cylinder block- crank case- cylinder liners- cylinder head- pistons- piston pins- piston rings- connecting rod, crank shaft- cam shaft- different types of valve operating mechanism- OHV, OHC side valve, Variable valve timing. Cooling System: Introduction- requirement of cooling system- direct- indirect cooling- Thermo siphon-pumped circulation- pressurized cooling – Radiator- radiator cap- use of thermostat-water circulating pump- cooling fan- types of fan drive. Lubrication: Main functions of lubricating system- properties of lubricants- different methods of engine lubrication-Petrol – Splash- pressure – wet sump- Dry sump. Air- fuel systems: Air filter- fuel filter- mechanical- electrical feed pumps (AC & SU) Carburetor- down- horizontal – up draft- constant and variable choke- modern carburetor- different circuits- Petrol injection system-MPFI-Contact point ignition system-electronic ignition system. Diesel engine fuel circuit- injector pumps- (constant and variable stroke- rotary pump)-CRDI system- fuel injector Electrical systems . Starter motor- different types of starter drive- Bendix- solenoid shift- over running clutch- Ignition system- Magneto coil- battery coil- electronic- spark advance- centrifugal- vacuum- spark plugs – Fuel gauge – direction indicator – wind screen wiper.

Module II

Transmission Systems : Clutch- single plate dry- multiplate wet- Constructional details of single plate dry Clutch- Automatic Clutch- centrifugal – semi centrifugal-magnetic- diaphragm- fluid coupling- Torque converters. Gear boxes- constant mesh-synchromesh- propeller shaft- front wheel- rear wheel drive- Hook's slip joints-differential unit- hypoid drive- details- non- slip differential – Axles- dead live- different types of rear live axles- semi floating- three quarter floating – full floating – four wheel drive. Automatic transmission: Epicyclic Gear box- Semi automatic pre-selector gear box- Brog warmer, Hobbs and smiths transmissions- over drive. Variomatic transmission used in two-wheelers.

Module III

Braking System: Mechanical, Hydraulic, Pneumatic brakes- internal expanding shoe-disc breakers- master Cylinder- wheel cylinder – power brakes- Steering systems-Steering Geometry – Castor- camber- king- pin inclination- toe in and toe – out- front wheel steering, rear wheel- four wheel steering, fifth – steering gears- worm and wheel- screw and nut recirculating ball- cam and roller- rack and pinion- power steering. Chassis and suspension: Construction of chassis- frame – body-suspension- independent- torsion bar- coil spring- leaf spring-chassis lubrication-Types wheels- integrated rim- flat base rim- Tyres. Exhaust emission- pollution control – low polluting engines- stratified charge engine-method of charge stratification. Hybrid vehicles. Automotive air-conditioning

References

1. Joseph Hietner, Automotive Mechanics, East- West Press Pvt. Ltd, Madras.
2. Station Abby, Practical Automobile Engineering, Asia Pub. House).
3. A.W. Judge, Modern Transmission System.
4. W. H. Crouse, Automotive Emission Control.
5. Edward F. Obert., Internal Combustion Engine and Air Pollution.
6. Kirpal Singh, Automobile Engineering- Vol. I & II, Standard Publishers Distributors, Delhi.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.804 COMPUTER INTEGRATED MANUFACTURING (MU)

L-T-D: 3-1-0 **Credits : 4**

Module I

CIM- Meaning and scope of CIM, Nature of CIM systems, Types of manufacturing systems-Computers in manufacturing- needs of CIM- CAM software, CIM software- manufacturing automation protocol (MAP)- Date base technology-basic concepts, requirements, Types-Data base management-DBMS- RDBMS.

CAD-areas of application-benefits, CAE-CAPP-Elements of CAPP system, advantages of CAAP- MRP.

Module II

NC machines- Types – Point- to point, straight cut and continuous path type-Open and closed loop controls-Accuracy of NC machines- Stick – Slip, Backlash. Antifriction bearings- linear guides.

Ball screws, stepper motor, servo meter, I V and PIV drives-CNC and DNC, Adaptive controls.

Part programming: Manual part programming, Preparatory and miscellaneous codes, Interpolation and canned cycle, Tool compensation, APT, Simple problems on turning and drilling.

Module III

Group Technology- Cellular manufacturing –FMS- JIT- communication networks in manufacturing. Robotics and material handling – Introduction, types- Programming- Robotic controls, Automated guided vehicles- types, Technology- AS/RS.

Role of management in CIM- Expert system, computer vision, concurrent Engineering.

References:

1. Mikell P Groover, CAD/CAM/CIM –- PHI
2. P. Radhakrishnan & S. Subramoniam, CAD/ CAM/CIM.
3. S. Kant and Vajpayeee, Principles of CIM, PHI
4. Kalpakijan, Manufacturing Engg & Technology.
5. Mikell P Groover, Industrial Robotics.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805 ELECTIVE IV

Refer Elective Section:

08.806 ELECTIVE V

Refer Elective Section:

08.807 INDUSTRIAL SEMINAR (MPU)

L-T-D: 0-0-2 **Credits : 2**

The Student shall present a Seminar based on industrial visits under taken from V-VII semesters. A minimum of four visits are compulsory. A report on industrial visits shall be submitted.
The institution shall arrange minimum four Seminars on latest topics by experts from Industry.
The student shall be evaluated based on the report on industrial visits, presentation, interaction, performance in the class and general awareness on topics of expert lectures

08.808 PROJECT AND VIVA VOCE (MPU)

L-T-D: 0-0-5 **Credits : 5**

A project work of good quality should be done under the guidance of project guide(s) and a project report should be submitted.

For internal assessment, 50% weightage to be given to the assessment of the guide and 50% to the committee assigned to assess the project work.

For University examination a Viva-voce examination shall be conducted. Marks of Viva voce examination shall be based on the overall performance, Project report, Seminar reports, Subject knowledge and general awareness in the developments in Mechanical Engineering.

ELECTIVE SECTION

LIST OF ELECTIVES

(Electives are common to Mechanical, Production and Automobile engineering branches unless otherwise specified in the title)

08. 506 Elective I

1. Communicative English and technical writing
2. Human aspects of management
3. Disaster Management
4. Glimpses of world thought
5. Professional ethics and human values
6. Environmental Science
7. Advanced Welding technology
8. Foundry Technology
9. Environmental Pollution Control
10. Advanced Fluid Mechanics
11. Composite Materials Technology
12. Internet Technologies
13. Non Destructive Testing
14. Powder Metallurgy
15. Vehicle Transport & Fleet Management
16. Automotive Airconditioning
17. Two And Three Wheeled Vehicles

08.606 Elective II	08.706 Elective III
1. Advanced mechanics of solids 2. New Energy systems 3. Object Oriented Programming 4. Nuclear Engineering 5. Mechanical working Methods 6. Artificial Intelligence Systems 7.System Modeling & Simulation 8. Instrumentation and control 9. Materials Handling 10. Agro Machinery 11. Total Quality Management 12. Precision Engineering 13 Advanced Manufacturing Processes 14. Material Characterisation 15. Micromachining Methods 16. Tool Engineering (MU) 17.Vehicle Body Engineering 18.Vehicle Performance And Testing 19.Automotive Fuels & Alternate Fuels	1. Computer Graphics 2. Advanced Thermodynamics 3. Industrial Heat Transfer 4. Plant Engg & Maintenance 5. Fracture Mechanics 6. Marketing Management. 7. Entrepreneurship Development 8. Industrial Hydraulics 9. Finite Element Methods 10. Metal Forming 11. Machine tool Technology 12.Non-conventional Machining Techniques 13. Turbo Machines 14 Experimental Methods in Engineering 15. Mech. Vibration & Noise Control 16. Failure Analysis 17. Theory of Machining (MU) 18. Bio Materials 19. Concurrent Engineering 20. Industrial Automation 21. Alternate Energy Sources 22. Automotive Pollution and Control 23. Creativity, Innovation and New Product Development

08. 805 Elective IV	08. 806 Elective V
1. Experimental Stress Analysis Techniques 2. Aerospace Engineering 3. Facilities Planning 4. Advanced Decision Modeling 5. Non linear Dynamics and Chaos 6. Design of jigs and fixtures 7. Multiphase flow 8. Controls in Machine tools 9. Design of Pressure Vessels & Piping 10. Tribology 11. Value Engineering. 12. Software Engineering 13. Cryogenic Engineering 14. Bio Medical Engineering. 15. Thermal Management of Electronic Systems 16. Continuum Mechanics 17. Product and brand management 18. Research Methodology 19. Nanotechnology 20. Automotive Technology (P) 21. High Temperature Materials 22. Industrial Safety Engineering 23. Engineering Design 24. Tractors & Farm Equipments 25. Embedded System In Automobiles 26. Computer Aided Vehicle Design	1. Propulsion Engineering 2. Industrial Refrigeration 3. Industrial Quality Control 4. Design of Heat transfer equipment 5. Creativity& Product Development 6. Computerized Materials Management 7. Random vibrations 8. Advanced Kinematics of Machines 9. Financial Management 10. Flexible Manufacturing Methods 11. Computational Fluid Dynamics 12. Technology Forecasting 13. Management Information Systems 14. Production & Operations Management 15. Project Management 16. Design of IC Engines 17. Robotics 18. Logistics and Supply Chain Management 19. Rapid Prototyping 20. Surface Engineering 21. Design of Cellular Manufacturing 22. Heating Ventilation and Air Conditioning Design 23. Automotive Aerodynamics 24. Off- Road Vehicles 25. Computer Simulation of IC Engine Processes.

ELECTIVE I

08.506.1 COMMUNICATIVE ENGLISH AND TECHNICAL WRITING

L-T-D: 3-1-0 **Credits : 4**

Module-I

Listening, Reading, Speaking and Writing skills.

Listening Skills: Listening for general content- Intensive listening-Listening for specific information.

Speaking Skills: Oral practice-Describing objects/situations/people-Role play-Just A Minute/Group Discussion- informal letters-essentials of telephonic conversation-invitations-minutes of a meeting.

Reading Skills: Skimming the text- exposure to a variety of technical articles, essays, graphic representation, and journalistic articles.

Writing Skills: Skills to express ideas in sentences, use of appropriate vocabulary - sentence construction-paragraphs development-note making-editing a passage and essay writing.

Basics of Technical Communication.

Technical communication- features, Distinction between general and technical communication- language as a tool of communication- levels of communication-interpersonal, organizational, mass communication-the flow of communication: upward, downward and lateral-importance of technical communication- barriers to communication.

Module-II

Forms of Technical communication.

Business letters-sales and credit letters, letter of enquiry, letter of quotation, placing order. Job application and resume. Official letters-govt. letters, letter to authorities. Reports-types, significance, structure and style, writing reports, condensing .Technical proposals-writing a proposal –the steps involved. Technical papers-projects- dissertation- thesis writing. Preparing audio-visual aids.

Module III

A non-detailed study of the autobiography: "Wings of Fire-an autobiography by Dr. APJ Abdul Kalam".

Students should read the book on their own and selected topics may be discussed in the class.

References.

1. Basic Communication Skills for Technology-Andrea J Rutherford. *Pearson Education.*
2. Business Correspondence and Report Writing- Mohan K and Sharma R C, TMH New Delhi.
3. Effective Technical Communication-Barun K Mitra. Oxford University Press, New Delhi.
4. Everyday Dialogues in English-Robert J Dixson, PHI.
5. English For Technical Communication, Vol. I &II. K R Lakshmi Narayanan-Sci Tech Publications.
6. Wings of Fire-an autobiography APJ Abdul Kalam.- Universities Press (2004)

University Examination:.

Six short questions to be answered out of 8 questions from Module I. Each answer carries 5 marks. (30 marks). Questions to be limited to the topics *Writing Skills& Basics of Technical Communication.* 2 questions out of 4 has to be answered from Module II. Each answer carries 15 marks. (30 marks).Two essays out of Four has to be answered from module III.. Each answer carries 20 marks. (40 marks).

08.506.2 HUMAN ASPECTS OF MANAGEMENT

L-T-D: 3-1-0 **Credits : 4**

Module1

Dimensions of Human Behaviour, Self development, Perception, Motivation and Personality-concepts, theories and applications .Modes of values, beliefs, attitudes and intelligents in determining human behaviour. Group dynamics-nature of groups and group decision making. Leadership –nature and significance ,theories and styles.Conflict management ,Transactional Analysis ,Case studies.

Module 2

Organizational development, Concepts of QWL-strategies for improved QWL, Organizational change, Resistance to change, Goals of organizational change and organizational development, Concept of organizational climate-health and effectiveness. Organizational culture- nature and characteristics, types, impact of culture in organizational behaviour, Motivation of person across cultures, Managerial leadership across cultures, Case studies.

Module 3

Human Resource Management –Concepts and objectives. Man power planning, Recruitment and selection, Training and development. Performance appraisal, Wage and salary administration, Grievance handling, Compensation policies, Safety and health maintenance, Labour legislation, Case studies.

References:

1. Fred Luthans ,Organizational Behaviour ,McGraw Hill.
2. Stephen P. Robbins, Organizational Behaviour ,Pearson Education.
3. Uma Sekharan, Organizational Behaviour-Text and Cases ,Tata Mc Graw Hill.
4. Gary Dessler,Human Resource Management ,Pearson Education.
5. Scott ,Personnel Management ,Tata Mc Graw Hill.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3x20=60)

08.506.3 DISASTER MANAGEMENT

L-T-D: 3-1-0 **Credits : 4**

Module I

Earth processes and natural disasters-significance of earth processes, natural hazards, risks and disasters. Basic principles of disaster management. Case histories of important natural disasters. Vulnerability assessment for earthquakes, floods, tsunamis, landslides and volcanoes. Human induced disasters.

Module II

Preparedness and mitigation measures for earthquakes, floods, tsunamis, landslides and volcanoes with special reference to construction of residential buildings and public utility buildings. Disaster mitigation planning of human settlements and townships for earthquakes, floods, tsunamis, landslides and volcanoes.

Module III

Issues in the prediction of natural disasters, land use practices and disaster mitigation. Integration of rural development programmes with natural disaster mitigation and planning. Information systems and decision making tools in disaster management. Disaster management in India.

References

1. Abbott, P.L(2001) Natural Disasters. 3rd Ed., McGraw Hill Company
2. Bryant,E.A(1991) Natural hazards. Cambridge University Press.
3. Murty, C.V.R. Earthquake tips
4. Ramakant Gaur(2008) Disaster management. GNOSIS, New Delhi, P. 172.

University Examination:

Duration: 3 hours

The question paper consists of Part A and Part B. Part A is for 40 marks. There will be 8 compulsory short answer questions of 5 marks each covering entire syllabus.

Part B is for 60 marks. There will be two questions from each module. The candidate has to answer one question of 20 marks from each module.

08.506.4 GLIMPSES OF WORLD THOUGHT

L-T-D: 3-1-0 **Credits : 4**

Module I

Introduction - Ancient Period - The History of 'ideas' - the earliest thinkers - *East and West* - Ancient Indian texts - *Vedas, Sutras, Sastras and Upanishds* - some early Greek thinkers - Anaxagoras, Ionians - other centres of learning in the ancient world - China, Egypt, South America - Mayars, Incars - Greek and Roman schools of thought **Medieval ages &Renaissance** - The Dark Ages - Renaissance Thinkers - Leornardo, Copernicus and Kepler - art and literary movements (school of paintings and other forms of reputation) - The Philosophy of science and the development of the Scientific Method - Arts Vs. Science - the flowering of academic disciplines - the science of 'knowledge' - the great intellectual debates - technology and revolutions - industrial and scientific revolution

Module II

The major schools of thought - positivism, nihilism, dialectical materialism - Marxism and its social, cultural and economic dimensions - revolutions in human perception - theories of human evolution - theories of human betterment theories of social analysis (French Revolution, October Revolution) - the great inventors and discoveries and their relation to human thought (Darwin's theory and growth of imperialism) - determinism, modernism and colonial theories.

Module III:

The modern era - structuralism - definition and implications in the various sciences - post-structuralism, post-modernism, Neo-Marxism and post-colonial theories - new disciplines - cognitive science - language, culture and cognition - current trends and issues - semiotics - the science of signs. Human values in Engineering.

References

1. Will Durrant, *The Story of Philosophy*, Simon & Schuster
2. Will Durrant, *The Pleasures Philosophy*, Silmon
3. Bertnard Russell, *History of Western Philosophy*, George Allen & Unwin
4. *Story of Civilisation - Volumes - Life of Grees*, (Excerpts) Oriental Heritage
5. Will & Ariel Durrent, *The Story of Civilisation,* Volume I to XII
6. Edward Gibbon, *The Rise and Fall of the Roman Empire*
7. Oswald Spingler, *Decline of the West*
8. Dr Radhakrishnan S., *The Creative Life*
9. Dr Radhakrishnan S., *The Present Crisis of Faith*
10. Dr Radhakrishnan S., *Our Heritage*
11. Dr Radhakrishnan S., *Religion and Culture*
12. Dr Radhakrishnan S., *Living With A Purpose*
13. Dr Radhakrishnan S., *True Knowledge*
14. Dr Radhakrishnan S., *Towards A New World*
15. Dr Radhakrishnan S., *Recovery of Faith*
16. *Dialogues of Plato*
17. Koide & Sawant, *Science & Scientific Method,* Prentice Hall
18. Alston, *Philosophy of Language*, Prentice Hall
19. Shaffer, *Philosophy of Mind,* Prentice Hall
20. Chisholm, *Theory of Knowledge,* Prentice Hall

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.506.5 PROFESSIONAL ETHICS AND HUMAN VALUES

L-T-D: 3-1-0 **Credits : 4**

Module I

HUMAN VALUES: Morals, Values and Ethics – Integrity – Work Ethic – Service – Learning – Civic Virtue – Respect for Others – Living Peacefully – Caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self Confidence – Character – Spirituality.

ENGINEERING ETHICS: Senses of "Engineering Ethics"– Variety of moral issues. Types of inquiry – Moral dilemmas – Moral autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of Professionals Roles – Theories about right action – Self interest – Custom and religion – Uses of ethical theories.

Module II

ENGINEERING AS SOCIAL EXPERIMENTATION: Engineering as experimentation - Engineering as responsible experimenters – Codes of ethics – A balanced outlook on law – The challenger case study.

SAFETY, RESPONSIBLITIES AND RIGHTS: Safety and risk – Assessment of safety and risk – Risk benefit analysis and reducing risk – The Three Mile Island and Chernobyl case studies.

Collegiality and loyalty – Respect for authority – collective bargaining – Confidentiality – Conflicts of interest – Occupational crime – Professional rights – Employee rights – Intel lectual property Rights (IPR) – Discrimination.

Module III

GLOBAL ISSUES: Multinational corporation – Environmental ethics – Computer ethics Weapons development – Engineers as managers – Consulting engineers and engineers as expert witness and advisor – Moral leadership – sample code of ethics like ASME, ASCE, IEEE – Institution of engineers (India) – Indian Institute of Materials Management – Institution electronics and telecommunication engineering (IETE) India etc.

References:

1. Jayashree Suresh, and B.S. Raghavan, Human Values and Professional Ethics, S. Chand & Co., New Delhi.
2. Mike W Martin and Schinzinger, Ethics in Engineering, Tata Mcgraw Hill.
3. John Ruth K, International Encyclopedia on Ethics, S.Chand &Co, New Delhi.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3x20=60)

08.506.6 ENVIRONMENTAL SCIENCE

L-T-D: 3-1-0 **Credits: 4**

Module I

Definition, Scope & Importance, Need For Public Awareness- Environment definition, Eco system – Balanced ecosystem, Human activities – Food, Shelter, Economic and social Security. Effects of human activities on environment-Agriculture, Housing, Industry, Mining and Transportation activities, Basics of Environmental Impact Assessment. Sustainable Development.

Module II

Natural Resources- Water Resources- Availability and Quality aspects. Water borne diseases, Water induced diseases, Fluoride problem in drinking water. Mineral Resources, Forest Wealth, Material cycles- Carbon, Nitrogen and Sulphur Cycles.

Energy – Different types of energy, Electro-magnetic radiation. Conventional and Non-Conventional sources – Hydro Electric, Fossil Fuel based, Nuclear, Solar, Biomass and Bio-gas. Hydrogen as an alternative future source of Energy.

Module III

Environmental Pollution and their effects. Water pollution, Land pollution. Noise pollution, Public Health aspects, Air Pollution, Solid waste management.

Current Environmental Issues of Importance: Population Growth, Climate Change and Global warming- Effects, Urbanization, Automobile pollution.

Acid Rain, Ozone Layer depletion, Animal Husbandry.

Environmental Protection- Role of Government, Legal aspects, Initiatives by Non-governmental Organizations (NGO), Environmental Education, Women Education. 3

REFERENCES:

1. Environmental Studies – Benny Joseph – Tata McgrawHill-2005
2. Environmental Studies – Dr. D.L. Manjunath, Pearson Education-2006.
3. Environmental studies – R. Rajagopalan – Oxford Publication - 2005.
4. Text book of Environmental Science & Technology – M. Anji Reddy – BS Publication.
5. Principles of Environmental Science and Engineering – P. Venugoplan Rao, Prentice Hall of India.
6. Environmental Science and Engineering – Meenakshi, Prentice Hall India.

University Examination:

Question Paper consists of two parts. In Part A, 10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). In Part B, 2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.506.7 ADVANCED WELDING TECHNOLOGY

L-T-D: 3-1-0 **Credits : 4**

Module I

Radiant energy welding: Electron Beam Welding- Background of the Process, Guns, Weld Environment, Welding in Different Degrees of Vacuum, Equipment and Safety, Joint Design, Applications, Laser Beam Welding, Process Parameters, Applications and Limitations.

Plasma arc welding: Plasma Arc Welding- theory and Principles, Transferred arc and Non-Transferred arc Techniques, Equipment and Tooling, Joint Design Advantages, Disadvantages, Economics, Materials and Applications.

Module II

Needle Arc Micro Plasma Welding - Characteristics of Process, Operating Characteristics, Fixturing and Joint Design Shielding, Weld Penetration and Shape, Applications.

Explosive Welding- theory and Key Variables, Parameters, Weld Quality, Equipment and Tooling, Advantages and Limitations, Joint Design, Materials and Applications. Adhesive Bonding- theory and Key Parameters, Physical Characteristics, Metal Adhesive, Equipment, Design, Economics of Process, Materials and Applications.

Module III

Friction and diffusion welding: Friction Welding- Basic Principles, Process Variants, Different Stages of Friction Welding, Mechanism of Bonding, Influence of Process Parameters, Weld Quality and Process Control, Joining of Dissimilar Materials, Advantages, Limitations and Applications.

Diffusion Welding- theory and Principle of Process, Key Variables, Intermediate Materials, Deformation Welding, Equipment and Tooling, Joint Design, Economics, Advantages and Limitations, Materials and Applications.

Vacuum brazing: Vacuum Brazing- theory, mechanisms and Key Variables, Equipment and Tooling, Stop-Off and Parting Agents, Advantages, Limitations, Economics Materials and Applications.

REFERENCES:

1. Schwartz M.M., “Metals Joining Manual”, McGraw-Hill Inc., 1979.
2. ASM Metals Hand Book “Welding and Brazing”, Vol. 6,ASM, Ohio, 1988.
3. Amar R.S., “Welding Processes and Technology”, Khanna Publishers, Delhi, 1998.
4. Rossi, Welding Engineering.
5. Udin et al., Metallurgy of Welding.
6. Teo goisky, The electric welder.
7. Welding Engineers Hand Book- ASHE Vol . I ,II , III and IV.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.506.8 FOUNDRY TECHNOLOGY

L-T-D: 3-1-0 **Credits : 4**

Module I

Casting as process of manufacture – Its advantages and limitations

Pattern making – Pattern materials – Factor effecting the choice of pattern materials – Pattern allowances – Types of pattern – Line diagram description and use of different types of patterns- colour codes of pattern .

Moulding process – Hand moulding tools and their uses – Different types of moulding boxes – Green sand moulds , dry hand moulds , Loan moulds , plaster moulds , cement bonded moulds – bench moulding , floor moulding and pit moulding .

Module II

Moulding sands : Natural sand , synthetic sand , sand mixing – General properties of moulding sand – testing of moulding sand – Ingredients for moulding sand - Special additives – Reliability of moulding sands - Maintenance of sand properties for regular use – Sand conditioning .

Cores and core making – Purpose of cores – core prints – Types of cores – Core sand and ingredients – Requirements of core sands – Core sand mixtures – Binding materials – Core boxes – Types of core boxes – Process of core making – Core baking , core creating , core reinforcing – core venting etc.

Gating and Risering – Solidification of pure metals and alloys in moulds – Factors affecting the nature and type of solidification – Gate and gating system – Types of gates – Deign of gating systems – Risering – Needs for risering – Requirements of a riser . Theoretical considerations – Riser shape and directional solidification – General considerations for risering – Bling riser – Use of chills , insulators and exothermic compounds .

Module III

Melting and pouring : Types of furnaces used for cast irons , steels and non ferrous metals – Composition , size and charge calculations – Details and calculations in Cupola charging – New developments in cupola design.

Mechanisation in foundry – Elementary ideas of machines used for sand conditioning, sand supply , moulding , core making . knockout and fottling .

Special moulding and Casting processes – Shell moulding , plaster mould casting – Investment casting ,CO_2 process –Graphite and ceramic moulds – Centrifugal casting – Continuous castings .

References

1. Hine and Resenthal, Principles of Metal Casting.
2. Howard, Modern foundry practice.
3. Camphell, Principles of Manufacturing materials and processes.
4. T.R.Bhanga, Foundry Engineering.
5. Russicof, Foundry practice.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.506.9 ENVIRONMENTAL POLLUTION CONTROL

L-T-D: 3-1-0 **Credits : 4**

Module I

Environmental aspects - Impact of environment - Environmental quality - Role of environmental engineer.

Air quantity - Definition, Characteristics and prospective - Types of our air pollutants - effect of air pollution on men and environment - Formation of air pollutants from combustion of fossil fuels and parameters controlling the formation.

Module II

Water pollution from tanneries and other industries - Engineered systems for waste water treatment and disposal - Control systems and instrumentation for pollution control.

Definition, characteristics - Types and sources of solid waste - Solid waste management - generation, collection, storage and processing techniques - Solid waste disposal.

Module III

Methods and equipment's for industrial waste treatment - Pollution thermal power plants and nuclear power plants - Sources and control methods - Emission from SI and CI engines - Evaporative emission control -Exhaust treatment devices - Noise pollution and their control.

References:

1. Howard S. Peavy, Donald R.Rowe, and George Tchobanoglous, " Environmental
2. Engineering ", (1985), Mc Graw Hill, New Delhi.
3. A.C.Stern, H.C.Wonter, R.W. Boubce and W.P.Lowry, “Fundamental of Air Pollution ", (1973), Academic Press.
4. Ikken P.A. Swart R.J. and Zwerves. S, " Climate and Energy ", (1989). Mc Graw Hill, New Delhi.
5. Metcalf and Eddy Inc, " Waste Water Engineering Treatment and Disposal Second Edition ", (1979), Mc Graw Hill, New York.
6. Wark, Kenneth and Cecil F.Warner, " Air Pollution: its Origin and Control ", (1976), Dun Dunnellers, New York.
7. Tchobanoglous.G, H.Theisan and R.Elaisen, " Solid Water: Engineering Principles and Management Issues ", (1977), Mc Graw Hill, New York.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.506.10 ADVANCED FLUID MECHANICS

L-T-D: 3-1-0 **Credits : 4**

Module I

Description of fluid motion – Lagrangian and Eulerian approaches, Velocity, gradient of velocity, rate of strain, stress, Newton's law of viscosity, Stokes hypothesis, acceleration, temporal acceleration, convective acceleration. Reynolds transport theorem, derivation of continuity and momentum equations using Reynolds transport theorem, Navier-Stokes equation for in-compressible flow, Stream function, rotation, vorticity, stream function-vorticity formulation, equation of potential flow.

Module-II

Derivation of Hagen Poissule equations for velocity and discharge through a pipe, derivation of friction factor for laminar flow, Couette flow for negative, zero and positive pressure gradients, flow in a rotating annulus, Viscometer based on rotating annulus. Potential flow, theory of complex variables, complex flow potential, complex flow potentials for source, sink, vortex and doublet. Potential flow past a cylinder,conformal mapping,flow over an ellipse, flow over a vertical flat plate, force and moment calculations (derivation of expression not required), Schawartz-Christoffel transformations, potential flow between two parallel plates, potential flow in a sector.

Module-III

Boundary layer theory,Boundary layer thickness, Displacement thickness and momentum thickness, Prandtl boundary layer equations, Blasius solution for flow over a flat plate,Momentum intergral equations,Pohlhausen approximation solution of boundary layer for non zero pressure gradient flow, favorable and adverse pressure gradients, flow separation, vortex shedding, introduction to turbulent flow, mean and fluctuating components, concept of eddy viscosity, short notes of velocity measurement technique using (a) multi hole probes (b) Hot wire anemometers (c) LDV (d) PIV

References:

1. K Muralidhar , G Biswas, Advanced Engineering Fluid Mechanics
2. H. Schlichting, K. Gersen , Boundary layer theory.
3. V.L.Streetor, Fluid mechanics
4. Vuan, Elements of fluid mechanics.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.506.11 COMPOSITE MATERIALS TECHNOLOGY

L-T-D: 3-1-0 **Credits : 4**

Module I

Composite Materials:- Definition, characteristics, Classifications based on structure and matrices, Structural, functional sensory and smart composites, Advantages and limitations, History, Industrial scene, Applications.

Introduction to micro-mechanics-unidirectional lamina – laminar stresses– inter laminar stresses - static mechanical properties - fatigue properties - impact properties - environmental effects - fracture mechanics and toughening mechanisms, damage prediction, failure modes. Failure predictions - design considerations - codes - design examples.

Module II

Fiber reinforced plastics: Reinforcement fibres:- High strength man made (glass, carbon, aramid) and natural fibres, Structure, characteristics, Properties and applications.

Whiskers:- Characteristics, properties and applications

Polymer matrix composites (PMC):- Thermo set, thermoplastic and e1astomeric polymers, their properties, characteristics and utilisation as matrices. Manufacturing methods for thermo set thermoplastic and elastomeric PMC. Their characteristic features. Properties of composites made and their applications.

Metal Matrix Composites (MMC): Metals. Inter-metallics and alloys used for MMC and their properties, Manufacture of MMC, their properties-characteristics and applications.

Module III

Ceramic Matrix Composites *(CMC):-* Classification of ceramics and their potential role as matrices. Ultra structure processing of ceramics, Manufacture, properties and applications of CMC using fine ceramics, carbon, glass, cement and gypsum as matrices.

Post processing operations:- Machining. cutting. polishing. welding of thermoplastic PMC. bonding. riveting and painting. Advanced post processing methods like ultrasonic welding, plasma coating, waterjet cutting and laser machining. Quality, inspection and non-destructive testing.

References

1. P.K.Mallicak, " Fiber-reinforced composites ", Monal Deklar Inc., New York, 1988.
2. B.D. Agarwal and L.J.Broutman, " Analysis and Performance of Fiber Composites ", John Wiley and Sons, New York, 1980.
3. F.L.Matthews & R.D.Rawlings, " Composite Materials, Engineering and Sciences ", Chapman & hall, London, 1994.
4. "Hand Book of Composites", George Lubin. Van _Nostrand, Reinhold Co. 1982.
5. "Encyclopaedia of Composites (6 volumes)", Ed. by Stuart, M. Lee. International, VCH, New York-1
6. Tasi. S.W., *Introduction to Composite Materials,* Technomic Publishing Company.
7. Chawla KK., *Ceramic Matrix Composites* Chapman & Hall
8. Schwartz M.M., *Composite Material handbook,* McGraw Hill, Inc.
9. Ronald Gibson, " Principles of Composite Material Mechanics ", TMH, 1994.
10. Micael hyer, " Stress Analysis of Fiber - Reinforced Composite Materials ", Tata McGraw Hill, 1998.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.506.12 INTERNET TECHNOLOGIES

L-T-D: 3-1-0 **Credits : 4**

MODULE I

Information Technology – Introduction – applications – The Internet and World wide web – the GPS.

The Computer Systems – Types, CPU – Memory – Input and Output devices – Inputing text and Graphics – Printing Devices – The foundation of Modern outputs – Printers – Secondary storage devices and media.

MODULE II

Software – User Interface and Operating systems – Types , File management , Utilities – Document – centric computing , Word Processing & Desktop publishing – Entering and Editing documents – Other word processing features – Formatting documents – desktop Publishing for print and for the screen .

Spread sheet applications – Data base applications – Queries – Internet connectivity.

Programs – Programming languages – Programming methods – Programming Techniques – System analysis and design .

MODULE III

The Electronic web – Network applications – Fax ,voice and Information services – Person to Person and group communication – Exchanging files – Foundations of modern networks – Local area networks – Wide area networks – Links between networks – Device and Media Protocols –Dial up Access – High bandwidth personal connections- Multimedia – Introduction – Tools – multimedia authoring Tools – Presentation device – Multimedia on the web.

IT in Business – Information processing – Transaction Processing – Computers for Management control , Marketing , Advertising , and sales – Design , Production and Manufacturing – Business on the Internet – Health Issues Associated with the use of computers – Computer viruses – Intellectual property rights – Computer crime – Cryptography – Issues caused by computers – Recent developments in IT.

REFERENCES

1. Dennis P. Curtin et al, Information Technology : The Breaking wave, Tata Mc. Graw Hill Pub.Co.
2. William Sawyor & Hutchingson, Using Information Technology, IRWIN Mc.Graw Hill Pub. Ltd.

Note :- This course is intended to provide an overview of fundamentals and concepts of IT useful to an undergraduate student in Mechanical Engineering only.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.506.13 NON DESTRUCTIVE TESTING

L-T-D: 3-1-0 **Credits : 4**

Module I

Introduction: Visual methods: Optical aids, In-situ metallography, Optical holographic methods, Dynamic inspection.

Penetrant flaw detection: Principles: Process: Penetrant systems: Liquid penetrant

materials: Emulsifiers: cleaners developers: sensitivity: Advantages: Limitations: Applications.

Module II

Radiographic methods and Limitations: Principles of radiography: sources of radiation, Ionising radiation - X-rays sources, gama-rays sources Recording of radiation: Radiographic sensitivity: Fluoroscopic methods: special techniques: Radiation safety.

Ultrasonic testing of materials: Advantages, disadvantages, Applications, Generation of Ultrasonic waves, general characteristics of ultrasonic waves: methods and instruments for ultrasonic materials testing: special techniques.

Module III

Magnetic methods: Advantages, Limitations, Methods of generating fields: magnetic particles and suspending liquids Magnetography, field sensitive probes: applications. Measurement of metal properties. Electrical methods: Eddy current methods: potential-drop methods, applications. Electromagnetic testing: Magnetism: Magnetic domains: Magnetization curves: Magnetic Hysteresis: Hysteresis-loop tests: comparator - bridge tests Absolute single-coil system: applications. Other methods: Acoustic Emission methods, Acoustic methods: Leak detection: Thermal inspection.

REFERENCES:

1. Non-Destructive Testing by P. Halmshaw
2. Metals Handbook Vol.II, Nondestructive inspection and quality control
3. Non-Destructive Testing by Warren J.Mcgomnagle, McGrawhill.
4. Non-Destructive Testing by Baldev Raj et. al., Narosa Publishing House.

University Examination:

Question Paper consists of two parts. In Part A, 10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). In Part B, 2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60).

08.506.14 POWDER METALLURGY

L-T-D: 3-1-0 **Credits : 4**

Module I

Manufacture of metal powders : Conventional methods and modern methods of metal powder manufacture. Purity of metal powders. Blending techniques. Powder characterization: problem of size determination. Method of size analysis and surface area assessment. Apparent density and flowability measurement.

Module II

Powder compaction: Mechanical, thermal and thermomechanical compacting processes. Presses used for transmission. Die design and tooling for consolidation of powders. New methods of consolidation. E.g. Powder rolling, Powder forging, Isostatic pressing. Advantages and limitations of these methods.

Module III

Theories of sintering: Sintering mechanism, Roll of diffusion, Recrystallization, Pore emigration, Pore-growth and coalescence. Liquid phase sintering and related processes. Effect of compacting pressure, sintering temperature and time on sintered properties. Types of sintering furnaces. Sintering atmospheres.

Manufacturing and application of important P/M components : Porous bearing, Electrical contact materials, Metallic filters, Cemented carbides, magnets, Friction materials and Composites.

REFERENCES:

1. Powder Metallurgy-ASM Vol. II.
2. Powder Metallurgy-Sands and Shakespeare.
3. Powder Metallurgy-Thumler
4. Powder Metallurgy-Dixtor R.H. and Clayton.
5. Powder Metallurgy-Gopal S. Upadhayay
6. Cemented Tungsten carbide Production, properties and testing,- Gopal S.Upadhayay.

University Examination:

Question Paper consists of two parts. In Part A, 10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). In Part B, 2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60).

08.506.15 VEHICLE TRANSPORT & FLEET MANAGEMENT

L-T-D; 3-1-0 **Credits 4**

Module I

Organization and management- Forms of ownership, principle of transport, management, internal organization, centralized & decentralized condition (Engineering, traffic and administration), administration, recruitment and training, welfare, health and safety.

Management Training and Operations- Basic principles of supervising, Organising Time and people, Job instruction training - Training devices and techniques - Driver and mechanic hiring - Driver checklist - Lists for driver and mechanic - Trip leasing

Module II

Route planning and Scheduling: Sources of traffic, town planning, turning points, stopping places, survey of rout, factors affecting frequency, direction of traffic flow, estimated traffic possibility. time table layout, use of flat graph method, preparation of vehicle and crew schedules, duty roaster, use of vehicle running numbers, determination of vehicle efficiency, checking efficiency of crew, duty arrangements, duty of drivers and conductors.

Vehicle maintenance, supply management and budget: Scheduled and unscheduled maintenace - Planning and scope - Evaluation of PMI programme – Work scheduling - Overtime - Breakdown analysis - Control of repair backlogs - Cost of options. Cost of inventory - Balancing inventory cost against downtime - Parts control - Bin tag systems – Time management - Time record keeping - Budget activity - Capital expenditures - Classification of vehicle expenses

Module III

Fleet Management, Data Processing And Fare Structure : Fleet management and data processing - Data processing systems - Software Model - Computer controlling of fleet activity - Energy management, Basis of fares, effect of competition and control, calculating average charge, zone systems, straight and tapered scales fare structure - Methods of fare collection - Preparation of fare table.

Motor vehicle act: Importance of motor vehicle act, Schedules and sections - Registration of motor vehicles - Licensing of drivers - Control of permits - Limits of speed - traffic signs - Constructional regulations - types of driving licenses, procedure for obtaining driving license, registration of vehicle, types of permits, procedure for obtaining permits, third party insurance.

References:

1. Rev. W. Faulks -Road and Coach Operation
2. John Dolu, "Fleet management ", McGraw-Hill Co., 1984.
3. Goverment Publication, "The Motor vehicle Act ", 1989.
4. Kitchin.L.D., " Bus operation ", llliffe and Sons Ltd., London, III Edition, 1992.
5. Kadiyali.L.R., " Traffic engineering and Transport Planning ".

University Examination:

Question Paper consists of two parts. In Part A, 10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). In Part B, 2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60).

08.506.16 AUTOMOTIVE AIRCONDITIONING

L-T-D; 3-1-0 **Credits 4**

MODULE I

Airconditioning Fundamentals: Definition of Air Conditioning, Psychrometry and air composition Adiabatic saturation and Thermodynamic wet bulb temperature Basic air conditioning system - Location of air conditioning components in a car - Schematic layout of a refrigeration system. Compressor components - Condenser and high pressure service ports. Thermostatic expansion value - Expansion value calibration - Controlling evaporator temperature - Evaporator pressure regulator - Evaporator temperature regulator.

MODULE II

Air Conditioner - Heating System: Automotive heaters - Manually controlled air conditioner - Heater system - Ford automatically controlled air conditioner and heater systems - Automatic temperature control - Air conditioning protection – Engine protection.

Refrigerant: Containers - Handling refrigerants - Tapping into the refrigerant container - Refrigeration system diagnosis - Diagnostic procedure - Ambient conditions affecting system pressures.

MODULE III

Air Routing & Temperature Control: Objectives - Evaporator care air flow through the Dash recirculating unit - Automatic temperature control – Duct system - Controlling flow - Vacuum reserve - Testing the air control and handling systems.

Air Conditioning Service: Air conditioner maintenance and service - Servicing heater system Removing and replacing components. Trouble shooting of air controlling system – Compressor service.

References:

1. William H Crouse and Donald L Anglin, " Automotive Air conditioning ", McGraw-Hill Inc., 1990.
2. Mitchell information Services, Inc, " Mitchell Automatic Heating and Air Conditioning Systems ", Prentice Hall Ind., 1989.
3. Paul Weiser, " Automotive Air Conditioning ", Reston Publishing Co Inc., 1990.
4. MacDonald, K.L., " Automotive Air Conditioning ", Theodore Audel series, 1978.
5. Leslie. F. Gamines &Boyce L. Dwiggins - Automotive Air Conditioning
6. Damkundwar - Refrigeration and Air Conditioning
7. C.PArora - Refrigeration and Air Conditioning -

University Examination:

Question Paper consists of two parts. In Part A, 10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). In Part B, 2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60).

08.506.17 TWO AND THREE WHEELED VEHICLES

L-T-D; 3-1-0 **Credits 4**

MODULE-I

General Introduction: Motor cycles, scooters, mopeds and three wheeled vehicles, classification, different arrangement of cylinders, carburetion system and operation. Power plants: Two stroke and four stroke, arrangements, engine ports, reed valves, valves and valve actuating mechanisms, valve timing, Types of scavenging processes, merits and demerits, scavenging efficiency. Scavenging pump,. Rotary valve engine lubrication and fuel supply systems in two wheelers, constructional features and types of oil seals, mufflers & silencers, Catalytic converters.

MODULE-II

Power transmission: Clutches, necessities, centrifugal clutch, multiple disc clutch, selective and progressive gear boxes, different types of synchronizers, gear drive, shaft drive and variable drive mechanisms and their constructional aspects. Electrical systems: Magneto ignition system, high tension and low tension magneto ignition, comparison with battery ignition system, electronic ignition systems like CDI, microprocessor controlled ignition system etc, starting motor, accessories horn, lighting system.

MODULE-III

Body: Constructional details of frames and front fork suspension systems, shock absorber systems, body manufacturer and paints & Painting methods
Brakes, Wheels and tyres: Drum brakes, Disc brakes, Front and rear brake links layouts. Spoked wheel, cast wheel. Disc wheel. Disc types. Tyres and tubes - Different types , constructional aspects, bearing system.
Case study of two and three wheelers: Salient features of modern two wheelers, Three wheelers – different types, layouts, transmission

References:

1. Irving.P.E., " Motor cycle Engineering ", Temple Press Book, London, 1992.
2. " The Cycle Motor Manual ", Temple PressLtd., London, 1990.
3. " Encyclopedia of Motor cycling, 20 volumes ", Marshall Cavensih, New York and London, 1989.
4. Bryaut.R.V., " Vespa Maintenance and Repair series ".
5. Raymond Broad, Lambretta - " A practical guide to maintenance and repair ", 1987.
6. Service Manuals of popular Indian two and three wheeled vehicles

University Examination:

Question Paper consists of two parts. In Part A, 10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). In Part B, 2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60).

ELECTIVE II

08.606.1 ADVANCED MECHANICS OF SOLIDS

L-T-D: 3-1-0 **Credits : 4**

Module I

Analysis of stress; State of stress at a point; Rectangular stress components; stress components on an arbitrary plane; Principal stress and Principal planes; Planes of maximum shear; State of pure shear; Differential equations of equilibrium in rectangular co-ordinates; Analysis of stress in two dimensions; Plane stress and plane strain. Transformation of stresses. Analysis of strain, strain-displacement relations–Principal strains and principal axes. Compatibility conditions. Stress-Strain relations.

Module II

Energy methods; Reciprocal relations; Maxwell-Betti-Rayleigh reciprocal theorem; Castigliano's I theorem; Fictitious load method; Theorem of virtual work; Castigliano's II theorem; Engessers theorem.

Bending of beams; Straight beams and asymmetrical bending; shear centre; shear stresses in thin walled open sections; Bending of curved bars (Winkler–Bach formula)

Module III

Torsion -Torsion of General prismatic bars; Torsion of circular, elliptic and equilateral triangular bars; Membrane analogy. Torsion of thin- walled tubes. Torsion of bars with narrow rectangular cross-section. Torsion of thin- walled multiple cell closed sections, Torsion of rolled sections, Center of twist and flexural centre.

References:

1. L.S Srinath, Advanced Mechanics of Solids, T.M.H
2. Timoshenko and Goodier, Theory of Elasticity, Mc Graw Hill.
3. S.M.A Kazimi , Solid Mechanics,T.M.H.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.606.2 NEW ENERGY SYSTEMS

L-T-D: 3-1-0 **Credits : 4**

Module I

Direct Energy Conversion Systems: Basic principles of thermoelectric and thermionic generations- Thermoelectric effects- Design and selection of materials.

Principle of MHD Generators – Choice of generator parameters – Applications.

Fuel cells- Thermodynamics of fuel cells- Selection of fuel and operating conditions- Practical fuel cells – The Redox cell- Merits and demerits. Photoelectric conversion – Conceptual Description of photovoltaic effect – Solar cell – Materials and prospects .

Module II

Nuclear fusion- Fusion fuels and reactions- Sustained fusion reaction- Production and containment of plasma – Fusion – breeder concept.

Solar energy – Terms and definitions- Applications- Solar collectors and Concentrations- performance analysis of flat plate collectors- Solar thermal devices – Solar power generation- Thermal storage. Ocean Power- Resources- Principle of OTEC systems- Ocean wave energy conversion systems- Tidal power.

Module III

Wind Energy- Fundamentals and Applications- Wind turbine- generator systems- Wind forms- Solar – wind hybrid.

Geothermal Energy- Energy resources – Geothermal electrical power plants – Non-electric applications- Biogas energy- Principle of biogas production- Biogas plants- Design and construction- socio- economic relevance.

Hydrogen- Introduction and Applications- Production, Storage and Transportation – production and application of methanol.

References :

1. R. A. Coobme – "An Introduction to Direct Energy Conversion", Isaac Pitman & Son Ltd.
2. Sheldon S. L. Chang – "Energy Conversion", Prentice Hall Inc.
3. Rao & Parulekar – " Energy Technology", Khanna Publishers.
4. G. D. Rai, "Non- Conventional Energy Sources"
5. Duff ice & Beckman, 'Solar Energy Thermal Processes", John wiley & Sons, New York.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.606.3 OBJECT OREINTED PROGRAMMING

L-T-D: 3-1-0 **Credits : 4**

Module I

OOPS and Java basics - Java virtual machine - Java platform API - extended security model - applet classes - exceptions and abstract classes - Java applet writing basics - GUI building with canvas - applet security - creating window applications - writing console applications - utility and math packages

Module II

Swing programming - working with swing components - using the clipboard - input/output streams - printing - working with 2D and 3D Graphics - using audio and video - creating animations

Java beans development kit - developing beans - notable beans - network programming - client and server Programs - naming and directory services - working with Java management APIS

Module III

Distributed application architecture - CORBA - RMI and distributed applications - working with remote objects - object serialization and Java spaces - Java IDL and ORBs, connecting to database - using JDBC - integrating database - support into web applications - Java servlets - JSDK - JAR files - Java native interface

References:

1. Campione, Walrath & Huml Tutorial team, "*The Java Tutorial Continued: The Rest of the JDK*", Addison Wesley
2. Jamie Jaworski, "*Java 2 Platform Unleashed: The Comprehensive Solution*", SAMS Teachmedia
3. Holzner S., *Java 2, Swings, Servlets, JDBC & Java Beans Programming*, IDG Books
4. Campione M. & Walrath K. " *The Java Tutorial: Object-Oriented Programming for the Internet*", Addison Wesley
5. Naughton Patrick & Herbert Schildt, "*Java 2: The Complete Reference",* Tata McGraw Hill

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.606.4 NUCLEAR ENGINEERING

L-T-D: 3-1-0 **Credits : 4**

Module I

Review of Elementary nuclear physics: Atomic structure – nuclear energy and nuclear forces – Nuclear fission.

Nuclear reactions and radiations – Principles of radio active decay interactions of an ray with matter – Neutron cross sections and reactions – The fission process – Chain reactions – Basic principles of controlled fusion .

Nuclear reactor principles – Reactor classification – Critical size – Basic diffusion theory - Slowing down of neutrons – Neutrons – Neutron flux and power – Four factor formula – Criticality condition – Basic features of reactor control .

Module II

Boiling water reactor . Description of reactor system – Main components – Control and safety features .

Materials of reactor construction – Fuel , moderator , coolant – Structural materials – Cladding –Radiation damage.

Nuclear fuels : Metallurgy of Uranium – General principles of solvent extraction – Reprocessing of irradiated fuel – Separation process fuel enrichment .

Module III

Reactor heat removal / equations of heat transfer as applied to reactor cooling – Reactor heat transfer systems – Heat removed in fast reactors .

Radiation safety : Reactor shielding – Radiation dozes – Standards of radiation protection – Nuclear waste disposal.

References

1. Classtone & Sesonske, Nuclear reactor Engineering –D Van Nostrand Co.
2. S Glasstono, Source book on atomic energy –. D.Van Nostrand Co

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.606.5 MECHANICAL WORKING METHODS

L-T-D: 3-1-0 **Credits : 4**

MODULE I

Introduction : Elements of mechanical processing systems – Definition of mechanical working – Hot and cold working – Comparison with other processing systems .

Elastic and plastic behaviour – Yielding and yield stress – Conventional stress – Strain curve and true stress-strain curve – Ductile and brittle behaviour – The flow curve. Energy and power requirements in plastic deformation – Factors affecting plastic deformation.– Deformation temperature – Rate of deformation – Friction and Lubrication.

Need for preheating- Need for heat treatments after mechanical working – Heat treatment methods – Furnaces for pre heating and heat treatment

MODULE II

Materials for mechanical working - A brief survey of the characteristics and composition of the common ferrous and non ferrous alloys and non metallic materials used for mechanical working .Rolling Metals – Fundamental principles of metal rolling classification of rolled products, types and sizes – Basic principles of draughting schedule design and roll pass design (simple examples) Roll load and power required in rolling – Problems encountered and defects in rolling practice.

MODULE III

Forging , Extrusion and Wire drawing – Principles of product design and die design in forging – Calculation of forging loads and selection of hammers and process for forging – Design of extrusion and wire – drawing dies – Computation of power requirements problems encountered and defects in the above processes .

Press working of metals – Description and classification of the processes – Product and die design for shearing , blanking drawing and bending – Compound and progressive dies – Computation of capacities and tonnage requirements for blanking ,piercing and drawing operations – Process selection and selection of process problems and defects in press working .

References:

1. Cambell, Principles of Manufacturing Materials and processing.
2. Alexander Brower, Manufacturing properties of Materials.
3. C B Cole , Tool Design.
4. ASTME, Fundamentals of tool design.
5. Richard Little, Metal Working Technology.
6. ASTME, The Design Handbook.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3x20=60)

08.606.6 ARTIFICIAL INTELLIGENCE SYSTEMS

L-T-D: 3-1-0 **Credits : 4**

Module I

Definition - history and applications - propositional calculus - predicate calculus - inference rules - structures and strategies for state space search - heuristic search algorithms - heuristics in games - complexity issues - control and implementation of state space search - production systems - planning - the blackboard architecture

Module II

Knowledge intensive problem solving - expert system technology - rule-based expert systems - model based reasoning - case based reasoning - knowledge representation problem - reasoning with uncertain or incomplete information - statistical approach - non-monotonic systems - fuzzy sets - knowledge representation - languages - issues - network representation - conceptual graphs - structured representation

Module III

Languages and programming techniques for AI - overview of LISP - search - higher order functions and procedural abstractions - search strategies - pattern matching - recursion - interpreters - logic programming in LISP - streams and delayed evaluation - expert system shell in LISP - network representations and inheritance - CLOS

Introduction to understanding natural language - introduction to automated reasoning - introduction to machine learning

References:

1. Luger G.F. & Stubblefield W.A., *Artificial Intelligence*, Addison Wesley
2. Nilsson N.J., *Artificial Intelligence - A New Synthesis*, Harcourt Asia Pte. Ltd.
3. Elain Rich & Kevin Knight, *Artificial Intelligence*, Tata McGraw Hill
4. Tanimotto S.L., *The Elements of Artificial Intelligence*, Computer Science Press
5. Winston P.H., *LISP*, Addison Wesley

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.606.7 SYSTEM MODELLING AND SIMULATION

L-T-D: 3-1-0 **Credits : 4**

Module I

System concepts - components of a system - discrete and continuous systems - types of system study - system analysis - system design and system postulation - system modelling - types of models - system simulation - steps in a simulation study - comparison of simulation and analytical models - Monte Carlo simulation - examples of simulation of single server, single queue systems and simple inventory systems - concepts in discrete event system simulation - event scheduling/time advance algorithm - modelling world views

Module II

Random number generation - techniques for generating random numbers - tests for random numbers - frequency tests - the Kolmogorov-Smirnov test and the Chi-square test - random variate generation - inverse transformation method - exponential, uniform and empirical discrete and empirical continuous distributions - Input modelling for simulation - data collection - identifying the distribution using histograms - parameter estimation - Chi-square goodness of fit test Verification and validation of simulation models - verification of simulation models - calibration and validation of models - face validity - validation of model assumptions and validating input-output transformations - output analysis for a single model - types of simulations with respect to output analysis.

Module III

Measures of performance and their estimation - output analysis for terminating simulations - confidence interval estimation for a fixed number of replication - confidence intervals with specified precision - output analysis for steady-state simulations - initialization bias - replication method - sample size determination for a specified precision - batch means method.

Simulation modelling and analysis of manufacturing systems - objectives - performance measures - issues in simulation of manufacturing systems - simulation of simple job shop manufacturing systems - Introduction to simulation software for manufacturing applications - salient features of simulation languages such as general purpose simulation system (GPSS) and simulation language for alternative modelling (SLAM) - salient features of simulators such as WITNESS and ARENA

References:

1. Banks J., Carson J.S. & Nelson B.L., *Discrete-Event System Simulation,* Prentice Hall of India Private Limited
2. Askin R.G. & Standridge C.R., *Modelling and Analysis of Manufacturing Systems,* John Wiley
3. Deo N., *System Simulation with Digital Computer*, Prentice-Hall of India Private Limited
4. Gordon G., *System Simulation*, Prentice Hall of India Private Limited
5. Law A.W. & Kelton W.D., *Simulation Modelling and Analysis*, Third Edition, McGraw Hill International Editions
6. Kelton W.D., Sadowski R.P. & Sadowski D.A., *Simulation with ARENA*, WCB/McGraw Hill International Editions

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.606.8 INSTRUMENTATION AND CONTROL

L-T-D: 3-1-0 **Credits : 4**

MODULE- I

Measurement: Aims- Fundamental methods- Measurement systems- Functions of Instrument- Static and dynamic Measurements, Terminology, Time element, Errors in measuring Instruments, Sources of error, Error distribution- Sensing element: Types- Sensors for motion- Angular motion, Speed, Force, ** Electrical transformation, Simple transducer elements- Types of transducers- Voltage and current generating Analog type, Variable parameter Analog type, Frequency and pulse generating transducers- Specification for transducers.

Measurement of Temperature- Temperature scales, Basic fixed point- Measuring devices and their ranges- Electrical type and mechanical type- Measuring system for resistance thermometers and Thermocouples- Bridge circuits- Calibration- Filled system thermometers- Ambient temperature compensation.

MODULE – II

Measurement of pressure- Force balance principles- Deformation of elastic members- Ring balance – Impulse line layout- Calibration Low pressure measuring devices.

Measurement of flow- Head flow meters- Primary elements – Secondary elements- Fleat monometers- squire root extraction- Flow transducers- Area flow meters- Rotameter- Measurements of liquid level- Direct methods- Inferential methods- Boiler drum- Level indicator.

MODULE – III

Control system- Classification of control system- Block diagram- Rule of Block diagram algebra- Transfer functions, Set point- Identification of plat Characteristics- First order proportional and second order proportional elements- Dynamic response – Analogues circuits stability of control systems- Routh – Hurvitz criterion- Nyquist criterion.

REFERENCES:

1. R.K. Jain, Mechanical and Industrial Measurements.
2. D. M. Considine, Process Instrument and Control Hand Book.
3. E. O Doeblin, Measurements System, Application and Design.
4. A. E. Pribanco, Industrial Instrumentation.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.606.9 MATERIALS HANDLING

L-T-D: 3-1-0 **Credits : 4**

MODULE I

Importance of Materials Handling- Principles of Materials Handling – Principal groups of Materials handling equipments – General characteristics and applications of materials handling equipments – Modern trends in Materials handling .

Lifting equipments – hoist –Components of hoist – Load handling attachments – hooks , grabs and clamps – Grabbing attachments for bulk materials – Wire ropes – and chains –

MODULE II

Lifting tackle pulleys for gain of force and speed – Tension in drop parts – Drums , shears and sprockets - Arresting gear and brakes – block brakes , band brakes , thrust brakes – Safety and hand cranks .Principle operation of EOT , Gantry and jib cranes – Hoisting Mechanisms , travelling mechanisms , luffing mechanisms – slewing mechanisms – Elevators and lifts .

MODULE III

Conveying Machines - Belt conveyers – Types , principal components of a conveyor and their purpose – Conveyor belts – tractive elements – take up devices – Special types of belt conveyors - Metal belt conveyors – Apron conveyors – Elevators , Passenger conveyors – Flight conveyors , Principal types and applications – Bucket flight conveyors – Cradle conveyors – Conveyor elevators .Overhead Conveyors – Principal types and applications – Overhead pusher conveyor – Overhead load towing truck conveyors – Load carrying car conveyors – Load towing and walking beam conveyors – Bucket elevators – Cradle conveyors – Screw conveyors - Oscillating conveyors – Roller conveyors – Hydraulic and pneumatic conveyors – Chutes – bins.

REFERENCES

1. Rudanko, Material Handling Equipments.
2. Alexandr V ,Material Handling Equipment.
3. A. Spivakvsky and V. Dyachkov , Conveying Machines -
I.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.606.10 AGRO MACHINERY

L-T-D: 3-1-0 **Credits : 4**

MODULE I

Tractors – Design and Operating principles of Engine transmission and control systems – Working details of different types of attachment in the tractor –Tillage – Soil structure – Moisture – Temperature and aeration – Destruction of weeds and posts – Types of tractor plough – Life Mechanisms. Pumps and Spraying machinery – Types of pumps and their selection – Installation and working details – Regulating arrangements spraying machinery - Spray pumps – Nozzles – Vibrated broom distribution – Spray materials – Types of field crop sprayers – Aircraft spraying – Dusting machines .

MODULE II

Earth moving equipments – Drainage Excavators – Ditching equipments – trench cutting machines – Bull dozers – Angle dozers – Earth scooper – graders – tractor winches – Road sweepers – Slurry scrappers .Working details of machinery like : Cultivators – harro weeding equipments – land levellers – seed drills – grass seed drills – Ridgers – Gapping or thinning machines – Manure distributors – Speeders – Lawn movers – Rotary grass cutters – Hay leaders - Silage and silage machinery – Winnowers - Combined clearing and grading machinery.

MODULE III

Machinery for milk production – Essentials of milking machines – Types of milking plane – Bucket , direct to churn milking parlours – Bulk handing milking bails – Milk cooling and serialisation – Cream separators .Testing of Machinery – H.P. Developed – other performance tests and testing equipments – wear testing , life testing – Tractor draw bar performance curves – Characterises curves for pumps – Maintenance Engineering – Servicing – check up – sparo parts – stand by sparo parts requirements – Service workshop – Organisation and management – Labour and Machinery required

References:

1. Rodichev and G.Rodicheva, "Tractor and Automobiles ", MIR Publishers, 1987.
2. Kolchin.A., and V.Demidov "Design of Automotive engines for tractor ", MIR Publishers, 1972.
3. A. Guruvech and B. Sorekin- Tractors, MI1R Publishers Moscow, 1975
4. Geleman and M. Maskovin- Farm tractors, MIR. Publishers, Moscow, 1975
5. Smith , Harris Pearson & Wilkes, Lambert Henry- Farm machinery and equipment, TATA McGraw Hill Publications, 1977
6. Herbert Nicholos- Moving the earth.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.606.11 TOTAL QUALITY MANAGEMENT

L-T-D: 3-1-0 **Credits : 4**

Module 1

Introduction to the concept of quality - Small 'q' & Big 'Q'- Total quality model – internal and external customer -TQM axioms Quality management philosophies: Major contributions of Deming, Juran and Crossby to quality management- Juran Trilogy, PDCA Cycle, 5S, Kaizen – Cost of quality-quality and cost-Characteristics of quality cost - Barriers to TQM Implementation.

Module II

TQM Principles-Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation. Quality planning: SWOT analysis-Strategic planning-strategic grid-organizational culture. Customer orientation: Customer focus-customer satisfaction model-customer retention model-Quality Function Deployment

Module III

Problem solving process: Steps involved in problem solving-Quality control tools: Brain storming-Histograms-Check sheets- Pareto diagram-Ishikawa diagram-Control charts-Scatter diagram- Introduction to seven new management tools. Continuous improvement strategies: Deming wheel-Zero defect concept- Six sigma approach – application of six sigma approach to various industrial situations. Quality circles- Benchmarking- Quality standards – Need of standardization - ISO 9000 series – ISO 14000 series – Other contemporary standards.

REFERENCES

1. Dale H.Besterfiled, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.
2 L .Suganthi and Anand A Samuel :Tatal Quality Management, Prentice Hall of India New Delhi.
3. K Sridhara Bhat :Total Quality Management , Text and cases. Himalaya Publishing House.
4. James R.Evans & William M.Lidsay, "The Management and Control of Quality", (5th Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).
5. Feigenbaum.A.V. "Total Quality Management", McGraw-Hill, 1991.
6. Oakland.J.S. "Total Quality Management", Butterworth Hcinemann Ltd., Oxford, 1989.
7. Narayana V. and Sreenivasan, N.S. "Quality Management – Concepts and Tasks", New Age International 1996.
8. Zeiri. "Total Quality Management for Engineers", Wood Head Publishers, 1991

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.606.12 PRECISION ENGINEERING

L-T-D: 3-1-0 **Credits : 4**

Module I

Concept of accuracy and of machine tools: Part accuracy–errors, accuracy of machine tools- spindle accuracy- displacement accuracy-errors due to numerical interpolation-definition of accuracy of NC system-errors in the NC machines-feed stiffness-zero stability.

Module II

Static stiffness and its influence and inaccuracy due to thermal effects in the machine tools: Overall stiffness of a lathe-compliance of work piece-errors caused by cutting forces deformation in turning-boring-milling-heat sources-thermal effects-rate of thermal expansion.

Dimensioning accuracy and surface finish: Definition of terms – dimensional chains – dimensional stepped shaft-assigning tolerances in the constituent dimensions-dimensional chains – concepts of precision machining-finish turning-boring-grinding.

Module III

Micro manufacturing process: Micro machining-photo resist process-lithography-optical. Processing of materials-electron beam machining-iron beam machining-micro forming, diamond turning-micro positioning devices.

Smart structures, materials and micro actuators: Smart Structures-smart sensors-micro valves-MEMS - micro motors - micro pumps - micro dynamometer - micro machines – structures - cooling channels - micro optics - micro nozzles.

REFERENCES:

1. Murthy.R.L. “Precision Engineering in Manufacturing”, New Age International (P) Ltd.,
2. Norio Tanigughi, “Nano Technology”, Oxford University Press, 1996.
3. Stephen A.Campbell, “The Science and Engineering of Micro electronic Fabrication”, Oxford University Press, 1996.
4. Randy Frank, “Understanding Smart Sensors”, Artech House, Boston, 1996.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.606.13 ADVANCED MANUFACTURING PROCESSES

L-T-D: 3-1-0 **Credits : 4**

Module I

Advances in casting: Newer casting processes - plaster mold and ceramic mold casting – vacuum casting – Evaporative pattern casting, ceramic shell investment casting, slush casting, squeeze casting and semisolid metal forming-Rapid solidification for Amorphous alloys.

Powder metallurgy processes: Methods of Powder production – Blending of metal powders- Compaction of metal powders- Sintering – hot pressing – Isostatic pressing – hot and cold (HIP and CIP), selective laser Sintering – Other shaping processes – Metal Injection moulding, pressureless compaction, ceramic moulds – spray deposition - Finishing of sintered parts.

Module II

Manufacturing processes for plastics: Extrusion, Injection, Blow and rotational moulding of plastics-Thermoforming-Compression moulding – Transfer moulding – Foam moulding - Processing of reinforced plastics and composite –Moulding – compression, vacuum bag – contact – resin transfer – transfer / injection. Filament winding.

Rapid prototyping and rapid tooling: Introduction – Stereo lithography – Fused deposition moulding – selective laser machining – Laminated object manufacturing – solid base curing – Direct manufacturing and rapid tooling.

Module III

Manufacturing processes for MEMS: Introduction to MEMS – semiconductors and silicon – crystal growing and wafer preparation –Films and film deposition – Oxidation- Lithography- diffusion and Ion implementation – Etching - wet etching – dry etching – wire bonding and packaging – printed circuit boards – Micro machining – Bulk micro machining – surface micro machining- Single crystal silicon reactive etching (SCREAM) - silicon micro machining by single step plasma etching (SIMPLE) – Etching combined with fusion bonding – LIGA micro fabrication process – Solid free form fabrication.

REFERENCES

1. Serope Kalpakjian, Steven R. Schemid, “Manufacturing processes for Engineering Materials”, Fourth edition, Pearson Education, 2003
2. Serope Kalpakjian, “Manufacturing Engineering and Technology”, Third Edition- Addison-Wesley Publication Co., 1995.
3. Brahem.T.Smith, “Advanced machining”, I.F.S., U.K.1989.
4. Amstead B.H., Ostwald Phylips and Bageman.R.L., “Manufacturing Processes” John Wileys Sons, 1987.
5. Muccic, E.A., “Plastic Processing Technology”, Materials park, OHIO, ASM Int., 1994.
6. Jaeger R.C., “Introduction to microelectronic Fabrication”, Addision-Wesley, 1988.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.606.14 MATERIAL CHARACTERISATION

L-T-D: 3-1-0 **Credits : 4**

Module I

Scope of metallographic studies in materials science. Understanding image formation, resolution of a microscope, numerical aperture, magnification, depth of field and depth of focus. Important lens defects and their correction, principles of phase contrast. Bright field and dark field contrast, sample preparation. Optical microscopy, interference and polarized light microscopy, quantitative analysis using optical microscopy (inclusion analysis, grain size determination volume fraction of phases etc.)

Module II

Production and properties of X-rays, X-ray diffraction, Bragg's law of diffraction, Scattering of an electron by an atom, by a unit cell, structure factor and intensity calculations. Stereographic projection, Effect of texture, particle size, micro and macro strain on diffraction lines. Indexing of powder photographs. Chemical analysis by X-rays, Stress measurement, Particle size determination

Module III

Construction and working principles of transmission electron microscopes. Image formation, resolving power, magnification, depth of focus, elementary treatment of image contrast. Bright field and dark field images, sample preparation techniques. Selected area diffraction, reciprocal lattice and Ewald sphere construction, indexing of selected area diffraction patterns. Scanning electron microscopy: construction; interaction of electrons with matter, modes of operation, image formation, resolution and magnification. Energy Dispersive Spectroscopy, Wavelength Dispersive Spectroscopy.

References:

1. Optical microscopy of metals : R.C . Gifkins,Publishers :Sir Isac pitman and Sons LTD ,1970
2. Elements of X-Ray diffraction :B.D Cullity , publishers addition ,Wesley publishing company.
3. Transmission electron microscopy –D.B Williams and C.Barry carter ,Planum press Newyork 1996.
4. Electron microscopy and analysis: P.J.Goodhew, J.Humphreys and R. Beanland , Publishers :Taylor and francis, 2001

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.606.15 MICROMACHINING METHODS

L-T-D: 3-1-0 **Credits : 4**

Module I

Introduction to Micro System design, Material properties, micro fabrication Technologies. Structural behavior, sensing methods, micro scale transport – feed back systems. Micromechanics: Microstructure of materials, its connection to molecular structure and its consequences on macroscopic properties – Phase transformations in crystalline solids including marten site, ferroelectric, and diffusional phase transformations, twinning and domain patterns, smart materials.

Module II

Micro-fabrication: Bulk processes – surface processes – sacrificial processes and Bonding processes – special machining: Laser beam micro machining-Electrical Discharge Machining – Ultrasonic Machining- Electro chemical Machining. Electron beam machining. Clean room-yield model – Wafer IC manufacturing – PSM – IC industry-New Materials-Bonding and layer transfer-devices.

Mechanical micromachining: Theory of micromachining-Chip formation-size effect in micromachining-microturning, micromilling, microdrilling-Micromachining tool design.

Module III

Precision Grinding-Partial ductile mode grinding- Ultraprecision grinding-Binderless wheel – Free form optics.

Micro electro mechanical system fabrication: Introduction – Advance in Micro electronics – characteristics and Principles of MEMS – Design and application of MEMS: Automobile, defence, healthcare, Aerospace, industrial properties etc., - Materials for MEMS – MEMS fabrication- Bulk Micro Machining-LIGA – Microsystems packaging- Future of MEMS.

REFERENCES:

1. Sámi Franssila, “Introduction to Micro Fabrication”, John Wiley and sons Ltd., UK, 2004.
2. Madore J, “fundamental of Micro fabrication”, CRC Press, 2002.
3. Mark J. Jackson, “Micro fabrication and Nanomanufacturing”, CRC Press, 2006.
4. Peter Van Zant, “Microchip fabrication”, McGraw Hill, 2004.
5. Mohamed Gad-el-Hak, “The MEMS Handbook”, CRC Press, 2006.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.606.16 TOOL ENGINEERING (MU)

L-T-D: 3-1-0 **Credits : 4**

MODULE I

Jigs and fixtures – Necessity for jigs and fixtures – Elements of fixtures , Design considerations , locators , Types of locators clamping .
Work holding devices different types – Design of drill jigs , bush specifications. Fixture for lathe operations, milling fixtures, fixtures for CNC machines , flexible fixtures , modular fixtures .

MODULE II

Press work tools , Blanking and piercing tools , Load variation during blanking – Reduction of cutting load stock step , striper , knecleant plates . Types of dies , simple die , compound die , progressive die , strap layout .
Fine blanking , press cycle , advantages – sheet metal bending –Bending dies , forming , forming dies – Embossing , coining , metal flow during drawing operations .

MODULE III

CAD for tooling :-Turret press FMS – Computer applications (CAD /CAM) in short metal press work – Quick die change method – Single minute exchange of dies – group tooling – Design of single point tools – Plastic as a tooling materials – Fluidised bed fixturing.

References:

1. Cysil Donaldson, Tool Design,TMH
2. William and Boyes, Jig and Fixture Design Hand Book.
3. Edward G.Hoffman, Fundamentals of tool design.
4. V.Koraskove Mir., Fundamentals of Fixture Design.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.606.17 VEHICLE BODY ENGINEERING

L-T- D; 3-1-0 **Credits 4**

MODULE-I

Modern materials for vehicle design: Introduction, Structure and manufacturing technology of automotive materials, Mechanical and physical properties of automotive materials, Material selection for automotive components,

Body design: coach and bus body styles, typical layout of bus and coach bodies, typical layout of commercial vehicle types, passenger car body styles,

Chassis design and analysis: chasis type, structural analysis by simple structural surface method, body frame construction, unitized frame and body construction, FR, FF, & MR body structure details

MODULE-II

Ergonomics method and tool to promote occupant accommodation: standards guidelines and recommendations, Anthropometry, 2-dimentional manikins, package drawing, Quick and dirty mock ups, vehicle seating configuration(based on SAE).

Crash testing: Human testing, Crash worthiness, Compliance testing, Component testing, Competitive race testing.

The role of endurance and durability studies in the manufacturing of vehicles. :Introduction, Failure and reliability, Testing and failure prediction, importance of avoiding failures

MODULE-III

Introduction to vehicle safety: Basic concept of vehicle safety-underlying principles, safety factors, warning and instructions, shielding, interlocking.

Minor auto body repairs: types of body fillers and its application, repairing rust damage, Painting: Corrosion and anticorrosion method .Paint and painting process

Diagnosing major collision damage: impact and its effect on a vehicle, determining the conditions of the collision, Porto power, the dozer technique, operation of conventional Porto power, operation of dozers, body bay systems (flexi-force), general repair techniques. Body alignment- straightening equipment, in-floor systems, chainless anchoring systems

References:

1. Pauloski- Vehicle Body Engineering
2. Robert Scharff & James.E.Duffy – Motor Auto body repair, Delmar Publishers
3. J. Fairbrother – Principles and practice of Vehicle body repair, Hutchinson
4. S.P. Page- Body Engineering
5. Paul Browne- Auto care manual
6. Redesign of bus bodies- Part I and Part H C,I.R,T,, Pune
7. George A Peters & Barbara J. Peters- Automotive vehicle safety-SAE 2002
8. Julian happian-smith An introduction to modern vehicle design-SAE 2004

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.606.18 VEHICLE PERFORMANCE AND TESTING

L-T- D; 3-1-0 **Credits 4**

MODULE-I

Laboratory testing: Basic engine parameters, Measurement of BHP, IHP, Engine testing on dynamometers, different types of dynamometers- hydraulic, eddy current etc, engine analyzers- for petrol and diesel engines, FIP calibrating and testing, exhaust gas analyzers - various types- Orsat apparatus, infrared gas analyzers, smoke meter.

Vehicle testing on chassis dynamometers: two wheel & four wheel dynamometers, vehicle testing lanes - side slip testers, wheel alignment testing, wheel balancing, brake testers, head light alignment testing.

MODULE- II

Noise vibration and Harshness: Review of vibration fundamentals, vibration control, fundamentals of acoustics, human response to sound, automotive noise criteria, Standard noise measurement methods, Noise inside and outside the vehicle, sources of vehicle noise- intake and exhaust noise, combustion noise, mechanical noise, noise from auxiliaries, wind noises, transmission noises, brake squeal, structure noise, noise control methods.

MODULE-III

Vehicle performance: Methods for evaluating vehicle performance- energy consumption in conventional automobiles, performance, emission and fuel economy, Operation of full load and part conditions, effect of vehicle condition, tyre and road condition and traffic condition and driving habits on fuel economy, CAFÉ standards.

Road and track testing: Initial inspection, PDI, Initial free services, engine running in and durability, intensive driving, maximum speed and acceleration, brake testing on the road, hill climbing, handling and ride characteristics, safety, mechanism of corrosion, three chamber corrosion testing, wind tunnel testing, road testing, test tracks.

References:

1. J. G. Giles- Vehicle operation and performance, Wildlife Publications, London, 1969
2. W, H. Crouse and L. Anglin- Motor vehicle inspection, McGraw Hill Book Co., 1978
3. Dr. N.K.Giri- Automotive technology – Khanna publishers, 2009
4. SAE Transaction papers- 831814,820346,820367,820371 and 820375
5. Julian Happian-Smith – An introduction to vehicle design – SAE, 2004
6. Advanced automotive technology – visions of a super efficient family car- technical paper - OTA-ETI-638, 1995

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.606.19 AUTOMOTIVE FUELS & ALTERNATE FUELS

L-T- D; 3-1-0 **Credits 4**

Module-I

Introduction: Physical, chemical & combustion properties of IC engine fuels, structure of petroleum, petroleum refining process-thermal cracking, catalytic cracking, polymerisation, alkylation, Isomerisation, reforming & blending, products of refining process, Indian standard for gasoline, gasoline blends, non- petroleum fuels, fuel additives.

Fuels for SI engines: Requirements of an Ideal gasoline, volatility of liquid fuels, effect of volatility on engine performance-ASTM distillation curve, winter and summer gasoline, knock rating of SI engine fuels, octane number and octane number requirement, sensitivity & performance number, numerical examples- volumetric and gravimetric analysis, a/f ratio, air requirement.

Module-II

Diesel engine fuels: Requirements for diesel fuel, handling & storage-properties of diesel, smooth and efficient burning – volatility, ignition quality, cetane number, diesel index, cleanliness, diesel blends, Indian standard for diesel.

Gaseous fuels: LPG as an IC engine fuel, natural gas – CNG and LNG, advantages of gaseous fuels, biogas, producer gas, engine modifications to run on gaseous fuels, dual fuel and multi fuel application.

Module-III

Alternate fuels: Alcohols for SI engines- manufacture of methanol, manufacture of ethanol, comparison of properties of alcohols and gasoline as SI engine fuels, engine performance with pure alcohols, alcohol gasoline fuel blends-gasohol- E85

Alternate fuels for Diesel engines: Alcohols as diesel fuels, vegetable oils as diesel fuels, straight vegetable oils and biodiesels, performance properties of engines with biodiesel, Indian specification for biodiesel,

References:

1. Mathur & Sharma – IC engines, Dhanpatrai publications
2. Dr.N.K.Giri- Automobile technology, khanna publications
3. T. K. Garrett: Automotive fuels system, SAE INC, Warrendale, 1991
4. David Powell and Richard P. Brennan- The Automobile technology and society Printice Hall.
5. Keeith Owen & Trevor Colley - Automotive Fuels reference book, SAE
6. Richard L. Bechtold- Alternate fuels guide book, SAE
7. Energy research group- Alternate liquid fuels Willey Eastern Ltd
8. T.N Vezgirigiu- Alternative energy sources

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

ELECTIVE III

08.706.1 COMPUTER GRAPHICS

L-T-D: 3-1-0 ` **Credits : 4**

Module – I

Introduction to computer Graphics, Description of graphic devices - Graphic standards. Colour graphic display techniques.
Graphic primitives- Circle generation algorithms – text generation. Polygons, Polygon filling

Module – II

Transformation: Simple problems on 3D transformations and applications, Viewing transformations, Windowing, Clipping, Cohen-Sutherland outcode algorithm, Sutherland-Hodgman Algorithm, Clipping of polygons.
Projections - Perspective geometry – Orthographic and Oblique projections – perspective transformations.

Module – III

Mathematical formulations on: Plane curves – Non parametric curves – space curves – Representation of space curves – cubic spline – Bezier curves , B- Spline curves , Fractals, NURBS etc..
Mathematical formulation on Surface description and generation- Surface of revolution – Sweep surfaces, quadric surfaces, Solid modeling techniques etc. Hidden line and hidden surfaces , Z-Buffer algorithm , Scan Line algorithm for curved surfaces.

References :

1. David F. Rogers & J.H Adams : Mathematical Elements of Computer Graphics ; 2nd Edition; McGraw Hill International Editions.
2. Donald Hearn & M. Pauline Baker : Computer Graphics, Second Edition; Prentice Hall of India Private Ltd
3. Steven Harrington, Computer Graphics, Second Edition, McGraw Hill International Editions.
4. Vera B Anand, Computer Graphics and 3D Modelling for engineers.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.706.2 ADVANCED THERMODYNAMICS

L-T-D: 3-1-0 **Credits : 4**

MODULE I

Review of the fundamentals of classical thermodynamics – Multi phase and multi component systems – Free energy functions – Applications of free energy functions to phase changes – Clausius – Clayperon equations – Binary systems containing liquid and solid phases.

Thermodynamics of reactive mixtures – Bond energy , heat of formation , heat of reaction –Adiabatic flame temperature entropy changes for reacting mixtures – Chemical equilibrium – Equilibrium criteria – Evaluation of equilibrium constants and equilibrium composition – Simple numerical solutions .

MODULE II

Statistical thermodynamics – Fundamentals of statistical inference – Probability and frequency stirling's approximation , Expected value , variance , elements of quantum statistics and quantum mechanics – The Schrodingar waves equation – Heisenburg uncertainty principle – Phase space – Quantum energy states .

Mean free path of molecules – Distribution of mean free path – Maxwell . Boltzmann law and velocity distribution – Maxwell's distribution functions , Evaluation of distribution – Constants – Principle of equipartition of energy – Degree of freedom – Viscosity , Specific heat and thermal conductivity .

MODULE III

Bose – Einstein Fermi – Direct and Maxwell – Boltzmann statistics – Partition function and its relation to microscopic properties of an ideal gas – Translational , rotational and vibrational partition functions – Thermodynamic probability and entropy thermodynamic properties of perfect diatomic gases.

REFERENCES

1. J.P.Holman, Thermodynamics.
2. Van Wylon, Thermodynamics.
3. Lay, Thermodynamics.
4. Myron Tribus, Thermostatics and Thermodynamics.
5. Kennath Wark,Thermodynamics
6. Warren Giodt , Thermophysics.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.706.3 INDUSTRIAL HEAT TRANSFER

L-T-D: 3-1-0 **Credits : 4**

MODULE I

One-dimensional steady state heat conduction with uniform internal heat generation. Plane wall with heat sources, cylinder with heat sources. Transient and periodic conduction (One-dimensional). Lumped heat capacity system. Simple analytical methods. Use of Heisler charts.

Principles of Convection – Viscous flow , different hydrodynamic boundary layer flow regimes and flat plates – Laminar boundary layer on a flat plate – Momentum equation of the laminar boundary layer with constant properties – Internal Momentum analysis of laminar boundary layer . Energy Equations – Significance of Prandtl Number . Flat plate heat transfer – Conduction by integral methods (Simultaneous development of hydrodynamic and thermal boundary layer only)

MODULE II

Emission and absorption of radiation by an absorbing medium. Determination of mean beam length – Particles in combustion products – Large particles, small particles, gases in combustion products – Effect of an absorbing medium on the radiative heat transfer within an enclosures – Exchange areas for absorbing media.

Furnaces – Furnace geometry – Variation of temperature with time – Variation of temperature within the furnace – Representation of real gases – Heat transfer between real surfaces

MODULE III

Boiling heat transfer, forced convection boiling curve saturated forced convective boiling in a round tube. The two phase forced convection and nucleate boiling regions. Critical heat flow in forced convective flow – Elementary concepts.

The basic processes of condensation – Liquid formation, nucleation of drops at solid surfaces, droplet growth – Film condensation on a vertical flat plate - Nusselt equation for a laminar film – Improvements to the original Nusselt theory – The influence of turbulence – Condensation of horizontal tubes – Condensation within a vertical tube - Drop wise condensation.

Elementary concepts of : Heat transfer in magneto fluid dynamic (Transpiration cooling , low density heat transfer and ablation .) (Description only).

REFERENCES

1. J.P.Holman, Heat transfer, Mc Graw Hill Book Co.
2. John G Gollier ,Convective Boiling and Condensation, Mc.Graw Hill
3. W.Grey A.Miller, Engineering Calculations in relative heat transfer, .International series on material science and technology , General editor : D.N.Hepking Vol .13

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.706.4 PLANT ENGINEERING &MAINTENANCE

L-T-D: 3-1-0 **Credits : 4**

Module I

Wear –fundamentals and analysis – Classification – Theories of wear – Analytical treatment of wear - Effect of moisture , gas and liquids on wear – Effect of temperature – Fatigue. Wear prevention methods.

Lubricants – Solid , fluid and semi fluid – Synthetic – General properties and applications – Tests and classifications – Additives-Testing of lubricants-selection of lubricants-lubricating mechanisms.

Module II

Reliability – Analysis and Concepts – Chance failure and wearout failure – Application of stochastic model for reliability studies – Reliability of series , parallel and stand –by systems – Estimation of parameters for failure distributions – Maintainability -availability.

Replacement – Analysis of different models - Causes of deterioration and obsolescence – Sudden and gradual obsolescence. Deterioration – MAPI method –simple problems .

Module III

Maintenance – types (corrective, scheduled, preventive, predictive and proactive maintenance). – Deterioration and failure analysis – planning , scheduling and controlling of maintenance work – organisation for maintenance, Safety engineering, accident prevention programme , safety design concepts, fire protection-industrial noise-Legislations on safety in industry .

Recent Developments in maintenance methods-RCM- CBM –DMS – TPM etc.

REFERENCES

1. Miller and Blood, Modern maintenance Management, D B Tarapur.
2. Plant Engineer's Hand Book - Mc Graw Hill Pub. Co.
3. Industrial Engineering Hand Book - Maynard ,Mill Pub. Co.
4. Reliability Hand Book - W.G.Irason, Mc Graw Hill.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.706.5 FRACTURE MECHANICS

L-T-D: 3-1-0 **Credits : 4**

Module I

Introduction: Significance of fracture mechanics - Griffith energy balance approach - Irwin's modification to the Griffith theory - stress intensity approach - crack tip plasticity - fracture toughness - sub critical crack growth - influence of material behaviour - modes I, II & III - mixed mode problems

Linear elastic fracture mechanics (LEFM): Elastic stress field approach - mode I elastic stress field equations - expressions for stresses and strains in the crack tip region - finite specimen width - superposition of stress intensity factors (SIF) - SIF solutions for well known problems such as centre cracked plate, single edge notched plate, and embedded elliptical cracks

Crack tip plasticity: Irwin plastic zone size - Dugdale approach - shape of plastic zone - state of stress in the crack tip region - influence of stress state on fracture behaviour

Module II

Energy balance approach: Griffith energy balance approach - relations for practical use - determination of SIF from compliance - slow stable crack growth and R-curve concept - description of crack resistance

LEFM testing: Plane strain and plane stress fracture toughness testing - determination of R-curves - effects of yield strength and specimen thickness on fracture toughness - practical use of fracture toughness and R-curve data

Elastic plastic fracture mechanics (EPFM): Development of EPFM - J-integral - crack opening displacement (COD) approach - COD design curve - relation between J and COD - tearing modulus concept - standard J_{Ic} test and COD test

Module III

Fatigue crack growth**:** Description of fatigue crack growth using stress intensity factor - effects of stress ratio and crack tip plasticity - crack closure - prediction of fatigue crack growth under constant amplitude and variable amplitude loading - fatigue crack growth from notches - the short crack problem

Sustained load fracture: Time-to-failure (TTF) tests - crack growth rate testing - experimental problems - method of predicting failure of a structural component - practical significance of sustained load fracture testing

Practical problems: Through cracks emanating from holes - corner cracks at holes - cracks approaching holes - fracture toughness of weldments - service failure analysis - applications in pressure vessels - pipelines and stiffened sheet structures

References:

1. Ewalds H.L. & Wanhill R.J.H., *Fracture Mechanics*, Edward Arnold Edition
2. Broek D., *Elementary Engineering Fracture Mechanics,* Sijthoff & Noordhoff International Publishers
3. Kåre Hellan, *Introduction to Fracture Mechanics*, McGraw Hill Book Company
4. Prashant Kumar, *Elements of Fracture Mechanics*, Wheeler Publishing

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.706.6 MARKETING MANAGEMENT

L-T-D: 3-1-0 **Credits : 4**

Module I

Introduction to marketing - concept of market and marketing - marketing environment - controllable factors - factors directed by top management - factors directed by marketing - uncontrollable factors - demography, economic conditions, competition, social and Marketing planning - marketing planning process - Boston consultancy group model - marketing mix - marketing mix variables. Developing, testing and launching of new products.

Module II

Market segmentation and market targeting - introduction to segmentation - targeting and product positioning.

Marketing research - need and scope - marketing research process - research objectives, developing research plan, collecting information, analysis, and findings - consumer behaviour - factors influencing consumer behaviour - perceived risks - product life cycle - marketing strategies for different stages of product life cycle

Module III

Marketing communication - marketing mix variables - steps in developing effective communication - identification of target audience - determination of communication objectives - designing the message - selecting the communication channels - promotion mix evaluation - advertising and sales promotion - factors in advertising - sales promotion tools.

New trends in marketing- Brand management - significance of branding to consumers and firms

References:

1. Kotler P., *Marketing Management: Analysis, Planning, Implementation and Control*, Prentice Hall of India Private Limited
2. Ramaswamy V.S. & Namkumari S., *Marketing Management: Planning, Implementation and Control*, Macmillan India Limited
3. T N Chabra and S K Grover : *Marketing management*, Dhanapat Rai and Co. (Pvt) Ltd.
4. Stanton W.J., Etzel M.J. & Walker B.J., *Fundamentals of Marketing,* McGraw Hill International Edition
5. Majumdar R., *Marketing Research*, *Text, Applications and Case Studies*, New Age International (P) Limited Publishers
6. Robert, *Marketing Research,* Prentice Hall of India

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.706.7 ENTREPRENEURSHIP DEVELOPMENT

L-T-D: 3-1-0 **Credits : 4**

Module I

Entrepreneurial perspectives - understanding of entrepreneurship process - entrepreneurial decision process - entrepreneurship and economic development - characteristics of entrepreneur - entrepreneurial competencies - managerial functions for enterprise

Module II

Process of business opportunity identification and evaluation - industrial policy - environment - market survey and market assessment - project report preparation - study of feasibility and viability of a project - assessment of risk in the industry.

Process and strategies for starting a venture - stages of small business growth

Module III

Entrepreneurship in international environment - achievement motivation - time management - creativity and innovation structure of the enterprise - planning, implementation and growth.

Technology acquisition for small units - formalities to be completed for setting up a small scale unit - forms of organizations for small scale units - financing of project and working capital - venture capital and other equity assistance available - break even analysis and economic ratios technology transfer and business incubation

References:

1. Harold Koontz & Heinz Weihrich, *Essentials of Management*, McGraw Hill International
2. Hirich R.D. & Peters Irwin M.P., *Entrepreneurship*, McGraw Hill
3. Rao T.V., Deshpande M.V., Prayag Metha & Nadakarni M.S., *Developing Entrepreneurship A Hand Book,* Learning Systems
4. Donald Kurado & Richard M Hodgelts*, Entrepreneurship A Contemporary Approach,* The Dryden Press
5. Dr Patel V.G., *Seven Business Crisis*, Tata McGraw Hill
6. Timmons J.A., *New Venture Creation-Entrepreneurship for 21st Century,* McGraw Hill International
7. Patel J.B., Noid S.S., *A Manual on Business Opportunity Identification*, *Selections*, EDII
8. Rao C.R., *Finance for Small Scale Industries*
9. Pandey G.W., *A Complete Guide to Successful Entrepreneurship,* Vikas Publishing

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.706.8 INDUSTRIAL HYDRAULICS

L-T-D: 3-1-0 **Credits : 4**

MODULE I

Introduction to fluid power – Hydraulics and Pneumatics systems – Fluid power systems – Fundamentals of fluid mechanics – Measurement of physical parameters – Hydraulic symbols .

Fluid power pumps and motors – Types of pumps – Characteristics – Hydraulic cylinders and rams – Fluid power pumping systems and components.

MODULE II

Pressure accumulators – Functions – Fluid reservoirs – Filter in hydraulic circuits. Loading and replacement of filter elements – Materials for filters.

Fluid temperature control – Fluid pressure control –control valves – Sequence valve – Counterbalance valve-unloading valve – Friction control valve – Servo systems.

MODULE III

Industrial hydraulic circuits - Circuit design for – shaper, grinder, material-handling equipments processes -Miscellaneous circuits.

REFERENCES

1. John pippon and Tylor Hicks, Industrial Hydraulics.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.706.9 FINITE ELEMENT METHODS

L-T-D: 3-1-0 **Credits : 4**

Module I

Introduction, historical background, applications, advantages, finite element softwares. Theory of elasticity - stress and equilibrium, stress-strain relationship, strain-displacement relationship, plane stress, plane strain and axi-symmetric approximation. Temperature effects. Potential energy and equilibrium, Principle of minimum potential energy. Discrete and Continuous systems, Rayleigh-Ritz method, Galerkin method. Solution of Algebraic equations, Banded and skyline solutions. Global, Local and Natural coordinates in 1, 2 and 3 dimensions - Area coordinates. Numerical Integration using Gauss quadrature. Finite element modeling - types of elements, Discretization, Mesh generation and numbering. Shape functions - types and properties. Iso parametric formulation. Largrangean and Serendipity elements.

Module-II

One dimensional elasticity problems - discretisation of domain into elements - generalised coordinates approach - derivation of elements equations - assembly of element equations - transformation matrices - global equations, load vector, properties of stiffness matrices, imposition of Boundary conditions - penalty and elimination approach, multi-point constraints. Finite element formulation of plane trusses, beams and beams on elastic supports.

Module-III

Finite element formulation of 2D problems using constant strain triangle element and isoparametric quadrilateral element. Axi-symmetric solids subjected to axi-symmetric loading. Features of 3D problems in stress analysis. Scalar field problems - one dimensional heat conduction through composite walls and fins, potential flow. Dynamic problems- Hamilton's principle, Mass matrices, lumped and consistent formulations.

References:-

1. Introduction to Finite Elements in Engineering, Tirupathy. R. Chandrapatla & Ashok D. Belagundu, Pearson.
2. Finite Element Analysis: Theory and Programming, C.S. Krishnamoorthy, Tata McGraw Hill.
3. Introduction to the Finite Element Method, J.N. Reddy, McGraw Hill.
4. Finite element Methods, O.C Zienkieviz & R.L.Taylor, Butterworth-heinemann
5. Concepts and Applications of Finite Element Analysis, R. D. Cook, Wiley.
6. The Finite Element Method in Engineering, S.S.Rao, Butterworth-Heinemann.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.706.10 METAL FORMING

L-T-D: 3-1-0 **Credits : 4**

Module I

Basic laws and theories of plasticity - stress space - yield criterion of metals - Von-Mises yield criterion - Tresca criterion - representation of the criteria in stress space - yield surface - subsequent yield surfaces - experimental investigations of the yield criteria - basic considerations of plasticity theory - simple models of material behavior - Levy-Mises stress strain relations - Prandtl-Reuss stress strain relations - experimental verification - plastic potential theory - plastic work - maximum work hypothesis - stability postulates - isotropic and kinematic hardening - plastic flow - temperature and strain rate effects in plastic flow

Module II

Processes - drawing and extrusion - process classification - lubrication - temperature effects - analysis of the processes of drawing and extrusion of wire and strip through friction less dies and dies with friction - production of seamless pipe and tubes - analysis - residual stresses in rods - wires - tubes, deep drawing

Classification of rolling processes - hot rolling - cold rolling - rolling of bars and shapes - analysis of rolling process in conditions of plane strain.

Classification of forging process - open die forging - closed die forging - analysis of forging process in conditions of plane stain - forging allowances and tolerances - sheet metal forming, shearing, blanking, bending and stretch forming

Module III

Slip line field theory - incompressible two-dimensional flow - slip lines - equilibrium equations referred to slip lines - Henkeys theorem - hodographs - simple slip line field analysis in extrusion - compression of block between parallel plates - strip load on semi-infinite body - lower and upper bound theorems with proofs and applications

References:

1. Oscar Hoffman & George Sachs, *Introduction to Theory of Plasticity for Engineers*, McGraw Hill
2. Dieter G.E., *Mechanical Metallurgy*, McGraw Hill.
3. Johnson W. & Mellor P.B., *Plasticity for Mechanical Engineers*, D Van Nostrand Co Ltd.
4. Chen W.F. & Han D.J., *Plasticity for Structural Engineers*, Springer Verlag

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.706.11 MACHINE TOOL TECHNOLOGY

L-T-D: 3-1-0 **Credits : 4**

MODULE I

Principal requirements and specifications – Requirements regarding quality of performance (Accuracy and surface finish) – Productivity(Rate of motel renewal) –Economy and efficiency of machine tools .

Design aspects – Kinematic principles in machine tools with respect to the basic elements and their design – tool , column , frame , slides , guide ways, shafts , spindles , bearings, clutches, rigidity of machine tools structures – Sources, effects and elimination of vibration – Machine tools drives and their kinematics – Electrical, Mechanical, Hydraulic and combination systems - Design of a stepped gear box.

MODULE II

Hydraulic power , Transmission systems used in machine tools and their various elements – A few common hydraulic circuits used the effect movement of tools slide and work tables.

Miscellaneous – Copying devices – Automates of various kinds feasibility determination for automation – Automatics and assembly line layout – unit heads and transfer machines - Vibration isolated tool holders – Friction and lubrication in machine tools .

MODULE III

Erection and testing of machine tools – Location and layout – Foundations vibration – Isolation – Erection process – Principles of acceptance tests – Measuring equipments and methods – Direction of tolerances – Maintenance of machine tools – Test charts for different machines .

Trends in the design of modern machine tools – Aims and future development - Design for improved static and dynamic performance – Fundamental aspects of numerical control – Adaptive control and hydraulic control of machine tools .

REFERENCES

1. S.K.Basu, Design of Machine tools, Allied pub.
2. Design principles of metal cutting machine tools – Koenisberger
3. Principles of Machine tools – G.G.Sen and Bhattacharya
4. The Design and Construction of Machine tools – M.C.Town
5. Machine tools design course – Central Machine tool Institute
6. Machine tools design Volume 1,2,3,4 – N. Acherkan
7. Tool Engineer Hand Book – Mc.Graw.Hill

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.706.12 NON CONVENTIONAL MACHINING TECHNIQUES

L-T-D: 3-1-0 **Credits : 4**

Module I

The need of the process-classification - Energies employed in the processes-EDM, EC, USM, LBM, PAM, AJM, WJM etc.

Electrical Discharge Machining Process, operating principles-Breakdown mechanism-Dielectric fluid-Electrode material-Tool wear – Power generator circuits- Process parameters - Metal removal rate - wire out EDM - Recent Developments in EDM. Applications

Module II

Electro Chemical Machining Process-principles-Equipment-Analysis of metal removal-tool material-Insulation-Process parameters-ECH,ECG etc. Applications

Electron Beam Machining Process, Principle-gun construction - Types of gun - Vacuum and non-vacuum technique Applications

Laser Beam Machining Process, principles, pumping processes, emission types-beam control. Applications

Module III

Ultrasonic Machining Process-working principles-types of transducers-concentrators-nodal point clamping-feed mechanism-metal removal rate-Process parameters. Applications

Abrasive Jet Machining Processes-Principle-Equipment-Metal removal rate process parameters. Applications

Water Jet Machining Process-Principle-Equipment. Applications

References:

1." Non Conventional Machining ", P.K.Mishra, The Institution of Engineers (India) Text Books: Series, 1997.

2. A Text Books: of Production Engineering, P.C.Sharma, 1995.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.706.13 TURBO MACHINES

L-T-D: 3-1-0 **Credits : 4**

Module I

Energy transfer between fluid and rotor, classification of fluid machinery, dimensionless parameters, specific speed, applications, stage velocity triangles, work and efficiency for compressors and turbines.

Module II

Centrifugal fans and blowers : Types, stage and design parameters, flow analysis in impeller blades, volute and diffusers, losses, characteristics curves and selection, fan drives and fan noise.
Centrifugal Compressors: Construction details, types, impeller flow losses, slip factor, diffuser analysis, losses and performance curves.

Module III

Axial flow compressors : Stage velocity triangles, enthalpy-entropy diagrams, stage losses and efficiency, work done factor, simple stage design problems and performance characteristics.
Axial and radial flow turbines : Stage velocity diagrams, reaction stages, losses and coefficients blade design principles, testing and performance characteristics.

References:

1. Yahya, S.H., " Turbines, Compressor and Fans ", Tata Mc Graw Hill
2. Publishing Company, 1996.
3. Bruneck, Fans, Pergamom Press, 1973.
4. Earl Logan, Jr., " Hand book of Turbomachinery ", Marcel Dekker Inc., 1992.
5. Dixon, S.I., " Fluid Mechanics and Thermodynamics of Turbomachinery ", Pergamom, Press, 1990.
6. Shepherd, D.G., " Principles of Turbomachinery ", Macmillan, 1969.
7. Stepanff, A.J., " Blowers and Pumps ", John Wiley and Sons Inc., 1965.
8. Ganesan .V., " Gas Turbines ", Tata Mcgraw Hill Pub. Co., New Delhi, 1999.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.706.14 EXPERIMENTAL METHODS IN ENGINEERING

L-T-D: 3-1-0 **Credits : 4**

MODULE I

Pressure measurement devices – U tube manometer – Well type manometer – Different types of manometers. Elastic pressure transducers – Bourdon tubes – Diaphragms – Bellows. Capacitance pressure gauge. Diaphragm type strain gauge pressure pickup. LVDT diaphragm differential pressure gauge. High-pressure measurement – very high-pressure transducer. Low-pressure measurement – Mc Leod-gauge pirani thermal conductivity gauge – Knudsen gauge – Ionization gauge. Dead weight tester for static calibration of pressure gauges.

Methods for flow measurement – Positive displacement methods – rotary vane flow meter – Lobed impeller flow meter. Flow obstruction methods – Venturi – flow nozzle – orifice. Practical considerations for obstruction flow meters. Recommended proportions for venturi tubes, flow nozzles and orifices. Flow measurement by drag effects – rotameter – turbine meter – vortex shedding flow meter. Hot wire and hot film anemometers. Thermal mass flow meter. Magnetic flow meter. Pressure probes – pitot tube – pitot static tube – Kiel probe. Yaw angel – yaw angle characteristics of various static pressure probes. Fluid factors, application factors and installation factors of different types of flow meters.

MODULE II

Temperature measurement by mechanical effects – mercury in glass thermometer – bimetallic strip type – fluid expansion thermometers. Temperature measurement by electrical effects – electrical resistance thermometer. Methods of correction for lead resistance – Siemens three lead arrangement – callender four lead arrangement and floating-potential arrangement. Thermostats. Temperature measurement due to thermo-electric effects – thermocouples – different types and its range – law of temperature – emf vs temp relationships for different thermocouples – sensitivity of thermocouples – thermopile and its practical application – installation of thermocouple on a metal plate – Thin foil thermocouples for rapid transient response. Temperature measurement by radiation – optical pyrometer.

Thermal conductivity measurement – guarded hot plate apparatus – measurement of thermal conductivity of metals. Thermal conductivity of liquids and gases – guarded hot plate apparatus – concentric cylinder method – apparatus for determination of thermal conductivity of gases at high temperatures. Measurement of viscosity – rotating concentric cylinder apparatus – Saybolt viscometer. Gas diffusion – measurement of diffusion coefficients in gases. Convection heat transfer measurements – forced convection heat transfer coefficients in smooth tubes. Humidity measurements. Heat flux meters.

MODULE III

Elastic elements for force measurements – simple cantilever and thin ring elastic elements – Proving ring. Torque measurements – hollow cylinder for torque measurement – Prony brake – hydraulic dynamometer – Cradled dynamometer. Strain measurements – electrical resistance strain gauges-

different types – characteristics of strain gauge materials. Temperatures compensation for electrical resistance strain gauges strain gauge rosettes – bonded and unbounded resistance strain gauges.
Cantilever beam used as a frequency measurement device. Principles of seismic instrument – practical considerations for seismic instruments – electrical resistance strain gauge seismic instrument – piezoelectric transducer type seismic instrument. Sound measurements – microphones – characteristics of microphones. Psychoacoustics factors – sound level meter – acoustic properties of materials – sound absorption coefficient – noise reduction coefficient. Air pollution measurement – units for pollution measurement – air pollution standards – Air sampling train.

REFERENCES:

1. J.P. Holman, Experimental Methods for Engineers.
2. Ernest O. Doebelin, Measurement System – application and Design.
3. Donald P. Eckman, Industrial Instrumentation.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.706.15 MECHANICAL VIBRATION AND NOISE CONTROL

L-T-D: 3-1-0 **Credits : 4**

MODULE I

Introduction – Harmonic motion – Beat frequency – Equations of motion – Concepts of forces and equilibrium – Systems with one degree of freedom – Free and forced vibrations with undamped and damped systems (Review)

Two degrees of freedom systems : Equations of motions for free and forced vibration without and with damping – Use of influence coefficients – The work and energy approach – Solutions to free , forced and damped vibrations and torsional systems – Dynamic absorbers periodic and Non periodic **.**

MODULE II

Vibration – Fourier series representation – Unit impulse step , ramp and arbitrary excitation – Response spectrum – Analog computer set up for solving vibration problems -,Vibration measuring instruments .

Solutions to Differential Equations , Laplace Transforms.

Jump phenomenon – Effect of damping – Self excited Oscillations.

MODULE III

Introduction to sound and vibratic wave motion – One dimensional plane waves – Characteristics impedance – Decibel seats power , density and intensity – Sound transmission through one and two intervening media .

Measurement of Sound – Loud speakers and microphones – Their characteristics , Band pass filters , graphic level recorder , Narrow Band Analysers - Measurement in reverberation and Vachaic chamber –Hearing mechanism of hearing and perception of sound (Description only)

Types of noise : Criteria for evaluation of noise problems – Threshold of hearing – Hearing loss with age – Equal loudness contours loudness and loudness level – Perceived noise level – N.C. curves – Noise and Number index – Noise pollution level – Noise induced hearing loss – Damage risk criteria – Criteria for noise and vibration in community buildings – General principles of noise control – Use of enclosures – Wrappings – Porous materials – Design of Auditorium – Acoustical requirements – Elimination of room acoustical defects – Articulation index – Sound reinforce systems – Design of time delays (Brief description only)

REFERENCES

1. Anderson Roger A, Fundamentals of Vibration.
2. W.T.Thomsom, Theory of Vibrations, Tata McGraw Hill.
3. Timosheako, Vibration problem in Engg.
4. Tee. Hinkle and Morse, Mechanical Vibrations.
5. Kinslor and Frey, Fundamentals of Acoustics.
6. Beronek .L.L, Noise and vibration Control, McGraw Hill.
7. Doello ,Deslie L, Environmental Acoustics.
8. C.Harris, Hand Book on Noise control.
9. Hand Book of Noise Measurement – General Radio Company .U.S.A

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.706.16 FAILURE ANALYSIS

L-T-D: 3-1-0 **Credits : 4**

Module I

Introduction: Objectives of failure investigation, Collection of background data- service history, photographic records, Selection of samples for various conditions, Preliminary examination of the failed part – visual inspection and non destructive techniques for failure investigation- Magnetic particle inspection, Liquid penetrant inspection, Eddy current inspection, ultrasonic inspection, radiography, acoustic emission inspection, experimental stress analysis, Mechanical testing, limitations of tensile testing, Selection preservation and cleaning of fracture surfaces- cleaning, sectioning, opening secondary cracks

Module II

Macroscopic examination of fracture surfaces, Microscopic examination of fracture surfaces – optical microscopy, scanning electron microscopy, transmission electron microscopy, Selection and preparation of metallographic sections, Examination and analysis of metallographic sections, Determination of fracture type- Failure mechanisms and Fractography of ductile fracture, brittle fracture, transgranular brittle fracture, Intergranular brittle fracture, Fatigue fracture- Mechanisms and general features of fatigue fracture, Stress corrosion cracking, Liquid metal embrittlement, Hydrogen embrittlement, Creep and stress rupture failures, ductile to brittle fracture transition

Module III

Chemical analysis- Analysis of bulk materials, analysis of surfaces and deposits, spot tests, Applications of fracture mechanics: Fracture mechanics concepts- Linear elastic fracture mechanics, Elastic-Plastic fracture mechanics (basic concepts), plane stress and plane strain, Fatigue crack growth rate their use in failure analysis, fracture toughness testing- Plane strain fracture toughness test, COD test, Simulated service testing, Analyzing the evidences formulating conclusions and report writing, Case studies of failures: failures of shafts, failures of heat exchangers

References:

1. ASM Handbook Volume 11: Failure analysis and Prevention
2. Fracture Mechanics by Prashant Kumar Wheeler Publishing
3. Mechanical Metallurgy by Dieter, McGraw Hill
4. Electron microscopy and analysis: P.J. Goodhew, J. Humphreys and R. Beanland , Pub: :Taylor and francis, 2001

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.706.17 THEORY OF MACHINING (MU)

L-T-D: 3-1-0 **Credits : 4**

MODULE I

General classification of Cutting Tool-single point multi point cutting tools and form tools-Cutting tool nomenclature, systems-types of single point cutting tools-Left hand , right hand ,straight shank, bent shank-offset and stepped. Geometry-Cutting tool signature-Effect of cutting tool geometry in metal cutting .Mechanism of metal removal-Mechanism of chip formations-classes of chips Friction in metal cutting –Methods of reducing friction –Chip control and chip breaker-Primary deformations on shear zone-secondary deformations on rake face.

MODULE II

Mechanism of metal cutting –Forces of deformations at the cutting edge. Shear angle lee and Shaffer's solution. Stress distribution on rake face – Velocity relationships-Chip thickness Ratio- Merchant's circle diagram-Relationship between forces, cutting speed, feed and depth of cut. Problems. Dynamometers – principle of cutting force, Measurements. Need and requirement of dynamometers –Turning, milling, drilling and grinding dynamometers-Deformation studies using quick-stop devices. Heat in metal cutting-zones of heat generation – variables affecting the tool temperature-Temperature in metal cutting – Tool work thermocouple- Embedded thermocouple – Calorimetric method. Surface finish- Parameters on surface finish.

MODULE III

Cutting tool materials, major tool material types-HSS, coated HSS, satellite, Cemented Carbides, Titanium Carbides Coated carbides, Ceramics, SIALON, Diamonds, CBN , Ucon, their characteristics and applications. Tool wear and life –Types of wear-mechanism of tool wear. Tool wear criteria –Tool life – Taylor's tool life equation. Modified tool life equation and estimation of tool life –Machinability. Parameters affecting tool life.- Problems – Economics of cutting. Machinability criteria-optimum cutting speed – cutting fluids- Selection of cutting fluids-Action of cutting fluids – Application of cutting fluids.

References:-

1. Sen and Bhattacharya, Principle of metal cutting.
2. Shaw M.C, Metal cutting principles.
3. Boothroyd, Fundamentals of Machining and Machine Tools.
4. Black P.H, Theory of metal cutting.
5. Production Technology, HMT
6. Venkitesh.V.G, Experimental methods in metal cutting.
7. Tool Manufacturing Engineers Hand Book, ASTME

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.706.18 BIO MATERIALS

L-T-D: 3-1-0 **Credits : 4**

Module I

Metallic biomaterials: Introduction, Stainless Steels, Cobalt Chromium Alloys, Titanium Alloys, Dental Materials, Corrosion of Medical Implants, Manufacturing of Implants.

Polymeric biomaterials: Polymers used as Biomaterials, Sterilisation, Surface Modification for improving bio compatibility, biodegradable polymeric materials, Tissue derived Biomaterials, Soft Tissue Replacement, Hard Tissue Replacement, Preservation Techniques.

Module II

Ceramic and composite biomaterials: Introduction, Bio inert Bio Ceramics, Biodegradable ceramics, Bioactive ceramics, deterioration of ceramics, manufacturing techniques, Biocompatibility and Application of Composite Biomaterials.

Biomaterial application of smart materials: Introduction, Properties, Biocompatibility, Shape Memory effect, Super Elasticity, Hysteresis, Anti – Kinking, Application with examples – Orthopedic, Dental, Surgical Instruments, Stent, Artificial Urethral Valves.

Module III

Biomaterial characterization and selection: Biomaterials surface analysis, Auger Electron Spectroscopy, Scanning ion mass Spectroscopy, Atomic Force Microscopy, Electron Spectroscopy for Chemical Analysis. Function, Biocompatibility, Material Selection for Orthopedic, Blood Contacting and Space Filling applications.

REFERENCES

1. Joseph D. Bronzino, “The Bio Medical Engineering Handbook”, Vol.I, CRC Press, 2000.
2. Mel Schwartz, “ Encyclopedia of Smart Materials”, Vol. I, John Wiley and Sons, USA, 2002.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.706.19 CONCURRENT ENGINEERING

L-T-D: 3-1-0 **Credits : 4**

Module I

Extensive definition of Concurrent Engineering (CE) - CE design methodologies - Organizing for CE - CE tool box collaborative product development. IT support - Solid modeling - Product data management - Collaborative product commerce.
Artificial Intelligence- Expert systems - Software hardware co-design.

Module II

Life-cycle design of products - opportunity for manufacturing enterprises - modality of Concurrent Engineering Design - Automated analysis idealization control - Concurrent engineering in optimal structural design - Real time constraints. Manufacturing competitiveness - Checking the design process - conceptual design mechanism – Qualitative physical approach - An intelligent design for manufacturing system. JIT system - low inventory - modular - Modeling and reasoning for computer based assembly planning –

Module III

Design of Automated manufacturing. Life Cycle semi realization - design for economics - evaluation of design for manufacturing cost – concurrent mechanical design - decomposition in concurrent design - negotiation in concurrent engineering design studies - product realization taxonomy - plan for Project Management on new product development – bottleneck technology development.

REFERENCES

1. Anderson MM and Hein, L. Berlin, "Integrated Product Development", Springer Verlog, 1987.
2. Cleetus, J, "Design for Concurrent Engineering", Concurrent Engg. Research Centre, Morgantown, WV, 1992.
3. Andrew Kusaik, "Concurrent Engineering: Automation Tools and Technology", Wiley, JOhn and Sons Inc., 1992.
4. Prasad, "Concurrent Engineering Fundamentals: Integrated Product Development", Prentice Hall, 1996.
5. Sammy G Sinha, "Successful Implementation of Concurrent Product and Process", Wiley, John and Sons Inc., 1998.
6. Web Reference: www.tm.tue.nl/race/ce/ce95.html

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.706.20 INDUSTRIAL AUTOMATION

L-T-D: 3-1-0 **Credits : 4**

Module I

Introduction: Basic concept of Automation, Types of Automation, Feasibility etc. Industrial Hydraulics: Introduction, basic concepts, Hydraulic fluids, Classification and properties of hydraulic fluids, Contaminates in hydraulic system, control and cleanliness standards, Fluid power generators, i.e. Gear, Vane, Piston pumps, linear and Rotary Actuators, Direction Control Valves, types, actuation methods, pressure control valves; pressure reducing valves, pressure relief valve, Unloading valve, Sequence valve, Counterbalance valve, Flow control valves simple and pressure compensated type.

Module II

Pneumatics: Introduction, Basic components, Source, storage and distribution, treatment of compressed air, linear and Rotary actuators, Direction control valves – types, actuation methods, pressure control valves, logic devices – twin pressure valve, shutter valve, time delay valve, Pneumatic circuit design and analysis, conventional as well as computer aided design. Robotics: Basic concepts, classification based on Geometry, programming, drives, work volume of robots world and joint coordinates various joints, DOF, end effectors – Types and uses, Sensors in Robots, programming – Teach pendant and Computer programming, Introduction to forward and inverse kinematics, Applications of Robots.

Module III

Automatic Assembly System: Development of Automatic Assembly process, Transfer devices – continuous, Intermittent, synchronous and asynchronous, Vibratory feeders – Mechanics, effect of frequency, acceleration, track angle, friction, load sensitivity, orientation of parts – active and passive devices, Mechanical feeders – computation and operational details, feed tracks, Escapement devices. Product design for high-speed automatic assembly, examples of design modifications.

Reference

1. Anthony Esposito, *"Fluid Power with Application",* 5th Edition, Pearson Education (2003).
2. Majumdar S R, *"Oil Hydraulic System"*, Tata McGraw Hill (2001).
3. Bolton W, *"Mechatronics"*, 2nd Edition, Pearson Education, New Delhi (1999).
4. Necsulelscu Dan*, "Mechatronics"*, Pearson Education, New Delhi (2002).
5. Geoffrey Boothroyd, "Assembly Automation and Product Design", Marcel Dekker Inc (1991).

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.706.21 ALTERNATE ENERGY SOURCES

L-T- D; 3-1-0 **Credits 4**

MODULE-I

Introduction: Need for non-conventional energy sources, energy conservation in transportation sector, alternative energy, alcohol, hydrogen, biomass, and electric energy

Alcohol: Methanol and Ethanol production methods, properties of methanol and ethanol as engine fuels, use of alcohols in Sl engines. performance of methanol and gasoline blends. Combustion characteristics of alcohols in S.1 engines, use of alcohols in Cl engines, different methods of use- Alcohol Diesel emulsions, dual fuel systems, Flex fuel Vehicles (FFV)

Hydrogen energy: Properties of hydrogen, sources of hydrogen, production of hydrogen, electrolysis of water, thermal decomposition of water, thermo chemical production and biochemical production, storage and transportation methods, applications to engines, modifications necessary, precautions and safety for use, performance characteristics in engines, use in fuel cells.

MODULE-II

Gaseous fuels: Biogas production, description of biogas plant, application of biogas as a single fuel and dual fuel, performance of LPG, property & its use in Sl engines, fuel metering system, natural gas and producer gas - use in S.I. and C.1 engines.

Vegetable oil: Vegetable oil properties, Production of Bio-diesel, esterification of vegetable oil, Soya bean diesel, rapeseed oil, rice bran oil etc., diesel and vegetable oil blends, and engine performance with vegetable oil.

MODULE-III

Solar power: Collection and storage of solar energy, collection devices, flat plate collectors, concentrating type collectors, principle and working photovoltaic conversion, application to automobiles

Electric vehicles: Design considerations, limitations, batteries for electric vehicles, types & capacities, driving requirements, applicability of electric cars, comparative use of fuel and energy recharging, Hybrid vehicles - types and layouts.

References:

1. T. K. Garrett: Automotive fuels system, SAE INC, Warrendale, 1991
2. David Powell and Richard P. Brennan- The Automobile technology and society Printice Hall.
3. Keeith Owen & Trevor Colley - Automotive Fuels reference book, SAE
4. Tom Koppel- Powering the future, SAE
5. Richard L. Bechtold- Alternate fuels guide book, SAE
6. Bob Brant.- Build your own Electric Vehicle, SAE
7. SAE papers: 73802, 750121, 750118. 741008
8. Energy research group- Alternate liquid fuels Willey Eastern Ltd,
9. New Delhi, 1990
10. T.N Vezgirigiu- Alternative energy sources
11. Mathur and Sharma- IC. Engines, Dhanpat Rai and Sons.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.706.22 AUTOMOTIVE POLLUTION AND CONTROL

L-T- D; 3-1-0 **Credits 4**

Module-I

Introduction: General Scenario on automotive Pollution, Pollutants-sources-formation-effects on human beings and environment, Green house gases and global warming, transient operational effects on pollution, Engine Combustion and Pollutant Formation: HC, CO, NOx, Particulate Matters, Aldehyde emissions, Effect of operating variables on emission formation.

Emission Control Efforts: Supply of fuel – establishment of national test centers, construction of road networks.

Module-II

Emission Standards : Driving Cycles, ECE, EUDC, Bharat Stages & Euro emission standards, Evaluation of Emission Standards – Mandatory Tests for Emission measurement –Type Approval & Production Conformity Tests

Control Techniques for SI and CI: Basics of diesel combustion - Smoke emission in diesel engines - NO emission from diesel engines – Particulate emission in diesel engines. Color and Aldehyde emissions from Diesel engines - Effects of operating variables on emission formation.

Design changes, optimization of operating factors, Control of Crankcase emission, Evaporative emission, Canisters, Exhaust emission - exhaust gas recirculation, air injector PCV system, thermal reactors, catalytic converters

Module-III

Test Procedure & Instrumentation for Emission Measurement: Test procedures- Calculation of volume of Exhaust gases, Volume of constituents for perfect combustion, Measurements of invisible emissions -ORSAT apparatus, NDIR analyzer, Flame ionization detectors, Chemiluminescent analyzer, Gas analyzer, Measurements of visible emissions – Comparison methods & Obscure methods - Smoke meters, Emission standards.

***References*:**

1. B.P. Pundir, “Engine Emissions”, Narosa Publishing House, 2007.
2. V. Ganesan, Internal Combustion Engines, Tata McGraw Hill Co., 2004.
3. K.K. Ramalingam, “Automobile Engineering”, Scitech Publications Pvt. Ltd., 2005
4. Amitosh De, “Automobile Engineering”, Galgotia Publications Pvt. Ltd., 2004
5. Dr. N.K. Giri, “Automobile Mechanic”, Khanna Publishers, 2006
6. Heywood. J.B., Internal Combustion Engine Fundamentals, McGraw Hill Book Co.,1995.
7. Automobiles and Pollution SAE Transaction, 1995

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.706.23 CREATIVITY, INNOVATION AND NEW PRODUCT DEVELOPMENT

L-T- D; 3-1-0 **Credits 4**

Module-I

The process of technological innovation - factors contributing to successful technological innovation - the need for creativity and innovation - creativity and problem solving - brain storming - different techniques.

Invention and Creativity - Intellectual Property (IP) - Importance - Protection of IPR - Basic types of property (i. Movable Property ii. Immovable Property and iii. Intellectual Property).

Module-II

Collection of ideas and purpose of project - Selection criteria - screening ideas for new products (evaluation techniques). Research and new product development - Patents - Patent search - Patent laws - International code for patents - Intellectual property rights (IPR). IP - Patents - Copyrights and related rights - Trade Marks and rights arising from Trademark registration

Definitions - Industrial Designs and Integrated circuits - Protection of Geographical Indications at national and International levels - Application Procedures

Module-III

Indian Position Vs WTO and Strategies - Indian IPR legislations - commitments to WTO-Patent Ordinance and the Bill - Draft of a national Intellectual Property Policy - Present against unfair competition.

Design of proto type - testing - quality standards - marketing research - introducing new products.

Creative design - Model Preparation - Testing - cost evaluation - Patent application

References:

1. Harry Nystrom, " Creativity and innovation", John Wiley & Sons, 1979.
2. Brain Twiss, " Managing technological innovation", Pitman Publishing Ltd., 1992.
3. Harry B.Watton, " New Product Planning ", Prentice Hall Inc., 1992.
4. P.N.Khandwalla - " Fourth Eye (Excellence through Creativity) - Wheeler Publishing ", Allahabad, 1992.
5. I.P.R. Bulletins, TIFAC, New Delhi, 1997.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

ELECTIVE IV

08.805.1 EXPERIMENTAL STRESS ANALYSIS TECHNIQUES

L-T-D: 3-1-0 **Credits : 4**

MODULE I

Basic concepts : The generalized basic systems – Definition – Stress at a point - Stress equation of equilibrium – Principal stress – Two dimensional stress systems – Strain and stress relations – Principal strain – Strain compatibility – Plane stress – Plane stress and strain problems –
Photoelastic methods : Behaviour of light – Polarised light – Plane polariser – Wave plate – Conditioning of light by a series combination of linear polariser and a wave plate – Arrangement of optical elements in polariscope . The stress optic law in two dimensions at normal incidence – Plane polariscope – Circular polariscope - Fringes – Moiré techniques – Photo elastic photography – Photo elastic model materials – Properties – Calibration methods – Analysis of photoelastic data – Isochromatics – Isoclinics – Compensation techniques - Application of photo elastic methods .

MODULE II

Electrical strain gauges – Definition of strain and its relation to experimental determination – Strain gauge – Types – Analysis – Strain sensitivity – Gauge construction – Temperature compensation – Rosette analysis – Rectangular Delta - Delta – Stress gauge – Strain gauge circuits – Wheatstone bridge – Null Balance recording instruments – Cathode Ray Oscilloscope.

MODULE III

Non Destructive Tests – Need , Types – Visual Examinations , penetrate tests, Hammer tests – Brittle coating techniques – Crack patterns – Types of coatings – Elementary ideas-Holographic non Destructive testing .

REFERENCES

1. Photo elasticity - M.M.Frocht
2. Experimental stress analysis – J.W.Dally and W.P.Railey
3. Applied stress Analysis – Durelli and Philips
4. Experimental stress analysis and Motion Measurement – R.C.Dove and B.H.Adams
5. Moire Fringes Strain Analysis – Pericles Theocaries

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.2 AEROSPACE ENGINEERING

L-T-D: 3-1-0 **Credits : 4**

Module – I

The atmosphere-characteristics of troposphere , stratosphere , thermosphere , and ionosphere- pressure, temperature and density variations in the atmosphere. Application of dimensional analysis – aerodynamic force – model study and similitude. 2D aero foils -Nomenclature and classification- pressure distribution in inviscid and real flows- momentum and circulation theory of aerofoil- characteristics. 3D or Finite aero foils – effect of releasing the wing tips- wing tip vortices- replacement of finite wing by horse shoe vertex system- the lifting line theory-wing load distribution – aspect ratio, induced drag- calculation of induced drag from momentum considerations. Skin friction and from drag- changes in finite wing plan shape.

Module II

Propellers – momentum and blade element theories –propeller coefficients and charts. Aircraft performance-straight and level flight –power required and power available graphs for propeller and jet aircraft-gliding and climbing –rate of climb-service and absolute ceilings-gliding angle and speed of flattest glide- take off and landing performance – length of runway required- aircraft ground run- circling flight – radius of tightest turn-jet and rocket assisted take –off- high lift devices-range and endurance of airplanes-charts for piston and jet engine aircrafts.

Module III

Flight Instruments-airspeed indicator, calculation of true air speed-altimeter- gyro horizon -direction indicator-vertical speed indicator –turn and back indicator-air temperature indicator. (Brief description and qualitative ideas only). Ideas on stability-static and dynamic stability- longitudinal, lateral and directional stability- controls of an aero plane- aerodynamic balancing of control surfaces- mass balancing (Qualitative ideas only). Principles of wind tunnel testing –open and closed type wind tunnels-wind tunnel balances- supersonic wind tunnels. Study of subsonic, Transonic, and supersonic aircraft engines (Description with fig. Only). Elementary ideas on space travel-calculation of earth orbiting and escape velocities ignoring air resistance and assuming circular orbit.

References:

1. Mechanics of flight. A. C. Kermode
2. Aerodynamics for Engineering Student Houghton and brock.
3. Fundamentals of Aerodynamics Anderson
4. Aircraft Instruments and Integrated systems- EHJ Pallett

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.3 FACILITIES PLANNING

L-T-D: 3-1-0 **Credits : 4**

Module I

Design of layout of factories, Office, Storage area etc. on consideration of facilities of working people, Storage facilities and general equipment for amenities of working people – Product, Process and combination layout – Systematic layout planning – Design of Assembly lines, Line balancing methods, Computer applications in layout designs.

Module II

Environmental aspects like lighting, Ventilation, dust control, humidity. Different type of Plant services like steam compressed air etc. – Plant safety, Elements off Industrial safety- Causes and prevention of accidents – Pollution and environmental consideration.

Module III

Material handling system and equipment – Material handling in Plants , Stores and warehouses , Receiving and dispatching area – Choice of material handling equipment – Cost control in material handling.

Equipment replacement – Repair, replacement depends on technical and economical consideration. Use of DCF techniques.

REFERENCE

1. Plant layout and Material Handling- John A Sehbin
2. Plant layout and Material Handling - James A Apple
3. Plant layout and Material Handling - A W Peymberton
4. FF & Control - G Aysan

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.4 ADVANCED DECISION MODELLING

L-T-D: 3-1-0 **Credits : 4**

MODULE I

Development of operations research as a branch of knowledge since 2nd world war – Fields of application of operations.

Queuing theory – Birth and death processes – Basic queuing process – Single server and multiple server models – Poison input and exponential service – Limited source, limited queue etc. Priority disciplines – Practical applications.

Linear programming – Graphical solutions – Simplex method – Transportation problem –Assignment problem solution to transportation, Assignment and trans-shipment problems – Post optimality analysis – Complications and their resolution – Practical applications and examples.

MODULE II

Network theory – Maximal flow problems – Travelling salesman problems - network with PERT / CPM.

Introduction to dynamic Programming, Stochastic programming and integer programming

Inventory theory – deterministic inventory models.

MODULE III

Decision making – Statistical decision theory. Decision trees . Replacement – replacement in anticipation of failure – Group replacement.

Scheduling on machines 2 job – 2-machine problem – Johnson's algorithm – graphical solution.

Game theory – Practical application of game theory – 2 person zero – Sum games – Solving simple games – Mixed strategy – Graphical solution.

REFERENCE

1. Introductions to operations research – Hillier and Lieberman ,Holden day.
2. Introductions to operations research – Wagner and Pranti ,Philips and Ravindran
3. Fundamentals of operations research – Ackeff and Sasionic, Wiley.
4. Operations research - Churchman ,Ackeff and Arneff, Wiley.
5. Operations research - Taha, Mc graw Hill.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.5 NON LINEAR DYNAMICS AND CHAOS

L-T-D: 3-1-0 **Credits : 4**

Module I

Introduction to dynamical systems: discrete time systems - continuous time systems - autonomous and non autonomous systems - phase space and flows - attracting sets - concepts of stability

Equilibrium solutions: fixed points and stability of continuous - time systems - classification and stability of equilibrium solutions - fixed points of maps and their stability - local and global bifurcation of continuous systems - static and dynamic bifurcations - bifurcation of maps

Module II

Periodic solutions - periodic solutions of continuous - time dynamical systems - autonomous and non autonomous systems - limit cycle - floquet theory - poincare' maps - bifurcation - symmetry breaking - cyclic fold - period doubling - transcritical and Hopf bifurcations

Quasiperiodic solutions: Poincare' maps - circle map - construction of quasiperiodic solutions

Chaotic solutions of maps: dynamics of logistic equation - bifurcation diagram of one-dimensional maps - feigenbaum number - Henon map

Chaotic solutions of continuous systems: Duffing's equation - Rossler equations - period doubling and intermittency mechanisms

Module III

Experimental methods in chaotic vibrations: experimental system to measure the Poincare' map of a chaotic physical system

Fractals and dynamical systems: Koch curve - cantor set - fractal dimension - measures of fractal dimension - capacity dimension - correlation dimension and Information dimension - fractal dimension of strange attractors

Tools to identify and analyze motions: time history - state-space and pseudo state space - embedding dimension and time delay - Fourier spectra, Poincare' sections and maps - lyapunov exponents

References:

1. Nayfeh A.H. & Balachandran B., *Applied Nonlinear Dynamics*, John Wiley
2. Thomson J.M.T. & Stewart H B, *Nonlinear Dynamics And Chaos*, John Wiley
3. Moon F.C., *Chaotic and Fractal Dynamics*, John Wiley
4. Wiggins S., *Introduction To Applied Nonlinear Dynamical Systems And Chaos*, Springer Verlag
5. Baker G.L.& Gollub J.P., *Chaotic Dynamics,* Cambridge University Press
6. Peitgens, Jurgens & Saupe, *Chaos and Fractals,* Springer Verlag
7. Scheinerman E.R., *Invitation to Dynamical Systems*, Prentice Hall

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.6 DESIGN OF JIGS AND FIXTURES

L-T-D: 3-1-0 **Credits : 4**

Module I

Introduction - purpose of work holding devices - principles of jig and fixture design - construction methods and materials used - process planning and typical operation layout product considerations - pre-design analysis - product analysis - operation analysis - machine analysis - operator analysis and cost analysis - examples of pre-design analysis - principles of locating and positioning - definition of location - basic principles - methods of location - pin and button locators - plane, concentric, spherical, radial and V-locators - redundant locators

Module II

Design and mechanics of clamping devices - principles of clamping - standard fixture components - types of clamps - strap, swing, hinge and two-way (multiple) clamps - wedge, pinch and magnetic clamps - latch and self locking clamps - pneumatic, hydraulic and pneumo-hydraulic clamps - design considerations in work holder design and selection - design calculations of lever type clamp - hook type clamp - wedge type clamp - screw clamps - mandrels and collet - chucks - worked examples

Module III

Fixtures - milling fixtures - slot and key-way milling fixtures - fixture for milling flanges - straddle milling fixtures - indexing fixture - face milling fixture with equalizers - profile milling fixtures - universal fixture for profile milling - boring and lather fixtures - fixture design - examples of design and drawing of milling fixtures for machining of simple components - fixtures for inspection testing and assembly - welding fixtures - economics

Drill Jigs -definition - drill guide bushings - jig feet and legs - types of drill jigs - template -vise - leaf box and tumble jigs - indexing jigs - jaw chucks - drive chucks - magnetic chucking devices -mandrels - machine vices - indexing tables and worktables - examples of design and drawing of drill jig for machining of simple components

References

1. Kempster M.H.A., "*An Introduction to Jig and Tool Design"*, ELBS
2. ASTME, *Fundamentals of Tool Design*
3. Grant H.E., "*Jigs and Fixtures - Non Standard Clamping Devices*", Tata McGraw Hill
4. Goroshkin A.K., "*Jigs and Fixtures Hand Book*", MIR Publishers
5. Wilson & Holt, "*Hand book of Fixture Design*", McGraw Hill
6. Colving & Haas, "*Jigs and Fixtures - A Reference Book*", McGraw Hill
7. Cole B., "*Tool Design*", Taraporevala
8. Donaldson, Lecain & Goold, "*Tool Design*", Tata McGraw Hill

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.7 MULTIPHASE FLOW

L-T-D: 3-1-0 **Credits : 4**

Module I

Basic equations and empirical correlations for multi-phase flow - flow patterns - identification and classification - flow pattern maps and transition - momentum and energy balance - homogeneous and separated flow models - correlations for use with homogeneous and separated flow models - two phase flow through inclined pipes and singularities - void fraction and slip ratio correlations - influence of pressure gradient - empirical treatment of two phase flow - drift flux model - correlations for bubble, slug and annular flows - pressure losses through enlargements, contractions, orifices, bends and values

Module II

Boiling and multiphase heat transfer - vapour-liquid equilibrium mechanisms - pool boiling convective boiling - heat transfer in partial and fully developed sub-cooled boiling - void fraction and pressure drop in sub-cooled boiling - saturated boiling heat transfer - two phase forced convection laminar and turbulent flow solutions for film heat transfer - empirical equations for film boiling and transition boiling - burnout mechanism and correlations - critical coefficient in nucleate and convective boiling

Module III

Condensation - basic processes of condensation - mechanism of evaporation and condensation - film condensation on a planar surface - dropwise condensation - pressure gradient in condensing systems - methods of improving heat transfer coefficient in condensation.

Critical multiphase flows - mathematical models - critical flow criterion - compatibility conditions and their physical interpretation - experimental observations - propagation of small disturbances - pressure drop limitation effect - graphical representation of critical flow conditions

References:

1. Collier J.G., *Convective Boiling and Condensation,* McGraw Hill
2. Hsu Y.Y. & Graham R.W., *Transport Processes in Boiling and Two Phase Systems*, Hemisphere
3. Ginoux J.J., *Two Phase Flows and Heat Transfer*, Hemisphere, McGraw Hill
4. Tong L.S., *Boiling Heat Transfer and Two Phase Flow*, Wiley
5. Hewitt G., Delhaye J.M. & Zuber N., *Multiphase Science and Technology*, Vol. I., McGraw Hill

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.8 CONTROLS IN MACHINE TOOLS

L-T-D: 3-1-0 **Credits : 4**

MODULE-I

Hydraulic control- Hydraulic principles- elements of hydraulic systems- pumps filters, seals, valves, accumulators etc. Study of their functional & design characteristic. Analysis and study of typical hydraulic circuits in machine tools. Design of systems for specific requirements- Introduction to servo systems- maintenance of hydraulic systems- Pneumatic and hydro pneumatic circuits.

MODULE- II

Numerical control: Introduction to numerical control- Application of NC machines – Types of Numerical control- Information flow in NC machine tool- Information carriers- tape reader- interpolator – Measuring devices- analogue, Digital incremental and digital absolute.

MODULE-III

Programming- manual and computer aided programming- Programming languages- APT, ADAPT, EXAPT, Economics of numerically controlled machines, adaptive control principles.

REFERENCES:

1. Industrial Hydraulics- John Pippinger
2. Machine Tools Design—Acherkan
3. CAD/CAM- Mikel P Groover
4. NC Machines & CAM- Kundra. C. K, P. N. Rao, N. K. Temeri

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.9 DESIGN OF PRESSURE VESSELS AND PIPING

L-T-D: 3-1-0 **Credits : 4**

Module I

Methods for determining stresses - Terminology and Ligament Efficiency - Applications.

Stresses in pressure vessels: Stresses in a circular ring, cyclinder - Membrane stress Analysis of Vessel Shell components - Cylindrical shells, spherical shells, torispherical heads, conical heads - Thermal stresses - Discontinuity stresses in pressure vessels.

Module II

Design of vessels : Design of tall cyclindrical self supporting process columns - supports for short vertical vessels – stress concentration - at a variable thickness transition section in a cylindrical vessel, about a circular hole, elliptical openings. Theory of reinforcement - pressure vessel design.

Module III

Bucking and fracture analysis in vessels : Buckling phenomenon - Elastic Buckling of circular ring and cylinders under external pressure - collapse of thick walled cylinders or tubes under external pressure - effect of supports on Elastic Buckling of cylinders - Buckling under combined External pressure and axial loading - Control and significance of Fracture Mechanics in Vessels - FEM application.

Piping : Introduction - Flow diagram - Piping layout and piping stress Analysis.

References:

1. John F. Harvey, " Theory and Design of Pressure Vessels ", CBS Publishers and Distributors, 1987.
2. Henry H. Bedner*, " Pressure Vessels, Design Hand Book ", CBS Publishers and Distributors, 1987.*
3. Stanley, M. Wales*, " Chemical Process Equipment, Selection and Design. Buterworths series in Chemical Engineering ", 1988.*

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.10 TRIBOLOGY

L-T-D: 3-1-0 **Credits : 4**

MODULE I

Friction : Nature of surfaces – Mechanism of friction – Laws of friction and friction theories – Merits and demerits .

Wear : Classification of wear – Theories of wear – Stages of Cohesive wear – Quantitative relationship for abrasive wear – Minor types of wear – Factors affecting wear .

MODULE II

Lubrication : Role of lubrication in present day practice – Fundamentals of viscosity and viscous flow – Flow through capillary tubes – Parallel plates – Radial flow between parallel circular plates – Continuity equation and Raynold's equation .

Viscosity and Viscometers – Starsor Viscometer – Falling sphere viscometer – Saybelt Universal Viscometer – Viscosity index.

MODULE III

Analysis of hydrostatic oil pads – Load carrying capacity – Oil flow – Power loss – Application to thrust bearing , use of restrict hydro static squeeze films .

Analysis and application of Hydrodynamic Lubrication – Load carrying capacity , power loss and friction in ideal journal bearings – Use of linkage factors – Significance of Sommerfeld number – Eccentricity ratio – Unit load

References:

1. Basu, SenGupta and Ahuja, Fundamentals of Tribology, PHI.
2. Sushil Kumar and Srivatsava, Tribology in Industry, S.Chand Co.
3. Majumdar .B.C., Tribology

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.11 VALUE ENGINEERING

L-T-D: 3-1-0 **Credits : 4**

Module I

Introduction: History, Basic concepts of value engineering, development and scope of value management, value analysis, functions and value-Basic functions, Secondary functions values-Use value, Esteem value, Cost value and Exchange value Costing Vs Value engineering, principles of costing &cost estimation, benefits.

Steps in value engineering process-preparation problem selection, information, evaluation. Creation, selection and presentation, implementation and follow up.

Module II

Selection of project, team members, general phase, information phase, Creation phase, evaluation phase, investigation and implementation phase, audit. Project work: work sheets, objectives, techniques, guidelines, Checklist, cost worth model, role of creativity.

Approaches-job plan, DARSIRI, FAST Diagram as a tool, examples on usage of these tools

Module III

Value Engineering cases: Value Engineering raises production and productivity, Value Engineering is intensive cost search, Value Engineering prevents unnecessary uses of resources. Methodology, Industrial cases - Product manufacturing, Chemical processing, Automated Production, Semi – Automated production.

References:

1. S.S. Iyer, Value Engineering, New Age International (P) Ltd, New Delhi, 2000.
2. A. K. Datta, Materials Management, Inventory Control and Logistics, Jaico Publishing House, Mumbai, 2001.
3. Miles . L. D, Techniques of Value Analysis and Value Engineering, McGraw hill, 2000.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.12 SOFTWARE ENGINEERING

L-T-D: 3-1-0 **Credits : 4**

Module I

Introduction - FAQs about software engineering - professional and ethical responsibility - system modelling - system engineering process - *the software process* - life cycle models - iteration - specification - design and implementation - validation - evolution - automated process support - *software requirements* - functional and non-functional requirements - user requirements - system requirements - SRS - *requirements engineering processes* - feasibility studies - elicitation and analysis - validation - management - *system models* - context models - behaviour models - data models - object models - CASE workbenches

Software prototyping - prototyping in the software process - rapid prototyping techniques - *formal specification* - formal specification in the software process - interface specification - behaviour specification - *architectural design* - system structuring - control models - modular decomposition - domain-specific architectures - distributed systems architecture

Module II

O*bject-oriented design* - objects and classes - an object oriented design process case study - design evolution - *real-time software design* - system design - real time executives - *design with reuse* - component-based development - application families - design patterns - *user interface design* - design principles - user interaction - information presentation - user support - interface evaluation. *Dependability* - critical systems - availability and reliability - safety - security - critical systems specifications - critical system development - *verification and validation* - planning - software inspection - automated static analysis - clean room software development - *software testing* - defect testing - integration testing - object-oriented testing - testing workbenches - critical system validation -

Module III

S*oftware evolution* - legacy systems - software change - software maintenance - architectural evolution - software re-engineering - data re-engineering

Software project management - project planning - scheduling - risk management - *managing people* - group working - choosing and keeping people - the people capability maturity model - *software cost estimation* - productivity estimation techniques - algorithmic cost modeling, project duration and staffing *quality management* - quality assurance and standards - quality planning - quality control - software measurement and metrics - *process improvement* - process and product quality - process analysis and modeling - process measurement - process CMM - *configuration management* - planning - change management - version and release management - system building - CASE tools for configuration management

References :

1. Ian Sommerville, *Software Engineering*, Pearson Education Asia
2. Pressman R.S., *Software Engineering*, McGraw Hill
3. Mall R., *Fundamentals of Software Engineering*, Prentice Hall of India
4. Behferooz A. & Hudson F.J., *Software Engineering Fundamentals*, Oxford University Press
5. Jalote P., *An Integrated Approach to Software Engineering*, Narosa

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.13 CRYOGENIC ENGINEERING

L-T-D: 3-1-0 **Credits : 4**

MODULE –I

Introduction to Cryogenic Systems, Historical development, Low Temperature properties of Engineering Materials, Mechanical properties- Thermal properties- Electric and magnetic properties –Cryogenic fluids and their properties.

Applications of Cryogenics: Applications in space, Food Processing, super Conductivity, Electrical Power, Biology, Medicine, Electronics and Cutting Tool Industry. Law temperature properties of engineering materials:

MODULE –II

Liquefaction systems ideal system, Joule Thomson expansion, Adiabatic expansion, Linde Hampson Cycle, Claude & Cascaded System, Magnetic Cooling, Stirling Cycle Cryo Coolers.

Gas liquefaction systems: Introduction-Production of low temperatures-General

Liquefaction systems- Liquefaction systems for Neon. Hydrogen and Helium – Critical components of Liquefaction systems.

MODULE –III

Cryogenic Refrigeration systems: Ideal Refrigeration systems- Refrigeration using liquids and gases as refrigerant- Refrigerators using solids as working media;, cryogenic fluid storage and transfer systems: Cryogenic Storage vessels and Transportation, Thermal insulation and their performance at cryogenic temperatures, Super Insulations, Vacuum insulation, Powder insulation, Cryogenic fluid transfer systems

Pressure flow-level and temperature measurements.–. Types of heat exchangers used in cryogenic systems. Cryo pumping Applications.

References:

1. Klaus D.Timmerhaus and Thomas M.Flynn, " Cryogenic Process Engineering " Plenum Press, New York, 1989.
2. Cryogenic systems Randal F.Barron, McGraw Hill, 1986
3. Cryogenic Engineering , R. B. Scott
4. Cryogenic Engineering, J. H. Boll Jr

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.14 BIO MEDICAL ENGINEERING

L-T-D: 3-1-0 **Credits : 4**

MODULE I

Human Anatomy & physiology: Anatomy & Physiology of major systems of the body. Principle of generation and propagation of Bioelectric potentials. Electrical activity of heart, propagation of action potential through nerves, conduction velocity and latency.

Transducers, Leads & Electrodes: Transducers - transducers for biological applications - principles, different types - active and passive transducers, implantable transducers.

MODULE II

Biodynamics:- Mechanics of lower limb during standing and walking, Dynamics and analysis of human locomotion.

Orthopaedic mechanics:- Structure, properties and rheology of bone, Cartilage and synovial fluid. Mechanics of lower limb, upper limb and Spine.

Introduction (Brief description only) to Diagnosis and Therapeutic equipments: Diagnosis equipments - BP monitors, ECG machine, EEG machine, EMG machine, PH meter. Therapeutic equipments - Pacemakers, Defibrillator, Heart - lung machine.

MODULE III

Biomaterials:- Different types of biomaterials - metals, polymers, ceramics, glasses, glass ceramics, composites. Material properties, structural mechanics. Reactions to biomaterials - inflammation, wound healing & foreign body response, immunology and compliment system, -, prostheses and orthotics. Artificial bio-implants – Dental implants, heart valves, kidneys, joints.

References

1. Text book of Medical Physiology – C., M. D. Guyton.
2. Biomechanics: Motion,Flow stress and Growth, Y.C. Fung, Springer, New York, 1990
3. Leslie Cromwell, Fred J.Weibell and Erich A.Pferffer. *Biomedical Instrumentation and Measurements* rentice Hall of India, New Delhi.
4. R.S.Khandpur. *Handbook of Biomedical Instrumentation* , Tata McGraw Hill, New Delhi.
5. Jacob Kline. *Handbook of Biomedical Engineering,* Academic Press Inc.
6. B.D.Ratner and Hoffman. An *Introduction to Materials in Medicine,* Academic Press.
7. John G.Webster. *Medical instrumentation - Application and Design,* Houghton Mifflin company, Boston.
8. John C.Cobbold. *Transducers for Biomedical Measurements,* John Wiley & Sons.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.15 THERMAL MANAGEMENT OF ELECTRONIC SYSTEMS

L-T-D: 3-1-0 **Credits : 4**

Module 1

Introduction to the modes of heat transfer -Conduction, Convection and Radiation- Steady State Heat Transfer- Transient Heat Transfer -Practical thermal resistances-Theoretical power dissipation in electronic components-Heat generation in active Devices-CMOS Devices- Junction FET- Power MOSFET-Heat generated in passive devices- Interconnects-Resistors-Capacitors -Inductors and Transformers-Thermal engineering software. Electronic Equipment for Airplanes, Missiles, Satellites, and Spacecraft -Electronic Equipment for Ships and Submarines -Electronic Equipment for Communication Systems and Ground Support Systems -Personal Computers, Microcomputers, and Microprocessors-Cooling Specifications for Electronics -Specifying the Power Dissipation

Module II

Conduction cooling for chassis and circuit boards: Concentrated Heat Sources- Steady State Conduction- Mounting Electronic Components on Brackets -Uniformly Distributed Heat Sources- Circuit Board with an Aluminum Heat Sink Core- Warping on PCBs with metal heat sink-Chassis with Non uniform Wall Sections- Two-Dimensional Analog Resistor Networks -Heat Conduction across Interfaces in Air - Heat Conduction across Interfaces at High Altitudes -Outgassing at High Altitudes- Heat Conduction through Sheet Metal Covers. Mounting and cooling techniques for electronic components Various Types of Electronic Components on PCB - Mounting Components on PCBs - Mounting High-Power Transistors on a Heat Sink Plate - Electrically Isolating High-Power Components- Component Lead Wire Strain Relief

Natural convection and radiation cooling: Natural Convection for Flat Vertical Plates -Natural Convection for Flat Horizontal Plates -Heat Transferred by Natural Convection -Turbulent Flow with Natural Convection -Finned Surfaces for Natural Convection Cooling - Natural Convection Analog Resistor Networks -Natural Convection Cooling for PCBs -Natural Convection Coefficient for Enclosed Airspace -High-Altitude Effects on Natural Convection. Radiation Cooling of Electronics - Radiation Heat Transfer in Space –view factor -Effects of cy/e on Temperatures in Space -Simplified Radiation Heat Transfer Equation – Combining Convection and Radiation Heat Transfer -Equivalent Ambient Temperature for Reliability Predictions

Module III

Forced convection cooling: Forced Cooling Methods -Cooling Airflow Direction for Fans - Static Pressure and Velocity Pressure -Losses Expressed in Terms of Velocity Heads. Establishing the Flow Impedance Curve for an Electronic Box-Hollow Core PCBs Cooling Air Fans for Electronic Equipment -Air Filters- Cutoff Switches -High-Altitude Conditions -Conditioned Cooling Air from an External Source - air flow direction- flow impedance curve for electronics box- cooling airflow curve-finned cold plates and heat exchangers-fin efficiency factor—undesirable airflow reversals- effect of altitude. Static Pressure Losses for Various Altitude Conditions -Total Pressure Drop for Various Altitude Conditions -Finned Cold Plates and Heat Exchangers -

Pressure Losses in Multiple-Fin Heat Exchangers -Fin Efficiency Factor - Undesirable Airflow Reversals -High-Power Cabinet Effects of Altitude on Heat Exchanger Performance - Different Altitude and Power Conditions. Transient cooing: Simple Insulated Systems -Thermal Capacitance -Time Constant Heating Cycle Transient Temperature Rise -Temperature Rise for Different Time Constants -Cooling Cycle Transient Temperature Change - Transient Analysis for Temperature Cycling Tests. Cooling : direct cooling and indirect cooling- heat sink, forced liquid system cooling, solid state thermoelectric cooling, heat pipe, jet impingement cooling, spray cooling- Environment stress screening techniques: damage during thermal cycling and vibration, single axis and multi axis vibration, orientation of circuit boards within the chassis.

References:

1. Ralph Remsberg, Thermal design pf electronic equipment, CRC Press LLC
2. Dave S. Steinberg Cooling Techniques for Electronic Equipment, John Wiley & Sons, Inc
3. Sadik Kakac, H.Yuncu,K,Hijikata, H.Hijikata, Cooling of electronic systems
4. J.P.Bardon,E.Beyna, J.B.Sauliniar, Thermal management of electronic systems
5. Yunus A Cengel, Heat Transfer: A Practical Approach, Tata McGraw Hill Inc., New York
6. Holman J P, Heat Transfer, McGraw Hill Inc., New York,
7. Frank P. Incropera and David P. Dewitt, Heat and Mass Transfer. John Wiley and sons
8. Nag P K., Heat and Mass Transfer, Tata McGraw Hill Publishing Company.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.16 CONTINUUM MECHANICS

L-T-D: 3-1-0 **Credits : 4**

Module 1

Continuum Theory- The Continuum Concept, Continuum Mechanics
Essential Mathematics - Scalars, Vectors, and Cartesian Tensors, Tensor Algebra in Symbolic Notation, Summation Convention, Indicial Notation, Matrices and Determinants, Transformations of Cartesian Tensors, Principal Values and Principal Directions of Symmetric, Second-Order Tensors, Tensor Fields, Tensor Calculus, Integral Theorems of Gauss and Stokes

Module 2

Stress Principles - Body and Surface Forces, Mass Density, Cauchy Stress Principle, The Stress Tensor, Force and Moment Equilibrium, Stress, Tensor Symmetry, Stress Transformation Laws, Principal Stresses, Principal Stress Directions, Maximum and Minimum Stress Values, Mohr's Circles for Stress, Plane Stress, Deviator and Spherical Stress States, Octahedral Shear Stress
Kinematics of Deformation and Motion - Particles, Configurations, Deformation, and Motion, Material and Spatial Coordinates, Lagrangian and Eulerian Descriptions, The Displacement Field The Material Derivative, Deformation Gradients, Finite Strain Tensors, Infinitesimal Deformation Theory, Stretch Ratios, Rotation Tensor, Stretch Tensors, Velocity Gradient, Rate of Deformation, Vorticity, Material Derivative of Line Elements, Areas, Volumes

Module 3

Fundamental Laws and Equations - Balance Laws, Field Equations, Constitutive Equations, Material Derivatives of Line, Surface, and Volume Integrals, Conservation of Mass, Continuity Equation, Linear Momentum Principle, Equations of Motion, The Piola-Kirchhoff Stress Tensors, Lagrangian Equations of Motion, Moment of Momentum (Angular Momentum) Principle, Law of Conservation of Energy, The Energy Equation, Entropy and the Clausius-Duhem Equation, Restrictions on Elastic Materials by the Second Law of Thermodynamics, Invariance, Restrictions on Constitutive Equations from Invariance, Constitutive Equations. Linear Elasticity - Elasticity, Hooke's Law, Strain Energy, Hooke's Law for Isotropic Media, Elastic Constants, Elastic Symmetry; Hooke's Law for Anisotropic Media, Isotropic Elastostatics and Elastodynamics, Superposition Principle, Plane Elasticity, Linear Thermoelasticity, Airy Stress Function, Torsion, Three-Dimensional Elasticity

References:

1. G. T. Mase & G. E. Mase, Continuum mechanics for engineers. --2nd ed.
2. J.N. Reddy, An Introduction to Continuum Mechanics.
3. Shaums outline, Continuum_Mechanics.
4. Sudhakar Nair, An Introduction to Continuum Mechanics.
5. J.H. Heinbockel, Introduction to Tensor Calculus and Continuum Mechanics.
6. Y.C. Fung, First Course in Continuum Mechanics (1993) -

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.17 PRODUCT AND BRAND MANGEMENT

L-T-D: 3-1-0 **Credits : 4**

Module I

Definition of a product- -product concepts-product mix concepts-product classification

Product planning: Marketing plan- portfolio analysis- Market potential and demand forecasting.

Product market strategies- product life cycle – product lifecycle stages and corresponding strategies

Module II

New product development-The challenges of product development-Identification of customer needs-Phages in product development- Opportunity identification and selection-concept generation-concept/project evaluation-Development-Launch (Brief description only)

Module III

Understanding brands: Brands vs. products-Benefits of branding-brand attributes-significance of branding to consumers and firms- selecting brand name.

Brand awareness- types of brand awareness-Brand image-Brand identity-brand personality-brand positioning-creating core brand values-Bringing brand to life- growing and sustaining brand equity-customer based brand equity-sources of brand equity-managing brands- building branding strategies- brand extensions-branch licensing and franchising-global branding.

References:

1.Merie Crawford : New Product management, McGraw-Hill Irwin
2. Donald Lehman: Product management, Tata MacGraw Hill.
3.Keller, Kevin Lane : Strategic Brand management, Building, measuring and managing Brand equity.
4.Karl T Ulrich and Steven D Eppinger : Product Design and development, Tata McGraw-Hill edition
5. Chunnawalla: Product Mmanagement, Himalaya publishing House

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.18 RESEARCH METHODOLOGY

L-T-D: 3-1-0 **Credits : 4**

Module 1

Introduction – meaning of research- objectives of research-motivation in research- types of research-research approaches – significance of research- research methods Vs methodology – criteria for good research
Defining research problem- what is a research problem- selecting the problem- necessity of defining the problem- literature review – importance of literature review in defining a problem- critical literature review – identifying gap areas from literature review

Module II

Research design–meaning of research design-need–features of good design- important concepts relating to research design- different types – developing a research plan
Method of data collection–collection of data- observation method-interview method- questionnaire method – processing and analyzing of data- processing options- types of analysis- interpretation of results

Module III

Report writing – types of report – research report , research proposal, technical paper- significance- different steps in the preparation – lay out, structure and language of typical reports- simple exercises - oral presentation – planning, preparation, practice- making presentation – answering questions-use of visual aids-quality and proper usage-Importance of effective communication with illustrations.

References:

1. Coley.S.M and Scheinberg C.A 1990 , *Proposal writing*, Newbury-Sage Publications.
2. Leedy.P.D, *Practical research planning and Design*, 4th edition ,MW Macmillan publishing company.
3. Day Ra,1989 "*How to write and publish a scientific paper*", Cambridge University Press .
4. Earl Babbie*,1994,* The practice and Social Research*,Wordsworth Publishing Company,*
5. *J.H. Ansari, Mahavir – ITPI Reading Material on Planning Techniques.*

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.19 NANOTECHNOLOGY

L-T-D: 3-1-0 **Credits : 4**

Module I

Introduction and scope-Classification of nanostructures: Quantum dots, quantum wires, quantum wells, nanoclusters, nanotubes, super lattices, nanocrystalline materials-Effects of nanometer length scale – Changes to the system total energy, changes to the system structures- Effect of Nanoscale dimensions on various properties – structural, thermal, chemical, mechanical, magnetic, optical and electronic properties.

Module II

Fabrication methods: Top down and bottom up approaches-Top down processes: Milling, Lithographics, machining process, pulsed laser methods- Bottom up processes: Vapour phase deposition methods, PVD, CVD, electrodeposition, plasma assisted deposition process, MBE, chemical methods, colloidal and solgel methods
Characterisation methods: General classification of characterization methods, Microscopy techniques: Scanning Electron Microscopy, Transmission Electron Microscopy, Scanning Tunneling Microscopy, Atomic Force Microscopy, Diffraction Techniques-Spectroscopy Techniques – Raman Spectroscopy, Surface analysis and depth profiling- Mechanical Properties-Magnetic and Thermal properties.

Module III

Applications of Nanotechnology (nano materials and devices)-Applications of nanocomposites, nanocrystalline materials, nanolayered structures, nanomagnetic materials-magneto resistance- Carbon nanotubes: SW, MW, nanostructured coatings- nano sensors: order from chaos, characterization, perception, nanosensor based on quantum size effect, Electrochemical sensors, Sensors based on physical properties, Nanobiosensors, smart dust- nanomachines: covalent and non covalent approaches, Molecular motors and machines, molecular devices, single molecular devices, practical problems with molecular device- nanofluids: nanoparticles, preparation of nanofluids, thermophysical properties of nanofluids in comparison with base fluid- nanoswitches - nano computers- nanofilters

References:

1. Nano science and Technology, V.S.Muralidharan, A Subramnya, Ane books Pvt Ltd
2 .Nano: The essentials , T Pradeep , McGraw – Hill education
3. Nano Technology, John Mongillo, Greenwood Press
4. Nanomaterials, A.K. Bandyopdhyay, New age international publishers
5. Nanotechnology, Jeremy Ramsden
6. Nanoscale Science and Technology,Kelsall Robert. W, Ian Hamley, Mark Geoghegan, , Wiley Eastern
7. Nanotechnology, Gregory Timp, Springer-Verlag,
8. Introduction to Nanotechnology, Charles P Poole, Frank J Owens, John Wiley and Sons.
9 Springer Handbook of Nanotechnology, Bharat Bhushan

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.20 AUTOMOTIVE TECHNOLOGY (P)

L-T-D: 3-1-0 **Credits : 4**

Module I

Introduction: History and General classification of automobiles, layout of chasis, types of drives of automobile. Engines: Component details – engine parts – cylinder head – cylinder block – piston – piston rings – connecting rod – crank shaft – valve actuating mechanism – combustion chambers.

Fuel systems: Fuel pump - fuel filter - simple carburettor – modern carburettors. Petrol injection – MPFI, CRDI.

Ignition system: Classification – battery ignition – electronic ignition – starter mechanism – solenoid switch – bendix drives.

Cooling system: Methods of cooling – coolant types.

Lubrication system: Pressurised systems – SAE classification of lubricating oil – oil filter – oil pump.

Module II

Transmission: Clutch – single and multi-plate clutches – centrifugal clutches – fluid couplings.

Gear box: Principle and necessity of manual gear box – constant mesh, sliding mesh and synchro mesh gear boxes – over drives – rear wheel and four wheel drives – universal joint – rear axles.

Brakes: Mechanical, hydraulic, vacuum and air brakes – antilock braking systems.

Module III

Steering and suspension: Different steering mechanisms – power steering – suspension systems – front axle, rigid axle and independent suspensions – anti-roll bar –coil spring and leaf spring – torsion bar – Macpherson struct shock absorber – steering geometry – caster-camber, toe-in, toe-out.

Types of wheel: Integrated rim – flat base rim alloy wheel – wheel balancing.

Tyres: Tubeless tyres – ply ratings – radial tyres.

References:

1. Automotive Mechanics, Joseph Hietner, East- West Press Pvt. Ltd, Madras.
2. Practical Automobile Engineering, Station Abby, (Asia Publishing House).
3. Modern Transmission System., A.W. Judge
4. Automotive Emission Control, W. H. Crouse
5. Internal Combustion Engine and Air Pollution, Edward F. Obert.
6. Automobile Engineering- Vol. I & II, Kirpal Singh, Standard Publishers Distributors, Delhi.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.21 HIGH TEMPERATURE MATERIALS

L-T-D: 3-1-0 **Credits : 4**

Module I

Creep: Factors influencing functional life of components at elevated temperatures, definition of creep curve, various stages of creep, metallurgical factors influencing various stages, effect of stress, temperature and strain rate.

Design for creep resistance: Design of transient creep time, hardening, strain hardening, expressions of rupture life of creep, ductile and brittle materials, Monkman-Grant relationship.

Module II

Fracture: Various types of fracture, brittle to ductile from low temperature to high temperature, cleavage fracture, ductile fracture due to micro void coalescence-diffusion controlled void growth; fracture maps for different alloys and oxides.

Oxidation and hot corrosion: Oxidation, Pilling, Bedworth ratio, kinetic laws of oxidation- defect structure and control of oxidation by alloy additions, hot gas corrosion deposit, modified hot gas corrosion, fluxing mechanisms, effect of alloying elements on hot corrosion, interaction of hot corrosion and creep, methods of combat hot corrosion.

Module III

Super alloys and other materials: Iron base, Nickel base and Cobalt base super alloys, composition control, solid solution strengthening, precipitation hardening by gamma prime, grain boundary strengthening, TCP phase, embrittlement, solidification of single crystals, Intermetallics, high temperature ceramics.

REFERENCES:

1. Raj. R., “Flow and Fracture at Elevated Temperatures”, American Society for Metals, USA, 1985.
2. Hertzberg R. W., “Deformation and Fracture Mechanics of Engineering materials”, 4th Edition, John Wiley, USA, 1996.
3. Courtney T.H, “Mechanical Behavior of Materials”, McGraw-Hill, USA, 1990.
4. Boyle J.T, Spencer J, “Stress Analysis for Creep”, Butterworths, UK, 1983.
5. Bressers. J., “Creep and Fatigue in High Temperature Alloys”, Applied Science, 1981.
6. McLean D., “Directionally Solidified Materials for High Temperature Service”, The Metals Society, USA, 1985.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.22 INDUSTRIAL SAFETY ENGINEERING

L-T-D: 3-1-0 **Credits : 4**

Module I

Introduction to the development of industrial safety and management - History and development of Industrial safety – implementation of factories Act – formation of various council – safety and productivity – safety organizations- safety committees – safety committees structure – roll of management and roll of Govt. in industrial safety - safety analysis.

Module II

Operational safety (Hot Metal Operation): Hot metal operation – safety in Cutting – safety in welding – safety in Boilers- Pressure vessels – Furnace (all types) - Heat treatment processes shops – electroplating – grinding – forming processes- rolling – forging - surface hardening – casting – Moulding – coiling. Operational safety (cold metal operation): Safety in handling of portable power tools – hand grinder - machining shop – drilling – polishing machine – safety in assembly shop – material handling – dock safety – safety in generation and distribution of power – distribution and handling of industrial gases – safety in inspection – safety in chemical laboratories – ammonia printing – safety in power press – safety in sewage – disposal and cleaning. Safety in Industrial pollution and control – working at height..

Module III

Accident prevention and protective equipments: Personal protective equipment – survey the plant for locations and hazards – part of body to be protected. Education and training in safety – prevention causes and cost of accident. House keeping – first aid – fire fighting equipment – Accident reporting – investigations. Industrial psychology in accident prevention – safety trials. The Acts which deal the safety and industrial hygiene: Features of Factory Act – explosive Act – boiler Act – ESI Act – workman's compensation Act – industrial hygiene – occupational safety – diseases prevention – ergonomics. Occupational diseases, stress, fatigue. Health, safety and the physical environment. Engineering methods of controlling chemical hazards, safety and the physical environment: Control of industrial noise and protection against it- Code and regulations for worker safety and health.

REFERENCES:

1. Ray Asfahl C., "Industrial Safety and Health Management", Fifth Edition, Prentice Hall, 2003 - ISBN: 0131423924
2. Willie Hammer, "Occupational Safety Management and Engineering", 5th Edition, Prentice Hall; 5th edition, 2000 - ISBN: 0138965153
3. "Occupational safety manual" – BHEL.
4. N.V. Krishnan, "Safety in Industry", Jaico publishers House – 1996
5. John Ridley, "Industrial safety and the law", P.M.C. Nair Publishers, Trivandrum, 1998.
6. John Channing, "Safety Law For Occupational Health and Safety", Butterworth-Heinemann; 1999. ISBN: 075064559

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.23 ENGINEERING DESIGN

L-T-D: 3-1-0 **Credits : 4**

Module-I

Engineering activities, The Engineering Profession, Ethics in Engineering, Product Life Cycle, The design Process- Steps, Morphology of Design, Design Drawings, simple design examples, review of CAD,FDM,FEM , Creative problem solving and decision making, Modeling and simulation, mathematical modeling and computer simulation, optimization, search methods, linear programming, Methods of optimum design

Module-II

Material selection, Performance characteristics of materials, Material selection process, Evaluation methods for materials, value analysis, weighted property index, cost versus performance relations, design examples, Role of processing in design, Design for Casting, Design for Machining, Design for welding, residual stresses in design, Design for assembly, Design for brittle fracture and fatigue fracture, design for corrosion resistance, designing with plastics.

Module-III

Economic decision making, cost comparison, depreciation, profitability, inflation, sensitivity and break even analysis, Cost evaluation, categories of cost, method of developing cost estimates, how to price a product, life cycle costing, cost models

Failure analysis, Causes of failures, Failure modes, Techniques for failure analysis, Nondestructive testing methods, Probabilistic approach to design, Reliability theory, Design for reliability, Communicating the design, recording of results and writing technical reports, visual aids and graphics.

REFERENCES

1. Engineering Design- A Materials and Processing Approach, George E. Dieter, Mc Graw Hill.
2. Design Engineering Harry Cather, Richard Morris, Mathew Philip, Chris Rose Elsevier Science and Technology books
3. Design Engineering-John R.Dixon
4. Mechanical Engineering Design, Shigley

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.24 TRACTORS & FARM EQUIPMENTS

L-T-D: 3-1-0 **Credits : 4**

MODULE I

General Design of Tractors: Classification of tractors - Main components of tractor - Safety rules. Layout of wheeled tractor, , hydraulic control system, power take off, tractor stability and ride characteristics Layout of crawler tractors, , crawler details , methods of selection of equipments, selection of machines, basic rules for matching machines, selection of equipments including the nature of operating selection based on the type of soil, selection based on haul distance, selection based on weather conditions.

MODULE II

Power Plant in Tractors: Engine cycles – Operation of multicylinder engines - General engine design - Basic engine performance characteristics, Cylinder and pistons - Connecting rods and crankshafts - Engine balancing - Construction and operation of the valve mechanism - Valve mechanism components -

Cooling system - Classification - Liquid cooling system - Components, Lubricating system servicing and troubles - Air cleaner and turbo charger - Fuel tanks and filters - Fuel pumps.

MODULE III

Control System of Tractors: Power transmission, steering system, brakes and braking system, wheels, rims and tyres and accessories of wheeled tractors, power transmission, steering clutch and braking system in crawler tractors. Agricultural Implements:

Working attachment of tractors - Farm equipment - Classification - Auxiliary equipment - Trailers and body tipping mechanism.

References:

1. Rodichev and G.Rodicheva, " Tractor and Automobiles ", MIR Publishers, 1987.
2. Kolchin.A., and V.Demidov " Design of Automotive engines for tractor ", MIR Publishers, 1972.
3. A. Guruvech and B. Sorekin- Tractors, MI1R Publishers Moscow, 1975
4. Geleman and M. Maskovin- Farm tractors, MIR. Publishers, Moscow, 1975
5. Smith , Harris Pearson & Wilkes, Lambert Henry- Farm machinery and equipment, TATA McGraw Hill Publications, 1977

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.25 EMBEDED SYSTEM IN AUTOMOBILES

L-T-D: 3-1-0 **Credits : 4**

MODULE - I

Architecture general 8 bit micropocessor and its architecture 8085, z-80 and mc 6800 mpu and its pin function - architecture - function of different sections. Instruction set instruction format - addressing modes - instruction set of 8085 mpu-t-state - machine cycle and instruction cycles - timing diagrams - different machine cylces - fetch and execute operations - estimation of execution times.

MODULE -II

Assembly language programmimg construct of the language programming - assembly format of 8085 - assembly directive - multiple precision addition and subtraction - bcd to binary and binary to bcd, multiplication, division, code conversion using look up tables - stack and subroutines.

Data transfer schemes interrupt structure - programmed i/o - interrupt driven i/o, dma - serial i/o.

MODULE - III

Interfacing devices types of interfacing devices - input / output ports 8212, 8255, 8251, 8279. octal latches and tristate buffers - a/d and d/a converters - switches, led's rom and ram interfacing.

Applications data acquisitions - temperature control - stepper motor control - automotive applications engine control, suspension system control, driver information systems), development of a high speed, high precision learning control system for the engine control.

References:

1. Ramesh, Goankar.S., " Microprocessor Architecture Programming and Applications", Wiley Eastern Ltd., New Delhi, 1986.
2. Aditya.P.Mathur, " Introduction to Microprocessors ", III Edition, Tata McGraw-Hill Publishing Co Ltd., New Delhi, 1989.
3. Ahson.S.I. " Microprocessors with Applications in Process Control ", Tata McGraw-Hill, New Delhi, 1986.
4. SAE Transactions, 1986 Sec 3.
5. Jabez Dhinagar.S., " Microprocessor Application in Automoblies ".
6. L.Bianco and A.Labella., " Automotive Micro Electronics ", Elsevier science publishers. 1986.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.805.26 COMPUTER AIDED VEHICLE DESIGN

L-T-D: 3-1-0 **Credits : 4**

MODULE - I

Vehicle frame and suspension study of loads - moments and stresses on frame members. computer aided design of frame for passenger and commercial vehicle - computer aided design of leaf springs - coil springs and torsion bar springs.

Clutch torque capacity of clutch. computer aided design of clutch components, design details of roller and sprag type of clutches.

MODULE -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 dimensions and proportions for steering linkages ensuring minimum error in steering.

MODULE - III

Gear box computer aided design of three speed and four speed gear boxes.

Drive line and read axle computer aided design of propeller shaft. design details of final drive gearing. design details of full floating, .semi-floating and three quarter floating rear shafts and rear axle housings.

References:

1. Dean Averns, " Automobile Chassis Design ", Illiffe Books Ltd, 1992.
2. Heldt.P.M., " Automotive Chassis ", Chilton Co., New York, 1992.
3. Steeds.W., " Mechanics of Road vehicles ", Illiffe Books Ltd., London, 1990.
4. Giles.J.G., Steering, " Suspension and tyres ", Illiffe Books Ltd., London, 1988.
5. Newton, Steeds & Garret, " Motor vehicle ", Illiffe Books Ltd., London, 1982.
6. Heldt.P.M., " Torque converter ", Chilton Book Co., New York, 1982.
7. Giri.N.K. " Automobile Mechanics ", Khanna Publisher, New Delhi, 1996

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

ELECTIVE V

08.806.1 PROPULSION ENGINEERING

L-T-D: 3-1-0 **Credits : 4**

Module- I

Fundamentals of Propulsion- Classification types of propulsive devices- Airscrew, Turbojet, Turboprop, turbofan, Turboshaft, Ramjet, Scramjet, Pulsejet and Rocket engines. Comparative study of performance characteristics applications. Theory of propulsion – Thrust, thrust power and efficiencies of turbojet engine. Thermodynamics analysis of turbojet engine cycle.

Module II

Turbojet engine components- air intakes, Compressors, Combustion chambers, turbines, nozzles turbine and compression matching – Thrust-augumentation. Rocket propulsion- general operating principles of chemical, electrical nuclear and solar rockets.

Module- III

Chemical Rockets- Classification. Performance parameters for chemical rockets and their relationship, Energy and efficiencies, simple problems, Solid propellants- Types- burning rate- grain Configurations, Igniters liquid propellants- Classification- Typical fuels and oxidizers, properties and specifications, Selection. Liquid propellant feed systems injectors. Starting and ignition – Precautions in propellant handling- Hybrid Rockets combustion processes in SPR and LPR combustion instability- Control of instabilities – Cooling of Rocket motors Flight Performance- Velocity and attitude in simplified vertical Refractory staging of rockets.

Rocket Testing- Test facilities and safeguards. Measurement System Terminology, Flight Testing.

References.

1. Rocket Propulsion elements- G. P. Sutton
2. Mechanics and Thermodynamics of propulsion- Hill and Peterson
3. Gas Turbines and Jet and Rocket Propulsion- Mathur and Sharma

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.806.2 INDUSTRIAL REFRIGERATION

L-T-D: 3-1-0 **Credits : 4**

Module I

Brief Review of the methods of refrigeration – Air vapor compression and vapor absorption refrigeration systems. Review of the components of a vapor compression system.

Methods of Food Preservation :Microbiology of foods. Theories and methods of chilling and freezing.

Temperature – Time graph of Freezing process. Relation between air velocity and freezing time. Calculation of freezing time. Heat velocity of foods. Relation between moisture content and time. Drying during constant and falling the above periods. Refrigeration load in freezers.

Module II

Processing, storage and distribution of chilled and frozen foods. Such as Meat, Poultry, Fish, Eggs, Dairy products, Beverage Products, Fruits, Vegetables, Fruit Juice Concentrates and Bakery products. Food storage requirement. Cold storage, frozen storages. Design of cold storage and frozen stores . Refrigerated warehouse , Refrigerated trucks, trailers and containers. Railway refrigerated cars, marine refrigeration. Refrigeration in Air transport. Refrigeration in chemical Industry.

Module III

Industrial Air conditioning – for different type of Buildings – Hospitals, Computer Centre , Laboratories. Theaters, printing plants, Textile processing etc. Automobile air conditioning Air conditioning for Aircrafts, ships and in space crafts. Heating and cooling loads. System Design – Ventilation requirements. Plant air flow design. duct work design – variation of air pressure along a duct, Duct sizing.

Introduction to Automatic control systems – components of control systems. Control systems diagram. Heating and ventilating control. single duct variable air temperature and volume controls. Elementary ideas of the controls used in chilled water plants.

References

1. Principles of Refrigeration – Dossat
2. ASHRAE Date Book- (3 Volumes)

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.806.3 INDUSTRIAL QUALITY CONTROL

L-T-D: 3-1-0 **Credits : 4**

Module 1

Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality cost-Variation in process- factors – process capability – process capability studies and simple problems – Theory of control chart- uses of control chart – Control chart for variables – X chart, R chart and σ chart. Control chart for attributes –control chart for proportion or fraction defectives – p chart and np chart – control chart for defects – C and U charts, State of control and process out of control identification in charts.

Module II

The concept of Acceptance sampling, Economics of inspections ,Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – The Operating characteristic curve– producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts-standard sampling plans for AQL and LTPD- uses of standard sampling plans. Minimum inspection per lot, Formulation of Inspection lots and selection of samples.

Module III

Life testing – Objective – failure data analysis, Mean failure rate, mean time to failure, mean time between failure, hazard rate, system reliability, series, parallel and mixed configuration – simple problems. Maintainability and availability – simple problems. Reliability improvements – techniques- use of Pareto analysis – design for reliability – redundancy unit and standby redundancy – Optimization in reliability – Product design – Product analysis – Product development – Product life cycles.

References;

1. Grant, Eugene .L "Statistical Quality Control", McGraw-Hill
2. L.S.Srinath, "Reliability Engineering", Affiliated East west press
3. Monohar Mahajan, "Statistical Quality Control", Dhanpat Rai & Sons
4. R.C.Gupta, "Statistical Quality control", Khanna Publishers
5. Besterfield D.H., "Quality Control", Prentice Hall
6. Sharma S.C., "Inspection Quality Control and Reliability", Khanna Publishers
7. Danny Samson, "Manufacturing & Operations Strategy", Prentice Hall
8. Connor, P.D.T.O., " Practical Reliability Engineering", John Wiley

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.806.4 DESIGN OF HEAT TRANSFER EQUIPMENT

L-T-D: 3-1-0 **Credits : 4**

Module I

Classification and General features of heat Exchangers, Shell and Tube Heat Exchangers, Regenerators and Recuperators- Industrial Applications. Temperature distribution and its implications, Overall heat transfer co-efficient, Counter flow and parallel flow, Logarithmic mean temperature difference (LMTD), Effectiveness. NTU – Effectiveness– Calculation of heat transfer area by different methods – Caloric or average fluid temperature – The pipe wall temperature. Effect of Turbulence, Friction factor, Pressure loss, Channel divergence. Computation of total pressure drop of shell side and tube side for both baffled and unbaffled types – Pressure drop in pipes and pipe annulus- Thermal Stress in tubes, Types of failures.

Module II

Design of double pipe Exchanges – Shell and tube pipe exchangers – The tubular element – Tube pitch – Shells – Tube sheet – Baffles – Tube sheet layout and tube counts (tube matrix) – V-band Exchangers – Shell side film coefficients – Shell side mean velocity – Shell side Equivalent diameter – The true temperature difference in 1-2 Exchanger – Shell side and tube side pressure drips – Fouling factors – Design of a shell and type – Type 1 Exchangers – Extended surface exchangers – Design of a Finned type double pipe exchanger – Longitudinal Fins and Transverse fin.

Module III

Design of Evaporators: Design of Shell and Tube, Plate type evaporators. Cooling Towers : Packing, Spray design, Selection of pumps, Fans and Pipes, Testing and Maintenance, Experimental Methods. Condensers – Condensation of a single vapour –Dropwise and film wise condensation – Process applications – Condensation on a surface – Development of equation for calculation – Comparison between horizontal and vertical condensers – The allowable pressure drop for a condensing vapour – Influence of impurities on condensation – Condensation of steam – Design of a surface condenser – Different types of boiling .

References:

1. D.Q.Kern, " Process Heat Transfer ", Tata McGraw Hill, Edition, New Delhi, 1997.
2. Arthur P.Frass, " Heat Exchanger Design ", Second Edition, John Wiley & Sons, New York, 1996.
3. T.Taborek, G.F.Hewitt and N.Afgan " Heat Exchangers ", Theory and Pratice, McGraw Hill Book Co., 1980.
4. Walker, " Industrial Heat Exchangers " - A Basic Guide, McGraw Hill Book Co., 1980.
5. Nicholas Cheremisioff, " Cooling Tower ", Ann Arber Science pub., 1981.
6. Holger Martin, " Heat Exchangers ", Hemisphere Publishing Corporation, London, 1992.
7. A Text book on Heat Transfer – S.P.Sukatme, TEMA standards

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.806.5 CREATIVITY AND PRODUCT DEVELOPMENT

L-T-D: 3-1-0 **Credits : 4**

Module I

The process of technological innovation - factors contributing to successful technological innovation - the need for creativity and innovation - creativity and problem solving - brain storming - different techniques.

Module II

Collection of ideas and purpose of project - Selection criteria - screening ideas for new products (evaluation techniques).

Research and new product development - Patents - Patent search - Patent laws - International code for patents - Intellectual property rights (IPR).

Module III

Design of proto type - testing - quality standards - marketing research - introducing new products.

Creative design - Model Preparation - Testing - cost evaluation - Patent application

References:

1. Harry Nystrom, " Creativity and innovation", John Wiley & Sons, 1979.
2. Brain Twiss, " Managing technological innovation", Pitman Publishing Ltd., 1992.
3. Harry B.Watton, " New Product Planning ", Prentice Hall Inc., 1992.
4. P.N.Khandwalla - " Fourth Eye (Excellence through Creativity) - Wheeler Publishing ", Allahabad, 1992.
5. I.P.R. Bulletins, TIFAC, New Delhi, 1997.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.806.6 COMPUTERIZED MATERIALS MANAGEMENT

L-T-D: 3-1-0 **Credits : 4**

MODULE - I

Introduction to Materials management – Importance of material management and its role in industries. The need for the integrated approach in Material management

Demand forecasting – Various qualitative and quantitative methods of demand forecasting – Different type of averaging, Exponentially weighed smoothening, Correction for fluctuations, Time series analysis, Delphi and other Group techniques. Development of simple Computer Programme for forecasting.

MODULE - II

Inventory control – Basic methods in Inventory – Assumptions used in deriving models. Inventory costs and EOQ model. Price breaks and quantities – Effects of variations in lead-time and demand. Effects of shortage cost on EOQ. Systems of Inventory control, Design of Inventory control systems.

Development of Computer Programme for forecasting.

Classification systems and selective Inventory control – ABC, VED, FSN, HML, and MUSIC, 3-D approaches, Coverage analysis in Material management.

Development of Computer Programme for ABC analysis – Codification and standardization Systems and Techniques, Effects in Cost.

MODULE -III

Vendor rating and source selection. Techniques and materials. Use of Indian Standards for Vendor rating. Make or buy decisions – Materials Requirements Planning Concept, methods and illustration examples.

Introduction to JIT philosophy – Features and impact in Materials Management.

Purchasing – Purchase organization – legal aspects of buying – Purchase Procedure. Store and Material control – Receipts and issues – Stores Record. Methods and principles of Storing and retrieving items.

Material handling devices used in stores – Application of Computers in Material handling – Design of informatic systems for procurement and storage using computer.

REFERENCES

1. Scientific Inventory Management - Bnchan & Kbenigsberg
2. Inventory Management - Starr & Miller
3. Materials Management - R.M .Shah
4. Integrated Material management - P.Gopalakrishnan
5. Principles of Inventory management - Tershine

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.806.7 RANDOM VIBRATIONS

L-T-D: 3-1-0 **Credits : 4**

Module I

Basic probability concepts - events and probability - elements of set theory - simple events and combination of events - Venn diagram - mutually exclusive events and collectively exhaustive events - De Morgan's rule - basic axioms of probability - conditional probability - statistical independence - theorem of total probability - Bayes' theorem - definition of a random variable - probability distribution and probability distribution and probability density of discrete and continuous random variables - main descriptors of a random variable (mean, mode, median, variance, standard deviation, coefficient of variation, skewness and kurtosis) - absolute moments and central moments - moment generating functions, characteristic functions and log characteristic functions. Useful probability distributions - normal distribution - standard normal distribution - lognormal distribution - binomial distribution - geometric distribution - negative binomial distribution - Poisson process and Poisson distribution - hypergeometric distribution - beta distribution - gamma distribution - extreme value distributions - joint and conditional probability distributions - covariance and correlation mean and variance - functions of single random variable - single function of multiple random variables - multiple functions of multiple random variables - moments of functions of random variables

Module II

Random processes - introduction - ensemble averages and correlation functions - time averages and correlation functions - weakly stationary and strongly stationary random processes - ergodic random processes - probability density and distribution functions - properties of autocorrelation functions - Fourier transforms - power spectral density functions - Wiener-Khintchine equations - properties of spectral density functions - spectral classification of random processes (narrow band, wide band, white noise) - level crossing - expected frequency and amplitude of narrow band Gaussian processes - Rayleigh distribution

Module III

Response to random excitations - introduction - impulse response and frequency response function as Fourier transform pair - response of a linear system function to stationary random excitation - response of a single degree of freedom system to random excitation - contour integration - joint probability distribution of two random variables - joint properties of stationary random processes - joint properties of ergodic random processes - cross-correlation functions for linear systems - response of multi-degree of freedom system to random excitations - response of one - dimensional continuous systems to random excitations

References:

1. Ang A.H.S. & Tang W.H., "*Probability Concepts in Engineering Planning and Design"*, Vol. I, John Wiley
2. Meirovitch L., "*Elements of Vibration Analysis*", McGraw Hill
3. Lin Y.K., "*Probability Theory In Structural Dynamics*", McGraw Hill
4. Bendat & Piersol, "*Random Data Analysis And Measurement Procedure*", Wiley Inter Science, John Wiley
5. Papoulies A., "*Probability, Random Variables And Stochastic Processes*", McGraw Hill, Kogakusha Ltd.
6. Rice S.G., "*Mathematical Analysis Of Random Noise", in "Selected Papers on Noise and Stochastic Processes"*, Over Publications
7. Crandall S.H. & Mark W.D., "*Random Vibration in Mechanical Systems*", Academic Press
8. Lutes L.D., Shahram Sarkoni, "*Stochastre Analysis of Structural & Mechanical Vibration"*, Prentice Hall, Inc.
9. Jullius Solnes, "*Stochestic Process & Random Vibration*, John Wiley

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.806.8 ADVANCED KINEMATICS OF MACHINES

L-T-D: 3-1-0 **Credits : 4**

MODULE I

Kinematics Pairs : Classifications of kinematics pairs – Number of points of support in a plane – Subdivision of higher pairs – Kinematics chains – Classification of Kinematics chains – Coupler curves : Definition and Equation – Roberts law – Cognate linkages – Cognate of the slider crank – Double points of a coupler curve – Coupler curve atlas .

Analytical Design of 4 bar Mechanism for co-ordinated motion of the crank: Fneuden – Steins equations – Sample design – Three co-ordinate crank position – Co-ordinates of the crank velocities and derivatives – Design of a four bar mechanism for constant angular velocity ratio of the cranks – Choice of knecesion points .

MODULE II

The Euler – Savarg equation and its graphical representation – Determination of the Centre of Curvature of the path of a point – Euler savarg equation for points between the instantaneous centre and the inflexion point – General form of the Euler – Savarg equation – Relation between the position of a point in the movable plane and the centre of the curvature of its path – The inflection circle – Envelops and generation curves – Transformation of Euler – Savarg equation – Graphical construction – Construction of the inflexion centre if the centre of the curvature of both centrodes are known .

MODULE III

Kinematics chains of n-links : Number of lines of centres – Kinematics chains with constrained motion – Minimum number of hinges in one link in a closed chain with constrained motion – General analysis of Kinematics chains – Transformation of kinematics chain by the use of higher hinges – Replacement of turning pairs by sliding pairs – Criterion of constrained motion for Kinematic chain with higher pairs .

An Introduction to the Synthesis of mechanism : Two position of link – Three position of a link – The pole triangle and practical application.

REFERENCES

1. Kinematics of Mechanism - Rosenouver and Willis
2. Linkage Design - Jr. Hall

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.806.9 FINANCIAL MANAGEMENT

L-T-D: 3-1-0 **Credits : 4**

Module I

Introduction - finance and related disciplines scope of financial management - functions - objectives of financial management - an overview on Indian financial system

Financial analysis - financial statement analysis - ratio analysis

Module II

Statement of change in financial position - working capital basis only

Capital budgeting: nature - evaluation techniques - traditional technique - discounted cash flow techniques (NPV & IRR)

Module III

Working capital: nature - determinants - computation of working capital

Sources of corporate finance - capital market - stock exchanges - equity - debt - other financial instruments - foreign investments and financing sources - Euro currency market, Euro issues, GDR, ADR etc.

References:

1. Khan & Jain, *"Financial Management"*, TMH
2. Prasanna Chandra, *"Financial Management"*, TMH
3. Shapiro A.C., *"Modern Corporate Finance",* Max well Macmillan
4. Brealey & Onyers, *"Principles of corporate Finance"*, McGraw Hill
5. Pandey I.M., *"Financial Management",* Vikas publisher

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.806.10 FLEXIBLE MANUFACTURING METHODS

L-T-D: 3-1-0 **Credits : 4**

Module I

Introduction Computer technology - hardware - types of memory - input/output devices – software - mini/micro computers and programmable controllers - computer aided design - fundamentals of CAD - the design process - application of computers for design - manufacturing data base.
Numerical control of machine tools- basic components of NC systems - NC coordinate systems - motion control system - application of numerical control - NC part programming - punched tape - tape coding and format - manual part programming - computer assisted part programming - APT language - NC programming with interactive graphics

Module II

Manufacturing systems - development of manufacturing system - components of FMS - FMS work station - Job coding and classification - group technology - benefits of FMS - tools and tooling - machining centres - head indexers - pallets - fixtures - work handling equipments - system storage - automated guided vehicles - industrial robots - programming of robots - assembly & inspection

Module III

Flexible manufacturing system management - FMS control software - manning of FMS - tool management - controlling precision - simulation and analysis of FMS - approaches to modelling for FMS - network simulation - simulation procedure - FMS design - economics of FMS - artificial intelligence

References *:*

1. Groover M.P. *"Automation, Production Systems and Computer Integrated Manufacturing*", Prentice Hall of India
2. Groover, Emory & Zimmers, *"CAD/CAM Computer Aided Design and Manufacturing"*, Prentice Hall of India
3. Joseph Talavage & Hannam, "*Flexible Manufacturing Systems in Practice"*, Marcel Dekker Inc.
4. Kant Vajpayee, *"Principles of Computer Integrated Manufacturing*", Prentice Hall of India.
5. Yoram Koren, *"Computer Control of Manufacturing Systems*", McGraw, Hill Book Company.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.806.11 COMPUTATIONAL FLUID DYNAMICS

L-T-D: 3-1-0 **Credits : 4**

Module I

Introduction to CFD, Historical background, applications, advantages. Basic steps of CFD. Meshes, Structured and unstructured mesh, Classification of structured grids. Governing equations: continuity and momentum equations. Equation of transport of a scalar. Potential, Euler and Navier-Stokes equations. - Steady and unsteady flows. Typical boundary conditions such as Dirichlets and Neumann conditions. TDMA method., Numerical problem up to four unknowns using TDMA.

Module II

Cell centered finite volume discretisations of terms of governing equations such as time derivative, convective and diffusion. Analytical solution of a one-dimensional convection diffusion equation. Upwind, central and blended difference approximations for convection term, QUICK scheme. Implicit, explicit and Crank-Nicolson schemes. Characteristics of turbulent flow, Eddy diffusivity, Turbulent Kinetic energy and dissipation rate. Turbulence models: Baldwin-Lomax and k-ε models only. Near wall treatments and wall functions.

Module III

Pressure-velocity decoupling for incompressible flows - SIMPLE and PISO algorithms. Density based solutions for compressible flow, TVD and Van-leer schemes for compressible flow. Typical results of CFD analysis. Stream lines, method for generating stream line, velocity contours and pressure contours, Method of drawing a velocity vector. Solution of Lagrangian coordinates of a fluid particle. Commerical CFD packages.

References:

1. Patankar Suhas V., "*Numerical Heat Transfer and Fluid Flow*", Taylor & Francis
2. Versteeg H.K. & Malalasekera W., "An introduction to Computational Fluid Dynamics" Longman
3. Fletcher C.A.J., "*Computational Techniques for Fluid Dynamics I*, Springer Verlag
4. Anderson Dale A., Tannehill John C. & Pletcher Richard H., "*Computational Fluid Mechanics and Heat Transfer*", Taylor & Francis

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.806.12 TECHNOLOGY FORECASTING

L-T-D: 3-1-0 **Credits : 4**

MODULE I

Introduction and Historical Background – Examples of notable successes and failures.

Epistemology of forecasting : Nature of technological change – ontological and teleological views – Types of forecasts – Exploratory projections – Target projections – Validity criteria .

Dimensions of technological change : Intellectual , Philosophical and cultural factors – Political and international factors – Military and strategic posture – Macro economics – Micro economics – Communications and social feed back – Technological diffusion and innovation .

MODULE II

Forecasting techniques Morphological analysis : Analysis of functional capabilities - Morphological analysis of future words – Network methods .

Trend extrapolation : Curve fitting – Envelops , constraints and scales – intensive and extensive micro variables – The inertia of trend curves .

Heuristic forecasts : Extrapolation of dependant variables and constrained variables – analogies ,metaphors and structural models – Phenomenological models – Operational models and simulations .

Intuitive methods – Forecasting by experts – Structured interactions – Man – machine interactions.

MODULE III

Policy and strategic planning : Planning as tool for forecasting – Policy – Planning methods – Strategic planning methods – Cast effectiveness – PPOS – Demand oriented planning – Operations analysis and systems analysis .

Introduction to technology assessment . TA and its relevance – History of TA in Government and Industry – Steps in TA – The MITRE Methodology – Brief review of techniques which can be used in TA including cross impact analysis , systems analysis , cost benefit analysis and formal models – Case studies – (Suggested projects : To be a TA project relevant to the Kerala context)

REFERENCES

1. Technology forecasting - Rober U Ayres , Mc Graw Hill
2. Selected readings on Technology assessment – IIT Bombay and Dept. of Science and Technology, New Delhi.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.806.13 MANAGEMENT INFORMATION SYSTEMS

L-T-D: 3-1-0 **Credits : 4**

MODULE I

Introduction to Information Systems - Challenges of Information Systems - Contemporary approach to Information systems - Computer based Information Systems - Types and examples of Information systems. OAS, TPS, MIS,DSS and ESS. Information technology Infrastructure- Hardware, Software, Database, People and Procedures -Data Communication network- Modems, Types of Communication Channels, Channel configurations, Channel sharing devices, Types of networks.

System concept: Organisation as a system- The strategic role of information in Organisational Management; Technical foundations of information systems

MODULE II

System Development – system development life cycle – structured methodologies – Prototyping – CASE methodology**.**

System analysis, Need for System analysis, Role of System Analyst in Data processing and User departments. Project selection, Feasibility study. Cost-benefit analysis- System Investigation, Fact finding, Identifying areas for system study, inspection of Documents, Interviewing staff, Tools for determining System requirement, Activities in requirement determination, Identify Data and Information Produced, Development of System Profiles, tools for Documenting procedures and Decisions. Structured analysis, Documentation tools, Flow charts, Data flow diagram, Data dictionary, Data structure diagram, structure chart, System analysis completion report.

MODULE III

System Design, Structured system design, Input design and control, Output system design, File and data base design, System Development, System control, Documentation, Coding techniques- Detection of errors – verification and validating- System Implementation and control - testing –Software quality assurance-software metrics- Security.

Application of Information Systems: Accounting Information systems and Financial Information System, Marketing Information System, Banking Information Systems.

REFERENCES

1. Management Information Systems – Managing the digital firm, Kenneth C. Laudon and Jane P. Laudon, Pearson education, 2002.
2. Management Information Systems : Conceptual Foundations, structure and Development, Gordon B Davis, McGraw Hill
3. Computers and Information Systems – Robert .A.S, Prentice-Hall
4. Information Systems theory And Practice- Burch John.G Jr and Others, John wiley &Sons
5. Management Information Systems-James A O'Briean, Tata Mc Graw Hill
6. Information Systems – A Management Perspective – Steven Alter, Addison Wesley, 1999.
7. Information Systems for Modern management, Murdick and Ross

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.806.14 PRODUCTION AND OPERATIONS MANAGEMENT

L-T-D: 3-1-0 **Credits : 4**

Module I

Demand forecasting:- basic models, Long and Short-term demand forecasting methods, Regression analysis and smoothing methods, Estimation of trend, cycle, and seasonality components, Analysis of forecast error and computer control of forecasting systems, multi item forecasting, slow-moving item forecasting. Basic inventory models:- assumptions, performance measures, multi-item joint replacement model. Inventory systems under risk:- service levels, safety stock, joint determination of Q and R, time-varying demands. Aggregate inventory management:- Exchange curves, stock out situations, safety stock policies, distribution inventory systems.

Module II

Design of layout of factories, Office, Storage area etc. on consideration of facilities of working people, Storage facilities and general equipment for amenities of working people – Product, Process and combination layout – Systematic layout planning – Design of Assembly lines, Line balancing methods, Computer applications in layout designs. Routing problems:- algorithms, Dispatching

Module III

Aggregate planning:- definition, value of decision rules, aggregate planning strategies, methods. Master production schedule:- bill of material, structuring BOM, disaggregation techniques, managing and maintenance of MPS. Material Requirements Planning:- MRP and MRP II, MRP concepts and advantages, implementation. Capacity planning and control, controlling continuous production, batch processing technique, Just-in-time, KANBAN system. Job Shop production activity planning:- scheduling, shop loading, sequencing, priority rules for dispatching jobs, mathematical programming and heuristics. Introduction to Business Process Re-engineering, Enterprise Resource Planning, and software packages**.**

References:

1. Production Planning and Inventory Control – Narasimhan et al., PHI
2. Facilities Location and Layout – an analytical approach – R. L. White and J. A. White – PHI
3. Production and Operations Management – Buffa – John Wiley & Sons
4. Operations Management: Strategy and Analysis – Krajewski LJ – Pearson Education
5. Production systems – James .L. Riggs – John Wiley & Sons
6. Inventory Management and Production Planning and Scheduling – Silver, Pyke & Peterson – John Willey & Sons

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.806.15 PROJECT MANAGEMENT

L-T-D: 3-1-0 **Credits : 4**

Module I

Concept of a project-classification of projects- importance of project management- The project life cycle- establishing project priorities(scope-cost-time)project priority matrix- work break down structure.

Capital budgeting process- Planning- Analysis-Selection-Financing-Implementation-Review.

Generation and screening of project ideas- market and demand analysis-Demand forecasting techniques. Market planning and marketing research process- Technical analysis.

Module II

Financial estimates and projections: Cost of projects-means of financing-estimates of sales and production-cost of production-working capital requirement and its financing-profitability- projected cash flow statement and balance sheet. Break even analysis.

Basic techniques in capital budgeting-non discounting and discounting methods- pay back period- Accounting rate of return-net present value-Benefit cost ratio-internal rate of return. Project risk.

Social cost benefit analysis and economic rate of return. Non-financial justification of projects.

Module III

Project administration- progress payments, expenditure planning, project scheduling and network planning, use of Critical Path Method (CPM), schedule of payments and physical progress, time-cost trade off.

Concepts and uses of PERT, cost as a function of time, Project Evaluation and Review Techniques/cost mechanisms. Determination of least cost duration. Post project evaluation.

Introduction to various Project management softwares.

References:

1. Project planning, analysis, selection, implementation and review – Prasannachandra – Tata McGraw Hill
2. Project Management – the Managerial Process – Clifford F. Gray & Erik W. Larson -McGraw Hill
3. Project management - David I Cleland - Mcgraw Hill International Edition, 1999
4. Project Management – Gopalakrishnan – Mcmillan India Ltd.
5. Project Management-Harry-Maylor-Peason Publication

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.806.16 DESIGN OF IC ENGINES

L-T-D: 3-1-0 **Credits : 4**

MODULE 1

Introduction-Basic engine components and nomenclature- First law analysis of engine cycles-engine performance parameters –simple problems.

Review of Air standard cycle(brief description regarding the concepts)-Fuel air cycle and their analysis-dissociation, effects of operating variables like compression ratio, fuel-air ratio on thermal efficiency and power.

Actual cycle and their analysis-time loss factor, heat loss factor, exhaust blow down. Comparison of fuel air cycle and actual cycle.

MODULE II

Two stroke engines-introduction-advantages and disadvantages-Scavenging-various methods of scavenging and charge induction. -Terminologies like reference mass, delivery ratio, scavenge ratio, trapping efficiency, scavenging efficiency, and charging efficiency, relative cylinder charge. Scavenging models-perfect displacement and complete mixing model-scavenging efficiency-simple problems. Supercharging, Design of Intake and Exhaust port calculations (with the help of charts)

Study of transducers for IC engine application (only brief description about various types)

MODULE III

Design of IC engines-Basic decisions, Preliminary analysis, Cylinder number, size and arrangement - Detailed design procedure for piston, connecting rod, crank shaft, poppet valves, cylinder and cylinder head- Materials and manufacturing process of main components of engines.

Measurement aspects related to IC engines-speed measurement, torque measurement (only dynamometers), airflow measurement, exhaust gas measurement and treatment.

References:

1 IC Engine theory and practise – C.F Taylor,Vol.1 and Vol.2
2. IC Engines - Lickty
3. IC Engines – Heywood
4. IC Engine design –Richard James
5. Scavenging of 2 stroke engines – Schweitzer
6. Fundamentals of IC Engines- V.Ganesan
7. IC Engines – Shyam K Agarwal

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.806.17 ROBOTICS

L-T-D: 3-1-0 **Credits : 4**

Module I

Fundamentals of robot: Robot – Definition – Co-ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Basic robot motions - Point to point control, Continuous path control. Robot Parts and Their Functions – Need for Robots – Different Applications. Robot drive systems and end effectors: Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of all these Drives. End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations

Module II

Sensors and machine vision: Requirements of a sensor, Principles and Applications of the following types of sensors – Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Laser Range Meters), Proximity Sensors (Inductive, Capacitive, and Ultrasonic), Touch Sensors, (Binary Sensors, Analog Sensors), Wrist Sensors, Compliance Sensors, Slip Sensors. Camera, Frame Grabber, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques.

Module III

Robot kinematics and robot programming: Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two Degrees of Freedom (In 2 Dimensional) – Deviations and Problems. Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effecter commands, and Simple programs

Industrial Applications: Application of robots in machining, welding, assembly, and material handling.

References

1 K.S. Fu., R.C.Gonalez, C.S.G.Lee, " Robotics Control sensing ", Vision and Intelligence, McGraw Hill International Edition, 1987.
2 M.P.Groover, “Industrial Robotics – Technology, Programming and Applications”, McGraw-Hill, 2001
3 Fu.K.S. Gonzalz.R.C., and Lee C.S.G., “Robotics Control, Sensing, Vision and Intelligence”, McGraw-Hill Book Co., 1987
4 Yoram Koren, “Robotics for Engineers”, McGraw-Hill Book Co., 1992
5 Janakiraman.P.A., “Robotics and Image Processing”, Tata McGraw-Hill, 1995
6 Richard D. Klafter, Thomas A. Chmielewski and Michael Negin, " Robotic engineering- An Integrated Approach ", Prentice Hall Inc, Englewoods Cliffs, NJ, USA, 1989.
7 Industrial Robots, Yu.Kozyrev

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.806.18 LOGISTICS AND SUPPLY CHAIN MANAGEMENT

L-T-D: 3-1-0 **Credits : 4**

Module I

Introduction: Logistics – Concepts, definition, approaches - factors affecting logistics. Supply chain: Basic tasks – new corporate model. Supply chain management (SCM): The new paradigm- the modular company – network relation – supply process –procurement process – Distribution management.

Module II

Evolution of supply chain models: Strategy and structure – Factors of supply chain – Manufacturing strategy stages - supply chain progress – model for competing through supply chain management – PLC grid – supply chain redesign – Linking SC with customer.

Module III

Supply chain activity systems: Structuring the SC – SC and new products – functional roles in SC – SC design framework – collaborative product commerce. SCM – Organization and information system: Management task – logistics organization – logistics information systems – topology of SC application – MRP, ERP – warehouse management system – product data management – cases.

References:

1. Schraj, P.B. Lasen, T.S, “Managing Global Supply Chain”, Viva Books, New Delhi 2000.
2. Ayers, J.B., “Hand Book of Supply Chain Management”, St. Lencie press, 2000
3. Nicolas, J.N, “Competitive Manufacturing Management”, McGraw-Hill, NY 1998.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.806.19 RAPID PROTOTYPING

L-T-D: 3-1-0 **Credits : 4**

Module I

Introduction: Need - Development of RP systems – RP process chain - Impact of Rapid Prototyping on Product Development –Digital prototyping - Virtual prototyping- Rapid Tooling - Benefits- Applications.

Reverse engineering and CAD modeling: Basic concept- Digitization techniques – Model Reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data Requirements – geometric modeling techniques: Wire frame, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing and contour data organization, direct and adaptive slicing, Tool path generation.

Module II

Liquid based and solid based rapid prototyping systems: Stereolithography (SLA): Apparatus: Principle, per-build process, part-building, post-build processes, photo polymerization of SL resins, part quality and process planning, recoating issues, materials, advantages, limitations and applications. Solid Ground Curing (SGC): working principle, process, strengths, weaknesses and applications. Fused deposition Modeling (FDM): Principle, details of processes, process variables, types, products, materials and applications. laminated object manufacturing(LOM): Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies.

Module III

Powder based rapid prototyping systems: Selective Laser Sintering(SLS): Principle, process, Indirect and direct SLS- powder structures, modeling of SLS, materials, post processing, post curing, surface deviation and accuracy, Applications.

Laser Engineered Net Shaping(LENS): Processes, materials, products, advantages, limitations and applications– Case Studies.

Other rapid prototyping technologies: Three dimensional Printing (3DP):Principle, basic process, Physics of 3DP, types of printing, process capabilities, material system. Solid based, Liquid based and powder based 3DP systems, strength and weakness, Applications and case studies. Shape Deposition Manufacturing (SDM): Introduction, basic process, shape decomposition, mold SDM and applications. Selective Laser Melting, Electron Beam Melting – Rapid manufacturing.

REFERENCES:

1. Rapid prototyping: Principles and applications, second edition, Chua C.K., Leong K.F., and Lim C.S., World Scientific Publishers, 2003.
2. Rapid prototyping, Andreas Gebhardt, Hanser Gardener Publications, 2003.
3. Rapid Prototyping and Engineering applications : A tool box for prototype development, Liou W.Liou, Frank W.Liou, CRC Press, 2007.
4. Rapid Prototyping: Theory and practice, Ali K. Kamrani, Emad Abouel Nasr, Springer, 2006.
5. Rapid Tooling: Technologies and Industrial Applications, Peter D.Hilton, Hilton/Jacobs, Paul F.Jacobs, CRC press, 2000.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.806.20 SURFACE ENGINEERING

L-T-D: 3-1-0 **Credits : 4**

Module I

Tribology: Introduction to tribology, Wear: Types of wear - adhesive, abrasive, oxidative, corrosive, erosive and fretting wear, roles of friction and lubrication and wear testing.

Plating Processes: Fundamentals of electrodeposition, plating of nickel, chromium, tin and copper, pulsed plating, hydrogen embrittlement, plating adhesion, electroless plating, electrochemical conversion coating, selective plating for repair, plating properties, hard anodizing.

Module II

Hardfacing processes: SMAW, GTAW, GMAW, FCAW, SAW, PAW, Oxy-Acetylene Welding, Furnace fusing, Thermal -spray, flame spray processes - HVOF, Detonation gun and jet kote processes, hard facing consumables.

Special diffusion processes: Principle of diffusion processes – Boriding, Aluminising, Siliconising, Chromising, Sursulf - Selection of diffusion processes – Characteristics of diffused layer – micro structure and micro hardness evaluation – properties and applications.

Module III

Thin film coatings: Physical vapour deposition processes – Thermal evaporation - sputter coating - Ion plating – Chemical vapour deposition – reactive sputtering - TiC, TiN, Alumina, CBN, Diamond and DLC coatings. Structure, properties and applications.

High energy modification and special processes: Electron beam hardening/ glazing, Laser beam hardening / glazing ion inplantation, Composite surface created by laser and Electron beam. Surface cements, Wear tiles, Electro spark deposition, fused carbide cloth, thermal / chemical,Ceramic coatings, centrifugal cast wear coatings, Wear sleeves and Wear plates.

REFERENCES:

1. Kenneth G.Budinski, “Surface Engineering for Wear Resistance”, Prentice Hall, Englewood Cliff, 1990.
2. ASM Metals Handbook, Vol.5, “Surface Engineering”,Metals Park,Ohio, 1994.
4. Ernest Rabinowicz, “Friction and Wear of Materials”, 2nd edition, John Wiley & Sons, NY, 1995.
3. Sudarshan T S, “Surface Modification Technologies – An Engineer’s guide”, Marcel Dekker, New York, 1989.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.806.21 DESIGN OF CELLULAR MANUFACTURING

L-T-D: 3-1-0 **Credits : 4**

Module I

Introduction to Group Technology (GT), Limitations of traditional manufacturing systems, characteristics and design of groups, benefits of GT and issues in GT.

Cellular Manufacturing System (CMS) planning and design: Problems in GT/CMS.

Module II

Design of CMS - Models, traditional approaches and non-traditional approaches -Genetic Algorithms, Simulated Annealing, Neural networks.

Implementation of GT/CMS: Inter and Intra cell layout, cost and non-cost based models, establishing a team approach, Managerial structure and groups, batch sequencing and sizing, life cycle issues in GT/CMS.

Module III

Performance measurement and control: Measuring CMS performance - Parametric analysis - PBC in GT/CMS, cell loading, GT and MRP - framework.

Economics of GT/CMS: Conventional Vs group use of computer models in GT/CMS, Human aspects of GT/CMS - cases.

REFERENCES

1. Askin, R.G. and Vakharia, A.J., G.T "Planning and Operation, in The automated factory-Hand Book: Technology and Management", Cleland.D.I. and Bidananda, B (Eds), TAB Books , NY, 1991.
2. Kamrani, A.K, Parsaei, H.R and Liles, D.H. (Eds), "Planning, design and analysis of cellular manufacturing systems", Elsevier, 1995.
3. Burbidge, J.L. Group "Technology in Engineering Industry", Mechanical Engineering pub.London, 1979.
4. Irani, S.A. "Cellular Manufacturing Systems", Hand Book.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.806.22 HEATING, VENTILATION AND AIR CONDITIONING DESIGN

L-T-D: 3-1-0 **Credits : 4**

Module I

Principles of refrigeration and psychrometry. Psychrometric properties and processes. Air conditioning systems and its applications – Psychrometric chart- various process-sensible cooling and heating-adeabate saturation- use &absorbent or adsorbent - Heating and humidification - cooling and dehumidification - mixing of air streams - use of psychrometric chart for air conditioning - various process - S.H.F, G..S.H.F, E.S.H.F Etc.

Module II

Cooling and heating load calculation - selection of design temperatures - sources of heat load- heat transfer through structures - solar radiation - Infilteration and ventilation- Heat generation inside the conditioned space - heat storage, Diversity and stratification.

Design of air conditioning system. Continuty equation, Bernoulli's equation, pressure losses, Duct design - pressure drop in ducts, pressure drop by graphical method- method of duct design- Arrangements of ducts, fan – design, thermal insulation

Module III

Heating systems-warm air systems-hot water systems steam heating systems-panel and central heating systems-heat pump circuit. Applications-comfort air conditioning-effective temperature-thermal analysis of human body- Air conditioning systems- evaporate cooling- low humidity applications Automobile and Train car air conditioning.

References:

1. C. P. Arora, *Refrigeration and Air Conditioning*.
2. Manohar Prasad, *Refrigeration and Air Conditioning*.
3. W. P. Jones, *Air-conditioning Engineering*
4. Carriers Handbook system design of Air Conditioning
5. R. G. Jordan, G. B. Priester, *Refrigeration and Air conditioning*.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)

08.806.23 AUTOMOTIVE AERODYNAMICS

L-T- D; 3-1-0 **Credits 4**

MODULE-I

Introduction scope - historical development trends - fundamental of fluid mechanics - flow phenomenon related to vehicles -external & internal flow problem - resistance to vehicle motion - performance - fuel consumption and performance - potential of vehicle aerodynamics.

Aerodynamic drag of cars cars as a bluff body - flow field around car - drag force - types of drag force - analysis of aerodynamic drag - drag coefficient of cars - startegies for aerodynamic development - low drag profiles.

MODULE-II

Shape optimization of cars front end modification - front and rear wind shield angle - boat tailing - hatch back, fast back and square back -dust flow patterns at the rear - effects of gap configuration - effect of fasteners.

Wind tunnels for automotive aerodynamic introduction - principle of wind tunnel technology - limitation of simulation - stress with scale models – full scale wind tunnels - measurement techniques - equipment and transducers - road testing methods – numerical

MODULE-III

Vehicle handling the origin of forces and moments on a vehicle - side wind problems - methods to calculate forces and moments - vehicle dynamics under side winds - the effects of forces and moments - characteristics of forces and moments - dirt accumulation on the vehicle - wind noise - drag reduction in commercial vehicles.

References:

1. Hucho.W.H., " Aerodynamic of Road vehicles ", Butterworths Co. Ltd., 1997.
2. Pope. A., " Wind Tunnel Testing ", John Wiley & Sons, 2nd Edn, New York, 1974.
3. Automotive Aerodynamic : Update SP-706, SAE, 1987.
4. Vehicle Aerodynamic, SP-1145, SAE, 1996

University Examination

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08.806.24 OFF- ROAD VEHICLES

L-T- D; 3-1-0 **Credits 4**

MODULE I

Introduction: Power plants, chassis and transmission, Multiaxle vehicles. Heavy duty petrol engines and high speed diesel engines, air cooled and water cooled engines and air filters as in off highway vehicles. Performance characteristics of vehicles, resistance to digging and motion, tractive effort, power required, number of speeds and gear ratios desirable, double reduction arrangements. (Only theory with out any numerical problems)
Land Clearing Machines: Construction and working of Bush cutter, stampers, Tree dozer, Rippers.

MODULE II

Earth Moving Machines: Bulldozers, cable and hydraulic dozers. Crawler track, running and steering gears, scrapers, drag and self powered types - Dump trucks and dumpers - Loaders, single bucket, multi bucket and rotary types - Power and capacity of earth moving machines. Scrapers and Graders: Scrapers, elevating graders, self powered scrapers and graders.

MODULE III

Shovels and Ditchers: Power shovel, revolving and stripper shovels - drag lines - ditchers - Capacity of shovels. Construction & Industrial Equipments: Construction and operational aspects of mobile cranes, road rollers, elevators / Man lifters, Fork Lifters

References:

1. K. Abrosimov, A. Bromberg and F. Kaloyer- Road making machinery, MIR Publishers, Moscow
2. Herbert Nicholos- Moving the earth
3. Jagman Singh- On and with the earth

University Examination

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08.806.25 COMPUTER SIMULATION OF IC ENGINE PROCESSES

L-T- D; 3-1-0 **Credits 4**

Module-I

Introduction - heat of reaction - measurement of urp - measurement of hrp - adiabatic flame temperature: complete combustion in c/h/o/n systems, constant volume adiabatic combustion, constant pressure adiabatic combustion, calculation of adiabatic flame temperature - isentropic changes of state.

Diesel engine simulation multi zone model for combustion, different heat transfer models, equilibrium calculations, simulation of engine performance, simulation for pollution estimation.

Module-II

SI engine simulation with air as working medium deviation between actual and ideal cycle - problems, SI engine simulation with adiabatic combustion, temperature drop due to fuel vaporization, full throttle operation - efficiency calculation, part-throttle operation, super charged operation.

Module-III

Progressive combustion SI engines simulation with progressive combustion with gas exchange process, heat transfer process, friction calculation, compression of simulated values, validation of the computer code, engine performance simulation, pressure crank angle diagram and other engine performance. SI engine simulation

References:

1. Ganesan.V. " Computer Simulation of spark ignition engine process ", Universities Press (I) Ltd, Hyderbad, 1996.
2. Ramoss.A.L., " Modelling of Internal Combustion Engines Processes ", McGraw Hill Publishing Co., 1992.
3. Ashley Campbel, " Thermodynamic analysis of combustion engines ", John Wiley & Sons, New York, 1986.
4. Benson.R.S., whitehouse.N.D., " Internal Combustion Engines ", Pergamon Press, oxford, 1979.

University Examination

Question Paper consists of two parts. Part A-10 compulsory short answer questions for 4 marks each, covering the entire syllabus (10 x 4=40). Part B-2 questions of 20 marks each, from each module and student has to answer one from each module (3 x 20=60)