COURSE CURRICULUM

OF

B.TECH. IN MECHANICAL ENGINEERING

FACULTY OF ENGINEERING & TECHNOLOGY

CHANDRA SHEKHAR AZAD UNIVERSITY OF AGRICULTURE & TECHNOLOGY,

CAMPUS ETAWAH-206001
INDIA

(2003-04)

Course Curriculum of B.Tech.(Mechanical Engineering)

BRANCH: Mechanical Engineering YEAR: 1 SEMESTER – I (Common to all branches)

Sl.No.	Course No.	Subject	Periods			Credits
			L	T	P	
1.	HU 111	Professional Comm. I (common to all branches)	2	1	0	3
2.	CH 111	Engineering Chemistry I	2	1	3*	4
3.	PH 111	Engineering Physics I	3	1	3*	5
4.	MA 111	Mathematics I	3	1	0	4
5.	CE 111	Engineering Mechanics	3	1	3**	5
6.	EE 111	Basic Electrical Engineering	3	1	3**	5
7.	CE 112	Engineering Graphics I	0	0	3	2
8.	ME 111	Workshop Practice I	0	0	3	2
9.	GP 111	GENERAL PROFICIENCY				2
Total			16	6	12	32

* To be taken in alternate weeks.
** To be taken in alternate weeks.

Total Periods: 34
Total credits:32

BRANCH: Mechanical Engineering YEAR: 1 SEMESTER – II

Sl.No.	Course No.	Subject	Periods			Credits
			L	T	P	
1.	HU 121	Professional Commn II (common to all branches)	2	0	1	3
2	CE 122	Environmental Studies	3	0	1	4
2.	CS 121	Introduction to Computing	2	1	3	4
3.	CH 121	Engineering Chemistry II (Environment & Ecology)	2	1	0	3
4.	PH 121	Engineering Physics II	3	1	0	4
5.	MA 121	Mathematics II	3	1	0	4
6.	ME 121	Engineering Thermodynamics	3	1	0	4
7.	EC 121	Basic Electronics	3	1	3	5
8.	ME 121	Engineering Graphics II (M/C Drawing)	0	0	3	2
9.	ME 122	Workshop Practice II	1	0	2	2
10.	GP 121	GENERAL PROFICIENCY				2
Total			19	6	12	37

Total Periods: 37

Total Credits: 37

BRANCH: Mechanical Engineering YEAR: I1 SEMESTER – III

Sl.No.	Course No.	Subject	Periods			Credits
			L	T	P	
1.	CS 231	Numerical Analysis & Computer Programming (C, C++)	3	1	3	5
2.	ME 231	Material Science	3	1	3	5
3.	CE 231	Strength of Materials	3	1	0	4
4.	CE 232	Fluid Mechanics	3	1	3	5
5.	ME 232	Applied Thermodynamics	3	1	3	5
6.	MA 231	Mathematics III	3	1	0	4
7.	GP 231	GENERAL PROFICIENCY				2
Total			16	6	12	30

Total Periods: 34
Total Credits: 30

BRANCH: Mechanical Engineering YEAR: II SEMESTER – IV

Sl.No.	Course No.	Subject	Periods			Credits
			L	T	P	
1.	ME 241	Mechanical Measurement & Metrology	2	1	3	4
2.	ME 242	Industrial Engineering	2	1	0	3
3.	ME 243	Advance Strength of Materials	3	1	0	4
4.	ME 244	Kinematics of Machine	3	1	3	5
5.	ME 245	Manufacture Science I	3	1	3	5
6.	EE 241	Electrical Machine	3	1	3	5
	GP 241	GENERAL PROFICIENCY				2
Total			16	6	12	28

Total Periods: 34
Total Credits: 28

BRANCH: Mechanical Engineering YEAR: III SEMESTER – V

Sl.No.	Course No.	Subject	Periods			Credits
			L	T	P	
1.	HU 351	Management Science	2	1	0	3
2.	ME 351	Product Development	2	1	0	3
3.	ME 352	Machine Design I	3	1	3	5
4.	ME 353	Dynamics of Machines	3	1	3*	5
5.	ME 354	Manufacture Science II	3	1	3	5
6.	ME 355	Heat & Mass Transformation	3	1	3*	5
7.	ME 356	Computer Aided Drafting	0	0	3	2
	GP 351	GENERAL PROFICIENCY				2
Total			16	6	12	30

* To be taken in alternate weeks.

Total Periods: 34
Total Credits: 30

BRANCH: Mechanical Engineering YEAR: III SEMESTER – VI

Sl.No.	Course No.	Subject	Periods			Credits
			L	T	P	
1.	HU 361	Project Management Business Management	2	1	0	3
2.	ME 361	IC Engine	2	1	3	4
3.	ME 362	Machine Design II	3	1	3	5
4.	ME 363	Fluid Machinery	3	1	3	5
5.	ME 364	Automatic Control	3	1	0	**4**
6.	ME 365	Refrigeration & Air Conditioning	3	1	3	5
7.	ME 366	Seminar	0	0	3	2
	GP 361	GENERAL PROFICIENCY				2
Total			16	6	15	30

Note: Summer field training of one credit (0-0-2) of four week is compulsory in this semester in the month of June and evaluation of which will be carried out along with seventh semester.

Total Periods: 37
Total Credits: 30

BRANCH: Mechanical Engineering YEAR: IV SEMESTER – VII

Sl.No.	Course No.	Subject	Periods			Credits
			L	T	P	
1.	ME 471	Computer Aided Design	3	2	4	6
2.	ME 472	Numeric Control of Machine Tools and Robotics	3	1	3	5
3.	ME 473	Automobile Engineering	3	1	3	5
4.	OE 471	Open Elective I	3	1	0	4
5.	ME 474	Professional Elective I	3	1	0	4
6.	ME 475	Project I	0	0	4	2
7.	ME 476	Summer Field Training	0	0	2	1
	GP 471	GENERAL PROFICIENCY				2
Total			15	6	16	29

Total Periods: 37
Total Credits: 29

BRANCH: Mechanical Engineering YEAR: IV SEMESTER – VIII

Sl.No.	Course No.	Subject	Periods			Credits
			L	T	P	
1.	ME 481	Power Plant Engineering	3	1	0	4
2.	ME 482	Mechanical System Design	3	1	0	4
3.	ME 483	Professional Elective II	3	1	0	4
4.	ME 484	Professional Elective III	3	1	0	4
5.	OE 481	Open Elective II	3	1	0	4
6.	ME 485	Project II	0	0	12	6
	GP 481	GENERAL PROFICIENCY				2
Total			15	5	12	28

Total Periods: 32
Total Credits: 28

HU 111 PROFESSIONAL COMMUNICATION – I 3(2-1-0)

Unit-I

Grammar & Composition-Articles, prepositions, spotting errors, Modals, foreign expression and their usage, Formation of nouns, adjectives, precis writing, paragraph writing.

Unit-II

Nature of communication- Process of communication, non verbal communication, business communication, barriers to communication, global aspects. Ethical aspects, legal aspects, accuracy, brevity, clarity and appropriateness in communication.

Oral presentation- Importance of acquiring oral presentation skills, body language, voice, modulation, audience awareness, presentation plan, visual aids, use of connectives, conducting a meeting, participating in a meeting.

Unit III

Report writing – structure of reports, front matter, main body, back matter.

Style of reports- Definition, the scientific attitude, readability of report, choice of words and phrases, construction and length of paragraphs and sentences.

Business correspondence- Memorandum, Notice, agenda, general principles of business correspondence, forms of business letters- indented form, block form, full- block form, semi block form, hanging indented form.

Unit-IV

- Study of selected literary texts
- Collection of short essays
- of studies- Francis Bacon
- A Bookish topic- RK Narayan
- Science & Human Life- JBS Haldane
- Water- CV Raman

Unit V

- Collection of short stories
- The barbar's trade union – Mulk Raj Anand
- The lament
- The gift of magi- O' Hanry
- The eyes are not here – Ruskin Sond
- Renunciation- Ravindra Nath Tagore
- The capital of the ward- Earnest Hemingway

Practical Aspects

Use of language laboratoryto develop communication skills

Word accent- Production of coorect accentual patterns involving two or three syllabis words

Intonation- Rising tone, and talkingtime , ear trainig, production tests.

Common errors- In articles. prepositions, conjuctions, connectives and other aspects of language and grammer, listing reading material, tables, spelling, semanties of connectives, modifiers and varities in sentences and paragraphs.

Books recommended

1. Legget Glenn (etal), "Essentials of grammar and composition", Macmillan, Delhi.
2. Strunk, Jr. William, (etal), "The element of style',Macmillan, 1987.
3. Thomson and Martinat, " A practical book of english grammar", Oxford University Press, Delhi, 1985.
4. Bhaskar, W.W.S., and Prabhu, N.S>, " Engilish Through Reading", Vol1&2 MacMillan, 1978.
5. D, Souza Eurince and Shahani, " Communication skills in engilish", Noble publishing house, 1997.

CH 111 ENGINEERING CHEMISTRY I 4(2-1-3*)

Atoms and Molecules

Particle in a box illustrating energy quantization, angular momentum quantization, radial and angular parts of H atom wave functions/orbitals, probability and charge distribution. Many electron atoms. Homonuclear and eteronuclear diatomic, covalent bonds, ionic bonds and electro negativity concepts, hybridization and shapes of molecules. Non-covalent interaction (Van Der Waals and hydrogen bonding).

Solid State

Idea of spatial periodicity of lattices; elements of bond theory. Conductors, semiconductors and insulators.

Experimental methods of structure determination using spectroscopic techniques such as IR, UV-Vis, NMR and Mass Spectrometry.

Reaction Dynamics

Rate laws, mechanisms and theories of reaction rates (collision and transition state theory). Lasers in Chemistry.

Electrochemistry

Application of electrode potentials to predict redox reactions in solution with special reference to Lattimer and Frost diagrams.

Transition Metal Chemistry

Structures of coordination compounds corresponding to coordination numbers up to 6. Types of ligands. Isomerism (geometrical, optical, ionization, linkage and coordination). Theories of bonding in coordination compounds, viz. crystal field theory, valence bond theory. Chelation. Brief application in organic synthesis and medicines etc.

Organ metallic Chemistry and Catalysis

Structure and bonding in organ metallic complexes, the sixteen and eighteen electron rules. Homogeneous catalysis, the role of metals in catalytic cycles during- some chemical reactions (e.g. hydroformyalation, hydrogenation etc.). Role of metals in biology; oxygen carrier, electron transfer.

Structure and Reactivity of Organic Molecules

Inductive effect, resonance, hyper conjugation, electrometric effect. Carbonation, carbanion and free radicals. Brief study of some addition, elimination and substitution reactions. Conformational analysis (a cyclic and cyclic molecules), geometrical and optical isomerism; E, Z and R, S nomenclature.

Polymerization

Basic concepts, classification and industrial application.

Photochemistry

Photo excitation of carbon substrates (Noh-ish type I and type II reactions), selected examples of the application of photolysis. Photosynthesis (Z-diagram). Chemistry of vision. .

List of Experiments

- Acid-base titration (estimation of commercial caustic soda).
- Redox titration (estimation of iron using permanganometry).
- Complex metric titration (estimation of hardness of water using EDTA titration).
- Preparation and analysis of a metal complex (for example thiourea/copper sulfate or nickel chloride/ammonia complexes).
- Chemical kinetics (determination of relative rates of reaction of iodide with H_20_2 at room temperature (clock reaction).
- Heterogeneous equilibrium (determination of partition coefficient of acetic acid between n-butanol and water).
- Photochemical oxidation-reduction (study of photochemical reduction of ferric salt).
- Viscosity of solutions (determination of percentage composition of sugar solution from viscosity).
- Synthesis of aspirin.
- Synthesis of p-nitro aniline from acetanilide.
- Detection of functional groups in organic compounds.
- Utilization of paper/thin layer/column chromatographic techniques in the separation of organic compounds.
- Radical polymerization of vinyl monomers such as styrene, acrylonitrile etc.
- Conductometric titration (determination of the strength of a given HCL solution by titration against a standard NaOH solution).

Suggested Text Books & References

1. "Blocks 1-5 of Chemistry Course", Indira Gandhi Open University, IGNOU, New Delhi, 1996.
2. Alberty, R.A., and Silbey, R. J., "Physical Chemistry", John Wiley & Sons, Inc., Singapore, 1996.
3. Cotton, F.A., Wilkinson, G., and Gaus, P. L., "Basic Inorganic chemistry", John Wiley & Sons, Inc., Singapore, 3rd Ed., 1996.
4. Graham-Solomon, T.W., "Fundamentals of Organic Chemistry", John Wiley & Sons, Inc., Singapore, 1997.
5. Odian, G.G., "Principles of Polymerization", John Wiley & Sons, Inc., New York, 1981.
6. Sykes, P., "A Guidebook to Mechanism of Organic Chemistry", Longman Inc., New York, 1981.
7. Dyer, J.R., "Application of Absorption Spectroscopy of Organic Compounds", Prentice Hall of India, 1965.
8. Williams D.H and Fleming; I., "Spectroscopic Methods in Organic Chemistry", Tala McGraw Hill Edition, New Delhi, 4th Ed., 1988.
9. Atkins, P.W. "Physical Chemistry", Oxford Univ. Press, 4th Ed., 1990.
10. Pine,.S.H., "Organic Chemistry", McGraw Hill Book Co., New Delhi, 5th Ed., 1987.
11. Sharma, B.K., "Engineering Chemistry", Krishna Prakashan Media (P) Ltd., Meerut, 1996.
12. E.E. Conn and Stumpf, P.K. "Outlines of Biochemistry", Wiley Eastern Ltd., New Delhi, 4th Ed, 1985.
13. Morrison R.T and Boyd, R.N. "Organic Chemistry", Prentice Hall of India, 6th Ed., 1992.
14. Rao C.N.R. and Agarwala, U.C. "Experiments in General Chemistry", East-West Press, New Delhi, 1969.
15. Furnis, B.S., Hannaford, A.J. Smith P.W.G. and Tatchell, A.R., Vogel's "Textbook of Practical Organic Chemistry", ELBS, 5th Ed., 1989.
16. Vogel's "Textbook of Quantitative Analysis", Longman, New York, 4th Ed., 1978.
17. Elias, A.J. Sundar Manoharan S. and Raj, H. "Laboratory Experiments for General Chemistry", I.I.T. Kanpur, 1997.

PH 111 ENGINEERING PHYSICS-I 5(3-1-3*)

Theory of Relativity

Inertial frame of reference, Noninetrial frames and fictitious forces, Outline of relativity, Michelson-Morley experiment, Lorentz transformation of space and time, length contraction, variation of mass with velocity, equivalence of mass and energy.

Geometrical Optics

Combination of thin lenses, cardinal points of coaxial system of thin lenses, thick lenses, location and properties of cardinal points, graphical construction of images.

Physical Optics

Interference- analytical treatment of interference, intensity distribution of fringe system, coherent and non-coherent sources, fundamental conditions of interference, Fresnel's biprism, displacement of fringes, wedge shaped films, Newton's rings Diffraction- single slit and double slit diffraction, diffraction grating, Limit of resolution, resolving power of grating and image forming systems. Polarisation-Brewster's law, double refraction,. geometry of calcite crystal, optic axis, nicol prism, circularly and elliptically polarised light, retardation plates, production and analysis of planes, polarimeter.

Thermal Physics

Kinetic theory of gases, maxwellian distribution, mean free path, .transport phenomena in gases, Imperfect gases and vander Waal's equation of state.

Acoustics

Production and applications of Ultrasonics, Acoustics of buildings.

Dynamics of fluids

Continuity equation, Bernoulli's theorem and its applications, Torcelli's theorem, Viscosity, flow of liquid through a capillary tube, capillaries in series and parallel, stoke's formula, rotation viscometer.

List of Experiments

- To determine the coefficient of viscosity of water by capillary flow.
- To determine the thermal conductivity of a bad and good conductor by Lee's method and Searl's method, respectively.
- To determine the wave length of light by Newton's ring method.
- To determine the wave length of light b1 Fresnel's biprism.
- To determine the dispersive power of the given material of the prism.
- To determine the focal length of combination of two thin lenses by nodal slide assembly and its verification.
- Determination of e/m by J. J. Thomson's method.
- Measurement of thermo emf between different types of thermocouples as a function of temperature difference between the junction, measurement of an unknown temperature.
- Use of Carry Foster Bridge. Study of electromagnetic induction.
- Study of electromagnetic damping and determination of terminal velocity reached by a magnet falling in a metallic tube.
- Study of LCR circuits with AC current.
- Determination of Plank's Constant using photocells.

Suggested Text Books & References

1. Jenkins and White, "Optics", McGraw-Hill Book Company.
2. Mathur, D.S., "Mechanics".
3. Saha and Srivastava" A Treatise on Heat".
4. Singh, RB., "Physics of Oscillations and Waves".
5. Ghatak, A.K., "Optics".

MA 111 MATHEMATICS – I 4(3-1-0)

Calculus of Functions of One Variable

Successive differentiation, Libnitz's theorem (without proof). Rolle's theorem mean value theorems and Taylor's theorem. Fundamental theorems of integral calculus, elementary reduction formulae for integrals. Applications to length, area, volume, surface area of revolution, moments and centers of gravity.

Infinite Series: Convergence, divergence, comparison test, ratio test, Cauchy Leibnitz's theorem, absolute and conditional convergence. Expansions of functions into Taylor and Maclaurin series.

Calculus of Functions of Several Variables

Partial derivatives, chain rule, gradient and directional derivative. Differentiation of implicit functions, exact differentials. Tangent planes and normals. Maxima, minima and saddle points. Simple problems in extrema of functions with constraints - method of Lagrange multipliers. Multiple integrals - double and triple integrals. Jacobeans and transformations of coordinates. Applications to areas, volumes etc.

Vector Calculus

Scalar and vector fields. Line and surface integrals. Gradient, divergence and curl. Line integrals independent of

path. Green's theorem, divergence theorem and Stoke's theorem (without proofs) and their simple applications...

Suggested Text Books & References

1. Thomas, G. B., and Finney, R. L., "Calculus and Analytic Geometry", 6th edition, Addison-Wesley/Narosa, 1985.
2. Piskunov, "Differential and Integral Calculus", Vol.-I & II, Mir Publishers, Moscow, 1979.

CE 111 ENGINEERING MECHANICS 5(3-1-3**)

Fundamental of Mechanics- Basic concepts

Force Systems and Equilibrium

Force, Moment and couple, Principle of Transmissibility, Varignon's theorem, Resultant of force systems- Concurrent and non-concurrent coplanar forces, Free body diagram, Equilibrium equations and their uses in solving elementary engineering problems.

Plane Trusses

The structural model, simple trusses, analysis of simple trusses: method of joints, method of sections, graphical method.

Friction

Introduction, laws of coulomb friction, simple contact friction problems, belt friction, the square screw thread, rolling resistance.

Properties of Surface

First moment of an area and centroid, second moment and product of area of a plane area, transfer theorems, relation between second moment and product of area, polar moment of inertia, principal axes, mass moment of inertia.

Virtual Work

Work of a force, Principle of Virtual work and its application.

Kinematics of Rigid bodies

Plane motion, Absolute motion, Relative motion, Translating axes and rotating axes.

Kinetics of Rigid Bodies

Plane motion, Work and energy, Impulse and momentum.

List of Experiments

- To determine the Newton's second law of motion by Fletcher's trolley apparatus.
- To determine the moment of inertia of a flywheel about its axis of rotation.
- To verify: (a) the conditions of equilibrium of forces by parallel force apparatus. (b) The principal of moments by crank lever.
- To find the compression in the rafters and tension in ties of simple roof truss models and to verify graphically.
- To determine the dry friction between inclined plane and slide boxes of different materials.
- To determine the coefficient of friction between the belt and rope and the fixed pulley.
- To determine the velocity ratio of a simple screw jack and to plot graph between (a) Effort-Load. (b) Friction-Load. (c) Efficiency-Load.
- To measure the area of a figure with the help of a Polar Planimeter.

Suggested Text Books & References

1. Beer, F.P., and Johnston, F. R., "Mechanics for Engineers", McGraw Hill.
2. Shames, I.H., "Engineering Mechanics", Prentice Hall of India.
3. Meriam, J.L, "Statics", John Wiley.
4. Meriam, J.L., "Dynamics", John Wiley.

EE 111 BASIC ELECTRICAL ENGINEERING 5(3-1-3**)

DC Networks

Kirchoff's laws, node voltage and mesh current methods; Delta-star and star-delta conversion; Classification of Network Elements, Superposition principle, Thevenin's and Norton's theorems.

Single Phase AC Circuits

Single phase EMF generation, average and effective values of sinusoids; Solution of R, L, C series circuits, the j operator, complex representation of impedances; Phasor diagram, power factor, power in complex notation; Solution of parallel and series-parallel circuits; Resonance.

Three phase AC Circuits

Three phase EMF generation, delta and Y-connection, line and phase quantities; Solution of three phase circuits, balanced supply voltage and balanced load; Phasor diagram, measurement of power in three phase circuits; Three phase four wire circuit; Unbalanced circuits.

Magnetic Circuits

Ampere's circuital law, B-H curve, solution of magnetic circuits; Hysteresis and eddy current losses; relays an application of magnetic force.

Transformers

Construction, EMF equation, ratings; Phasor diagram on no load and full load; Equivalent circuit, regulation and

efficiency calculations; Open and short circuit tests; Auto-transformers and three phase transformers.

Induction Motors

The revolving magnetic field, principle of operation, ratings: Equivalent circuit; Torque-speed characteristics; Starters for squirrel cage and wound rotor type induction motors; Single phase induction motors. .

DC Machines

Construction, EMF and torque equations; Characteristics of DC generators and motors; Speed control of DC motors and DC motor starters; Armature reaction and commutation.

Electrical Measuring Instruments

DC PMMC instruments, shunts and multipliers, multi-meters; Moving iron ammeters and voltmeters; Dynamometer wattmeters; AC watt-hour meters, Extension. of instrument ranges.

Power Supply Systems

General structure of electrical power systems; Power transmission and distribution via overhead lines and underground cables, Steam, hydro, gas and nuclear power generation.

List of Experiments

- To measure the armature and field resistance of a DC machine.
- To calibrate a test (moving iron) ammeter, and a (dynamometer) wattmeter with respect to standard (DCPMMC) ammeter and voltmeters.
- Verification of circuit theorems, Thevenin's and Superposition theorems (with DC sources only).
- Voltage-current characteristics of incandescent lamps and fusing time-current characteristics of fuse wire.
- Measurement of current, voltages and power in R-L-C series circuit excited by (single phase) AC supply.
- Open circuit and short circuit tests on a single-phase transformer.
- Connection and starting of a three-phase induction motor using direct on line (DOL), or star-delta starter.
- Connection and measurement of power consumption of a fluorescent lamp.
- Determination of open circuit characteristics (GCC) of a DC machine.
- Starting and speed control of a DC shunt motor.
- Connection and testing of a single-phase energy meter (unity power factor load only).
- Two-wattmeter method of measuring power in three-phase circuit (resistive load only).
- Measurement of thermo emf between different types of thermocouples as a function of temperature difference between the junction, measurement of an unknown temperature.
- Design and use of potentiometer.
- Study of LCR circuits with AC current.

Suggested Text Books & References

1. Hughes Edward (revised by Ian McKenzie Smith), "Electrical Technology", Seventh Edition, English Language Book Society Publication with Longman, 1995.
2. Del Torro, Vincent "Electrical Engineering Fundamentals", Second- Edition, Prentice Hall of India Pvt. Ltd., 1994.
3. Cotton, H., "Advanced Electrical Technology", Issac Pitman, London, 1967.
4. Wildi, Theodore "Electrical Machines, Drives and Power Systems", Second Edition, Prentice Hall, 1991.
5. Cogdell, J R "Foundations of Electrical Engineering", Second Edition, Prentice Hall, 1996.
6. Parker Smith S. (Ed. Parker Smith N N), "Problems in Electrical Engineering", Tenth Edition, Asia Publications, 1995.

CE 112 ENGINEERING GRAPHICS-I 2(0-0-3)

General

Importance, Significance and scope of engineering drawing, Lettering, Dimensioning, Scales, Sense of proportioning, Different types of projections, Orthographic projections, B.I.S. Specifications.

Projections of Points and Lines

Introduction of planes of projection, Reference and auxiliary planes, projections of points and lines in different quadrants, traces, inclinations, and true lengths of the lines, projections on auxiliary planes, shortest distance intersecting and nonintersecting lines.

Planes Other than the Reference Planes

Introduction of other planes (perpendicular and oblique), their traces, inclinations etc., projections of points and lines lying in the planes, conversion of oblique plane into auxiliary plane and solution of related problems.

Projections of Plane Figures

Different cases of plane figures (of different shapes) making different angles with one or both reference plaI1es and lines lying in the plane figures making different given angles (with one or both reference planes). Obtaining true shape of the plane figure by projection.

Projection of Solids

Simple cases when solid is placed in different positions, Axis, faces and lines lying in the faces of the solid making given angles.

Development of Surface

Development of simple objects with and without sectioning.

Isometric Projection
Nomography
Basic concepts and use.
Suggested Text Books & References

1. Narayana, K.L. and Kannaiah, P. "Engineering Graphics.", Tata McGraw Hill, New Delhi, 1988.
2. Bhatt, N.D. "Elementary Engineering Drawing", Charotar Book Stall, Anand, 1998.
3. Lakshminarayanan, V. and Vaish Wanar, R.S., "Engineering Graphics", Jain Brothers, New Delhi, 1998.
4. Chandra, A.M. and Chandra Satish, "Engineering Graphics", Narosa, 1998.

ME 111 WORKSHOP PRACTICE I 2(0-0-3)

Carpentry Shop

- Study of tools & operations of a carpentry joints.
- Simple exercise using jack plain.
- Prepare half lap corner joints, mortise & tenon joints.
- Simple exercise on wood working lathe.

Fitting Shop

- Study of tools & operations.
- Simple exercise involving fitting work.
- Making perfect male – female joints.

Black Smithy Shop

- Study of tools & equipments.
- Simple exercises based on black smithy operation such as upsetting, drawing down, punching, bending, fullering, swaging.

Welding Shop

- Study of tools & operations.
- Preparation of simple butt & lap joint.
- Oxy-acetylene welding.

Sheet Metal Shop

- Study of tools & operations.
- Making funnel complete with soldering.
- Fabrication of toolbox, tray, electrical panel boxes etc.

Machine Shop

- Study of tools & operations.
- Plane turning, step turning, taper turning, threading.
- Single point cutting tool grinding.

Suggested Text Books & References

1. Begeman, M.L.. and Amstead, B.H. "Manufacturing Process", John Wiley, 1968.
2. Chapman, W .A.J. and Arnold, E. "Workshop Technology", Vol. I & III, Viva Low Priced Student Edition, 1998.
3. Raghuwanshi, B.s. "Workshop Technology", Vol. I & II, Dhanpat Rai and Sons, 1998.
4. Chaudhary, Hajra "Elements of Workshop Technology", Media Promotors & Publishers, 1997.
5. Crawford, S. "Basic Engineering Processes", Hodder & Stoughton, 1985.

HU 121 PROFESSIONAL COMMUNICATION – II 3(2-0-1)

Unit-I

Technical written communication- Nature origin and development of technical communication, salient features, chief characteristics of technical writing, basic difference between technical writing and general writting, Role of diction in technical writing and general writing.

Unit II

The salient features of scientific and technical communication

1. Fragmented sentences
2. Parallel comparisons
3. Squinting construction and split infinitive
4. Dangling Participles and gerunds
5. Coherence, unity, chronological, method, spatial method, inductive method, deductive method.

Unit III

Proposal writing- Types of proposals, The chief characteristics of a good proposal, structure or format of proposal the deference between a report and a proposal.

Writing scientific and semi-technical articles- Tables, figures, footnotes, bibliography, pie graphs, bar charts, flow charts, line graphs.

Unit IV

Study of scientific and general tests- Arora, V.N., " Improve your writing " Delhi; Oxford University press, 1981.

1. The effect of the scientific temper on Man –Bertrand Russell.
2. Technological Ombudsman-Alvin Toffler.
3. Population Explosion – Robert Arvill
4. The Scientist and Poet-D.G. King – Hele
5. The Language of literature and science-Aldous Huxley
6. The aims of science and the humanties – MoodyE.
7. The mother of the science- A.J. Bahm
8. The progress in the arts and science-Bronowski

Unit V

Phonetic Transcription – The definition , Broad phonetic transcription, narrow phonetic transcription, Dipthong, plosives, Frieatives, Lateral

Practical Aspects- Listing comprehension

a. Ear Training
b. Uses of latest scientific techniques (AVR comprehension training) comprehension accelerator, AVR comprehension reteometer.

Reading comprehension- Reading at various speeds, slow, fast, very fast, reading diferent kinds of texts for different purposes (for example, for relaxation, for information, for discussion at a later stage etc.)

Speaking- Achieving desired clarity and fluency, manipulating, paralinguistic features of speaking voice quality pitch tone, pausing for effectiveness, while speaking , making a short class room presentation,

Group Discussion- Use of persuasive strategies including rhetorical devices (for emphasizing , for instance , being polite and firm; handling question and taking in criticism of self ; term taing strategies and effective intervention using body language.) .

Books Recommended

1. Fiske, John, " Introduction to communication studies", Rotlegde London, 1990
2. Gartside, I " Modal Business letter" , Pitman London, 1992
3. Nurnberg. Maxwell and Morris, Rosen Blum. " All about words", General book report, New Delhi, 1995
4. O. Cooner, JD. " Better english pronunciation", Oxford University press, 1992.

CE 122 ENVIRONMENTAL STUDIES 4(3-0-1)

Unit 1: The Multidisciplinary nature of environmental studies (2 lectures)

Definition, scope and importance

Need for public awareness

Unit 2; Natural Resources (8 lectures)

Renewable and non-renewable resources:

Natural resources and associated problems

a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.
c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
d) Food resources: World food problems, changes caused by agricultural and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
e) Energy resources: Growing energy needs, renewable and non renewable energy sources, sue of alternate energy sources. Case studies.
f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conserve of natural resources.
- Equitable use of resources for sustainable lifestyles.

Unit 3: Ecosystems (6 lectures)

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Producers, consumers and decomposers.
- Energy flow in the ecosystem.
- Ecological succession.
- Food chains, food webs and ecological pyran.
- Introduction, types, characteristic features, Structure and function of the following ecosystem :-
    a. Forest ecosystem
    b. Grassland ecosystem
    c. Desert ecosystem
    d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit 4 : Biodiversity and its conservation (8 lectures)

- Introduction- Definition: genetic, species and ecosystem diversity.
- Biogeographical classification of India.
- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- Biodiversity at global, National and local levels.
- India as a mega-diversity nation.
- Hot-spots of biodiversity.
- Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India
- Conservation of biodiversity : In-situ and Ex-situ conservation, of biodiversity.

Unit 5: Environmental Pollution (8 lectures)

Definition

- Causes, effects and control measures of
  a. Air pollution
  b. water pollution
  c. Soil pollution
  d. Marine pollution
  e. Noise pollution
  f. Thermal pollution
  g. Nuclear hazards
- Solid waste management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution.
- Pollution case studies.
- Disaster management: Floods, earthquake, cyclone and landslides.

Unit 6: Social Issues and the Environment (7 lectures)

- From Unsustainable to Sustainable development
- Urban problems related to energy
- Water conservation, rain water harvesting, water and management
- Resettlement and rehabilitation of people; its problems and concerns. Case studies.
- Environmental ethics : Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- Wasteland reclamation.
- Consumerism and waste products.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Public awareness

Unit 7 : Human Population and the Environmental (6 lectures)

- Population growth, variation among nations.
- Population explosion-Family Welfare Programme.
- Environmental and human health.
- Human Rights.
- Value Education.
- HIV/AIDS
- Women and Child Welfare
- Role of Information Technology in Environmental and human health
- Case Studies.

Unit 8 : Field work (5 lectures)

- Visit to a local area to document environmental assets-rive/forest/grassland/hill mountain.
- Visit to a local pollution site-Urban/rural/Industrial/Agricultural.
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc. (Field work Equal to 5 lecture hours)

References:

1. Agarwal. K.C. 2001. Environmental Biology, Nibi Publ. Ltd. Biknaner.

2. Bharucha Erach, The Biodiversity of India. Mapin Publishing Pvt. Ltd. Ahmedabad-3080 013, India, Email : mapin@icenet.net (R)
3. Brunnner R.C., 1989. Hazardous Waste Incineration. McGraw Hill Inc. 480p.
4. Clark R.S., Marine Pollution, Clanderson Press oxford (TB)
5. Cunningham, W.P. Copper, T.H. Gorhani, E & Hepworth, M. T. 2001 Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p
6. De. A.K., Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environmental (R)
8. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute. Oxford Univ. Press 478p.
9. Hawkins R.E. Encyclopedia of India Natural History, Bombay natural history Society, Bombay (R)
10. Heywood, V.H. & Watosn, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140 p.
11. Jadhav, H. & Bhosale, V.m. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p.
12. Mekinney, M.L. & Schoeb, R.M. 1996 Environmental Science system & Solutions, Web enhanced edition 639p.
13. Mhaskar A.K. Matter Hazardous. Techno-Science Publications (TB)
14. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
15. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 5749.
16. Rao M.N. & Datta, A.K. 1987. Waste Water Treatment, Oxford & IBH Publ. Co. Pvt. Ltd. 345p.
17. Sharma B.K.; 2001. Environmental Chemistry. Goel Publ. House, Meerut.
18. Survey of the Environment, The Hindu (M)
19. Townsend C., Harper J, and Muicheal Begon, Essentials of Ecology, Blackwell Science (TB).
20. Trivedi R.K. Handbook of Environmental laws, Rules, Guidelines, Compliances and Standards Vol. I & II, Enviro Media (R)
21. Trivedi R.K. and P.K. Goel, Introduction to air pollution, Techno-Science Publications (TB)
22. Wagner K.D., 1998. Environmental Management n.B. Saunders Co. Philadephia, USA 499p.
(M) Magazine (R) Reference (TB) Texbook

CS 121 INTRODUCTION TO COMPUTING 4(2-1-3)

Introduction

Introduction to the computer devices such as keyboard, mouse, printers, disk, files, floppies, etc. Concept of computing, contempory, OSs such as DOS, Window 95, MAC-OS, UNIX, etc. (Only brief user level description).
Introduction to the e-mail, ftp, rlogin and other network services, world wide web. Introduction to the typesetting softwares such as Microsoft office.

Introduction to Programming

Concept of algorithms, Example of Algorithms such as how to add ten numbers, roots of a quadratic equation. Concept of sequentially following up the steps of the algorithm.
Notion of program, programmability and programming languages. Structure of programs, object codes, compilers.
Introduction to the Editing tools such as vi or MS- VC editors.
Concepts of the finite storage, bits, bytes, kilo, mega and gigabytes. Concepts of character representation. Languages for system programming: study of Basics, Fortran, Pascal, Cobol etc.

Computer Programming Lab

- Concepts of flow charts and decision tables, Examples and practice problems.
- Introduction to Digital computers and its components, Introduction to DOS and UNIX operating systems.
- Development of computer program for example
- Roots of quadratic and Cubic equations
- Summation of N natural numbers
- Arranging numbers in ascending and descending orders
- Separation of odd arid even numbers, etc.

Suggested Text Books & References

1. Kernighan, B.W., "The Elements of Programming Style", Mcgraw-Hill.
2. Yourdon, E., "Techniques of Program Structures and Design", Prentice-Hall.
3. Press, W.H., Teukolsky, S.A., Vetterling, W.T., & Flannery, B.P., " Numerical Recipies in Fortran", Cambridge university press.
4. Gotterfried, B.S. " Schaum's Outline of Theory & Programming With Basic", McGraw Hill, New Delhi.
5. Schied, F.S., " Theory and Problems of Computers & Programming", McGraw Hill New Delhi.
6. Divakar Singh & Bajpayee, “Computer & Programming Language”, New Age Publication.
7. Divakar Singh, “Foundation of Information Technology”, New Age Publication.

CH 121 ENGINEERING CHEMISTRY II (ENVIRONMENT AND ECOLOGY) 3(2-1-0)

General

Introduction, components of the environment, environmental degradation.

Ecology

Elements of Ecology: Ecological balance and consequences of change, principles of environmental impact assessment.

Air Pollution and Control

Atmospheric composition, energy balance, climate, weather, dispersion, sources and effects of pollutants, primary and secondary pollutants, green house effect, depletion of ozone layer; standards and control measures. .

Water Pollution and Control

Hydrosphere, natural water, pollutants their origin and effects, river/lake/ ground water pollution, standards and control.

Land Pollution

Lithosphere, pollutants (municipal, industrial, commercial, agricultural, hazardous solid wastes): their origin and effects, collection and disposal of solid waste, recovery and conversion methods.

Noise Pollution

Sources, effects, standards and control.

Books & References

1. Masters, G.M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd., 1991.
2. Nebel, B.J., "Environmental Science", Prentice-Hall Inc., 1987.
3. Odum, E.P, "Ecology: The Link Between The Natural and Social Sciences", IBH Publishing Com. Delhi.

PH 121 ENGINEERING PHYSICS-II 4(3-1-0)

Vector analysis

Scalar and vector fields, gradient of a scalar field, Divergence and curl of a vector fields, Line integral of a vector field, Gauss- divergence theorem, Stoke's theorm

Electromagnetism

Quantization & conservation of charge, Coulomb's law (vectorial form) and superposition principle,

Concept of electric field lines, flux of E-field, Gauss' law, Electric Potential energy and potential,

Conductors, capacitors and dielectric materials, Magnetic field, Force on a moving charge in a magnetic field, Force on current element, Torque on current loop, Biot-Savart law, Ampere's law,

Electromagnetic induction and Faraday's law, Magnetism in materials, Maxwell's, equations, Electromagnetic Waves.

Thermoelectricity

Seebeck effect, law of successive temperatures, law of intermediate metals, peltier effect, Thomson effect, Thermoelectric power, application of thermodynamics on thermocouple.

Modern Physics

Elements of wave properties of particles and particle properties of waves, Nuclear Energy, Lasers- spontaneous and stimulated emission of radiation, Einstein coefficient, Parts of laser, types of lasers and their application.

Solid State Devices

Energy band diagram; covalent bonds; bound and free electrons, holes; electron and hole mobilities; intrinsic and estrinsic semiconductors; Fermi and impurity levels; impurity compensation, charge neutrality equation and semiconductor conductivity; Einstein relation; drift and diffusion current; photo conductivity and Hall effect.

Suggested Text Books & References

1. Rangwala and Mahajan "Electricity and Magnetism", Tata McGraw Hill, 1998.
2. Verma, H.C., "Concepts of Physics, Part-2", Bharati Bhawan (P&D),.1998.
3. Beiser, "Modern Physics", McGraw-Hill Inc., New York, 1995.
4. Mani and Mehta, G.K., "Modern Physics", Affiliated East-West Press Pvt. Ltd,1998.

MA 121 MATHEMATICS – II 4(3-1-0)

Linear Algebra

Vector spaces-linear independence and dependence of vectors, inner Products, linear transformations. Matrices and determinants. Systems of linear equations-consistency and inconsistency. Gauss elimination, rank of a matrix, inverse of a matrix. Eigenvalues and eigenvectors of a matrix, diagonalization of a matrix.

Ordinary Differential Equations

Formation of ODE's, definition of order, degree and solutions. ODE's of first order: separable variables, homogeneous and nonhomogeneous equations; exactness and integrating factors, linear equations and Bernoulli equations. General linear ODE's of nth order: solutions of homogenous and nonhomogenous equations, operator method, methods of undetermined coefficients and of variation of parameters. Solutions of simple simultaneous ODE's.

Laplace Transforms

Transforms of elementary functions, transforms of derivatives and derivatives of transforms, inverse transforms, transforms of periodic functions, unit step function, shifting theorems, solutions of ODE's using Laplace transforms.

Numerical Methods

Difference operators-forward, backward, central, shift arid average operators and relations between them. Newton's

forward and backward interpolation: Lagrange interpolation and the error formula for interpolation. Numerical differentiation and integration-Trapezoial rule and Simpson's one-third rule including error formulas.

Suggested Text Books & References

1. Kreyszig, E., " Advanced Engineering Mathematics", 5th Ed., Wiley Eastern, 1985.
2. V. Krishnamurthy, V., Mainra, V.P., and Arora, J.L. " An Introduction to Linear Algebra", Affiliated East-West, 1976.
3. Boyce and Diprima, RC., "Elementary Differential Equations and Boundary Value Problems", 3rd Ed., Wiley, 1977.

ME 121 ENGINEERING THERMODYNAMICS 4(3-1-0)

Fundamentals and Definitions System, Control Volume, properties, state, state change, and diagram, Dimensions and units. Work Mechanics and Thermodynamics definitions, Displacement work at part of a system boundary, Engine Indicator, Displacement work in various quasi-static processes, shaft work, electrical work Heat Temperature, thermal equilibrium, Zeroth law of thermodynamics, sign convention for heat transfer. First Law of Thermodynamics Statement, Application to noncyclic process, Energy, modes of energy, Pure substance, Specific heats, First Law for Control Volumes. Second Law of Thermodynamics Direct and reversed heat engines, Kelvin-Planck and Clausius Statements and their equality, reversible and irreversible processes, Carnot cycle, Thermodynamic temperature scale. Entropy Definition, calculation through T ds relations, T -s diagrams, entropy as a measure of irreversibility Properties of pure substances - Use of steam Tables and Mollier Diagram. Ideal gas Properties of ideal gas and ideal gas mixtures with and without a condensable vapour-psychrometry.

Real gas, Equations of state, generalised charts for compressibility, enthalpy changes and fugacity. Second Law Analysis of Engineering Processes Availability and irreversibility and their application in Thermal Engineering.

Suggested Text Books & References

1. Spalding, D. B. and Cole, E.H., "Engineering Thermodynamics", Edward Arnold, 1959.
2. Hawkins, G.A., "Engineering Thermodynamics", John Wiley and Sons, 1955.
3. Van Wylen, G. J. and Sonntag, R.E., "Fundamentals of Classical Thermodynamics", John Wiley and Sons, 4th edition, 1997.
4. Nag, P.K., "Engineering Thermodynamics", Tata McGraw Hill, 2nd edition, 1998.
5. Onkar Singh, & Chandra, “Introduction to Mechanical Engineering – Engineering Thermodynamics & Strength of Material”, New Age Publication.

EC 121 BASIC ELECTRONICS 5(3-1-3)

Semiconductor Diodes Introduction, Ideal diode, PN semiconductor diode, Diode equivalent circuits, Zener diode, Light diodes. Bipolar Junction Transistor Introduction, Transistor construction, Transistor operation, Common-base configuration, common emitter and common collector configuration. Field Effect Transistor Introduction, Construction, and characteristics of JFETs, Transfer characteristics, Depletion type MOSFET, Enhancement type MOSFET. Operational Amplifier Introduction, Differential and common mode operation, Constant gain' multiplier, voltage summing, voltage buffer. Semiconductor Devices

Introduction of silicon controlled rectifier, GTO, TRIAC,DIAC, .injunction transistors: IGBT. Cathode Ray Oscilloscope Introduction, Cathode ray tube- theory& construction.

Electronic Instruments Introduction, Electronic voltmeters, Vacuum type voltmeters, Differential amplifiers, D.C. Voltmeter with direct coupled amplifier, Electronic multimeter. Transducers Introduction, classification and types of electrical transducers. Display Devices and Recorders Introduction, Digital instruments, Digital V s Analog instruments, Recorders- Analog recorders, graphic recorders, strip chart recorders. Data Acquisition Systems Introduction, Components and uses.

BASIC ELECTRONICS LAB

- Characteristics Curve for common base emmitor & common collector transducers.
- Characteristics of field effect transistors.
- Verification of properties of operational amplifiers.
- Study of CRO.
- Study of working of data acquisition system.

Suggested Text Books and References

1. Robert Boylestad & Louis Nashelsky, "Electronic Devices & Circuit Theory", Prentice Hall of India.
2. Milliman & Halkias, "Basic Electronics Principle".
3. Sawhney, A. K., "Electrical & Electronics Measurement and Instrumentation", Dhanpat Rai & Sons.

ME 121 ENGINEERING GRAPHICS-II (M/C DRAWING) 2(0-0-3)

Basic Concepts

I. S. drawing-conventions, line symbols, kinds of line, drawing sheet lay-out, rules of printing, preferred scales.

Projections

Perspective, orthographic, isometric and oblique projections, isometric scale, isometric drawing. Technical sketching.

Shape Description (External)
Multiplanar representation in first- and third angle systems of projections, glass-box concept, sketching of orthographic views from pictorial views, precedence of lines.
Sketching of pictorial (isometric and oblique) views from Multiplanar orthographic views. Reading exercises. Missing line and missing view exercises.
Shape Description (Internal)
Importance of sectioning, principles of sectioning, types of -sections, cutting plane representation, section lines, conventional practices.
Size Description
Dimensioning, tools of dimensioning. Size and location dimensions. Principles and conventions of dimensioning. Dimensioning exercises.
Computer Aided Drafting
Basic concepts and use.
Suggested Text Books & References

1. French and Vireck, "The fundamental of Engineering Drawing and Graphic Technology", McGraw Hill, 4th Ed., 1978.
2. "IS: 696 (1972) Code of Practice for General Engineering Drawing", ISI New Delhi.
3. P.S. Gill, "A Text Book of Machine Drawing", Katson Publishing House, Ludhiana, 1980.
4. Giesecke, Mitchell, Spener, Hill and Dygon, "Technical Drawing", McMillan & Co., 7th Ed., 1980.
5. George Omura, "Mastering AUTOCAD", B.P.B. Publication; New Delhi, 1994.

ME 122 WORKSHOP PRACTICE II 2(1-0-2)

Carpentry
Timber, seasoning and preservation, plywood and ply boards. Engineering applications.
Foundry
Moulding sands, constituents and characteristics, pattern, materials, types, core prints. Role of gate, runner, riser, core and chaplets, causes & remedies of some common casting defects like blow holes, cavities and inclusions.
Metal Joining
Definitions of welding, brazing & soldering processes; and their applications. Oxy-acetylene gas welding processes, equipments, techniques, type of flames; and their applications. Manual metal arc welding technique and equipment, AC and DC welding electrodes, constituents and functions of electrode coating. Welding positions. Type of welding joints. Common welding defects such as cracks, undercutting, slag inclusions, porosity.
Metal Cutting
Introduction to machining and common machining operations. Cutting tool material. Definitions of machine tools, specification and block diagram of lathe, shaper, drilling machine and grinder. Quick return mechanism of shaper. Difference between drilling and boring. Files material and classification.
Forging
Forging principle, materials, operations like drawing, upsetting, bending and forge welding, use of forge parts.
List of Practical
Carpentry Shop

- Preparation of cross lap joints.
- Preparation of bridle joints.

Fitting Shop
Simple exercising involving filing, drilling, taping and dieing.
Foundry Shop

- Mould of any pattern.
- Casting of any simple pattern.

Machine Shop
Job on lathe with plane turning, taper turning, step turning, chamfering, threading. Study of drilling, grinding; and shaping machine.
Welding Shop

- Preparation of square butt joints by MMA welding.
- Prepare lap joint MMA welding.

CS 231 NUMERICAL ANALYSIS & COMPUTER PROGRAMMING (C, C++) 5(3-1-3)

I. Numerical Analysis

Approximations and round of errors, Truncation errors and Taylor Series, Determination of roots of polynomials and transcendental equations by Newton-Raphson ,Secant and Bairstow's method. Solutions of linear simultaneous linear algebraic equations 'by Gans;; Elimination and Gauss- Siedel iteration methods. Curve fitting- linear and nonlinear regression analysis.Backward, Forward _d Central difference relations and their uses in Numerical differentiation and integration, Application t of difference relations in the solution of partial differential equations. Numerical solution of ordinary differential equations by Euler, Modified Euler, Runge-Kutta and Predictor-

Corrector method.

II. Computer Programming

Introduction to computer programming in C and C++ languages. Arithmetic expressions, Simple programs. The emphasis should be more on programming techniques rather than the language itself. The C programming language is being chosen mainly because of the availability of the compilers, books and other reference materials. Example of some simple C program. Dissection of the program line by line. Concepts of variables, program statements and function calls from the library (printf for example) C datatypes, int, char, float etc. C expressions, arithmetic operations, relational and logic operations. C assignment statements, extension of assignment to the operations. C primitive input output using getchar and putchar, exposure to the scanf and printf functions. C statements, conditional execution using if, else. Optionally switch and break statements may be mentioned. Concepts of loops, example of loops in C using for, while and do-while. Optionally continue may be mentioned. One dimensional arrays and example of iterative programs using arrays, 2-d arrays. Use in matrix computations. Concept of Sub-programming, functions. Example of functions. Argument passing mainly for the simple variables. Pointers, relationship between arrays and pointers. Argument passing using pointers. Array of 'pointers, Passing arrays as arguments. Strings and C string library. Structure and unions. Defining C structures, passing structures as arguments. Program examples. File I/O. Use of fopen, fscanf and fprintf routines.

List of practical

Development of computer program for

- Numerical integration by Trapezoidal and Simpson's rule.
- Gauss-Siedel iteration method.
- Various matrix operation and their use as sub-routines

Suggested Text Books & References

1. Shastry, S.S., “Numerical Methods", Prentice Hall Inc., India, 1998.
2. Noble Ben, “Numerical methods", New York International Publications, New York, 1964.
3. Stanton Ralph G., “Numerical Methods for Engineering", Englewood Cliffs, N.J., Prentice Hall Inc., 1961.
4. Buckingham R.A., "Numerical Methods", Sir Isaac Pitman Sons. Ltd., London, 1957.
5. Bakhvalov, N.S., “Numerical Methods", Mir. Pub., Moscow, 1977.
6. Grewal, B.S., “Numerical Methods", Khanna Pub., New Delhi, 1998.
7. Sudhit Kaicker, “The Complete ANSi C", BPB Publications, New Delhi, 1996.
8. Kernighan, B.W. and D.M. Ritchie, “The C Programming Language", Prentice Hall of India, 1998.
9. Byron, S. Gottfreid, “Programming with C", Tata McGraw Hill, 2nd edition 1998.
10. Divakar Singh & Girish Chandra, “ Computer Numerical Analysis”, New Age Publication.

ME 231 MATERIAL SCIENCE ME 231 5(3-1-3)

Classification of engineering materials, Metals, nonmetals, plastics, Ceramics and composites.

Structure of materials

Crystalline structure of solids: Concept of unit cell and space lattice, miller indices, Crystal structure determination by X-ray diffraction. Crystal structure of ferrous and non-ferrous metals. Crystal imperfections. Description of material properties like strength, hardness, toughness, ductility, brittleness, their importance in engineering application of materials and manufacturing. Quantitative evaluation of these properties with destructive testing methods.

Plastic deformation

Mechanism of plastic deformation, role of dislocations, slip and twinning. Strain hardening and recrystallisation. Elementary treatment of creep, fatigue and fracture.

Phase diagrams

Phase and phase equilibrium: solidification of pure metals and alloys, phase diagrams. Eutectic, eutectoid, Peritectic and peritectoid systems, Allotropy of iron and Fe-C diagram.

Heat treatment

Introduction and purpose of heat treatment T-T-T curve and micro constituents in steel heat treatment processes like hardening, tempering, annealing, normalizing. electrical, magnetic; and optical properties of materials. Surface treatment processes.

Engineering materials

Ferrous; Cast irons, carbon and alloy steels and their coding. Non ferrous; Aluminum, copper, nickel, chromium, zinc, lead, tin, Tungsten, etc and their alloys.

Classification, structure, general properties and applications of polymers, ceramics and composites.

List of practical

- Making a plastic mould for a small metallic specimen
- Specimen preparation for microstructural examination cutting, grinding, polishing etching.
- Grain size determination of a given specimen.
- Comparative study of micro structures of different given specimens (mild steel, gray C.I., brass, copper etc.)
- Heat treatment experiments such as annealing, normalizing, quenching, case hardening and comparison of

hardness before and after.

- Material identification of say 50 common items kept in a box.
- Faradays law of electrolysis experiment.
- Study of corrosion and its effects.
- Study of microstructure of welded component and HAZ Macro & Macro examination.

Suggested Text Books and References

1. Lawrence, H. Vanvlack, "Elements of Material Science and Engineering"; Addison-Wesley.
2. Raghvan, V., "Material Science and Engineering". Prentice Hall of India.
3. Agrawal, B. K., "Introduction to Engineering Materials" Tata McGraw Hill, N.Delhi

CE 231 STRENGTH OF MATERIALS 4(3-1-0)

Stress (Axial Load)

Normal stress, Shear stress, Factor of safety.

Stress-strain diagram

Hook's Law, Poission's ratio.

Torsion

Basic assumptions, Torsion formula, Hollow and Stepped circular shafts, Angular Deflection, Shaft couplings.

Flexural Loading

Theory of pure bending, Flexural formula, Shear force and Bending moments diagrams for different types of loading and support conditions on beams. Transverse shear stress distribution in circular, hollow circular, I, box and T, angle sections.

Deflection of Beams

Strain curvature and moment curvature relation, Solution of beam deflection problems by Direct integration method, Area moment method.

Principal Stresses and Strains

Normal and shear stress, Concept of equivalent bending & equivalent twisting moment, Mohr's circle of stress and strain, Strain Rosette's.

Columns

Euler's formula for different end conditions, Concept of equivalent length, Eccentric loading. Rankine formula.

Energy Methods

Strain energy for Uniaxial stress, Pure bending, Shearing stresses, Use of energy theorems to determine deflection and twist of shafts.

Suggested Text Books & References

1. Ramamurtham, S., "Strength of Matreials", Dhanpat Rai & Sons, 1991.
2. Popov, E.P., "Mechanics of materials", Prentice Hall Inc., 1984.
3. Andrew, P. and Singer, F.L., "Strength of Materials" , Happer & Row Publishers, New York, 1987.

CE 232 FLUID MECHANICS 5(3-1-3)

Introduction

Fluid and flow-definition and types, properties of ideal and real fluids, continulim concept, Lagrangian & Eulerian approach.

Fluid static's

General differential equation, Hydrostatics manometry; Force on plane and curved surfaces; stability of floating and submerged bodies; Relative-equilibrium.

Kinematics of fluid

Steady flow; uniform flow; stream, streak and path lines; continuity equation; stream function; irrational flow; velocity potential; flow nets; circulation; simple flows; flow around half body circular cylinder with and without rotation; lift and drag.

Dynamics of fluids

Concept of system and control volume; Reynolds transportation theorem, Euler's equation, Bernoulli's equation, Navier Stock's equation to nozzle, venturimeter orifices and mouth pieces; time taken in emptying a vessel; pitot and prandtl tube.

Flow in pipes

Laminar flow through pipe; total and hydraulic gradient lines; series and parallel connection of pipes; transmission of power through pipes.

Laminar flow of viscous fluids

Boundary layer concept; boundary layer thickness; displacement, momentum and energy thickness; integral method; drag on flat plate; flow around-of airfoil; boundary layer separation; flow; plane flow.

Turbulent flow

Fluid friction and Reynolds's number; Prandtl mixing length hypothesis velocity distribution in pipes; the universal pipe friction flows; Cole Brook White formula.

Dimensional analysis

Buckingham's P theorem; Non-dimensional numbers and there application; similitude.

Compressible fluid flow

Velocity of sound, Mach number; Steady isentropic flow through ducts; choked flow; flow through convergent and convergent-divergent nozzle; Adiabatic flow; Fanno lines; diabetic flow; Rayleigh lines.

List of practical

- To determine experimentally the metacentric height of a ship model.
- To verify the momentum equation experimentally
- To plot ht e flow net for a given model using the concept of electrical analogy.
- To measure surface tension of a liquid.
- To calibrate an orifice meter and study the variation of the coefficient of discharge with the Reynolds number.
- To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
- To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.
- To study the variation of friction factor, 'f' for turbulent flow in smooth and rough commercial pipes.
- To determine the loss coefficients for the pipefittings.
- To study the boundary layer velocity profile and to determine boundary layer thickness and displacement thickness. Also to determine the exponent in the power law of velocity distribution.

Suggested Text Books & References

1. Agarwal, "Fluid Mechanics and Machinery", Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
2. Som, S. K. and Biwas, G. "Introduction To Fluid Mechanics and Fluid Machines", Tata McGraw Hill, New Delhi ,1998.
3. Bansal, Dr. R.K. "A Text Book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications (P) Ltd., New Delhi, 1998.
4. Rajput, R.K. "A Text Book of Hydraulics", Sultan Chand and Sons, New Delhi, 1998.

ME 232 APPLIED THERMODYNAMICS 5(3-1-3)

Introduction to Thermodynamic Systems

Definition; Familiarity with common examples of thermodynamic systems such as steam power plant, vapour-compression refrigerator, automobile engines, air compressor, a rocket engine.

Review of basic concepts

Working fluids (air, steam, refrigerants) and calculation of their properties for various thermodynamic processes; Thermodynamic processes and cycles; Psychometry; Use of psychrometric chart for calculation of properties of air-water vapour mixture.

First Law of Thermodynamics

Quantity of energy and its measurements; First law energy equations for closed and open systems under SSSF and USUF conditions; Application of First law energy equations to thermodynamic system components such as boiler, turbine, compressor, nozzle, expander, pump, condenser; First law efficiency; First law analysis of combustion processes.

Second Law of Thermodynamics

Quality of energy and its measurement; Reversible and irreversible processes; Entropy and its significance; Principle of increase of entropy of the universe; Carnot cycle; Second law entropy relations for closed and open systems under SSSF and USUF conditions; Clausius inequality; Applications of second law to various thermodynamic systems; Availability and irreversibility; Second law analysis of combustion processes.

Third Law of Thermodynamics

Measurement of entropy; Zero value of entropy; Absolute zero temperature.

Thermodynamic (PVT) relations of Working Fluids

Equation of state for ideal gas; Behaviour of real gases and compressibility factor; Generalized, empirical and theoretical equations of state for real gases; Law of corresponding states and use of generalized compressibility chart; Helmoltz and Gibbs functions; Maxwell's relations; Enthalpy, entropy, internal energy, and specific heat relations; Clausius-Clapeyron's equation; Applications to ideal and real gases. Joule-Thomson coefficient.

Gas Power Cycles

Carnot, Diesel, Otto, Dual combustion, Brayton, Sterling, Atkinson, and Ericssion cycles; Air standard thermal efficiency and conditions for maximum work output and efficiency; Concepts of mean effective pressure, indicated power and brake power for reciprocating engines.

Vapour power cycles

Carnot and Rankine cycles; Reheating and regenerative feed heating Rankine cycles; Binary vapour cycle; Thermal efficiency and work ratios; Factors affecting efficiency and work output.

Refrigeration Cycles/Processes

Brayton air refrigeration cycle; Vapour compression cycle; Vapour absorption cycle; Water refrigeration; Vortex tube and pulse tube refrigeration; thermoelectric refrigeration.

List of Experiments

- Study of steam power plant, automobile engines, and air compressor.
- Study of parallel flow and counter flow heat exchangers
- Study of components of air, vapour, and water refrigeration; and air conditioning in a cold storage plant.
- Study of systems and components of internal combustion engines.
- Study of boilers, turbines, and pumps.
- Performance evaluation of air compressor, petrol and diesel engine.
- Measurement of steam quality.
- Exhaust gas analysis.

Suggested Text Books & References

1. Wylen, G. Van, Sonntag,R., & Borgnakke, C., "Fundamentals of Classical Thermodynamics", John Wiley & Sons/New Age International, Delhi.
2. Nag, P. K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi.
3. Cengel, Y. A., & Boles, M.A., "Thermodynamics-An Engineering Approach", McGraw-Hill Inc.
4. Spalding, D. B. and Cole, E.H., "Engineering Thermodynamics", Edward Arnold, 1959.
5. Hawkins, G.A., "Engineering Thermodynamics", John Wiley and Sons, 1955.
6. Wylen Van, G. J. and Sonntag, R.E., "Fundamentals of Classical Thermodynamics", John Wiley and Sons, 4th edition, 1997.
7. Nag P.K., "Engineering Thermodynamics", Tata McGraw Hill, 2nd edition, 1998.
8. Yadav, R., "Thermodynamics & Heat Engine Part I & II", Central Publishing House, Allahabad.
9. Yadav, R., " Steam & Gas Turbines", Central Publishing House, Allahabad.
10. Onkar Singh, "Applied Thermodynamics", New Age Publication.

MA 231 MATHEMATICS-III 4(3-1-0)

Fourier Series

Fourier series, Half-range series, Harmonic analysis.

Solution in Series

Differentiation and integration of Infinite series, Series solution of differential equations; Bessel and Legendre equations, their series solution, elementary properties of Bessel functions and Legendre polynomials.

Complex Variables

Functions of a complex variable; Exponential, trigonometric, hyperbolic and logarithmic functions; Differentiation, Analytic functions, Cauchy-Riemann equations, conjugate functions; Application to two dimensional potential problems; Conformal transformations, Schwartz-Christoffel transformation; Cauchy's Integral theorem, Taylor's and Laurent's expansions; Branch points, zeros, poles and residues; Simple problems on contour integration.

Boundary Value Problems

Equations for vibrations of strings, heat flow and electrical transmission lines; Laplace's equation in Cartesian, cylindrical polar and spherical polar coordinates; Solution by separation of variables.

Integral Transforms

I Fourier integral theorem, Fourier transforms, Convolution theorems, Inversion theorem for Fourier and Laplace transforms, Simple applications of these transforms to one-dimensional problems.

Suggested Text Books & References

1. Npiskunov, S. "Differential and Integral Calculus", Vol. I & II, Mir Publishers, Moscow, 1979.
2. Churchill, R.V., "Fourier Series and Boundary Value Problems", McGraw Hill, 1963.
3. Sneddon, I.N., "Fourier Transforms", McGraw Hill, 1951.
4. Churchill, Brown and Verhey, "Complex Variables and Applications", McGraw Hill, 1997.
5. LePage, W.R., "Complex Variables and The Laplace Transform for Engineers", McGraw Hill, 1961.
6. Markushevich, A.I., "The Theory of Analytic Functions", Mir Publishers, Moscow, 1983.

ME 241 MECHANICAL MEASUREMENTS & METROLOGY 4(2-1-3)

I. MECHANICAL MEASUREMENTS

Introduction

Introduction to measurement and measuring instruments, Generalised measuring system and functional elements, units of measurement, static and dynamic performance characteristics of measurement devices, calibration, concept of error, sources of error, statistical analysis of errors.

Sensors and Transducers

Types of sensors, types of transducers and their characteristics.

Measurement of displacement and angular velocity

Measurement of pressure

Gravitational, directing acting, elastic and indirect type pressure transducers. Measurement of very low pressures.

Strain measurement

Types of strain gauges and their working, strain gauge circuits, temperature compensation. Strain rosettes.

Measurements of force and torque.

Temperature measurement

By thermometers, bimetallic, thermocouples, thermistors and pyrometers.

Measurement of Flow

Obstruction meters, variable head meters, hot wire and magnetic meters, ultrasonic flow meters etc.

Vibration and noise measurement

Seismic instruments, vibration pick ups and decibel meters.

Data acquisition system

Introduction to data acquisition systems, single and multi channel systems, microprocessors and PC based data acquisition systems. Input-output devices Signal transmission and processing: Devices and systems.

II. METROLOGY

Standards of linear measurement, line and end standards. System of limits and fits. Linear and angular measurements devices and systems. Limit gauges and their design. Measurement of geometric forms like straightness, flatness, roundness and circularity. Optical projectors, tool makers microscope, autocollimators. Interferometry: principle and use of interferometry, optical flat and interferometers, laser interferometers. Comparators: types, working principles and magnification range. Measurement of screw threads and gears. Surface texture: quantitative evaluation of surface roughness and its measurement. Introduction to CMM. In-process gauging systems. Inspection: In-process and final inspection. Sampling and 100% inspection. Sampling plans.

List of practical

- Study and working of simple measuring instruments, like vernier calipers, micrometer, tachometer etc.
- Measurement of effective diameter of a screw thread using three wire method.
- Measurement of angle using sine bar and slip gauges.
- Study of limit gauges.
- Study and angular measurement using bevel protector.
- Adjustment of spark plug gap using feeler gauges.
- Study of dial indicator.
- Use of dial indicator to check a shape run use.
- Study and understanding of limits, fits & tolerances.
- Pressure measuring experiment.
- Temperature measuring experiment.
- Strain gauge measurement.
- Speed measurement using stroboscope.
- Flow measurement experiment.
- Vibration/ work measuring experiment.

Suggested Text Books & References

1. Beckwith Thomas G., "Mechanical Measurements", Narosa Publishing House N. Delhi.
2. Doeblein, E.O., "Measurement Systems, Application Design" ,McGraw Hill, 1990.
3. Kumar, D. S., "Mechanical Measurements and Control", Metropolitan, N. Delhi.
4. Hume, K.J., "Engineering Metrology", MacDonald and Co. 1963.
5. Gupta, I.C.," Engineering Metrology", Dhanpat Rai & Sons, New. Delhi, 1994.

ME 242 INDUSTRIAL ENGINEERING 3(2-1-0)

Evaluation of Work Study

Work of F.W. Taylor; Frank and Lillian Gilbreth and others; Productivity definition; Means of increasing productivity; Work study definition; Productivity and work study; Human factor in the application of work study.

Motion Study

Definition; aims; procedure for method study; selection of jobs; Recording Techniques; Micro motion study; Therbligs; Cyclograph and Chronocyclo-graph; Principles of motion economy; Design of work place layout; Analysis in the form of a chart; operation chart; flow process chart; flow diagram; String diagram; Man machine chart; Two hand chart; Simo chart.

Work Measurement (Time Study)

Definition; uses; procedure; time study equipment; Performance rating; allowances; Number of cycles to be studied; Determination of standard time; Predetermined Motion Time Systems.

Job Evaluation

Job evaluation; objectives of job evaluation; Methods of job evaluation; Non quantitative and quantitative.

Wages and Incentives

Characteristics of a good wage or incentive system, Methods of wage payment. Concept of wage incentive schemes; financial and non financial; Halsely premium plan; Merric's Multiple piece rate system.

Concept of New Techniques

Scheduling through Network C.P.M. and PERT; use of linear programming methods to solve product - mix problems.

Value Engineering

Concept of value, product life cycle, value engineering approaches, job plan, value tests.

Suggested Text Books & References

1. ILO, "Introduction to Work Study", Universal Publishing Corporation, Bombay, 1986.
2. Mundel, "Motion and Time Study", Prientice Hall of India, 1995.
3. Ralph M. Barnes, "Motion and Time Study", John Wiley and Sons, 1990.
4. Miles, L. D., "Techniques of Value Engineering and Analysis", McGraw Hill second Edition, 1972.

ME 243 ADVANCED STRENGTH OF MATERIALS 4(3-1-0)

Stresses and Strains in three dimensions, Theories of failure. Beams on elastic foundations, infinite, semi-infinite and finite beams. Bending of curved beams in the plane of loading- crane hooks and chain links. Bending of curved beam out of its initial plane, Saint Venant's equations and equations of equilibrium. Bending of circular beams subjected to symmetric loading. Torsion of non-circular members, St. Venant's theory, Torsional stresses in elliptical, triangular shafts, Approximate solutions for rectangular section, Membrarie analogy, Torsion of hollow sections, Torsional stresses in thin walled open and closed sections, Plastic yielding of circular shafts. Bending of thin plates, Assumptions of plate theory, GDE for deflection of plates, Boundary conditions, Solutions for rectangular plates, Navier's and Levy's solutions, circular plates, Membrane theory of shells of revolution and cylindrical shells.

Suggested Text Books & References

1. Boresi, A.P., and Sidebottom, O.M., "Advanced Mechanics of Materials", John Willey and Sons, 1985.
2. Srinath, L.S., "Advanced Mechanics of Materials", 1952.
3. Seeley, F.B.and Smith, J.O., " Advanced Mechanics of Materials", 1952.
4. Richard, G. Budynas, "Advanced Strength and Applied Stress Analysis", McGraw Hill, New Delhi,1999.

ME 244 KINEMATICS OF MACHINE 5(3-1-3)

Kinematics

Elements, pairs, mechanisms, four bar chain and its inversions, velocity and acceleration, diagrams, Klein's construction, Coriolis component, instantaneous centre method, synthesis of mechanism, pantograph, Scott-Russel, Indicator diagram mechanisms, Davis and Ackermenn steering mechanism, Hook's Joint.

Brakes and Dynamometers

Band, Block and Band & Block brakes, braking action, absorption and transmission type dynamometers, Prony, rope and hydraulic dynamometers, Braking systems of automobiles.

Inertia Force Analysis

Velocity and acceleration of slider crank and four bar mechanisms, inertia force, piston thrust and forces in connecting rod, turning moment diagram, flywheel.

Governors

Simple, Porter, Proell, Hartnell and spring controlled governors, Governor effort, Power stability, inertia effects.

Cams

Types of cams, displacement, velocity, and acceleration curves for different earn followers, consideration of pressure angle and wear, analysis of motion of follower for cams with specified contours.

Gyroscope

Principles of gyroscopic couple, effect of gyroscopic couple and centrifugal force on vehicle taking a turn, stabilization of sea vessels.

Balancing

Balancing of rotating masses in the same and different planes, balancing of reciprocating masses, swaying couple, hammer blow and tractive effort, primary and secondary balancing of a locomotive and internal combustion engines, balancing machines.

List of practical

- Study of mechanisms.
- Study of slider crank and four bar mechanisms, fly wheel.
- Study of band, block and band & Block brakes; and transmission type dynamometers, Prony, rope dynamometers.
- Study of cam and follower motion; and jump phenomenon.
- Study of gyroscopic effect.
- Study of different type of governors and inertia effect.
- Demonstration of static and dynamic balancing.

Suggested Text Books & References

1. Rao, R.V. Dukkipati , "Mechanism and Machine Theory", New Age International (P) Ltd., 1995 reprint. [1992 Wiley Eastern Ltd. Publishing].
2. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS, 1984.
3. Rattan, "Theory of Machines" , Tata McGraw Hill, New Delhi, 1992.
4. Shigley, J.E. and Vicker, J.J., "Theory Machines an Mechanisms", McGraw Hill, 1988.
5. Ghosh, Amitabha and Kumar, Mallick Ashok, "Theory of Mechanisms and Machines", Affiliated East-

West Pvt. Ltd., 1988.

ME 245 MANUFACTURE SCIENCE I 5(3-1-3)

Importance of manufacturing. economic & technological definition of manufacturing, Survey of manufacturing processes.

Casting

Basic principle & survey of casting processes. Sand casting: patterns, pattern materials, allowances. Green and dry sand moulding, moulding methods, moulding sand properties and testing. Elements of mould and design considerations. Cores; use, materials and making practice. Die, investment and centrifugal casting processes. Melting practice and concepts in solidification. Inspection and defects analysis.

Forming

Elastic and plastic deformation, Concept of strain-hardening. Rolling, forging, extrusion, wire & tube drawing: processes, machines and equipments, parameters and force calculations.

Sheet-metal working

Role of sheet metal components. Cutting mechanism. Description of cutting processes like blanking, piercing, lancing etc. Description of forming processes like bending, cup drawing, coining, embossing etc. Basic elements of Presses for sheet metal working. Part feeding systems. Punch and die clearances and die elements.

Welding

Principle of welding, soldering, brazing and adhesive bonding. Survey of welding and allied processes. Arc Welding: power sources and consumables. MMAW, TIG & MIG processes and their parameter selection. Resistance Welding: principle and equipments. Spot, projection and seam welding processes, Gas welding and. cutting: Processes and equipments.

Powder Metallurgy

Powder manufacturing, compaction and sintering processes, advantages and applications of P/M.
Manufacturing of plastic components.

List of practical

- Design of pattern for a desired casting (containing hole)
- Pattern making
- Making a mould (with core) and casting.
- Sand testing (at least one such as grain fineness number determination)
- Injection moulding with plastics.
- Forging hand forging processes
- Forging – power hammer study and operation
- Tube bending with the use of sand and on tube bending machine
- Press work experiments such as blanking / piercing washer making etc.
- Wire drawing/ extrusion on soft material
- Rolling- experiment.
- Bending and spring back
- Powder metallurgy experiment.
- Jigs & fixture experiments.

Suggested Text Books & References

1. Rao, P.N, "Manufacturing Technology", Tata McGraw Hill, N. Delhi.
2. Kalpakjian," Manufacturing Engineering and Technology", Addison Wesley.
3. Chapman, WAJ, "Workshop Technology", 5th Edition, Viva Books Private Limited, New Delhi

EE 241 ELECTRICAL MACHINE 5(3-1-3)

Fundamental concepts of Electrical machines

Elementary synchronous machines; Relation between Electrical & Mechanical angle; Deduction of synchronous frequency; Elementary 2-pole D.C. machine, Generated e.m.f. due to short pitched distributed winding, Rotating magnetic field, Torque equation of A.C. machines.

D.C. Machine

Construction details of D.C. motors, e.m.f. and torque equation, Types of Excitation method of D.C. motors and corresponding Torque-speed characteristics, speed control of Motors.

Induction Motor

Construction feature of motor, Equivalent circuit analysis, Torque-slip-characteristics, starting Methods of Induction Motor, Speed -Control

Synchronous Machine

Construction details of Alternator, Analysis of Equivalent Circuit, Operating characteristics of Alternatives, V-Curve, parallel operation of Alternators.

Drives

Speed torque characteristics of Industrial Equipment, joint speed-torque characteristics, Stability of drives systems, Force and torque acting in Electric drives, Acceleration and Deceleration time, Motor power Rating Selection and

load diagram.

I-Phase Machine

Cross-field theory, Torque-slip characteristics, Single-phase two-winding motor, split phase motor.

List of practical

- To obtain Magnetization characteristic of a D.C. shunt generator
- To obtain load characteristic of a D.C. component generator.
- To obtain load characteristic of a D.C. series generator
- To obtain load characteristic of a D.C. shunt generator
- To obtain speed torque characteristic of a D.C. shunt motor
- To study parallel operation of two D.C. shunt generator
- To obtain efficiency and regulation a I phase transformer by sumpner's (back to back) test
- To perform no load test & blocked rotor test on a three phase induction motor & determine its efficiency
- To perform no load test & blocked rotor test on a I phase induction motor and determine its efficiency
- To perform no load test on three phase induction motor & draw its performance curve
- To plot V curve synchronous motor at a no load ½ & full load
- To perform no load test & short circuit test on a three phase alternator and to find voltage regulation by synchronous impedance method at power factor of unity, 0.8 lagging & 0.8 leading.
- To study the parallel operation of three phase alternator

Suggested Text Books and References

1. Cotton, H., "Electrical Technology".
2. Kothari and Nagarath, "Electrical Machines".
3. Partab, H., " Art and Science of Utilisation of EleCtrical Energy", Dhanpat Rai & Sons, Delhi, 1985.
4. Pillai, S.K., " A First Course on Electrical drives", Wiley Eastern Ltd., New Delhi 1982.
5. Chilikin, H.G., "Electric Drives", H.I.I. Publications, Moscow, 1976

HU 351 MANAGEMENT SCIENCE 3(2-1-0)

Basic Concepts and Functions of Management Planning

Nature, Purpose and Objectives of Planning, Organizing: nature and Purpose, Authority and Responsibility, Staffbug, Supply of Human Resources, Performance Appraisal, Controlling: System and Process of Controlling, Control Techniques.

Human Resource Management

Nature and Scope of Human Resource Planning, Training and Development, Recruitment and Selection, Career Growth, Grievances, Motivation and its types, Need for Motivation, Reward and Punishment, Models for Motivation, Leaders: Kind of Leaders, leadership styles, Roles and Function of Leaders, Conflict Management, Kinds and Cause of Conflict, Settlement of Conflict, Group and Team working, Organizational Design and Development.

Marketing Management

Marketing Environment: Consumer Markets and Buyer Behaviour, Marketing Mix, Advertising and Sales Promotion, Channels of Distribution.

Financial Management and Accounting Concepts

Book Keeping, Financial Statement Analysis, Financial Ratios, Capital Budgeting, Break-Even Analysis.

Production/Operation Management

Planning and Design of Production and Operation Systems, Facilities Planning, Location, Layout and Movement of Materials, Materials Management and Inventory Control, Maintenance management, PERT & CPM.

Management Information System

Role of information in decision making, Information system planning, Design and Implementation, Evaluation and Effectiveness of Information System.

Statistical Quality Control, TQM and ISO Certification

Social and Ethical Issues in Management

Ethics in management, Social Factors, Unfair and Restrictive Trade Practices.

Strategic and Technology Management

Need, Nature, Scope and Strategy, SWOT analysis, value and concepts.

Suggested Text Books & References

1. Kotler Philip," Marketing Management", Prentice Hall of India 1997.
2. Luthans Fred," Human Resource Management", McGraw Hill, Inc. 1997.
3. Stephen, P. Robbins," Organizational Behaviour Concepts, Controversies and Applications", Prentice Hall, Englewood, Cliffs, New Jersey,1989.
4. Khan, M.Y., and Jain, P.K., "Financial Management", Tata McGraw Hill,1997.
5. Porter Michael, "Competitive Advantage", The Free Press, 1985.
6. Porter Michael, "Competitive Strategy", The Free Press, 1985.
7. Bhusan, Y.K., "Fundamentals of Business Organisation and Management", Chand S. and Sons,1998.
8. Ahuja, K.K.," Industrial Management", Khanna Publishers,1998.

ME 351 PRODUCT DEVELOPMENT 3(2-1-0)

Background for design, design theory, design materials, human factors in design, applied ergonomics, product development processes and organizations, identifying. Customer needs, establishing product specifications, concept generation and selection, product architecture.

Product design methods

Creative and rational, clarifying objectives - the objective trees method, establishing functions -the function analysis method, setting requirements - the performance specification method, determining characteristics -the QFD method, generating alternatives - the morphological chart method, evaluating alternatives - the weighted objectives method, improving details - the value engineering method and design strategies.

Design for manufacture

Estimating manufacturing costs, reducing component, assembly and support costs, design for assembly, design for disassembly, design for environment, design for graphics and packaging, effective proto typing - principles and planning.

Industrial design

Its need, impact and quality, industrial design process and its management. Legal issues in product design, design resources, economics and management of product development projects.

Suggested Text Books & References

1. Chitale & Gupta, "Product Development", Tata Mc Craw Hill.
2. Monks, J.G., "Operations Management", Mc Graw Hill, 1977.
3. Francis, RL, and White, J.A., "Facility Layout and Location", Prentice Hall, 1974.

ME 352 MACHINE DESIGN I 5(3-1-3)

Materials

Properties and IS coding of various materials, Selection of material from properties and economic aspects.

Design for Strength

Allowable stresses, detailed discussion on factor of safety (factor of ignorance), Stress concentration- causes, Introduction of various design considerations like strength, stiffness, weight, cost, space etc., Concept of fatigue failures. Design of pin, cotter and keyed joints, screw fastenings, subjected to direct stress: Levers, laminated springs under bending: shafts and shaft couplings in torsion. Design of shafts and brackets subjected to combined stresses. Design of thin and thick cylinders, power screws, lead screws. Design of weldments subjected to eccentric loading and combined stresses.

List of practical

- Design & Drawing of riveted joints for a given operating conditions.
- Design of an eccentrically loaded welded, riveted or bolted joint.
- Design of bolted joint for fluctuating loads.
- Design & drawing of a cotter joint.
- Design & drawing of a Knuckle joints.
- Design & drawing of a simple screw jack.
- Design of shaft for different loading conditions.
- Design & drawing of rigid coupling (flanged type)
- Design & drawing of a flexible coupling (pin-bush type).
- Design & drawing of a leaf spring for an automobile.
- Design & drawing of a helical spring for a given application.

Note-

1. Students may be advised to use design data book for design.
2. Drawing shall be made wherever necessary on small drawing sheets.

Suggested Text Books & References

1. Shigley and Mische, "Mechanical Engineering Design", Mc Graw Hill, 1992.
2. Robert, L. Mott, "Machine Elements in Mechanical Design", MacmIllan Publishing Co., London, 1992.
3. Bandari, V.B., "Design of Machine Elements", Tata McGraw Hill, 1995.
4. Sundararajamoorthy, T.V., and Shanmugam, N. "Machine Design", Khanna Publishers, Delhi, 2000.

ME 353 DYNAMICS OF MACHINES 5(3-1-3*)

Gears

Laws of gearing, gears terminology, tooth form, standard interchangeable tooth profile, minimum number of teeth on pinion in contact with a gear, interference and under cutting, bevel, helical and spiral gears.

Gear Trains

Simple, compound, reverted and epicyclic gear trains, analytical, tabular, graphical and vector methods for velocity ratio, gear boxes-sliding and constant mesh gear box for automobiles.

Vibrations

One dimensional longitudinal, transverse and torsional vibration, natural frequency, effect of damping on vibration, different types of damping. Forced vibrations, force and displacement transmissibility, vibration Isolation, vibration measuring instruments.

Many Degree of Freedom System

Exact analysis of undamped and damped continuous systems subjected to periodic force, influence numbers, analysis of two and three degree of freedom lumped mass system, principle of tuned absorbers.

Numerical Methods

Raleigh, Dunkerley Stodola, Rayleigh-Ritz and Holtzer methods for finding natural frequency of continuous / lumped mass systems for different types of end conditions.

Critical Speeds of Shafts

Critical speeds of shaft having multiple discs with and without damping, secondary critical speed.

List of practical

- Experiment on critical speed of shaft (whirling of shaft).
- Experiment on Gears (tooth profile, interference, minimum number of teeth on pinion & gear) for bevel, helical & spiral gears.
- Experiment on damped vibration
- Experiment on Gear trains.
- Experiment on Vibration (spring).
- Experiment on Vibration (beam).
- Experiment on Vibration (Torsional).
- Experiment on Engine.

Suggested Text Books & References

1. Thomson, W.T., "Theory of Vibration with Applications", CBS Pub. And Distributors,3rd ed., 1988.
2. Tse, Morse and Hinkle, “Mechanica1 Vibration", Prentice Hall of India Ltd.,1987.

ME 354 MANUFACTURE SCIENCE II 5(3-1-3)

Classification of metal removal processes and machines.

Mechanics of metal cutting

Geometry of single point cutting tool and tool angles. Tool nomenclature in ASA, ORS & NRS and interrelationship. Mechanism of chip formation and types of chips, chip breakers. Orthogonal and oblique cutting, cutting forces and power required, theories of metal cutting. Thermal aspects of machining and measurement. of chip tool interface temperature. Friction in metal cutting.

Machinability

Concept and, evaluation of machinability, tool life, mechanisms of tool failure, tool life and cutting parameters, machinability index, factors affecting machinability.

Cutting fluids

Types, selection and application methods.

General purpose machine tools

Constructional details of, lathe, drilling, milling, shaping and planning machines. Tooling, attachments and operations performed, selection of cutting. parameters, calculation of forces and time for machining. Broaching operation.Capston and turret lathes, single and multiple spindle automates, operations planning and tool layout.

Abrasive processes

Abrasives: natural and synthetic, manufacturing, nomenclature. Selection of grinding wheels, wheel mounting and dressing. Machines for surface arid cylindrical grinding, their constructional details and processes.

Surface finishing

Honing, lapping, superfinishing, polishing and buffing processes. Screw threads and gear manufacturing methods. Introduction to Jigs and fixture and their use for productivity improvement.

Non-conventional machining

Benefits, general applications and survey of Non-conventional machining processes. Mechanisms of metal removal, tooling and equipments, process parameters, surface finishing obtained, and specific applications of EDM, LBM, EBM, ECM, USM, AJM processes.

List of practical

- Shear angle determination (using formula) with tube cutting (for orthogonal) on lathe machine.
- Bolt (thread) making on Lathe machine.
- Tool grinding (to provide tool angles) on tool-grinder machine.
- Gear cutting on Milling machine.
- Machining a block on shaper machine.
- Finishing of a surface on surface-grinding machine.
- Drilling holes on drilling machine & study of twist drill.
- Study of different types of tools and its angles & materials.
- Experiment on tool wear and tool life.
- Experiments on jigs/fixtures and its uses.

- Calculate the power requirement in orthogonal & oblique cutting
- To study the performance & use of different type of cutting fluids
- Study of grinding wheel & use of cylindrical & surface grinder

Suggested Text Books & References

1. Boothroyd Geoferry, "Fundamentals of Metal Cutting and Machine Tools", Mcgraw Hill, Kogakuha Ltd.
2. Chapman, "Workshop Technology", Volume I, II and III, ELBS, 1980.
3. "Production Technology", HMT, McGraw Hill, N. Delhi.
4. Jain, RK., and Gupta, S.C., "Production Technology", Khanna Publishers, 1989.

ME 355 HEAT AND MASS TRANSFORMATION 5(3-1-3*)

Introduction

Various modes of heat transfer, 'Fourier's, Newton's and Stefan Boltzman's Law. Combined modes of heat transfer, thermal diffusivity, overall heat transfer coefficient.

Conduction

The thermal conductivity of solids, liquids and gases, factors influencing conductivity, measurement. The general differential equation of conduction. One dimensional steady state conduction, linear heat flow through a plane and composite wall, tube and sphere, critical thickness of insulation, Effect of variable thermal conductivity, Conduction with heat sources, heat transfer from rods heated at one both ends. Heat transfer from fins of uniform cross-section. Errors of measurement of temperature in thermometer wells.

Convection (Forced)

Introduction, laminar boundary layer equations on a flat plate and in a tube, laminar forced convection on a flat plate and in a tube, simple Reynold's analogy, Dimensional analysis of forced convection, empirical relationship for forced convection.

Convection (Natural)

Dimensional analysis of natural convection; empirical relationship for natural convection. Convection with phase change. Description of condensing flow. A theoretical model of condensing flow, Boiling heat transfer, Empirical relationships for convection with phase change.

Heat Exchangers

Different types of heat exchangers; Determination of heat exchanger performance, Heat exchanger transfer units, Analysis restricted to parallel and counter flow heat exchanger.

Thermal Radiation

Introduction, absorption and reflection of radiant energy, Emission, Radiosity and irradiation, Black and non black bodies, Krichoff's law; intensity of radiation, radiation exchange between black surface, geometric configuration factor, grey body relation exchange between surfaces of unit configuration factors. Grey body relation exchange between surfaces of unit configuration factors. Electrical analogy to simple problems. Non-luminous gas radiation. Errors in temperature measurement due to radiation.

Introduction to Mass Transfer

Mass and mole concentrations, molecular diffusion, eddy ,diffusion, Molecular diffusion from an evaporating fluid surface, Introduction to mass transfer in laminar and turbulent convection Combined heat and mass transfer, the wet and dry bulb thermometer.

List of practical

- Conduction - Composite wall experiment.
- Conduction - Composite cylinder experiment.
- Convection - Pool Boiling experiment.
- Convection - Experiment on heat transfer from tube-natural convection.
- Convection - Heat pipe experiment.
- Convection - Heat transfer through fin-natural convection.
- Convection - Heat transfer through tube / fin-forced convection.
- Any experiment on radiation - Such as on Stefan’s Law, determination of emissivity, etc.
- Any experiment on radiation - Such as on solar collector, etc.
- Heat exchanger – Parallel flow experiment.
- Heat exchanger – Counter flow experiment.
- Any other suitable experiment such as on critical insulation thickness.
- Conduction – Determination of thermal conductivity of fluids.
- Conduction - Thermal contact resistance effect.

Suggested Text Books & References

1. Kothandaraman, C.P., "Fundamentals of Heat and Mass Transfer", Second Edition, New Age International Publishers, Chennai, 1997.
2. Sachdeva, R.C., "Fundamentals of Engineering Heat and Mass Transfer", New Age International Publishers, New Delhi, 1996.
3. Holman, J.P., "Heat Transfer", Tata McGraw Hill Book Company, 1988.
4. Yadav, R., “ Heat & Mass Transfer”, Central Publishing House, Allahabad.

ME 356 Computer Aided Drafting 2(0-0-3)

Introduction, input, output devices, introduction to drafting software like Auto Cad, basic commands & development of simple 2D and 3D drawing.

List of Practical

- Construct a regular octagon in a square.
- Construct a square and draw in it four equal circles each touching two adjacent sides and two other circles.
- In a slider crank mechanism, plot locus of mid point P of AB (connecting rod) for one revolution of the crank.
- Construct a triangle and draw using AutoCAD three circles, each touching one of the sides and the other two sides produced.
- A line OA, 100 mm long rotates about O in anti clockwise direction. A point P on the line, 15 mm away from O, moves and reaches the end A, while the line has rotated through 2/5 of a revolution, assuming the movements of the line and the point to be uniform, trace the path of the point P. The work is to be done using AutoCAD.
- For the object (from lab assignments) draw a top view and a front view. Dimension the views.
- For the object (from lab assignments) draw an isometric view. Using Hide command, remove the hidden lines of the object. Also find out how a trimetric view of the object can be done using VPOINT command.
- Draw the following views of a component pictorially (from lab assignments).
  - (i) Sectional Front View.
  - (ii) Outside Top View.
- Draw two orthographic views of a right angled bracket (from lab assignments).
  - (iii) Front Elevation.
  - (iv) Right Side Sectional View.
- Draw 3D model of isometric parts (from lab assignments). Also create multiple view ports.
- Assembly drawing of engine parts, valves etc.

Suggested Text Books & References

1. Machine Drawing by Narayana, et al, New Age Publications.
2. Production Drawing by Narayana, et al, New Age Publications.
3. Auto Cad 14 for Engineering Drawing by Nageshwar Rao, TMH.
4. Auto Cad 2000 by George Omura.
5. Auto Cad 2000 for Mechanical Engineering by Sham Tickoo.
6. Auto Cad by Rice & Raker.

HU 361 PROJECT MANAGEMENT & BUSINESS MANAGEMENT 3(2-1-0)

I. PROJECT MANAGEMENT

Concept of Project, Types of project, Project life cycle. Project identification formulation, Need analysis, Resource surveys marketing research. Project feasibility analysis, Technical feasibility, Choice of technology, financial feasibility, Project budgeting, Geographic feasibility, Location and site selection. Investment analysis, Project appraisal, NPV,IRR, ROI, Payback period, Consideration of risk and uncertainly in the project. Project finance, Sources of finance, Internal and external finance, World Bank, etc. role of financial institutions. Project organization : Role and importance of project manager, Project team structure Task force, Selection and training of Project manager. Project planning, Implementation and control, Routing and scheduling of project, CPM, PERT and GERT, Project Programming Budgeting System (PPBS). Project maintaining tool and techniques, Project management information system (PMIS), Project documentation and audit, Computer application in project management.

II. BUSINESS MANAGEMENT

Concept, System approach for business management, Social and political aspects on business, Forms of business single proprietorship, Partnership, Joint ventures, Components of business management, Business organization: Kinds of organization, Organization structure, Line, Functional, Staff, Line and staff etc.

Financial management

Need of finance, Kinds and source of capital, Shares & Debentures, Fixed and working capital, Assets, Financial statements and their importance in business, Financial ratio, current ratio, Liquidity ratio, Equity ratio, inventory ratio, etc., Relation with other departments.

Cost and cot control

Elements of cost, Types of cost-direct and indirect, variable and fixed, labor cost, material cost, over head cost, Cost control techniques, Budgets-meaning, kinds, Budgetary control break even analysis.

Interest and depreciation

Meaning, Compound interest, Annuity-type-capital recovery annuity, present worth annuity , etc, Nominal and effective rate of interest, Depreciation-meaning, kinds and causes, methods of calculating depreciation-straight line, sinking funds method, declining balance method, etc.

Human Resource Management

Need & Importance for business, acquisition of human resource; personnel management, different/relationship between HRP & personnel management, strategic human resource management; Relationship with other departments, labor relation, Trade union, Employees union, Disputes and method of settling disputes-collective bargaining conciliation, arbitration, etc.

Sales & Marketing

Importance for growth for business; idea or overview of sales & marketing; effect of consumer behavior on business; relationship of marketing with other departments.

Purchase Management

Importance and objectives, Functions and duties, Purchasing procedure, Kinds of purchasing, Relationship with other departments.

Managerial Economics

Economic background to management, Economic system and its function, Managerial economics- nature and scope, its relationship with other disciplines; Determinants, elasticities and kinds of demand; Pricing decisions, Monopoly and Oligopoly, Perfect and monopolistic competition, Capital budgeting.

Economic Environment

Need and importance of regulation of business, Capitalism, Socialism, Democratic socialism and mixed economic. Directive principles of state policy (DPSP), Government policies-Economic, commercial, banking, fiscal, monetary, industrial fluctuation, Stabilization.

Suggested Text Books and References

1. Chase, Aquilano, " Production and operations Management" 7th Edition, McGraw Hill Companies Inc., 1995.
2. Chary, " Theory and Problems in Production and Operations Managements", 2nd reprint, Tata McGraw Hill, 1996.
3. Nair, N.G., "Production and Operations Management", 1st reprint, Tata McGraw, Hill, 1997.
4. Phillips, Don. T., Ravindran, A. and James Solberg, " Operational Research-Principles and Practice", John Wiley and Sons, 1986.
5. Chandra Presanna, " Fundamentals of Financial Management", Tata McGrawa Hill, 1994.
6. Kolter Philip, " Marketing Management", Prentice- hall of India, 1988.

ME 361 IC ENGINE 4(2-1-3)

Fuel air cycles real cycles; volumetric efficiency any thermal efficiency; effect of variable specific heats and dissociation on indicator diagram.

S.I. Engine

Principles of carburetion, effect of nozzle tip and compressibility, jet size and depression at ventuni-choke and compensation.

Combustion in S.I. Engines

Flame development and its propagation, ignition lag, effects of engine parameters, Preignition, Combustion chambers.

Ignition system

Battery and coil ignition system, Magneto system, spark advancing.

Combustion in I.C. Engines

P.O. Indicator diagram and their study for various stages of combustion, delay period combustion chambers.

Detonation in I.C. Engines

Various parameters effecting detection, knock rating of fuel, Octane and centane numbers, H.U.C.R. action of dopes; Valve timing and firing order.

Fuel injection system

Air and solid injection; fuel pump and injectors; petrol injection.

Supercharging in I.C. Engine

Effect of attitude on power output; types of supercharger.

Two Stroke Engine

Constructional detail, scavenging system, valve diagrams, Supercharging

Cooling system

Piston and cylinder temperature distribution; air and water cooling.

Lubrication system Principles various methods

Testing of Engines

Engine indicator, measure of air and fuel supply , Friction losses, Mechanical and thermal efficiencies engines losses and heat balance.

Compressor

Centrifugal and axial type, Performance

Gas Turbine

Introduction, ideal cycles, regeneration reheating and inter-cooling, closed and open cycles, operating variables.

List of Practical

- Study of different types of carburetors, fuel pumps, fuel injectors, nozzles, etc

- Study & experiment on battery ignition systems
- Study & experiment on magneto ignition systems
- Study of different types of superchargers & its effect on altitudes
- Comparative study of valve timing diagrams of 2 & 4-stroke engines
- Comparative study of different mean of cooling & a study of effects of lubrications
- Experiments on testing of engines such as Morse testing
- Study of centrifugal & axial compressors & its performance checks
- Study of reciprocating compressors with & without inter-cooling
- Study of gas turbine models
- Experiment on IC engine test rig (petrol/ diesel) with water brake dynamometer / electrical dynamometer

Suggested Text Books and References

1. Ganesan, V; "Internal Combustion Engine", Tata McGraw Hill, New Delhi, 1995.
2. Colin, R. Ferguson, " Internal Combustion Engine", John Wiley and Sons, 1986
3. Edward, F. Obert, " Internal Combustion Engine", Interscience Publishers,
4. Yadav, R., " Internal Combustion Engine & Air Pollution", Central Publishing House, Allahabad.

ME 362 MACHINE DESIGN II 5(3-1-3)

Fatigue consideration in design

Variable load, Loading pattern, Endurance stresses; influence of size, surface finish notch sensitivity & stress concentration. Goodmann line, Soderberg line; Design of machine members subjected to combined steady & alternating stresses; Design of finite life.

Design of gear tooth

Lewis and Buckingham equations; wear and dynamic load consideration. Design & force analysis of spur, helical, warm gears. Bearing reactions due to gear tooth forces. Details design of the fixed ratio gearboxes

Design of sliding & journal bearing, method of lubrication, hydrodynamic, hydrostatic, boundary etc. Minimum films thickness & thermal equilibrium

Design of flywheels, plate clutches, brakes, crank-shafts, cam shaft & connecting rod. Design of helical springs. Design of crane hook, C-clamp, machine frame etc

List of practical

At least 2 experiments/ turns (lecture-classes) from each of the 4 following sections. Say, 3 turns for A, 3 turns for B, 2 turns for C and 2 turns of D, total 10

A Conventional Design & Drawing-
Conventional Design & drawing on small drawing sheet using handbook for items such as engine parts, shafts, gears, bearings, etc. by students.

B Computer & Language-
Lectures should be given by teachers on introduction to computer & language such as C input Output statements, control statements, if, for, while, switch statement, etc. Function & it's uses. Structure. To make students able to write computer program in C

C Writing computer program for conventional design-
After section B, students can write computer program for the design done in section A/ theory subjects.

D AutoCAD-
With initial review teaching of AutoCAD, students can do drawing & drafting of design done in section A.

Suggested Text Books and References

1. Shigley and Mische, " Mechanical Engineering Design," McGrawa Hill, 1992
2. Robert, L. Mott, " Machine Elements in Mechanical Design", Macmillan Publishing Cp., London, 1992.
3. Sundararajamoorthy, T.V., and Shanmugam, N., "Machine Design", Khanna Publishers, Delhi, 2000
4. Maitra, G.M, " Handbook of Gear design," Tata McGraw Hill, 1988.

ME 363 FLUID MACHINERY 5(3-1-3)

Introduction

Classification energy transfer between fluid and rotor-Flow through machines-ideal and actual slip.

Hydraulic Turbines

Impulse type-Pelton wheel-Reaction type-Francis, Kalpan and Propeller-Principal of operation and performance-Draf tube

Hydraulic Pumps

Radial Flow, axial flow and mixed flow type – reciprocating and centrifugal pumps-performance studies-fluid coupling and torque converter

Compressors and Blowers

Radial Flow an axial flow type-reciprocating and centrifugal compressors-applications-characteristics.

List of practical

- Impact of jet experiment
- Turbine experiment on Pelton wheel

- Turbine experiment on Francis Turbine
- Turbine experiment on Kaplan turbine
- Experiment on reciprocating pump
- Experiment on centrifugal pump
- Experiment on hydraulic jack/ press
- Experiment on hydraulic brake
- Study through first visit of any pumping station / plant
- Study through second visit of any pumping station/ plant
- Any other suitable experiment / test rig such as comparison and performance of different types of pumps and turbines.
- Experiment on torque converter & hydraulic coupling

Suggested Text Books and Reference

1. Kothandaraman, C.P., and Domkundwar, S., " Thermal Engineering", Dhanpat Rai and Sons, Delhi 1989.
2. Govinda Rao N.S., "Fluid Flow Machines", Tat Mc Graw Hill Publishing Company Ltd., 1983.
3. Edward, E. Obert., Internal Combustion Engines", International Text Book Company, Pennsylvania, USA, 3rd Edition, 1970
4. Banal, R.K., Fluid Mechanics and Hydraulic Machines", Lakshmi Publications, 1993.

ME 364 AUTOMATIC CONTROL 4(3-1-0)

Introduction

Meaning and need of automation, Type of automation: fixed programmable flexible and integrated automation.

Components of automation

Actuators, controllers, sensors. **Actuators;** Solenoids and torque motors, Hydraulic and pneumatic actuators, valves and circuits. **Sensors;** Characteristics, contact and non-contact type, Pressure switches, proximity and position sensors. Encoders, resolvers, synchors. **Vision systems;** Components of vision systems, image, camera, image capturing systems, processing systems bad coding and other identification system, systems. **Controllers;** Digital and analog control, open and closed loop control, servo systems analysis and response, control configuration.

Logic control and PLCs

Logic control, logic control elements, Programmable logic controlled: Applications, architecture, operation, and programming of PLCs. Typical applications.

Automated Material handling systems

Automated flow lines, transfer mechanisms, conceyors, robots, Automated guided vehicles; categories, guidance technologies and control. Automated Storage and Retrieval Systems, categories and components.

Automated inspection systems

In process gauging systems, Co-ordinate measuring machines: Construction, operational modes and different probes. Automated assembly systems:

Factory communication

Interface standards, communication networks, LAN, WAN, Protocols : OSI and MAP.

Flexible Manufacturing systems

Types, components, architecture and control. Computer integrated manufacturing.

Suggested Text Books and Reference

1. Morriss, S. Brian, " Automated Manufacturing System", Clanncoe McGraw International Series, 1995.
2. Croover Mikell. P. , " Automated Production System, and Computer Integrated Manufacturing ", PHI, 1992
3. Boothroyd, G, and Poli, C, " Automated Assembly", Marcel Dekker, New York, 1982.
4. David Bed worth, et al., Computer Integrated Design and Manufacturing McGraw hill 1991.

ME 365 REFRIGERATION AND AIR-CONDITIONING 5(3-1-3)

Refrigeration and heating systems

Air Refrigeration systems; Bell Coleman air refrigeration cycle. Air craft air-conditioning systems and its performance; steam and air heating systems; piping and accessories.

Vapor compression refrigeration

Simple cycle; T-S and p-h charts, analysis of vapor compression cycle; factors effecting performance of vapor compression cycle, actual compression cycle; use of multistage compression, heat exchangers, flash chambers; properties of refrigerants and their suitability.

Vapor absorption and other refrigeration systems

Description of system components, generator, rectifier, condenser, absorber, heat exchanger and water pump; Aqua ammonia and water Lithium bromide systems.

Refrigeration equipment

Constructional details, capacity control and performance of compression, condensers, evaporators, Expansion devices: Purpose; capillary tubes and their selection; design of capillary tube; choked flow; thermostatic expansion valve; electric expansion valve; float valves.

Psychrometrics

Psychrometry and Psychrometric properties, psychrometric relations, psychrometric chart and its use, psychrometric processes. Humidification and dehumidification, evaporative cooling ; jet water cooling; air washers and air cleaners; Human comfort; Factors affecting comfort; comfort charts.

Solar radiation

Distribution of solar radiation; direct & diffuse radiation; each sun angles and their relationships; direct solar radiation on a vertical, horizontal, inclined surface; heat grain through glass; effect of shading devices; heat transfer in building structures through walls and roofs; temperature. Empirical methods to evaluate heat transfer through walls & roofs; infiltration; passive heating and cooling of building.

Estimating Requirement

Heating cooling; humidifying and dehumidifying requirements, Loads: Building transmission, infiltration and air charges. Heat grain from people, light, power and duct. Winter and summer design conditions, air quantity and temperature requirements.

Ducting System

Pressure losses in ducts, duct materials and sizing-design of return and exhaust. Duct heat grains and losses-Heat insulation. Air leakage and duct maintenance; High velocity and pressure air distribution; Direction and volume control, Outlet location; return and exhaust grills. Types of outlets.

Automotive Air Conditioning

System location and layout, components, Automotive heaters, air routing and temperature control-Objectives, evaporator care air blow, through the dash circulating unit duct system, system maintenance.

List of practical

- Experiment on refrigeration test rig and calculations of various performance parameters
- To study different types of expansion devices used in refrigeration system.
- To study different types of evaporators used in refrigeration systems
- To study basic components of air-conditioning system
- Experiment on air-conditioning test rig and calculation of various performance parameters
- To study air washers
- Study of window air-conditioner
- Study and determination of volumetric efficiency of compressor
- Visit of a central air-conditioning plant
- Visit of cold storage
- Experiment on total heat load calculation of air conditioning space
- To study the factors effecting on human comforts
- To calculate the by pass factor of cooling coil & heating coil

Suggested Text Books and References

1. Arora, S.C. and Domkundwar S., " Refregeration and Airconditioning", Dhanpat Rai & Sons, New Delhi 1997.
2. Arora, C.P., Refrigeration and Air Conditioning", Tata McGraw Hill Publishing, New Delhi 1994.
3. Stocker, " Refrigeration and Air Conditioning" Tata McGraw Hill Publishing Company Ltd., 1981.
4. Manohar Prasad, "Refrigeration and Air Conditioning", New Age Publication.

ME 471 COMPUTER AIDED DESIGN 6(3-1-4)

Computer graphics hardware-interactive input and output devices, graphics software, output primitives and attributes, line drawing and ellipse generating algorithms, interactive picture construction technique, 2D geometric transformations-, windows, view port and clipping, 3D display methods a, 3 D object representation- Bezier curves and splines, 3D geometric and modeling transformations, 3D viewing, wire frame, surface and solid modeling kinematics analysis of open and closed loop mechanisms.

Purpose and applications of optimum design, formulation and classification of optimization problems, liner programming-simplex method, one dimensional minimization based on elimination and interpolation, unconstrained optimization-direct search and descent methods, constrained optimization-penalty function method.

Introduction geometric, dynamic, integer and quadratic programming, computer aided optimum design of machine of machine elements like gears, bearing, shafts and springs.

List of practical

- Line drawing or circle drawing algorithm experiment: writing the program and running it on computer
- Transformations algorithm experiment for translation/ rotation/ scaling : writing program and running it on computer
- Design problem experiment: writing the program for the design of machine element or other system and running it on computer
- Optimization problem experiment: writing a program for optimizing a function and running it on computer
- AutoCAD experiment: understanding and use of auto CAD commands
- Writing a small program for FEM for 2-spring system and running it. Or using a FEM package.

- Use of graphic software standard packages e.g. GKS/ PHIGS/GL etc.
- Use of Pro Engineer/ Ideas, etc.
- Optimization for linear programming by simplex method

Suggested Text Books and References

1. Ibrahim Zeid, " CAD/CA, Theory and Practice", Tata McGraw Hill, 1998
2. Micheal, E. Mortenson, "Geometric Modeling", John Wiley and Sons, Inc., Second Edition, 1997.
3. Grover & Zimmer, " CAD/CAM". T.M.H.

ME 472 NUMERIC CONTROL OF MACHINE TOOLS AND ROBOTICS 5(3-1-3)

1. NUMERIC CONTROL

Introduction to numerical control, components, axes of NC machine tools, open and close loop control, actuation and feed back systems. Point to point, linear and Contouring systems. Tooling for NC systems . Sheps in NC manufacturing Machining and turning centers and their features. ATC and APC.

NC programming : Input media coding formats. Manual part programming for lathe, drilling and milling machines, cutter diameter and length compensation. Computer assisted par programming languages. APT, EXPAT, ADAPT, COMPACT, CAD/CAM approach of programming. Computer numerical control, direct and distributed numerical control, adaptive control.

II. ROBOTICS

Industrial robots and their applications for transformational and handling activities. Configuration and motions. Actuars, sensors and end effectors. Features like work envelop, precision of movements, weight carrying capacity. Robot programming languages. Vision systems. Introduction to intelligent robots.

List of practical

- Writing a part programming (in word address format or in APT) for a job for drilling operation (point to point) and running on NC machine.
- Writing a part programming (in word address format or in APT) for a job for milling operation (contouring) and running on NC machine
- Experiment on Robots and its programs
- Experiment on transfer line/ material handling
- Experiment on difference between ordinary machine and NC machine, Study or retrofitting
- Experiment on study of system devices such as motors and feed back devices
- Experiment on Mechatronics and controls

Suggested Text Books and References

1. Koren Yorem, " Computer Control of MachineTools".
2. Grober, MP. And Zimmer, J.R., "CAD/CAM", Prentice Hall of India.
3. Kundra, T..K. Roa and Tiwari, N.K., " Numerical Control and Computer Aided"

ME 473 AUTOMOBILE ENGINEERING 5(3-1-3)

The Automobile

History development, Automobiles industry in India and abroad, testing of automobiles.; Resistances to motion and power requirement for propulsion.

Automobile Engine

Requirement and classification, materials, constructional details and manufacturing process of engine components. Exhaust manifolds-types-necessity, maintenance problems: Materials used.

Frame

Layout of a chassis; types of chassis frames and bodies, their constructional features, loading points, testing of frames and materials.

Transmission System

Necessity of Clutch in automobile, Types of clutches, clutch material, clutch lining. Fluid coupling, over running clutch, necessity and field of application. Gear boxes, Necessity of gear box, construction details of sliding mesh, constant mesh, synchromesh and epicycle gear boxes, Automatic transmission system:, Hydraulic torque converter.

Drive Line and Rear Axle

Propeller shaft, universal joints, Rear axle drives, torque reaction, driving thrust, overdrive. Hotchkiss and torque tube drives; rear axle types and construction Principle of differential, types of differential.

Wheels and Tires

Types of wheels and tires. Tire construction; functions of tires, solid and pneumatic tires, tire inflation pressure, tire wear and their causes; repair of the tire and tube.

Steering system

Steering wheel and steering column, Steering boxes, steering linkages, steering mechanisms, under and over steering. Front axle, Steering Geometry wheel alignment wheel balancing, centre point steering; power steering.

Suspension system

Objects and requirements, Types of suspension systems, suspension spring, front and rear suspension systems; Independent suspension system; shock absorber.

Brakes
Necessity of brake, theory of brake shoe, Classification and function; self energizing brakes; lining materials, factors influencing operation of brakes such as operating temperature, using area etc.
Storage Battery
Charging, discharging and testing of battery, capacity and efficiently, method of charging from D.C. and A.C. mains, defects and remedies of battery of idle and new batteries, maintenance and storage of batteries.
Starter Motor
Battery motor starting system, series motor and its characteristics, consideration in selecting size of motor. Types of drives, starting and generating circuit, solenoid switches.
Wiring for Auto Electrical Systems
Wiring diagrams of typical; wiring systems and wire loops.
List of practical

- Study and experiment on braking system.
- Study and experiment on fuel supply system.
- Study and experiment on ignition system.
- Study and experiment on steering system.
- Study and experiment on transmission system.
- Study and experiment on suspension system.
- Study safety aspect of automobile design.
- Study and experiment on lighting or lubrication system.
- Study and experiment on lubrication and cooling system.
- Comparative study features of common small cars (such as Fiat, Ambassador, Maruti, Matiz, Santro, Indica; and its variations) available in India.
- Comparative study and technical features of common scooters and motorcycles available in India. Case study / term paper
- Comparative study and technical features of common heavy vehicles available in India. Case study / term paper.
- Engine tuning and carburetor servicing experiment
- Experiment and study of MPFI system
- Experiment on fuel; consumption measurement
- Review experiment on IC engines and modern trends
- Visit of an automobile factory
- Study and experiment of main gear box and differential gear box

Suggested Text Books and References

1. Crouse, " Automotive Mechanics", Tata McGraw hill, 1979
2. Crouse, " Automotive Transmission and Power Trains",
3. Crouse, "Automotive Chassis and Body", McGraw-Hill, 1967
4. McGrath, " Automotive Transmission and Drive Line," 1961
5. Ellinger, " Automechanics," 1972.

ME 481 POWER PLANT ENGINEERING 4(3-1-0)

Introduction
Power and energy, sources of energy, review of thermodynamic cycles related to power plant, fuels and combustion, steam generators and steam prime movers, steam condensers, water turbines.
Variable
Load problem: industrial production and power generation compared, ideal and realized load curves, terms and factors. Effect of variable load on power plant operation, methods of meeting the variable load problem.
Power plant economics and selection
Effect of plant type on costs, rates, fixed elements, energy elements, customer elements and investor's profit; depreciation and replacement, theory of rates. Economics of plant section, other consideration in plant selection.
Steam power plant
Power plant boilers including critical and super critical boilers. Fluidized bed boilers, boilers mountings and accessories. general layout of a team power plant. Different systems such as fluid handling system, combustion system, draft, ash handling system, feed water treatment and condenser and cooling system, turbine auxiliary systems such as governing, feed heating, turbine mounting, lubrication, flange heating and gland leakage. Operation and maintenance of steam power plant, heat balance and efficiency, trouble shooting and remedies.
Diesel power plant
General layout, performance of diesel engine, fuel system, lubrication system, air intake and admission system, supercharging system, exhaust system, cooling systems, diesel plant operation and efficiency, heat balance, trouble shooting and remedies.
Gas turbine power plant

Elements of gas turbine power plant, regeneration and reheating, cogeneration, auxiliary systems such as fuel, controls and lubrication, operation and maintenance performance and turbine shooting and remedies.

Nuclear power plant

Principles of nuclear energy, basic components of nuclear reactions, nuclear power station, trouble shooting and remedies.

Hydro electric station

Principles of working, applications, site selection classification and arrangement of hydro-electric plants, run off size of plant and choice of units, operation and maintenance, hydro systems, interconnected system, trouble shooting and remedies

Electrical system

Generators and generator cooling, transformers and their cooling, bus bar etc.

Instrumentation

Purpose, classification, selection and application, recorders and their use, listing of various control rooms.

Suggested Text Books and References

1. "Power Plant Engg.': p.t. morse, Affiliated East-West Press Pvt. Ltd. New Delhi madras.
2. Verma Mahesh, " Power Plant Engg.", Metropolitan Book Company Pvt. Ltd. New Delhi.
3. " Modern Power Station Practice', Central Electricity Generating Board (UK) vol. no. 1 to 7
4. "Power Plant Technology", Vakil

ME 482 MECHANICAL SYSTEMATIC DESIGN 4(3-1-0)

Design of Engineering System with it sub-system including consideration of alternatives.

Specifications of components of engineering system

Deigning various components of the system from manufacturing point of view.

System will be selected out of the following:

a) Material handling and transportation systems
b) A systems power plant
   (i) Boiler (ii) Condenser (iii) Turbine (steam0
c) Refrigeration and Air-conditioning
   (i) Compressor (ii) Condenser (iii) Evaporator
d) Pneumatic an Hydraulic Systems
   (i) Single and double acting cylinders
   (ii) Control valves
   (iii) Hydraulic Cylinders
e) A pressure vessel
   (i) Vessel (ii) Ends
   (iii) Supports (iv) Nozzles and manholes

Suggested Text Books and References

1. Kent's Mechanical Engineers Handbook
2. Mark's Mechanical Engineers Hand book
3. Rothbart Mechanical Engineering Handbook
4. ASHRAE Guide
5. P.S.G. Design Data Books
6. Hestnut, H., " System Engineering Tools"
7. Astrom & Wittenmark, " Computer Controlled Systems"

LIST OF SUGGESTED
OPEN ELECTIVES
&
PROFESSIONAL ELECTIVES

Open Elective

1. Enterprise Resource Management.
2. E-Commerce, Strategic IT
3. Technology Management
4. Decision Support and Executive Information system
5. Software Technology
6. Knowledge Management
7. IT in Marketing Management
8. IT in HR Management
9. IT in finance Management
10. Project Management and Software Tools
11. Human Values
12. Science Technology and society

Professional Elective

Design Engineering

1. Finite Element Analysis
2. Vibration Engineering
3. Machine Tool Design
4. Hydraulic Control
5. Experimental Mechanics
6. Pneumatic Control and Low Cost Automation
7. Computer Aided Engineering

Thermal Engineering

8. Energy Engineering
9. Automotive Chassis and Transmission
10. Pumps, Fans, Blowers and Compressors
11. Cryogenic Engineering

Manufacturing Engineering

12. Manufacture and Inspection of Gears
13. Computer Integrated Manufacture
14. Cost Estimation and Optimization
15. Terotechnology Mechatronics Engineering
16. Special Casting Techniques
17. Robotics

Industrial Engineering

18. Total Quality Management
19. Value Engineering
20. Entrepreneurship Development
21. Advanced Operations Research
22. Project Engineering
23. Enterprise Resources Planning
24. Industrial Design
25. Personnel Management
26. Financial Management and Accounting

NB: The College can frame syllabi of professional elective and open elective to be offered by them in the particular area.

FINITE ELEMENT ANALYSIS

Introduction

Structural analysis objective static, dynamic and kinematics analysis, skeletal and continuum structures, modeling of infinite d.o.f. system into finite d.o.f. system, basic steps in finite element problem formulation, general applicability of the method,

Element Types and Characteristics

Discrimination of the domain, basic element shapes, aspect ratio, shape function, generalized co-ordinates and nodal shape functions. ID spar and beam elements, 2D rectangular and triangular elements, axisymmetric elements.

Assembly of Elements and Matrices

Concept of element assembly, global and local co-ordinate systems, band width and is effects, banded and skyline assembly, boundary conditions, solution of simultaneous equations, Gaussian elimination and Choleksy decomposition methods, numerical interaction, one and 2D applications

Higher order and Isoperimetric Element

One dimensional quadratic and cubic elements, use of natural co-ordinate system, and triangular requirements

Static Analysis

Analysis of trusses and frames, analysis of machine subassemblies, use commercial software packages, advantages and legislations.

Dynamic analysis

Hamilton's principle, derivation of equilibrium, consistent and lumped mass matrices, derivation of mass matrices for ID elements, determination of natural frequencies and mode shapes, use of commercial software packages.

Suggested Text Books and References

1. Rao, s.s "The Finite Element Method in Engineering" 2nd ed, peragamon Press, Oxford, 1989
2. Robert, D.Cook: David, S. Malkins, and MICHAEL E.Plesha,, "Concepts and Application of finite Element analysis" , 3rd ., John Willey
3. Chandrupatla, T.R. an Belegundu, A.D., "Introduction to finite Elements if Ingineering", prentice Hall of India Pvt., 1971

VIBRATION ENGINEERING

Introduction

Harmonic motion periodic motion, vibration terminology

Single Degree of Freedom Systems

Free and forced vibration with and without damping magnification factor, transmissibility and isolation

Two degree of Freedom Systems

Generalized co-ordinates, principal co-ordinates, derivation of equation of motion, co-ordinate coupling, Lagrange's equation

Vibration Absorber

Tuned absorber, determination of mass ratio, tuned and damped absorber (qualitative treatment only), unturned viscous damper.

Multi Degree of Freedom Systems

Derivation of equations, calculation of natural frequencies by Rayeigh, Stodala, matrix, matrix iteration ad Holzer methods.

Torsional Vibration

Single and multi-rotor systems, geared systems, branched systems.

Vibration of Continuous Systems

Vibration string, string, longitudinal vibration of rods, torsional of rods, Euler equation of beams.

Signature Analysis and preventive Maintenance

Vibration testing equipments, vibration signatures, standards, field balancing of rotors.

Suggested Text Books & References

1. Thomson, W.T., " Theory of Vibration with Application", CBS Pub. And Distributors, 3rd ed., 1988.
2. Tse, Morse and Hinkle., " Mechanical Vibration", Prentice hall of India Ltd., 1987.
3. Schaum Outline Series., " Mechanical Vibration", McGraw Hill Book Company, 1990
4. Lindley and Higgins., Maintenance Engineers Hand Book", McGraw Hill Book Company, 1997.

MACHINE TOOL DESIGN

Introduction

Kinematics of different types of machine tools, selection of cutting conditions and tools, calculations of cutting force on single point and multipoint tools, hole machining, calculation of power, accuracy requirements and standards.

Design of rotary drives

Design of spindle drives, AC motors with stepped drive, DC and AC variable speed drive motors characteristics and selection, principle of speed controllers, timing belts and other types of transmission belting, pulleys, closed loop operation of main drives rotary indexing drives.

Design of feed drives

Feed drive using feed boxes, axes feed drive of CNC drives, DC and AC servomotors. Types characteristics controllers and their selection, ball screws and friction screws-guide ways, linear motion systems, design calculations of drives, closed loop operations of feed drives, linear indexing drives.

Control elements

Single and multi axis CNC controllers, hydraulic control, pneumatic control limit switches, proximity switches, sequencing control using hard wired and PLC systems.

Design of machines tool structures

Static and dynamic stiffness, dynamic analysis of cutting process, stability, forced vibration, ergonomics and aesthetics in machine tool design.

Design of spindle and spindle supports

Function of spindles, design requirements, standard, spindle noses, design calculations of spindles, bearing selection and mounting.

Finite elements analysis of M/C tool structures

Examples of static, dynamic and thermal analysis and optimization of typical machine tool structures like column and using a finite element analysis package.

Design of special purpose machines

Modular design concepts, standard modules, example of design of a typical SPM with CNC, transfer machines.

Suggested Text Books and References

1. Mehta, N.K., " Machine Tool Design" Tata McGrawa Hill Book Co. 1991.
2. "ANSYS 5.0 Manual" Swanson Associates, USA, 1993.
3. Macherkan, " Machine tool Design", Vol I and Vol III, Mir Publishers Moscow 1973.

HYDRAULIC CONTROL

Introduction to fluid power

Advantages of fluid power systems. Properties of hydraulic fluids, selection of hydraulic fluids, hydraulic symbols.

Pumps and motors

Characteristics and selection of hydraulic pumps and motors, fixed and variable displacement operation, calculation of flow, torque and power , hydrostatic transmission systems.

Elements of hydraulic systems

Types, construction and mounting, methods of hydraulic cylinders, calculation of area and flow are based on system force and velocity requirements, construction, selection and application of values for control of direction flow and pressure.

Accessories of hydraulic systems

Design of hydraulic power packs, pipes of main and return lines, pipe fittings, calculations involving the use of accumulators, intensifiers , selection and application of seals and pickings. Hydro mechanical servosystems, electrohydraulic servosystems, proportional valves, application for hydraulic servo systems, maintenance of hydraulic systems.

Sequential circuit design

Sequential module, fringe condition modules, cascade method, step counter method .

Typical industrial applications of oil hydraulics

Hydraulic circuits for declaration, regenerative circuits, differential circuits, feed circuits design, selection of elements, sizing of pipe, design of power packs.

Design of hydraulic circuits

Total design of a hydraulic circuit for linear drive applications in a SPM-Specification of the circuit, circuit design, selection of elements, sizing of pipe, design of power packs.

Design of electrical sequencing circuits

Ladder diagrams, introduction to the use of PLCs for sequence control in hydraulic circuits.

Suggested Text Books and References

1. Esposito, " Fluid Power with Application ", Prentice Hall Inc. 1988.
2. Lal Anthory, " Oil Hydraulics in the Service in Industry", Allied Publishers 1982.

EXPERIMENTAL MECHANICS

Elementary elasticity

Stress, stress equations of equilibrium, principle stresses, stress strain relation principle strains.

Brittle coating methods

Coating stress, brittle coating crack patterns, crack detection, test procedures, calibration, and analysis.

Strain gauges

Electrical resistance strain gauges, semi conductor strain gauges, strain gauge circuits recording instruments, analysis of strain gauge data.

Moire methods

Mechanism of formation of Moire fringe, geometrical approach to moiré fringe analysis, displacement field approach to Moire fringe analysis, out of plane measurement experimental procedure.

Photo elasticity methods

Temporary double refraction, stress optic law, effects of stressed model in plane polariscope, fringe multiplication.

Two dimensional photo elasticity

Isochromatic fringe patterns, isoclinic fringe pattern, compensation techniques, calibration methods separation methods, scaling model to prototype stresses, materials/

Three dimensional photo elasticity

Locking in model deformations, materials, shear difference method, scattered light method.

Birefirngent coatings

Coating stresses and stains, sensitively, materials and applications, effects of thickness, stress seperation.

Suggested Text Books and References

1. Dalley James and Riley, W.F., "Experimental Mechanics" Int. student edition McGraw hill Kogakusha l Ltd. 1992.
2. Adams Dove, " Experimental Stress Analysis", Prentice Hall In.c 1965.
3. Perry and lissiener, " Strain Gauge Primer", McGraw hill, 1965.
4. Durali," Photo Mechanics ", Prentice Hall Inc. 1972.'

PNEUMATIC CONTROL AND LOW COST AUTOMATION

Introduction

Production of compressed air, air receivers, accumulators, mains, airlines, dry and oil, free compressed air.

Pneumatic control

Components, constructional details, filter, lubricator, regulator, constructional features, types of cylinders, control valves for direction, pressure and flow-air hydraulic.

Pneumatic control systems

General approach to control system design, symbols and drawings, schematic layout, travel step diagram, circuit, control modes, program control, sequence control, cascade, Karnaugh, Veitch ,aping method, air hydraulic control, fringe condition modules, start, emergency, start restriction.

Electro, pneumatic logic circuits

Sequential logic circuit design with Karnaugh,, Veitch map method. Ladder diagram construction.

Pneumatic counters

RS Flip, Flop, combination logic circuit design, mixed logic circuit design, computer simulation of pneumatic and electro pneumatic circuits.

PLC Based Automation

Flexible/rigid automation, advantages, limitations, PLC configuration, input, output parts memory, PLC programming, timers and counters.

Typical application circuits

Metal working, handling, computation of force, speed, valve sizing, selection of cylindering, sizing of tubes, air receivers.

Sensors

P/E Converter, optical, capacitance type, inductive type, reflexive nozzle, back pressure nozzle, interruptible air jet; principle of operation and applications of proportional and servo valves.

Suggested Text Books and References

1. Wemer Deppert and Kurt Stoll, " Pneumatic Control" Vogel Butch Wurzbutg, 1987.
2. Wemer Deppert and Kurt Stoll, " Pneumatic Application" Kemparth Reihe, Vogel Verlag, 1976.
3. Festo, K.G., " Pneumatic Tips", Festo, Germany, 1987.

COMPUTER AIDED ENGINEERING

An overview of computer aided engineering

Application of computers to design, case studies of application of CAD and benefits of computer Aided Design. Computer hardware, computer fundamentals, classification of computers used for design, hardware of PENTIUM and RISC based graphic workstations. Serial and parallel interfacing, display devices, graphic input devices, output devices and operating systems, Windows 95 and windows NT.

Principles of computer graphics

Creation of graphic primitives, graphical input techniques, display transformation in 2D and 3-D viewing transformation, scan conversion, clipping, hidden line elimination, rendering, shading and animation.

Design Data base

Concept, objectives, data structures, creation of data files and accessing data flies in application programs and relational database management systems.

Automated drafting

Configuration of a typical drafting package, layers, entities, editing, display commands, hatching, dimensioning, text, plotting, script, files, DXF and IGES files, bocks, parametric programming, customization of drafting packages and graphics standards.

Modelling

Schemes for representing solid objectives, construction solid geometry and boundary representation, features of solid modeling packages, modeling of curves and surfaces, technique of spinning, cubic splines, Bezier splines, B-splines, non-uniform rational B-splines, Sculptured surfaces. Examples of seceation of solid models, interface to drafting, design analysis and NC programming.

Finite Element Analysis

Introduction, types of analysis, procedure of finite element analysis-stiffness matrix, solution procedure, details of a finite element analysis package, model building post processing and optimization.

Mechanisms Modelling

Inertial data specification, constraints, forces, generic systems, modeling, kinematics and dynamic analysis, post processing and simulation

Concurrent Engineering

Product data Management-Concurrent Engineering

Suggested Text Books and References

1. Radhakrishna, P. and Kothandaraman, C.P., " Computer Graphics and Design", Dhanpat Rai and Sons, New Delhi, 1991
2. "AutoCAD Manual", Auto Desk Inc. USA, 1992
3. "ANSYS 5.2 Manual", Swason Asociates, USA, 1993
4. "PRO/Engineer Manuals", Parametric Technology Corporation, USA, 1997
5. "I-DEAS Manuals", Structural Dynamics Research Corporation, USA, 1997
6. "ADAMS Manuals', Mechanical Dynamics, USA 1992

ENERGY ENGINEERING

Introduction

Trends of energy consumption, developed and developing countries, sources of energy, conventional and renewable. Fossil Fuel, availability and limitations. Need to develop new energy sources-energy conservation methods, energy audit.

Solar Energy

Solar insulation calculations. Flat plate and concentrating collectors for liquid and gases, construction.

Collector Area Calculations

Heat removal factor, efficiencies

Solar Systems
Power plants, low temperature and high temperature plants, solar driers, solar cookers, solar refrigeration systems.
Wind Energy
Types of rotors, horizontal axis and vertical axis systems, system design and site selection.
Biogas Plant
Types, parameters affecting plant performance, plant design.
Total Energy Conversion
Total energy concepts, Tidal plants, Cogeneration plants, Geothermal plants.
Direct Energy Conversion
Fuel cells, Thermoelectric, Thermionic and MHD systems
Suggested Text Books and References

1. Garg, HP and Prakash, J., " Solar Energy-Fundamental and Applications", Tata McGraw Hill Ltd. New Delhi, 1997
2. Sukhatme, S.P., : Solar Energy", Tata McGraw Hill Publishing Company Ltd. 1989.
3. Duffie and Backman, " Solar Energy Thermal processes', John Wiley, 1974.
4. Sutton, " Direct Energy Conversion", McGraw Hill, 1966.

AUTOMOTIVE CHASSIS AND TRANSMISSION

Types of Automobiles
The scope for automobile industries in Indian, general classification of vehicles, types of automobiles, layout of automobile, subsystems of automobile, front, rear and four wheel drives, general frame construction, Integral chassis.
Suspension Systems
Objectives and characteristics, quarter, semi and three quarter elliptic leaf springs, helper springs, torsion bar, coil springs, linkage suspension systems, air springs, rubber springs, hydro elastic springs, rigid axle suspension system, independent suspension, need for shock absorbers, principle of construction and working of shock absorbers.
Front Axle and Steering System
Front axle, types of stub axle, principles of steering, Ackerman steering, center point steering, steering geometry and wheel alignment, caster, camber and kingpin inclinations, toe-in and toe-out, steering system layout, types of steering gear boxes, power steering.
Wheels and Tyres
Types of wheels and brake drums, cross play and radial play tyres-tyres specification-tyre wear and maintenance.
Transmission Line
Cardan shaft, universal joints, constant velocity joints, rear types of live rear axle, quarter, semi and three quarter floating axles, two speed axles, hub reduction axle, Tandem axles, differential and differential lock.
Braking System
Principle of braking, types of brakes, mechanical breaking system, hydraulic brake system, vacuum suspended type, hydraulic servo system, compressed air brake system, drum and disc brakes.
The Clutch
Need for a clutch, cone clutch-diaphragm clutch, single plate and multiplate clutches, centrifugal clutches, fluid coupling, factors affecting the power transmitted by a clutch, clutch plate, clutch Linkage, clutch pedal adjustment.
The Gear Box.
The need for a gear box, rolling, air and gradient resistances, sliding, constant and synchromesh gear boxes, 3,4, and 5 speed gear boxes, hydrodynamic torque converter, free wheel drive and over drive. Automatic gearboxes, variator drives.
Recent Advances
Activate and passive suspension, rear independent suspension-McPherson strut with coil spring, Tiltable and collapsible steering, four wheel steering, Air bags, Bumpers and crumbles, Power windows and central locking systems, adjustable seats, Door release mechanism, Multi valve engines, Sensors and computer controls, petrol injection, Catalytic converter, crash studies and safety analysis
Newer Materials and Surface Treatments
Materials, Composite material, magnesium, lithium alloy, aluminium alloy, recyclable materials and their extent of usage. Surface coatings, corrosive, wear and temperature resistant coatings, decorative coatings, metallic and reflective paintings interior insulations.
Suggested Text Books and References

1. Newton and Steeds, "The motor Vehicle", ELBS, 1989
2. Martin, W. Stockel, and martin, T. Stockel, " Auto Mechanics Fundamentals" The Good Heart Wilcox Co. Inc., 1982
3. Crouse, W.H., "Automobile Chassis and Bodies", McGraw Hill Book Company, 5th Edition, 1976.
4. Crouse, W.H., " Automobile Electrical Equipment", McGraw Hill Book Company 5th Edition, 1976.

PUMPS, FANS, BLOWERS AND COMPRESSORS

Pumps

Theory of centrifugal pump impeller, vortex theory, design of impeller, volute and diffuser, specific speed and ensign constants.

Design of Mixed Flow Impellers

Geometric relationship, axial flow pumps, design, use of aerofoil data for impeller design, guided vane, pump casting**.**

Fans

Fan laws, performance coefficients, effect of change in fan speed, density. Series and parallel operation, fan design losses, blade shape, casings.

Propeller Fan

Cross flow fans, principle of operation, applications, regulation of volume flow, Sources of vibration in fans, noise, attenuation testing.

Blowers

Types, centrifugal and axial, design procedure, selection, performance, special application, control of volume flow.

Performance Estimation

Instrumentation test rig layout, measurement of pressure, temperature, use of hot wire anemometer, boundary layer probes, measurement of sound.

Compressors

Centrifugal compressor, multistage arrangement, blade design, types diffusers, performance, series and parallel operation.

Axial Flow Compressors

Cascade theory, efficiency, two dimensional cascade, velocity triangles and stage loading, stage reactions, Losses compressor testing procedure.

Suggested Text Books and References

1. Val, S. Lobanoff, and Robert, R.Ross, " Centrifugal Pumps Design and Application" Jaico Publishing House Madras, 1996.
2. Allam Wallis, R., " Axial Flow and Ducts", John Wiley & Sons, 1983
3. Ronald, P. Lapina, " Estimating Centrifugal Compressor Performance", Gulf Publishing Company, 1982.

CRYOGENIC ENGINEERING

Introduction

Industrial applications, research and development, properties of cryogenic fluids-oxygen, nitrogen, air, hydrogen and helium.

Liquefaction of Cryogenic Gases

Ideal cycle, liquefaction of Air, Hydrogen and helium, critical components of liquefiers, efficiency.

Separation of Gases

Rectifiers column, separation of air, separation of helium from natural gas, distillation of liquid hydrogen, purification.

Low temperature Thermometry

Temperature scales, gas, vapour, pressure, residency thermometry, adiabatic demagnetization.

Insulation

Vacuum Insulation, Fibrous materials, Solid foams, Gas-Filled power, comparison, critical thickness.

Storage

Size and shape of vessel, portable commercial containers, large stationery container, Power, Transport, Storage system, Liquid level indicators.

Transfer of Liquefied gases

Two phases flow Transfer through insulated and uninsulated lines, cryogenic pumps and Valves.

Behaviour of Structural materials at Cryogenic temperature

Mechanical properties, Thermal properties, Thermoelectric properties.

Suggested Text Books and References

1. Guy, k. White, " Experimental Technique in low Temperature Physics', Clarendon Press, Oxford, 1987
2. Marshall Sitting and Stephen Kidd, " Cryogenics Research and Applications," D.Van Nostrand Company, Inc. USA, 1963
3. "Advances in Cryogenic Engineering", Proceedings of Cryogenic Engineering Cinferenc, Vl-1-145, Plenum Press, New York, 1968

MANUFACTURE AND INSPECTION OF GEARS

Introduction to Gears

Types of gears, classification, gear drawings, gear boxes, application of gears, gear production methods, an overview.

Gear Materials

Non metallic, ferrous and non ferrous gears. Properties of gear materials, selection of material for typical gears and applications-blank preparation methods for different gears, size, type and material.

Production of Cylindrical Gears

Gear milling, different gears, cut quality obtainable. Gear hobbing, description and operation of machine, types of gears cut hobbing cutters, work holding methods gear shapping, disc type and rack type gear shapers, description of machine, types of green cut, gear shapper cutter.

Production of Conical Gears

Production of straight bevel gears and spiral gears, milling, generation by straight bevel gear generator. Duplex cutter, straight bevel gear generator, Gleason Rava cycle method. Spiral bevel gear generator. Description of machine, cutter, cutter setting and cutting of gears.

Heat Treatment of Gears

Through hardening, case hardening, flame hardening , induction hardening of gears nitriding of gears. Tuft riding of gears. Inspection of gears for hardening defects.

Gear finishing

Gear finishing advantages, finishing of gears by grinding, shaving, lapping, honing methods and cold rolling of gears. Description of machines, process and process parameters.

Gear Inspection

Types of gear errors, gear quality standards, tooth thickness and base tangent length measurement, pitch errors, radial runout errors, profiles errors, pitch error measurement. Composite error measurement. Computerized gear inspection centres. Reasons and remedies for gear errors.

Modern Gear Production Methods

Gear production by stamping, die casting, powder metal process, injection and compression moulding in plastics, Die casting, cold and hot rolling, mass production methods, shear speed shaping, gear broaching-Gleason G-Trac Gear generation method.

Suggested Text Books and References

1. HMT, " Production Technology", THM, India, 1992
2. Watson, " Modern Gear Pergaman Press", Oxford, 1984.
3. Weck, M., " Handbook Tools ", Vol. I, John Wiley and Sons, 1984.
4. Society of Manufacturing Engineers, " Gear Processing and Manufacturing", 2nd Edition, 1984.

COMPUTER INTEGRATED MANUFACTURE

Introduction

Evolution of CAD/CAM and CIM, scope of CIM, segments of generic CIM, computers and workstations, an overview of CIM software.

Product Development Through CAD And CAE

Geometric modeling technique, automated drafting, graphic standards, Engineering analysis, optimization, principles of concurrent engineering.

Automated Process Planning

Process planning, general methodology of group technology, code structures variant and generative process planning methods, AI in process planning, process software.

CNC Technology

Principles of numerical control, types of CNC machines, features of CNC systems, programming techniques, capability of typical NCCAM software, integration of CNC machines in CIM environment, DNC-Flexible manufacturing systems.

Manufacturing System Software

MRP II software production control software, forecasting, master production schedule, materials requirements planning, capacity requirements planning, shop floor control, shop floor data collection techniques, inventory management, purchase orders and receiving, financial control, bill of materials, standard product routing, job costing, marketing applications.

Robotics and Automated Quality Control

Types of robots and their performance capabilities, programming of robots, hardware of robots, kinematics of robots, product design for robotized manufacturing, selecting assembly machines, feeding and transfer of arts, applications of robots in manufacture and assembly, sensors.

Simulation and Automated Quality Control

Types of simulation, simulation methodology, simulation languages and packages, applications, statistical process control, objectives pf CAQC types of CMM, non contact inspection methods, in process and post process metrology, flexible inspection systems.

Data Communications and Technology Management

Technology issue, configuration management, database systems, management of technology, networking concepts, LAN, MAN and WAN, SQL fundamentals, MAP/TQP fundamental, CIM models, IBM Siemens, DEC, ESPRIT-CIM OSA model, economics of CIM, implementation of CIM.

Suggested Text Books and References

1. Radhkrishanan, P., " Computer Integrated Manufacturing", Deptt. of Mechanical & Production Engineering, PSC College of technology, 1992.
2. Eric Teichols and Joel Orr, " Computer Integrated Manufacturing Hand Book", McGraw Hill Book Co. 1989.

3. Paul, G. Ranky, " Computer Integrated Manufacturing" , 1985.

COST ESTIMATION AND OPTIMIZATION

Cost Accounting-Cost Estimation

Concepts, differences, steps involved, different types, cost grid uses.

Labour and Material Costs

Labour cost-direct-Indirect, Estimation Labour cost variance-Material cost-Direct-Indirect, Estimation material cost variance.

Overhead Cost

Elements in overhead cost, various methods of absorbing overhead costs, MHR calculation, overhead variance problems, Introductions to activity based costing method.

Cost Calculation

Machined components, Welded components, Cast components and forged components, calculation of sales cost, case studies, use of computers in cost estimation.

Cost Optimization

Cost optimization techniques-Analytical, graphical, incremental method for single and multi variable situations, Learning curve.

Optimum Machining Conditions

Taylor's equation deriving the equation for optimum economic cutting velocity, selection of sutting speed for optimum cost, Process capability analysis.

Break Even Analysis

Concept, applications and area of use, Value analysis steps in selection, Analysis and Implementation.

Group Technology and Productivity

Group technology, objectives, Steps, methods of codification, productivity, concepts, Labour, Machine, Material based productivity.

Suggested Text Books and References

1. Frederic, C., Jelen, C., and James, H. Black., " Cost and optimization Engineering", McGraw Hill International Book Company, New Delhi, 1983.
2. Narang, C.B.S. and Kumar, V., " Production and Casting", Khanna Publishers, New Delhi, 1985
3. Semuel Eilon, " Elements of Production and Control", Macmillan, 1985
4. ASME, "Manufacturing Planning and Estimation-Hand Book", McGraw Hill Book Company Inc. 1963
5. Haslhurst, M, " Manufacturing Technology", ELBS, 1985.

TEROTECHNOLOGY/MECHATRONICS ENGINEERING

TEROTECHNOLOGY

Maintenance Organization

Types of maintenance-planned and preventive maintenance, break down and predictive maintenance, history card. Selection of maintenance types for various industries like power plant, steel plant, chemical plant. maintenance and repair schedules, uptime, down time, maintenance of spare parts and control.

Introduction of Reliability/Failure Concepts

An introduction of reliability, definition of reliability and failure, bath-tube curve, early failure period, life cycle, wear out failure period.

Reliability

A took for preventive Maintenance Programme, maintainability, availability, MTBF and MTTR , Weibull distribution to describe the bath-tube curve, redundancy and stand by redundancy.

Methods of Lubrication

Need for lubricant change, change periods visual examination of used lubrication oils, laboratory test for used mineral oils.

Introduction to Vibration Analysis

Vibration parameters, vibration analysers/instruments, data presentation, survey chart, data interpretation.

Contaminant Analysis

Spectrometric oil analysis procedure, ferrograpphy, performance monitoring techniques, magnetic chip detectors.

Failure Analysis

Plain bearing failures, rolling element bearing failures and seal failures.

Maintenance Management

Computerized maintenance management system, case studies, single unit like diesel generator and industry like steel plant. House keeping, safety aspects, updating of spares and training of maintenance personnel.

Suggested Text Books and References

1. Gandhi, O.P., and Chawla, O.P., " Reliability, Availability and Maintainability", IIT Delhi, 1997.
2. Collacto, R.A., " Mechanical Fault Diagnosis and Condition Monitoring Chapman and Hall, Landon, 1977.
3. "Reliability Based Maintenance", Computational System Inc., Houston, USA, 1993.
4. Lindley, R. Higgins, P.E., "Maintenance Engineering Hand Book", McGraw Hill Book Company, 1988.

MECHATRONICS ENGINEERING

Introduction to Control Systems

Open loop and Closed loop Systems, Principle, Working. State Equation, Procedure for writing state equations, Node equations, Loop equations, Law governing node and loop equations, Electrical equivalents for Mechanical Systems.

Analog Control Systems

Transfer function, procedure for writing transfer function, Signle Flow diagram Procedure, Need for control system.

Stability Conditions

Routh Hurwitz criterion, Nyquist criterion, Bode plot, Nichols plot, root locus method.

Electronic Components

Switches, type, contact type, magnetic type, electromagnetic type, transducers, introduction and principle, sound, light, pressure, Sensors, Introduction and principle, types, pressure, temperature, slip other sensors, proximity pick ups, application.

Electrical Components

Motors, principle, construction, working of AC and DC motors, stepper motors, introduction and principle, construction, working servo motors, introduction and principle construction and principal, applications.

Advanced Digital Control System

Introduction to digital control system, control circuits, study, microprocessor based controls, problems, design, remote control, application.

Electro Mechanical Systems

Basics, mechanical systems involved, control of the above mechanical systems, mechanical operations, controls of these operations in various modes. Basics of CD ROM players, PLC, applications.

Advanced Electro Mechanical Systems

Robotics system, integration of various systems, vision speech, collision avoidance, other controls, CNC machines, controls of CNC machines applications.

Suggested Text Books and References

1. Cooper, W.D., and Helfrick, A.D., " Electronic Instrumentation and Measurement Techniques", 3rd Edition, 1979.
2. Benjamin, C. Kuo, ' Automatic Control System", Prentice Hall, New Delhi, 1992.
3. John, D. Lenk, " Complete Guide to Video Cassate Recorder: Operation and Servicing", Prentice Hall of India.
4. Phillipe Coiffect and Michael Chirouze, "An Introduction to Robot technology", McGraw Hill, 1983.
5. John, J.D. and Constantine, H. Houpis. " Linear Control Systems: Analysis and Design, Conventional and Modern", 1985.
6. Theraja, B.L., " Electrical Technology", Nirja 1983.
7. Anthony, C., " Robot technology: Theory, Design and Application", McDonald, 1985.

SPECIAL CASTING TECHNIQUES

Introduction to Special Casting Techniques

Shell Moulding

Shell moulding, Process, shell moulding machines, pattern equipment, sands, resins and other materials used in shell moulding, application of shell moulding, advantages of shell moulding over other method.

Centrifugal Casting

Principle of centrifugal casting, types of centrifugal casting processes, calculation of mould rotary speed, techniques, equipment used and production processes, advantages and limitations of centrifugal casting methods.

Investment Casting

Introduction, pattern and mould materials used, techniques and production of investment moulds and castings, application of investment casting process, advantages and limitations of investment casting.

Die Casting

Die Casting processes, Die Casting machines, operations and details, die materials, metals cast by die casting method, advantages and limitations of die casting.

Recent Development

Low pressure die-casting, squeeze casting, Rheocasting, V Process, High pressure moulding etc.

Suggested Text Books and References

1. Heine, R.W., Loper, C.R., and Rosenthal, P.C., " Principles of Metal Casting", 2nd edition, Tata McGraw Hill Publishers Co. Ltd., New Delhi 1996.
2. Jain, P.L., "Principles of Foundry Technology", 3rd Edition, Tata McGraw Hill Publishers Co. Ltd. New Delhi, 1997.
3. Beely, P.R.," Foundry Technology", Butterworths, London, 1972.
4. Dumond, T.C., " Shell Moulding and Shell Moulded Castings", Reinhold Publishers Corporation Inc. 1954.
5. Doehler, E.H., " Die Casting", I Edition, McGraw Hill Book Co. New Yark, 1951
6. Barton, H.K. "Dia Casting Processes', Odhams Press Ltd. 1957.

7. Wood, R.L., and Davidlee Von Lodwing, " Investment Casting for Engineering", Reinhold Publishers Corporation Inc., 1952

ROBOTICS

Fundamental Concepts of Robotics

History, present status and future trends, robotics and automation, laws of robotics, robot definition, robotics systems and robot anatomy, specifications of robots, resolutions, repeatability and accuracy of manipulator.

Drives, Transmission and End Effectors

Robot drives, power transmission systems and control, robot drive mechanisms, hydraulic, electric, pneumatic drives, mechanical transmission method, rotary-to-rotary motion conversion, rotary-to-linear motion conversion, end effectors, types, gripping problem, remote centered compliance devices, control of actuators in robotic mechanisms.

Sensors and intelligent Robots

Sensory devices, non-optical position sensors, optical position, sensors, velocity sensors, proximity sensors, contact and non-contact type, tough and slip sensors, force and torque sensors, AI and robotics.

Computer Vision for Robotic Systems

Robot vision systems, imaging components, image representation, hardware aspects, picture coding, object recognition and categorization, visual inspection, software considerations, application, commercial robotic vision systems.

Computer Considerations for Robotic Systems

Computer architecture for robots, hardware computational elements in robotic applications, robot programming-sample programs, path planning, robot's computer system.

Robot Kinematics

A brief overview of transformations and kinematics of robots.

Robot Cell Design and Control

Specifications of commercial robots, robotic application, obstacle avoidance, robotic in India, the future of robotics.

Application of Robots

Capabilities of robots, robotic applications, obstacle avoidance, robotics in India, the future of robotics.

Suggested Text Books and References

1. Richard, D. Klaftere. Thomos,A. Chmieleswki, and Micheal Negin," Robotic Engineering-An Integrated Approach", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd., 1989.
2. Fu, K.S., Gomaler, R.C. , and Lee, C.S.G., " Robotics : Control Sensing, Vision, Intelligence', McGraw Hill Book Company, 1987.
3. Shuman, Y.Nof., " Handbook of Industrial Robotic", John Wiley & Sons, New York , 1985.
4. Deb.S.R., "Robotics Technology and Flexible Automation," McGraw Hill Book Company, 1994.

TOTAL QUALITY MANAGEMENT

Quality Concepts

Evolution of quality control, concept change, TQM Modern concept, Quality concept in design, Review of design, Evolution of proto type.

Control on Purchased Product

Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure.

Manufacturing Quality

Methods and techniques for manufacture, Inspection and control of product, Quality is sales and services, Guarantee, analysis of claims.

Quality Management

Organization structure and design, quality function, decentralization, Designing and fitting organization for different types products and company, Economics of quality value and contribution, Quality cost, optimizing quality cost, seduction progremme.

Human Factor in Quality

Attitude of top management, co-operation of groups, operators attitude, responsibility, causes of operators error and corrective methods.

Control Charts

Theory of control charts , measurement range, construction and analysis of R charts, process capability study , use of control charts.

Attributes of Control Charts

Defects, construction and analysis of P-chart, improvement by control chart, variable sample size, construction and analysis of C-charts.

Defects Diagnosis and Prevention

Defect study, identification and analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building reliability in the product, evaluation of reliability, interpretation of test results reliability control, maintainability, zero defects, quality circle.

Suggested Text Books and References

1. Lt. Gen. H. Lol. " Total Quality Management", Wiley Eastern Limited, 1990.
2. Greg Bounds, " Beyound Total Quality Management", McGraw Hill, 1994.
3. Menon, H.G., " TQM in New Product Manufacturing", McGraw Hill 1992.

VALUE ENGINEERING

An Overview

Definition, value engineering recommendations, programmes, advantages.

Approach of Function

Evaluation of function, determining function, classifying function, evaluation of costs, evaluation of worth, determining worth, evaluation of value.

VE Job Plan

Introduction, orientation, information phase, speculation phase, analysis phase, development phase-implementation phase follow up phase.

Selection of Evaluation of VE Projects

Project selection, methods selection, value standards, application of VE methodology.

Versatility of VE

VE operation in maintenance and repair activities, value engineering in non hardware projects.

Initiating A VE Programme

Introduction, training plan, career development for VE specialties

Fast Diagramming

Cost models, life cycle costs

VE Level of Effort

VE team, co-ordinator , designer, different services, definitions, construction management contracts, value engineering case studies

Suggested Text Books and References

1. Tufty Harald , G., " Compendium on Value Engineering", The Indo American Society, First Edition, 1983.
2. Miles, L.D., " Techniques of Value Engineering and Analysis", McGraw Hill second Edition, 1972.
3. Khanna, O.P., " Industrial Engineering and Management", Dhanpat Rai & Sons, 1993.

ENTREPRENEURSHIP DEVELOPMENT

Need, Scope and Characteristics of Entrepreneurship

Special scheme for Entrepreneurs, exposure to demand based, resource based, service based, import substitute and export promotion industries, Identification of opportunities.

Market Survey Technique

Need, scope and approaches for project formulation, criteria for principles of product selections and development, structure of project report, choice of technology, plant and equipment.

Institutions, Financing Procedure and Financial Incentives

Financial ratios and their significance, books of accounts, financial statement and funds flow analysis.

Energy Requirement & Utilization

Resource management, men, machine and materials, critical path method (CPM)-project evaluation review techniques (PERT) as planning tools for establishing SSI.

Techno-Economic, Feasibility of the Project

Plant layout and process planning for the product quality control /quality assurance and testing of product, costing and pricing.

Elements of Marketing & Sales Management

Nature of product and Market strategy, packing and advertising, after sales service, social responsibility and business ethics.

Important Provisions of Factory Act.

Sales of good act, partnership act, Income tax, Sales Tax and Excise rules, Licensing, registration, Municipal bye laws and insurance coverage.

Dilution Control, Creativity and Innovation

Problem solving approach, strength weakness opportunity the threat (SWOT) techniques, management of self and understanding human behavior, coping with uncertainties, stress management and positive reinforcement.

Suggested Text Books and References

1. Chandra, Prasana, " Project-Preparation, AAPRAISAL and Implementation", Tata McGraw Hill, New Delhi, 1990
2. Kotlar, Philip, " Marketing Management", Prentice Hall, 1990.
3. Chandra, Prasanna " Fundamentals of Financing Management", Tata McGraw Hill Publication, 1995.

ADVANCED OPERATIONS RESEARCH

Introduction to Operations Research

Formulation of problems, simplex method problem of degenerals, duel simplex method revised simplex method, bounded variable problems.

Integer Programming

Graphical method, the branch and bound technique, Gomary's All-IPP method, transportation model, unbalance in transportation, transshipment problem, sensitively analysis in transportation problems.

Dynamic Programming

Bellman's principle of optimality, examples on the application on routing problem, inventory problem, simplex problem, marketing problem,

Network Analysis

PERT and CPM, probability of achieving completion data, cost analysis, graph reduction Theory, updating, resource allocation, resource smoothing.

Inventory Method

Variable in an inventory problem, inventory models with penalty, storage and quality discount, safety stock, inventory models with probability, demand, multi item deterministic model.

Queuing Theory

Poison arrivals and exponential service times, waiting time and idle time cost, single channel multichannel problem. Monte Carlo technique applied to queuing problems, Poisson arrivals and service time.

Decision Theory Game

Examples on the application of theory of games 2XM and MX2 Problems, graphic dominance and linear programming method for different problems, decision trees.

Replacement Models

Replacement of items that deteriorate, gradually, fail suddenly, group replacement policy, concept of system reliability.

Suggested Text Books and References

1. Kumar Gupta, Prem and Hira, D.S., " Operation Research", S. Chand & Company Limited, 1986.
2. Swarup, Kanti, Gupta, P.K., and Manmohan, " Operations Research", Sultan Chand & Sons, New Delhi 1988.
3. Srinath L.S., " PERT & CPM Principles and Applications", Affiliate East West Press (P) Limited, New Delhi, 1975.

PROJECT ENGINEERING

Project Feasibility Analysis

Marketing, Technical and financial feasibility's, case studies, report preparation.

Project Management

Nature, Scope, PERT, CPM Techniques, Principles, Applications

Internal and Time Value of Money

Simple Interest, Compound Interest, Present Worth Uniform Series Payments, Use of Interest Table, Nominal and Effective Interest Rates, Continuous Compounding Payment, Uniform Gradient.

Depreciation

Reasons for depreciation, causes of reclaiming values, depreciation methods, comparisons with accounting of time value of money and without it.

Methods of Tangible Evaluation of Alternatives

Equivalent annual worth comparisons, present worth comparisons, rate of return comparisons.

Methods of Forecasting

Need for forecast-statistical method, time series analysis, method of least squares, moving average method, curvilinear trend, correlation analysis.

Replacement Policy

Item deteriorating with time and items that fail completely (accounting for time value of money), accounting for time value of money, replacement policy for new and old machine with finite horizon.

Risk Analysis

Risk in economic analysis, measuring risk investment, risk profiles, decision trees, formulation of discounted decision tree, simulation.

Suggested Text Books and References

1. James, L. Riggs, " Engineering Economics", McGraw Hill Book Co., 1982
2. James, L. Rappas, and Eugene, F. Brigham, " Managerial Economics:" Holt Renehaut and Winston Ltd., 1983.
3. Norman, N.Barish., " Economic Analysis for Engineering", McGraw Hill Book Company, 1978.
4. Chandra, Prasanna " Projects". Tata McGraw Hill, 1996.

ENTERPRISE RESOURCE PLANNING

Manufacturing Industry-Management Characteristics and Information Requirements

Industry classification, Product/Market/process Characteristics, Manufacturing planning and control techniques, ERP Concept & Evaluation History: MRP-1, MRP-II, EPR. Information Technology Advancement: Client server technology, RDBMS.

Sales, Purchase & Inventory Control, Concepts

Classification/coding of material & finished goods, sales enquire, quotation, order, invoicing, delivery, finished good valuation, purchase requisition, enquiry, supplier quotation, purchase order, Material receipts, Material issues, methods of issue valuation (FIFO/LIFO/Weighted Average Cost/Std. Cost), Returns from operations, Returns of supplier, Stock Adjustments, Physical Stock verification, ABC analysis. Lot and Locations control, Replenishment order control (safety stocks, report point, economic order quantity)

Manufacturing

Product configuration, Bill of material, Master Production Scheduling, Material Requirement planning, capacity Requirement Planning, Loading and Scheduling. An over view of man power planning and customer manufacturing planning.

Financial and Cost Accounting

Basic accounting principles, Day book-Cash, Bank, Journal, Purchase and Sales. Ledger-General, Supplier, Customer, Advances, etc. Bank Reconciliation, Trial Balance, Profit & Loss/Income & Expenditure account and Balance Sheet. Fix Ed assets and depreciation. Budgeting-Revenue, Capital Cash, Cost Elements-Direct material, Direct Labour, Direct expenses and overheads. Margin at costing and Break even analysis, Standard Costing, Activity based costing .

Introduction to A Typical ERP Software

Overview of ERP modules and tools of a software like BaaN.

Distribution Module

Module architecture-an overview, item data, Purchase ordering/control, Sales ordering/control, Replenishment order control, Electronic Data Interchange.

Manufacturing Module

Module architecture-an overview, Capacity Requirement, Planning, Engineering change control, Engineering data Management, Master Production Scheduling Material requirement Planning, Product Classification/configuration , Production Planning/control, Repetitive Manufacturing.

Finance Module

Module architecture-an overview, Accounts payable, Accounts receivable, General ledger, Cost allocation, Cash management, Activity based costing, fixed assets, Financial budgeting system.

Suggested Text Books and References

1. Joseph Orlicky, " Materials Requirement Planning, The New Way in Production and Inventory Management". McGraw Hill book company, New Delhi, 1975.
2. BaaN Student Manuals, BaaN Education Centre, Hyderabed , 1996.

INDUSTRIAL DESIGN

Introduction

Approach of Industrial Design, elements of design, structure of industrial design in engineering application in modern manufacturing system.

Ergonomics and Industrial Design

Introduction, general approach to the man-machine relationship, workstation design, working position.

Control and Displays

Shapes and sizes pf various controls and displays, multiple display and control situations, design pf major controls in application in ergonomic design of office furniture, redesign of instruments.

Ergonomics and Product design

Ergonomics and automated systems, expert systems for ergonomic design anthropomorphic data and its application in ergonomic design, limitations of anthropomorphic data, use of computerized database.

Visual Effects Line and Form

The mechanics of vision, psychology of vision, general influences of lien and form.

Colour

Colour and light, colour and objects, colours and the eye, colour of purpose, style and environment, aesthetic expressions, style-components of style, house style, observing style in capital goods.

Industrial Design in Practice

General design situation, specifying design requirements, rating the importance of industrial design, typical industrial design projects.

Suggested Text Books and References

1. Mccormick, K.J., (Ed.), "Human Factor Engineering", 4th ed. McGraw Hill Book Company Ltd., USA, 1992.
2. Brian Shackle (ED), " Applied Ergonomics Handbook", Butter worth Scientific, London. 1982.
3. Mayall, W.H., " Industrial Design for Engineers", London Iiifee Book Ltd. 1967.
4. Dale Huchingson, R., " New Horizons for Human Factors in Design", McGraw hill Company, 1981.
5. Rebert, W. Bailey, " Human Perfromance Engineering", Prentice Hall Inc. New Jersey, 1982.

PERSONNEL MANAGEMENT

Introduction

Study and evolution of managerial practices and polices in the administration of personnel, role or personnel in the management, advisory and service function to other departments, typical organization set up of the personnel department.

Manpower Planning

Recruitment, selection and placement, sources of labour supply, methods of selection, use of tests in selection and placement, development of personnel.

Training and Programmed Learning Objectives

Type and methods, TWI management development-its meaning and administering promotion plans, work environment, safety and accident prevention.

Wages and Salary Administration

Principles and techniques of wage fixation, job evaluation, merit rating, methods of wage payment, incentives scheme, communication-importance, channel and media of communication, suggestion schemes.

Transactional Analysis

Brainstorming and other schemes, morale-importance of moral, employee attitudes and behabiour, their significance to employer productivity.

Industrial Dispute Act

Trade union movements in India, their organization structures and polices, joint consultation and employee participation in management, intervention of the state in the settlement of employer-employee difference, collective bargaining.

Personnel Policy

Integration of personnel policy directed towards good industrial relation, industrial psychology and workers welfare.

Suggested Text Books and References

1. Northcott, C.H., " Personnel Management", Sir Isace Pitman & Sons Ltd. 3rd Ed., 1986.
2. Lawrence, K.C., " Personnel Management", Hutchsion Educational Ltd. London, 1992

FINANCIAL MANAGEMENT AND ACCOUNTING

Goals & Functions of Finance

Evolution of finance, objectives of the firm, function of finance, concept of time value of money.

Principles of Capital Budgeting

Kinds of capital budgeting decisions, evaluation of proposals, capital discounting and non-discounting based method.

Working Capital Management

Definition and importance of working capital-working capital operating cycle, factors affecting working capital, inventory management, introduction to cash and receivables management.

Sources of Finance

Working capital financing , long-term finance, financial instruments, financing institutions, schemes, IDBI refinance lease financing.

Financing and Divided Policies

Capital structure of a firm, operating and financial leverage, BIT, EPS analysis.

Cost Accounting

Cost classification, cost grid, fixed and variable costs, marginal costing, significance of overhead cost, machine hour rate method, variance analysis.

Financial Accounting

Book keeping-single, double entry, journal and ledger, financial statement-profit and loss accounting, balance sheet.

Financial Ratio Analysis

Uses and nature, liquidity coverage ratios.

Suggested Text Books and References

1. Prasanna Chandra, K., " Fundamentals of Financial Management", Tata McGraw Hill Publishing Company, 1993.
2. Pandey, I.M., "Management Accounting" Vikas Publishing House, 1983.
3. Brown J.L., and Howard, L.R., "Principals and Practice of Management Accounting", The English Languages Book Society, London, 1975.

Open Electives

HUMAN VALUES

The objective of the course in an exploration of human values which go into making a " good" human being, a "good" human society and a "good" life. The context is work life and the personal life of modern Indian professionals .

1. The value-crisis in the contemporary Indian Society.
2. The nature of values : the value spectrum for a "good" life.

3. The Indian system of values.
4. Material development and its values : the challenge of science and technology.
5. Psychological values : integrated personality; mental health.
6. Societal values: the modern search for a 'good' society; justices, democracy, rule of law; values in the India constitution
7. Aesthetic values: perception and enjoyment of beauty.
8. Moral and ethical values; nature of moral judgments; canons of ethics; ethics of virtue; ethics of duty; ethic if responsibility.
9. Work ethics; professional ethics.
10. Spiritual values : different concepts; secular spirituality
11. Relative and absolute values.
12. Human values: humanism and human values; human right, human values as freedom, creativity, love and wisdom.
13. Management by values: professional excellence; inter-personal relationships at work place; leadership and team building; conflict resolution and stress management; management of power.

SCIENCE TECHNOLOGY AND SOCIETY

It will be innovative course dealing with social, human and ethical implications of engineering and technology, with special reference to the Indian situation. It three main components are:

(i) Social and Cultural history of technology
(ii) Social and human critiques to technology,
(iii) Engineering Ethics and Professional Ethics. The proposed course structure is a follow:

1. Science, Technology and Engineering, as knowledge as social and professional activities.
2. Inter-relationship of technology growth and social, economic and cultural growth; historical perspective.
3. Ancient, medieval and modern technology/Industrial revolution and its impact. The Indian Science and Technology.
4. Social and human critiques of technology: Mumford and Ellul.
5. Rapid technological growth and depletion of resources. Report of the club of Rome. Limits to growth; sustainable development.
6. Energy crisis; renewable energy recourses.
7. Environmental degradation and pollution. Eco-friendly technologies. Environmental regulations. Environmental ethics.
8. Technology and the arms race. The nuclear threat.
9. Appropriate technology movement Schumacher; later developments.
10. Technology and the developing nations. Problems of technology transfer. Technology assessment/impact analysis.
11. Human operator in engineering projects and industries Problems of man machine interaction. Impact of assembly line and automation. Human centred technology.
12. Industrial hazards and safety. Safety regulations. Safety engineering.
13. Politics and technology. Authoritarian versus democratic control of technology. Social and ethical audit of industrial organizations.
14. Engineering profession. Ethical issues in engineering practice. Conflicts between business demands and professional ideals. Social and Ethical responsibilities of the engineer. Codes of professional ethics. Whistle blowing and beyond. Case studies.