PREFACE

The need to ensure minimum acceptable standards and quality in curricula of Engineering Colleges spread across the country and recent technological advances have necessitated development of Model Curriculum for various disciplines of first degree course in Engineering by All India Council for Technical Education. The planning of engineering curricula is a complex exercise since it involves integration of not only the current educational needs of the profession but also the anticipated needs arising out of the fast changing national and international technological scene. To make the curricula both dynamic, to meet the evolving needs of the profession and flexible to adjust to unforeseen developments, the first step is to identify the core part of the curriculum which embodies scientific and engineering knowledge basic to the profession. To this core is added, in different proportions, the other ingredients of professional knowledge of both current and emerging technological processes and systems. With a proper balancing of the core, specialised and elective subjects and suitable integration of meaningful practical and field exercises and challenging project activity, the curriculum can, not only provide the students with relevant professional knowledge, but also develop in them the capacity to tackle unknown engineering problems and help them acquire sound. professional ethics and an awareness of their obligations to society.

In 1996 the AICTE initiated a program to upgrade the syllabi for undergraduate education in technical institutions in India. An exercise to develop detailed curricula which will serve as . a model for the institutions was taken up. The emergence, on the national scene, of several new engineering colleges added a sense of urgency to this effort. Since QIP Centres were already intimately involved with the curriculum development activities sponsored by AICTE, they were requested to undertake this important task.

I am glad that Model Curricula for various disciplines which are both dynamic and flexible and provide a proper balance in the teaching of basic sciences, social sciences and management, engineering sciences, technologies and their applications have been finalised. I am sure that this work will serve as a useful guide to the universities and institutions in framing their curricula.

I take this opportunity to express my deep appreciation for the valuable work done by the various members of the Expert Committees and the persons entrusted with the responsibility of co-ordinating the work in the respective disciplines.

(**Prof. N.C. Nigam**)

Chairman

All India Council for Technical Education

INTRODUCTION

All India Council for Technical Education (AICTE) has been entrusted with the responsibility of co-ordinated development of technical education system throughout the country. Uniform growth of technical education requires continuous up-gradation of Curricula for courses at all levels in Technical Education. This need is further accentuated by the emergence of a large number of self-financing institutions in technical education where faculty does not have sufficient expertise. In pursuance of clause 10(1) of AICTE Act and with an objective of bringing about uniformity in the curriculum of Engineering, AICTE has initiated a programme to come up with the syllabi for undergraduate education in technical institutions.

The broad strategies for framing the curricula included the study and analysis of the existing curricula followed in various institutions within the country and also the feedback received in various workshops involving faculty from different institutions. The draft Model Curriculum was discussed in a wide forum before coming up with the present version.

Based on the interaction and discussion with a number of experts the following recommendations were finalised.

The duration of a degree level course should be limited to 4 years/ 8 semesters of about 90 working days each.

- A common first year syllabus with sufficient emphasis on Hum. & Science and Management subjects shall be adopted for all branches of engineering.
- The contact hours per week should normally be kept at about 30 hours.
- Weightage of 15-20% shall be given to non-professional (Basic Sciences and Humanities) subjects and about 10% to Management subjects.
- Normally the curriculum should include a Major Project of minimum 8 credits in Final Year (2 credits in 7th semester and 6 credits in 8th semester). Emphasis should be given to industry sponsored projects.
- Wherever possible the students in 3^{rd} & 4^{th} year should be involved in group discussions on topics of current trends in Engineering & Technology. (No credit)
- There should be a continuous evaluation system. Various components of evaluation suggested are Teachers Assessment (TA), Class Tests (CT) also called minors in some of the institutions and End Semester Examination (ESE). To make the evaluation more objective, teachers assessment could be broken into various components like assignments, quizes, attendance, group discussions. Tutorials etc. Similarly marks of class Tests can be awarded by having at least two to three tests. These two components i.e. T A & CT put together would form the sessional components. End Semester Examination will have to be conducted by the Institute through concerned affiliating University, as per its regulations.
- On the basis of total marks (TA +CT +ESE) in each subject obtained, a letter grade

should be awarded where A = 10, B = 8, C = 6, D = 4, F = 0. Normally top 5 - 10% should be awarded 'A' Grade and last 5-10% 'F' Grade.

In order to evaluate grade point average for a semester the same could be done using the following illustration:

Subjects	L	T	P	Credit ={ L + (T +P)/2}	Grade Awarded
I	2	1	0	3	A
II	3	1	2	5	B
III	3	1	0	4	A
IV	3	1	0	4	B
V	0	0	3	2	C

Semester Grade Point Average = $\frac{3\,A + 5\,B + 4\,A + 4\,B + 2\,C}{3+5+4+4+2}$

= (30+40+40+32+ 12)/18 = 8.55

L : Lecture

T : Tutorial

P : Practical

- In order to meet the demand of changing trends and emerging areas a student be given a choice to choose subjects offered as electives which consist of a professional elective (PE) of '12' Credits and an open elective (non departmental elective) of' 8' Credits.
- Based on the recommendations a Model Curriculum has been framed. A model structure of the total courses to be undertaken by a student during his undergraduate program me :in Agriculture Engineering is shown in the subsequent tables. The institute may assign the course numbers depending upon the guidelines of the respective affiliating university.

This developmental exercise is underpinned by the philosophy that curriculum should transcend traditional instructional modes, embrace novel methods of teaching and enhance and embellish the learning process to produce quality engineers for the future. The success of the curriculum lies in its implementation. It is suggested that advantage be taken of modem technology by augmenting the role of a teacher with innovative audio-visual and digital teaching and learning aids. This curriculum is only a base line and institutions should aspire to develop over and above this. The development of this model curriculum

has been possible only through the sustained and dedicated efforts of a large number of faculty members from various institutions. The AICTE expresses its gratitude *to* them for contributing their time and expertise in this important national task. Suggestions to improve the quality of contents of this curriculum will be highly appreciated.

(**Prof. R.S. Nirjar**)
Member Secretary
All India Council for
Technical Education

COURSE STRUCTURE

BRANCH: Mechanical Engineering YEAR : I SEMESTER: I

(Common to all branches)

Sl. No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME					Credits
(THEORY)			L	T	P	SESSIONAL EXAM			ESE	SUB TOTAL	
						TA	CT	TOT			
1		Language (professional Comm. in English	2	1	-	15	10	25	50	75	3
2.		Engineering Chemistry	2	1	-	15	10	25	50	75	3
3.		Engineering Physics I	3	1	-	30	20	50	100	150	4
4.		Mathematics I	3	1	-	30	20	50	100	150	4
5		Engineering Mechanics	3	1	-	30	20	50	100	150	4
6.		Basic Electrical Engineering	3	1	-	30	20	50	100	150	4
(**PRACTICAL/DRAWING/DESIGN)**											
7.		Chemistry/Physics Lab. (To be taken in alternate weeks)	-	-	3	25	-	25	25	50	2
8.		Engineering Mechanics/ Electrical Laboratory	-	-	3	25	-	25	25	50	2
9.		Engineering Graphic I	-	-	3	25	-	25	25	50	2
10.		Workshop Practice – I	-	-	3	25	-	25	25	50	2
	GP-I	**GENERAL PROFICIENCY**						50	-	50	2
		Total	16	6	12					1000	**32**

TA- Teachers Assessment, CT- Class Test, ESE – End Semester Examination, Total Marks: 1000, Total Periods: 34, Total Credits: 32

BRANCH: Mechanical Engineering YEAR : I SEMESTER: II

(Common to all branches)

Sl. No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME					Credits
(THEORY)			L	T	P	SESSIONAL EXAM			ESE	SUB TOTAL	
						TA	CT	TOT			
1		Introduction to Computing	2	1	-	15	10	25	50	75	3
2.		Engineering Chemistry	2	1	-	15	10	25	50	75	3
3.		Engineering Physics II	3	1	-	30	20	50	100	150	4
4.		Mathematics II	3	1	-	30	20	50	100	150	4
5		Engineering Thermodynamics	3	1	-	30	20	50	100	150	4
6.		Basic Electronics	3	1	-	30	20	50	100	150	4
(**PRACTICAL/DRAWING/DESIGN)**											
7.		Basic Electronics Lab.	-	-	3	25	-	25	25	50	2
8.		Computer Programming Lab.	-	-	3	25	-	25	25	50	2
9.		Engineering Graphics II (M/C Drawing)	-	-	3	25	-	25	25	50	2
10.		Workshop Practice II	-	-	3	25	-	25	25	50	2
	GP-II	**GENERAL PROFICIENCY**						50	-	50	2
		Total	16	6	12					1000	**32**

TA- Teachers Assessment, CT- Class Test, ESE – End Semester Examination, Total Marks: 1000, Total Periods: 34, Total Credits: 32

BRANCH: Mechanical Engineering YEAR : II SEMESTER: III

Sl. No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME					Credits
(THEORY)			L	T	P	SESSIONAL EXAM			ESE	SUB TOTAL	
						TA	CT	TOT			
1		Numerical Analysis & Computer Programming (C, C++)	2	1	-	15	10	25	50	75	3
2.		Material Science	2	1	-	15	10	25	50	75	3
3.		Strength of Materials	3	1	-	30	20	50	100	150	4
4.		Fluid Mechanics	3	1	-	30	20	50	100	150	4
5		Applied Thermodynamics	3	1	-	30	20	50	100	150	4
6.		Mathematics-III	3	1	-	30	20	50	100	150	4
(**PRACTICAL/DRAWING/DESIGN)**											
7.		Numerical Analysis & Computer Programming (C, C++)	-	-	3	25	-	25	25	50	2
8.		Material Science	-	-	3	25	-	25	25	50	2
9.		Fluid Mechanics	-	-	3	25	-	25	25	50	2
10.		Applied Thermodynamics	-	-	3	25	-	25	25	50	2
	GP-III	**GENERAL PROFICIENCY**						50	-	50	2
		Total	16	6	12					1000	**32**

TA- Teachers Assessment, CT- Class Test, ESE – End Semester Examination, Total Marks: 1000, Total Periods: 34, Total Credits: 32

BRANCH: Mechanical Engineering YEAR : II SEMESTER: IV

Sl. No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME					Credits
(THEORY)			L	T	P	SESSIONAL EXAM			ESE	SUB TOTAL	
						TA	CT	TOT			
1		Mechanical Measurement & Metrology	2	1	-	15	10	25	50	75	3
2.		Industrial Engineering	2	1	-	15	10	25	50	75	3
3.		Advance Strength of Materials	3	1	-	30	20	50	100	150	4
4.		Kinematics of Machine	3	1	-	30	20	50	100	150	4
5		Manufacture Science-I	3	1	-	30	20	50	100	150	4
6.		Electrical Machine	3	1	-	30	20	50	100	150	4
(**PRACTICAL/DRAWING/DESIGN)**											
7.		Mechanical Measurement & Metrology	-	-	3	25	-	25	25	50	2
8.		Kinematics of Machine	-	-	3	25	-	25	25	50	2
9.		Manufacture Science-I	-	-	3	25	-	25	25	50	2
10.		Electrical Machine	-	-	3	25	-	25	25	50	2
	GP-IV	**GENERAL PROFICIENCY**						50	-	50	2
		Total	16	6	12					1000	**32**

TA- Teachers Assessment, CT- Class Test, ESE – End Semester Examination, Total Marks: 1000, Total Periods: 34, Total Credits: 32

BRANCH: Mechanical Engineering YEAR : III SEMESTER: V

Sl. No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME					Credits
(THEORY)			L	T	P	SESSIONAL EXAM			ESE	SUB TOTAL	
						TA	CT	TOT			
1		Management Science	2	1	-	15	10	25	50	75	3
2.		Product Development	2	1	-	15	10	25	50	75	3
3.		Machine Design I	3	1	-	30	20	50	100	150	4
4.		Dynamics of Machine	3	1	-	30	20	50	100	150	4
5		Manufacture Science II	3	1	-	30	20	50	100	150	4
6.		Heat & Mass Transformation	3	1	-	30	20	50	100	150	4
(**PRACTICAL/DRAWING/DESIGN)**											
7.		Machine Design I	-	-	3	25	-	25	25	50	2
8.		Heat & Mass Transfer/ Dynamics of Machine	-	-	3	25	-	25	25	50	2
9.		Manufacture Science II	-	-	3	25	-	25	25	50	2
10.		Computer Aided Drafting	-	-	3	25	-	25	25	50	2
	GP-V	**GENERAL PROFICIENCY**						50	-	50	2
		Total	16	6	12					1000	**32**

TA- Teachers Assessment, CT- Class Test, ESE – End Semester Examination, Total Marks: 1000, Total Periods: 34, Total Credits: 32

BRANCH: Mechanical Engineering YEAR : III SEMESTER: VI

Sl. No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME					Credits
(THEORY)			L	T	P	SESSIONAL EXAM			ESE	SUB TOTAL	
						TA	CT	TOT			
1		Project Management Business Mangement	2	1	-	15	10	25	50	75	3
2.		IC Engine	2	1	-	15	10	25	50	75	3
3.		Machine Design II	3	1	-	30	20	50	100	150	4
4.		Fluid Machinery	3	1	-	30	20	50	100	150	4
5		Automatic Control	3	1	-	30	20	50	100	150	4
6.		Refrigeration & Air-conditioning	3	1	-	30	20	50	100	150	4
(**PRACTICAL/DRAWING/DESIGN)**											
7.		IC Engine	-	-	3	25	-	25	25	50	2
8.		Machine Design II	-	-	3	25	-	25	25	50	2
9.		Fluid Machinery	-	-	3	25	-	25	25	50	2
10.		Refrigeration & Air-conditioning	-	-	3	25	-	25	25	50	2
	GP-VI	**GENERAL PROFICIENCY**						50	-	50	2
		Total	16	6	12					1000	**32**

TA- Teachers Assessment, CT- Class Test, ESE – End Semester Examination, Total Marks: 1000, Total Periods: 34, Total Credits: 32

BRANCH: Mechanical Engineering YEAR : IV SEMESTER: VII

Sl. No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME					Credits
(THEORY)			L	T	P	SESSIONAL EXAM			ESE	SUB TOTAL	
						TA	CT	TOT			
1		Computer Aided Design	2	1	-	15	10	25	50	75	3
2.		Numeric Control of Machine Tools and Robotics	3	1	-	30	20	50	100	150	4
3.		Automobile Engg.	3	1	-	30	20	50	100	150	4
4.		Open Elective I	3	1	-	30	20	50	100	150	4
5		Professional Elective -I	3	1	-	30	20	50	100	150	4
(**PRACTICAL/DRAWING/DESIGN)**											
7.		Computer Aided Design	-	-	3	25	-	-	25	50	2
8.		Numeric Control of Machine tools and Robotics	-	-	3	25	-	-	25	50	2
9.		Automobile Engg.	-	-	3	25	-	-	25	50	2
10.		Project - I	-	-	3	25	-	-	25	50	2
	GP-VII	**GENERAL PROFICIENCY**						50	-	50	2
		Total	16	6	12					1000	**32**

TA- Teachers Assessment, CT- Class Test, ESE – End Semester Examination, Total Marks: 1000, Total Periods: 31, Total Credits: 29

BRANCH: Mechanical Engineering YEAR : IV SEMESTER: VIII

Sl. No.	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME					Credits
(THEORY)			L	T	P	SESSIONAL EXAM			ESE	SUB TOTAL	
						TA	CT	TOT			
1		Power Plant Engg.	3	1	-	30	20	50	100	150	4
2.		Mechanical System Design	3	1	-	30	20	50	100	150	4
3.		Professional Elective -III	3	1	-	30	20	50	100	150	4
4.		Open Elective II	3	1	-	30	20	50	100	150	4
5		Professional Elective II	3	1	-	30	20	50	100	150	4
(**PRACTICAL/DRAWING/DESIGN)**											
6.		Project – II	-	-	12	100	-	100	100	200	6
	GP-VIII	**GENERAL PROFICIENCY**						50	-	50	2
		Total	**15**	**5**	**12**			**400**	**600**	**1000**	**28**

TA- Teachers Assessment, CT- Class Test, ESE – End Semester Examination, Total Marks: 1000, Total Periods: 32, Total Credits: 28

Total Credit of All the Four Year : 250

MODEL CURRICULUM AGRICULTURAL ENGINEERING

CONTENTS

ELECTIVE COURSES

OPEN ELECTIVES

ENGLISH FOR PROFESSIONAL COMMUNICATION

Objective of the Course

To impart basic skills of communication in English through intensive practice to the first year UG students of engineering so as to enable them to function confidently and effectively in that language in the professional sphere of their life.

Desired Entry Behaviour

The student must have some basic command of English that is must be able to:

- write reasonably grammatically
- understand (if not use) at least some 2500 general purpose words of English
- use some 2000 (at least 1500) general purpose words of English to express
- himself in writing and 1500 such words to talk about day-to-day events and experiences of life.
- understand slowly-delivered spoken material in Standard Indian English, and
- speak reasonably clearly (if not fluently) on routine matters with his fellow students.

Teaching Method

- The topics must be covered essentially through plenty of examples. Lecture classes must be conducted as lecture-cum-tutorial classes.
- It is a course that aims to develop skills. It is therefore "practical" in orientation. Plenty of exercises of various kinds must be done by the students both inside and outside the class-room.
- The teacher must not depend on a single or a set of two or three text books. He must choose his materials from diverse sources.
- Keeping in view the requirements of his students, the teacher may have to prepare some teaching and exercise materials.
- For practice in listening, good tape recorders can be used if the more advanced facilities (for example, language laboratory) are not available. In fact they can be used very fruitfully.
- The teacher must function as a creative monitor in the class-room.
- Minimum time should be spent in teaching phonetic symbols, stress, intonation, etc. The aim should be to enable the student to find out for himself the correct pronunciation of a word from a learner's dictionary. In teaching speaking, emphasis should be on clarity, intelligibility and reasonable fluency rather than no "correct" pronunciation of words. Classroom presentation and group discussion sessions should be used to teach speaking.

Some Key Concepts

Communication as sharing; context of communication; the speaker/writer and the listener/ reader; medium of communication; barriers to communication; accuracy, brevity, clarity and appropriateness in communication.

Writing

Selecting material for expository, descriptive, and argumentative pieces; business letters; formal report; summarizing and abstracting; expressing ideas within a restricted word limit; paragraph division; the introduction and the conclusion; listing reference material; use of charts, graphs and tables; punctuation and spelling; semantics of connectives, modifiers and modals; variety in sentences and paragraphs.

Reading Comprehension

Reading at various speeds (slow, fast, very fast); reading different kinds of texts for different purposes (for example, for relaxation, for information, for discussion at a later stage, etc.); reading between the lines.

Speaking

Achieving desired clarity and fluency; manipulating paralinguistic features of speaking (voice quality, pitch, tone, etc.); pausing for effectiveness while speaking; task-oriented, interpersonal, informal and semiformal speaking; making a short, classroom presentation.

Group Discussion

Use of persuasive strategies including some rhetorical devices (for emphasizing, for instance; being polite and firm; handling questions and taking in criticism of self; tum-taking strategies and effective intervention; use of body language.

Telephonic Conversation

Listening Comprehension

Achieving ability to comprehend material delivered at relatively fast speed; comprehending spoken material in Standard Indian English, British English and American English; intelligent listening in situations such as an interview in which one is a candidate.

Suggested Text Books & References

- Bhaskar W.W.S. and Prabhu N.S., "English Through Reading", Vol.-I & II**,** MacMillan, 1978.
- D'Souza Eunice and Shahani G., "Communication Skills in English", Noble Publishing House, 1977.
- Sharma RC. and Mohan K., "Business Correspondence and Report Writing", Tata McGraw Hill, New Delhi, 1994.
- Fiske John, "Introduction to Communication Studies", Rotledge London, 1990.
- Gartside L., "Model Business Letters", Pitman, London, 1992.
- Longman, "Longman Dictionary of Contemporary English", (or 'Oxford Advanced Learner's Dictionary of Current English', OUP), 1998.
- Numberg Maxwell, and Morris Rosenblum, "All About Words", General Book Depot, New Delhi, 1995.

ENGINEERING CHEMISTRY

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 heteronuclear 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 (Norrish 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 EDT A 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_2O_2 at room temperature (clock reaction).
- Heterogeneous equilibrium (determination of partition coefficient of acetic acid between n-butanol and water).
- Photochernical 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 HCI solution by titration against a standard NaOH solution).

Suggested Text Books & References

- "Blocks 1-5 of Chemistry Course", Indira Gandhi Open University, IGNOU, New Delhi, 1996.
- Alberty R.A. and Silbey R. J., "Physical Chemistry", John Wiley & Sons, Inc., Singapore, 1996.
- Cotton F.A., Wilkinson G. and Gaus P.L., "Basic Inorganic Chemistry", John Wiley

& Sons, Inc., Singapore, 3rd Ed., 1996.
- Graham-Solomon T.W., "Fundamentals of Organic Chemistry", John Wiley & Sons, Inc., Singapore, 1997.
- Odian T.W., "Principles of Polymerization", John Wiley & Sons, Inc., New York, 1981.
- Sykes P., "A Guidebook to Mechanism of Organic Chemistry", Longman Inc., New York, 1981.
- Dye J.R. r, "Application of absorption Spectroscopy of Organic Compounds", Prentice Hall of India, 1965.
- Williams D.H. and Fleming I., "Spectroscopic Methods in Organic Chemistry", Tata McGraw Hill Edition, New Delhi, 4th Ed., 1988.
- Atkins P.W., "Physical Chemistry", Oxford Univ. Press, 4th Ed., 1990.
- Pine S.H., "Organic Chemistry", McGraw Hill Book Co., New Delhi, 5th Ed., 1987.
- Sharma B.K., "Engineering Chemistry", Krishna Prakashan Media (P) Ltd., Meerut, 1996.
- Conn E.E. and Stumpf P.K., "Outlines of Biochemistry", Wiley Eastern Ltd., New Delhi, 4th Ed., 1985.
- Morrison R.T. and Boyd R.N., "Organic Chemistry", Prentice Hall of India, 6th Ed., 1992.
- Rao C.N.R. and Agarwala U.c., "Experiments in General Chemistry", East-West Press, New Delhi, 1969.
- Furnis B.S., Hannaford AJ., Smith P.W.G. and Tatchell A.R., Vogel's "Textbook of Practical Organic Chemistry", ELBS, 5th Ed., 1989.
- Vogel's "Textbook of Quantitative Analysis", Longman, New York, 4th Ed., 1978.
- Elias A.R., Sundar Manoharan S. and Raj R., "Laboratory Experiments for General Chemistry", I.I.T. Kanpur, 1997.

ENGINEERING PHYSICS-I

Theory of Relativity

Inertial frame of reference, Noninetrial frames and ficititious 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 by 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

- Jenkins and White," Optics", McGraw-Hill Book Company.

- Mathur D.S., "Mechanics" •
- Saha and Srivastava" A treatise on heat"
- Singh R.B. "Physics of Oscillations and Waves"
- Ghatak A.K. "Optics"

MATHEMATICS - I

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 extreme 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

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

ENGINEERING MECHANICS

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 Surfaces

First moment of an area and centroid, second moment and product of area of 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

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

BASIC ELECTRICAL ENGINEERING

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 c1nd 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 Celebrate a test (moving iron) ammeter and a (dynamometer) wattmeter \\ith respect to standard (DC Pi\1MC) 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 b\' (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 (OCC) 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

- Hughes Edward (revised by Ian McKenzie Smith), II Electrical Technology", Seventh Edition, English Language Book Society Publication with Longman, 1995.

- Del Torro, Vincent "Electrical Engineering Fundamentals", Second Edition, Prentice Hall of India Pvt. Ltd., 1994.
- Cotton, H., "Advanced Electrical Technology", Issac Pitman, London, 1967.
- Wildi, Theodore "Electrical Machines, Drives and Power Systems", Second Edition, Prentice Hall, 1991.
- Cogdell, J R "Foundations of Electrical Engineering", Second Edition, Prentice Hall, 1996.
- Parker Smith S. (Ed. Parker Smith N N), "Problems in Electrical Engineering", Tenth Edition, Asia Publications, 1995.

ENGINEERING GRAPHICS-I

General

Importance, Significance and scope of engineering drawing, Lettering, Dimensioning, Scales, Sense of proportioning, Different types of projections, Orthographic projections, B.1.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 planes 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

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

WORKSHOP PRACTICE I & II

Carpentry

Timber, definition, engineering applications, seasoning and preservation, plywood and plyboards.

Foundry

Moulding sands, constituents and characteristics. Pattern, definition, materials, types, core prints. Role of gate, runner, riser, core and chaplets. Causes and remedies of some common casting defects like blow holes, cavities, inclusions.

Metal Joining

Definitions of welding, brazing and soldering processes, and their applications. Oxy-acetylene gas welding process, equipment and 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 weld joint. Common welding defects such as cracks, undercutting, slag inclusions, porosity.

Metal Cutting

Introduction to machining and common machining operations. Cutting tool materials. Definition of machine tools, specification and block diagram of lathe, shaper, drilling machine and grinder. Common lathe operations such as turning, parting, chamfering and facing. 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 forged parts.

List of Jobs to be Made in the Workshop Group A

1.T-Lap joint and Bridle joint	(Carpentry shop)	4 hrs
2.Mould of any pattern	(Foundry shop)	2 hrs
3.Casting of any simple pattern	(Foundry shop)	2 hrs

Group B

1.	(a) Gas welding practice by students on mild steel flat	2 hrs
	(b) Lap joint by Gas welding	
2.	(a) MMA Welding practice by students	2 hrs
	(b) Square butt joint by MMA Welding	
3.	(a) lap joint by MMA Welding	1 hr
	(b) Demonstration of brazing	1 hr
4.	Tin smithy for making mechanical joint and soldering of joints.	2 hrs

Group C

1. Job on lathe with one step turning and chamfering operations.	2 hrs
2. Job on shaper for finishing two sides of a job.	2 hrs
3. (a) Drilling two holes of size 5 and 12 mm diameter on job used/ to be used for shaping	
(b) Grinding a corner of above job on bench grinder	2 hrs
4.Finishing of two sides of a square piece by filing	2 hrs

Suggested Text Books & References

- Begeman, M.L. and Amstead, B.H. "Manufacturing Process", John \Viley, 1968.
- Chapman, W.A.J. and Arnold, E. "Workshop Technology", Vol I & III, Viva Low Priced Student Edition, 1998.
- Raghuwanshi, B.S. "Workshop Technology", Vol. I & II, Dhanpat Rai and Sons,

1998.
- Chaudhary, Hajra "Elements of Workshop Technology", Media Promotors & Publishers, 1997.
- Crawford, S. "Basic Engineering Processes", Hodder & Stoughton, 1985.

INTRODUCTION TO COMPUTING

Introduction

Introduction to the computer devices such as keyboard, mouse, printers, disk, files, floppies, etc.

Concept of computing, contempory, ass 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 3equentially 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 or 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 and even numbers, etc.

Suggested Text Books & References

- Kernighan, *B.\N.*, "The Elements of Programming Style", rv1cgraw-HiIL
- Yourdon, E., "Techniques of Program Structures and Design", Prentice-Fiali
- Press, W.H., Teukolsky, S.A., Vetterling, W.T., & Flannery, B.P., " Numerical Recipies in Fortran", Cambridge university press.
- Gotterfried, B.S. "Schaum's Outline of Theory & Programming With Basic", McGraw Hill, New Delhi.
- Schied, F.S., "Theory and Problems of Computers & Programming", McGraw Hill, New Delhi.

ENVIRONMENT AND ECOLOGY

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

- Masters, C.M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd., 1991.
- Nebel, B.J., "Environmental Science", Prentice-Hall Inc., 1987.

- Odum, E.P, "Ecology: The Link Between The Natural and Social Sciences", IBH Publishing Com. Delhi.

ENGINEERING PHYSICS-II

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 faraday’s law Magnetism in materials ,Maxwell's equation lls, Electromagnetic Waves.

Thermoelectricity

Seebeck effect, law of successive temperatures law of intermediate metal 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

- Rangwala and Mahajan "Electricity and Magnetism", Tata McGraw Hill, 1998.
- Verma, H.C, "Concepts of Physics, Part-2", Bharati Bhawan (P&D), 1998.

- Beiser, "Modern Physics", McGraw-Hill Inc., New York, 1995.
- Mani and Mehta, G.K., "Modern Physics", Affiliated East-West Press Pvt. Ltd, 1998.

MATHEMATICS - II

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 non homogenous 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 and average operators and relations between them. Newton's forward and backward interpolation. Lagrange interpolation and the error formula for interpolation. Numerical dl Herenhahonana. integration - Trapezoial rule and Simpson's one-third rule including error formulas.

Suggested Text Books & References

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

ENGINEERING THERMODYNAMICS

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 Tds 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 Spalding, D. B. and Cole, E.H., "Engineering Thermodynamics", Edward Arnold, 1959.Hawkins, G.A., "Engineering Thermodynamics", John Wiley and Sons, 1955.Van Wylen, G. J. and Sonntag, R.E., "Fundamentals of Classical Thermodynamics", John Wiley and Sons, 4th edition, 1997.Nag, P.K., "Engineering Thermodynamics", Tata McGraw Hill, 2nd edition, 1998.

BASIC ELECTRONICS

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, TRI AC,DIAC, injunction transistors, IGBT. Cathode Ray Oscilloscope Introduction ll, Cathode ray tube theom & 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 Vs Analog instruments, Recorders- Analog recorders, graphic recorders, stripchart 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

- Robert Bovlestad & Louis Nashelskv, "Electronic Devices & Circuit Theory'. Prentice Hall of India.

- Milliman & Halkias, "Basic Electronics Principle".
- Sawhney, A. K., "Electrical & Electronics Measurement and Instrumentation", Dhanpat Rai & Sons.

ENGINEERING GRAPHICS-II

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

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

NUMERICAL ANALYSIS & COMPUTER PROGRAMMING

(C, C++)

1. 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 Gauss Elimination and Gauss- Siedel iteration methods.

Curve fitting- linear and nonlinear regression analysis.

Backward, Forward and 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 data types, 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.

Lab

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

- Shastry, S.S., "Numerical Methods", Prentice Hall Inc., India, 1998.
- Noble Ben, "Numerical Methods", New York International Publication, New

York 1964.

- Stanton Ralph G., "Numerical Methods for Engineering", Englewood Cliffs N.J., Prentice Hall Inc., 1961.
- Buckingham RA., "Numerical Methods", Sir Isaac Pitman Sons. Ltd., London 1957.
- Bakhvalov, N.S., "Numerical1vlethods", Mir. Pub., Moscow, 1977.
- Crewal, B.S., "Numerical Methods", Khanna Pub., New Delhi, 1998.
- Sudhit Kaicker, "The Complete ANSI C", BPB Publications, New Delhi, 1996.
- Kernighan, B.W. and D.M. Ritchie, "The C Programming Language", Prentice Hall of India, 1998.
- Byron, S. Gottfreid, "Programming with C", Tata McGraw Hill, 2nd edition 1998.

MATERIAL SCIENCE

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, normalising. Electrical, magnetic and optical properties of materials. Surface treatment processes

Engineering materials

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

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

Suggested Text Books and References

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

STRENGTH OF MATERIALS

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

• . Ramamurtham, S, "Strength of Matreials", Dhanpat Rai & Sons, 1991

- Popov, E.P., "Mechanics of Materials", Prentice Hall Inc., 1984
- Andrew, P. and Singer, F.L., "Strength of Materials", Happer & Row Publishers, New York, 1987

FLUID MECHANICS

Introduction

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

Fluid static's General differential equation, Hydrostatics manometry; Force on planed 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 ~thout 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.

Suggested Text Books & References

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

APPLIED THERMODYNAMICS

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 dlart 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; i'vlaxwcl1's relations; Enthalpy, entropy, internal energy, and specification, 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.

Suggested Text Books & References

- Wylen, G. Van, Sonntag, R, & Borgnakke, C., "Fundamentals of Classical Thermodynamics:', John Wiley & Sons/New Age International, Delhi.
- Nag, P. K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi
- Cengel, Y. A., & Boles, M. A., "Thermodynamics - An Engineering Approach", McGraw-Hill Inc.
- Spalding, D. B. and Cole, E.H., "Engineering Thermodynamics", Edward Arnold, 1959.
- Hawkins, G.A., "Engineering Thermodynamics", John Wiley and Sons, 1955.

- Wylen Van, G. J. and Sonntag, R.E., "Fundamentals of Classical Thermodynamics", John Wiley and Sons, 4th edition, 1997.
- Nag; P.K., "Engineering Thermodynamics", Tata McGraw Hill, 2nd edition, 1998.

MATHEMATICS-III

Fourier Series

Fourier series, Half-range series, Harrionic 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; Fxponenhal, 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

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

- Npiskunov, S. "Differential and Integral Calculus", Vol. I & II, Mir Publishers, Moscow, 1979.
- Churchill, R.V., "Fourier Series and Boundary Value Problems", McGraw Hill, 1963.
- Sneddon, LN., "Fourier Transforms", Mc Craw Hill, 1951.
- Churchill, Brown and Verhey, "Complex Variables and Applications" McGraw Hill, 1997.
- LePage, W.R., "Complex Variables and The Laplace Transform for Engineers",

McGraw Hill, 1961.
- Markushevich, A.I., "The Theory of Analytic Functions", Mir Publishers, Moscow, 1983.

MECHANICAL MEASUREMENTS & METROLOGY

I. MECHANICAL MEASUREMENTS

Introduction

Introduction to measurement and measuring instruments, Generalized 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, temperatiul 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 uses 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.

Suggested Text Books & References

- Beckwith Thomas *G.,* "Mechanical Measurements", Narosa Publishing House ,N. Delhi
- Doeblein, E. 0., "Measurement Systems, Application Design" ,McGraw Hill, 1990
- Kumar, D. S., " Mechanical Measurements and Control", Metropolitan, N. Delhi.
- Humc, K.] .,"Engineering Metrology", MacDonald and Co. 1963.
- Gupta, I.E., " Engineering Metrology", Dhanpat Rai & Sons, New. Dclhi,1994

INDUSTRIAL ENGINEERING

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 cvcles 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 vvage or incentive system, Methods of wage payment. Concept of wage incentive schemes; financial and non financial; Halsely premium plan; rvlerric's Multiple piece rate system.

Concept of New Techniques

Scheduling through Network C.P.M and P E R T; 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

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

second Edition, 1972.

ADVANCED STRENGTH OF MATERIALS

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 subject (Id to symmetric loading.

Torsion of non-circular members, St.Venant's theory, Torsional stresses in elliptical triangular shafts, Approximate solutions for rectangular section, Membrane analog,

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

- Boresi, A.P., and Sidebottom, O.M.," Advanced Mechanics of Materials". John Willey and Sons, 1985.
- Srinath, L.S., " Advanced tv1echanics of Materials", 1952.
- Seeley, F.B.and Smith, J.O, " Advanced ~1echanics of Materials", 1952.
- Richard, G.Budynas, "Advanced Strength and Applied Stress Analysis", McGraw Hill, New Delhi,1999.

KINEMATICS OF MACHINE

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

Banet 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 cOlL'1ecting 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 cam followers, consideration of pressure angle and wear, analysis of motion of follower for carns with specified contours.

Gyroscope

Principles of gyroscopic couple, effect of gyroscopic couple and centrifugal force on vehicle taking a turn, stabilisation 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.

Suggested Text Books & References

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

MANUFACTURE SCIENCE I

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. i\1eIting 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 mechamsm. Description of cutting processes like blanking, piercing, lancing etc. Description of forming processes like bending ,cup dr,Hving, 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 Power Metallurgy .

Manufacturing of plastic components.

Suggested Text Books & References

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

ELECTRICAL MACHINE

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 Moters.

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 torgue 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.

Suggested Text Books and References

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

MANAGEMENT SCIENCE

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

- Kotler Philip," Marketing Management', Prentice Hall of India 1997.
- Luthans Fred/' Human Resource Management', McGraw Hill, Inc. 1997.
- Stephen, P. Robbins/' Organizational Behaviour Concepts, Controversies and Applications", Prentice Hall, Englewood, Cliff", New Jersey,1989.
- Khan, M.Y, and Jain, P.K, "Financial Management", Tata McGraw Hi11,1997.
- Porter Michael, "Competitive Advantage", The Free Press,1985

- Porter Michael, "Competitive Strategy", The Free Press,1985
- Bhusan, Y.K, "Fundamentals of Business Organisation and Management", Chand S. and Sons,1998.
- Ahuja, KK," Industrial Management', Khanna Publishers,1998.

PRODUCT DEVELOPMENT

Background for design, design theory, design materials, human factors in design, applied ergonomics, product development processes and organisations, 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 prototyping - 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

- Chitale & Gupta, "Product Development", Tata Mc Craw Hill
- Monks, J.G., "Operations Management", Mc Grow Hill, 1977
- Francis, R.L., and White, J.A., "Facility Layout and Location", Prentice Hall, 1974.

MACHINE DESIGN I

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.

Suggested Text Books & References

- Shigley and Mische, "Mechanical Engineering Design", Me Craw Hill, 1992
- Robert, L. Mott, ":tv1achine Elements in Mechanical Design", Macmillan Publishing Co., London, 1992
- Bandari, V.B., "Design of Machine Elements", Tata Me Craw Hill, 1995
- Sundararajamoorthy, T.V., and Shanmugam, N., "Machine Design", Khanna Publishers, Delhi, 2000

DYNAMICS OF MACHINES

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.

Suggested Text Books & References

- Thomson, W.T., "Theory of Vibration with Applications", CBS Pub. and Distributors, 3rd ed., 1988
- Tse, Morse and Hinkle, "Mechanical Vibration", Prentice Hall of India Ltd., 1987

MANUFACTURE SCIENCE II

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 obl~que 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 and cylindrical grinding, their constructional details and processes.

Surface finishing

Honing, lapping, super finishing, 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.

Suggested Text Books & References

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

HEAT AND MASS TRANSFORMATION

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, Fffect 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 flovv heat exc ha n gl'r.

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 problem5. 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 Ian 'qar and turbulent convection Combined heat and mass transfer, the wet and drv ,,[) thermometer.

Suggested Text Books & References

- Kothandaraman, CP., "Fundamentals of Heat and Mass Transfer", Second Edition, New Age International Publishers, Chennai, 1997
- Sachdeva, KC, "Fundamentals of Engineering Heat and Mass Transfer", New Age International Publishers, New Delhi, 1996
- Holman, J.P., "Heat Transfer", Tata McGraw Hill Book Company, 1988

PROJECT MANAGEMENT & BUSINESS MANAGEMENT

I. PROJECT MANAGEMENT

Concept of Project, Types of project, Project life cycle

Project identification and 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 uncertainty 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 sources 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 cost 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 - types - 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, difference / relationship between HRM & personnel management, strategic human resource management; Relationship with other departments, Labor relation, Trade union, Employees union, Disputes and methods 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 functions, 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 economy. Directive principles of state policy (DPSP), Government policies - Economic, commercial, banking, fiscal, monetary, industrial and technological policy; Theory of national income, Determination, Economic fluctuation, Stabilization.

Suggested Text Books & References

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

IC ENGINE

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

S.I. Engines

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. Engines

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.

Compressors

Centrifugal and axial *type* Performance

Gas Turbine

Introduction, ideal cycles, regeneration reheating and intercooling, closed and open cycles, operating variables. Jet propulsion, Principles, turbojet and turboprop Engines Suggested Text Books & References

- Ganesan, V., "Internal combustion Engine", Tata McGraw Hill, New Delhi 1995
- Colin, R. Ferguson, "Internal Combustion Engines", John Wiley and Sons, 1986
- Edward, F. Obert, "Internal Combustion Engines", Interscience Publishers, 1971

MACHINE DESIGN II

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, bevel & warm gears. Bearing reactions due to gear tooth forces. Detailed design of the fixed ratio gear boxes.

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

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

Suggested Text Books & References

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

FLUID MACHINERY

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 Principle of operation- regulation 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 a pp I ica tions-characteristics

Suggested Text Books & References

- Kothandaraman, C.P., and Domkundwar, 5., "Thermal Engineering", Dhanpat Rai and Sons, Delhi 1989
- Govinda Rao *NS.*, "Fluid Flow Machines", Tat McGraw Hill Publishing Company Ltd., 1983
- Edward, F. Obert., "Internal Combustion Engines", International Text Book Company, Pennsylvania, USA, 3[IJ] Edition, 1970
- Banal, R.K., "Fluid Mechanics and Hydraulic Machines", Lakshmi Publications, 1993

AUTOMATIC CONTROL

Introduction

Meaning and need of automation, Types 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, synchros. **Vision systems;** Components of vision systems, image, camera, image capturing systems. processing systems Bar coding and other identification systems. **Controllers;** Digital and analog control, open and closed loop control, servosystems, servosystem analysis and response, control configuration.

Logic control and PLCs

Logic control, logic control elements, Programmable logic controllers: Applications, architecture, operation, and programn1ing of PLCs. Typical applications.

Automated material handling systems

Automated flowines, transfer mechanisms, conveyors, robots, Automated guided vehicles; categories, guidi11lCe 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 & References

- Morriss, S. Brian, "Automated Manufacturing Systems", Glanncoe Mcgra, International Series, 1995.
- Groover Mikell "Automated Production Systems, and Computer Integrate Manufacturing" / PHI, 1992
- Boothroyd, G. and Poli. C "Automated Assembly", Marcel Dekker, New' York/1982.
- David Bed worth, et a1., Computer Integrated Design and Manufacturing McGraw Hill 1991

REFRIGERATION AND AIR-CONDITIONING.

Refrigeration and heating systems

Air Refrigeration systems; Bell Coleman air refrigeration cycle. Air craft airconditioning 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 vapor 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 compressors, condensers, evaporators, Expansion devices: Purpose; capillary tubes and their selection; design of capillary tube; choked flow; thermostatic ex pansion valve, electric expansion valve; float valves.

Retype
58

- Stocker,"Refrigeration and Air Conditioning", Tata McGaw Hilll Publishing Company Ltd., 1981

COMPUTER AIDED DESIGN

Computer graphics hardware - interactive input and output devices, graphics software, output primitives and their attributes, line drawing and ellipse generating (Algorithms, interactive picture construction techniques, 2D geometric transformations, window, view port and clipping, 3D display methods, 3D object representation - 13ezier curves and splines, 3D geometric and modeling transformations, 3D viewing, wireframe, surface and solid modeling, kinematic analysis of open and closed loop mechanisms

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

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

Suggested Text Books & References

- Ibrahim Zeilt "CAD/CAM Theory and Practice", Tata McGraw-Hil1, F)9S
- Michaet E. Mortenson, "Geometric Modeling", John Wiley and Sons, Inc Second Edition, 1997.

NUMERIC CONTROL OF MACHINE TOOLS AND ROBOTICS

I. NUMERIC CONTROL:

Introduction to numerical control components, axes of NC machine tools, open and close loop control, actuation and feedback systems. Point to point, lined and contouring systems. Tooling for NC systems. Steps in NC manufacturing. Machining and turning centers and their features. A TC and APC.

NC programming: Input media and coding formats. Jv1anual part programming for lathe, drilling and milling machines, cutter diameter and length compensation. Computer assisted part 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.

Suggested Text Books & References

- Koren Yorem, "Computer Control of Machine Tools".
- Grover, M.P. and Zimmer, J.R., "CAD/CAM", Prentice Hall of India.
- Kundra, T.K. Rao and Tiwari, N.K., " Numerical Control and Computer Aided"

AUTOMOBILE ENGINEERING

The Automobile

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

Automobile Engines

Requirements 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 epicyclic 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 and 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, heel 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 or battery, capacity and efficiency, 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, ste1rting and generating circuit, solenoid switches.

Wiring for Auto Electrical Systems

Wiring diagrl1ms of typical wiring systems and wire loops.

Suggested Text Books & References

- Crouse," Automotive' Mechanics", Tata McGraw Hill 1979.
- Crouse," Automotive Transmission and Power Train", McGaw Hill, 1967.
- Crouse, Automobile Chassis and Body", McCraw-Hill,1967
- McGrath, Automobile transmission and Drive Line, 1961.
- Ellinger," Aeromechanics" :1972

POWER PLANT ENGINEERING

Introduction

Power and energy, sources of energy, review of thermodynamic cycles related to power plants, fuels and combustion, steam generators and steam prime movers, steam condensers, water turbines.

Variable

Load problem: industrial production and power generation compared, ideal and realised 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 element, customer element and investor's profit; depreciation and replacement, theory of rates.

Economics of plant section 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 handing system, combustion system, draft, ash handling system, feed water treatment and condenser and cooling system, turbine auxiliary systems such as governing feed heating, turbine mountings, 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 system, diesel plant operation and efficiency, heat balance, trouble shooting and remedies.

Gas turbine power plant:

Elements of gas turbine power plants, regeneration and reheating, cogeneration auxiliary systems such as fuel, controls and lubrication, operation and maintenance performance and trouble 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 systems, 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 & References

- "Power Plant Engg" .:p.t.morse, Affiliated East-West Press Pvt. Ltd; New Delhi Madras.
- Verma Mahesh ,"Power Plant Engg" , Metropolitan Book Company Pvt. Ltd New Delhi
- "Modern Power Station Practice", Central Electricity Generating Board(UK)vol.l to 7
- "Power Plant Technology", Vakil

MECHANICAL SYSTEMATIC DESIGN

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

Specifications of the components of engineering system

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

Systems will be selected out of the following:

a) Material handling and transportation systems

a) A system power plant

(i) Boiler (ii) Condenser (iii) Turbine(steam)

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 & References

- Kent's Mechanical Engineers Handbook
- Mark's Mechanical Engineers Hand Book
- Rothbart Mechanical Engineering HandBook
- ASHRAE Guide
- P.S.G Design Data Books
- Hestnut, H., "System Engineering Tools"
- Astrom & Wittenmark, "Computer Controlled Systems"

LIST OF SUGGESTED OPEN ELECTIVES

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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 Electives

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 Resource Planning
24. Industrial Design
25. Personnel Management
26. Financial Management and Accounting

Note: The Institutions Can Frame Syllabi of Professional Electives and 0 electives to be offered by them in the particular area.

Professional Electives:

FINITE ELEMENT ANALYSIS

Introduction

Structural analysis objectives, static, dynamic and kinematic analyses, 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

Discretization of the domain, basic element shapes, aspect ratio, shape functions, 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 integration, one and 2D applications

Higher Order and Isoperimetric Elements

One dimensional quadratic and cubic elements, use of natural co-ordinate system, area co-ordinate system continuity and convergence requirements, 2D rectangular and triangular requirements

Static Analysis

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

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 & References

- Rao, 5.5., "The Finite Element Method in Engineering", 2nd ed .. , Peragamon Press, Oxford, 1989
- Robert, D. Cook., David, S. Malkins, and Michael E. Plesha, "Concepts and Application of Finite Element Analysis", 3rd ed., John Wiley
- Chandrupatla, T.R. an Belegundu, A.D., "Introduction to Finite Elements in Engineering", Prentice Hall of India Pvt. Ltd., 1991

VIBRATION ENGINEERING

Introduction

Harmonic motion, periodic motion, vibration terminology

Single Degree of Freedom Systems

Free and forced vibrations 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), untuned viscous damper.

Multi Degree of Freedom Systems

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

Torsional Vibration

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

Vibration of Continuous Systems

Vibrating string, string, longitudinal vibration of rods, torsional vibration of rods, Euler equation for beams.

Signature Analysis and Preventive Maintenance

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

Suggested Text Books & References

- Thomson, W.T., "Theory of Vibration with Applications", CBS Pub. And Distributors,3rd ed., 1988
- Tse, Morse and Hinkle., "Mechanical Vibration", Prentice Hall of India Ltd., 1987
- Schaum Outline Series., "Mechanical Vibration", McGraw Hill Book Company, 1990
- Lindley and Higgins., "Maintenance Engineers Hand Book", McGraw Hill Book Company, 1977

MACHINE TOOL DESIGN

Introduction

Kinematics of different types of machirle 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 screwsguide 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:

- Mehta, N. K., "Machine Tool Design" Tata McGraw hill Book Co. 1991.
- "ANSYS 5.0 Manual" Swanson Associates, USA, 1993.
- 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 servo systems, electrohydraulic servosystems, proportional valves, application for hydraulic servo systems, maintenance of hydraulic systems.

Sequential circuit design

Sequencing 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 pipes, 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, selections of elements, sizing of pipes, design of power packs.

Design of electrical sequencing circuits

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

Suggested test books and references:

- Esposito, "Fluid Power with Application", Prentice Hall Inc., 1988.
- Lal Anthony, "Oil Hydraulics in the Service of Industry", Allied Publishers, 1982.

EXPERIMENT At MECHANICS

Elementary elasticity

Stress, stress equations of equilibrium, principle stresses, stress strain relations, principal 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 moire fringe analysis, displacement field approach to Moire fringe analysis, out of plane: measurements experimental procedure.

Photo elasticity methods

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

Two dimensional photo elasticity

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

Three dimensional photo elasticity

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

Birefringent coatings

Coating stresses and strains, sensitivity, materials and applications, effects of thickness, stress separation.

Suggested Test Books and References:

- Dalley James and Riley, W. F., "Experimental Mechanics" lnt. student edition McGraw Hill Kogakusha Ltd., 1992.
- Adams Dove, "Experimental Stress Analysis", Prentice Hall Inc. 1965.
- Perry and Lissiener, "Strain Gauge Primer", McGraw Hill, 1%5.
- 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 equipments.

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 mapping 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, combinational 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 cylinders, 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

- Werner Deppert and Kurt Stoll, "Pneumatic Control" Vogel Buch Wurzbutg, 1987.

- Werner Deppert and Kurt Stoll, "Pneumatic Application" Kemprath Reihe, Vogel Verlag, 1976.
- 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 compu ters 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 2-D and 3-D viewing transformation, scan conversion, clipping, hidden lime elimination, rendering, shading and animation.

Design Data base

Concept, objectives, data structures, creation of data files and accessing data files 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 ICES files, blocks, parametric programming, Customization of drafting packages and graphic standards.

Modelling

Schemes for representing solid objectives, construction solid geometry and boundary representation, features of sol id modeling packages, modelling of curves and surfaces, techniques 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, kinematic", and dynamic analysis, post processing and simulation

Concurrent Engineering Product data Management - Concurrent Engineering

Suggested Text Books and References:

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

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 MHO systems. Suggested Text Books and References

- Garg, HP. and Prakash, J., "Solar Energy-Fundamentals and Applications", Tata McGraw Hill Ltd. New Delhi, 1997.
- Sukhatme, 5. P., "Solar Energy", Tata McGraw Hill . Publisi ng Company Ltd. 1989.
- Duffie and Beckman, "Solar Energy Thermal processes", John Wiley, 1974.
- Sutton, "Direct Energy Conversion," McGraw Hill, 1966.

AUTOMATIVE CHASSIS AND TRANSMISSION

Types of Automobiles

The scope for automobile industries in India, 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 System

Objectives and characteristics, quarter, semi and three quarter elliptic leaf springs, helper springs, torsion bar, coil springs, linked 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 inclination, 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 ply tyres- tyres specification tyre wear and maintenance.

Transmission Line

Card an shaft, universal joints, constant velocity joints, rear axle, types of live rear axle, quarter, semi and three quarter floating axles, two speed axles, hub reduction axles, Tandem axles, differential and differential lock.

Braking System

Principal 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, varia tor 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 converters, crash studies and safety analysis.

Newer Materials and Surface Treatments

Materials, Composite materials, 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

- Newton and Steeds, "The Motor Vehicle", ELBS, 1989 "
- Martin, W. Stockel, and Martin, T. Stockel, "Auto Mechanics Fundamentals, The Good Heart Wilcox Co. Inc., 1982.
- Course, W H "Automobile Chassis and Bodies", McGraw Hill Book Company,5th Edition, 1976. .
- Course, W H "Automotive Electrical Equipment", McGraw Hill Book Company 5th Edition, 1976.

PUMPS, FANS BLOWERS AND COMPRESSORS

Pumps

Theory of centrifugal pump impeller, vertex theory, design of impeller, volute and diffusers, specific speed and design 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 Fans

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:

- Val, S. Lobanoff, and Robert, R. Ross, "Centrifugal Pumps Design and Application", Jaico Publishing House, Madras, 1996.
- Allam Wallis, R., "Axial Flow and Ducts", John Wiley & Sons, 1983.
- 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 liquifiers, 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 demagnetisation

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 Liquified 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:

- Guy, K. White, "Experimental Techniques in Low Temperature Physics", Clarendon Press, Oxford, 1987
- Marshall Sitting and Stephen Kidd, "Cryogenics Research and Applications", D. Van Nostrand Company, Inc USA, 1963

- "Advances in Cryogenic Engineering" , Proceedings of Cryogenic Engineering Conference, Vol 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 shaping, disc type and rack type gear shapers, description of machine, types of green cut, gear shapers cutter.

Production of Conical Gears:

Production of straight bevel gears and spiral bevel gears, milling, generation by straight bevel gear generator. Duplex cutter, straight bevel gear generator, Gleason Reva 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, profile errors, pitch error measurement.

Composite error measurement. Computerized gear inspection centres. Reasons and remedies for gear errors.

Modem 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:

- HMT, "Production Technology", THM, India, 1992.
- Watson, "Modem Gear Pergaman Press", Oxford, 1984.
- Weck, M., "Handbook Tools", Vol. I, John Wiley and Sons, 1984.
- 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 softwares.

Product Development Through CAD And CAE

Geometric modeling techniques, 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, capabilities of a typical NC CAM 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 issues, configurations management, database systems, management of technology, networking concepts, LAN, MAN and WAN, SQL fundamentals, MAP / TQP fundamentals, CIM models, IBM Siemens, DEC, ESPRIT -CIM OSA model, economics of CIM, implementation of CIM.

Suggested Text Books and References:

- Radhakrishnan, P., "Computer Integrated Manufacturing", Deptt. of Mechanical & Production Engineering, PSG College of technology. 1992
- Eric Teichols and Joel Orr, "Computer Integrated Manufacturing Hand Book", McGraw Hill Book Co. 1989.
- Paul, G. Ranky, " Computer Integrated Manufacturing", 1985.

COST ESTIMATION AND OPTIMISATION

Cost Accounting-Cost Estimation

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

Labour and Materials Costs

Labour cost-direct-Indirect, Estimation Labour cost variance -Material cost-DirectIndirect, 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 Calculations

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 methods 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

- Frederic, C., Jelen, C., and James, H. Black., "Cost and Optimization Engineering", McGraw Hill International Book Company, New Delhi, 1983.
- Narang, C. B. S. and Kumar, V., "Production and Casting", Khanna Publishers,New Delhi, 1985.
- Samuel Eilon, "Elements of Production and Control", MacMillan, 1985.
- ASME, "Manufacturing Planning and Estimation-Hand Book", McGraw Hill Book Company Inc. 1963.
- 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 to Reliability/Failure Concepts

An introduction to reliability, definition of reliability and failure, bath-tub 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-tub curve, redundancy and standby redundancy.

Methods of Lubrication:

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

Introduction to Vibration Analysis

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

Contaminant Analysis

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

Failure Analysis

Plain bearing failures, rolling element bearing failures, gear 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

- Gandhi, A. P., and Chawla, A.P., "Reliability, Availability and Maintainability", IIT Delhi, 1997.
- Collacot, R. A., "Mechanical Fault Diagnosis and Condition Monitoring", Chapman and Hall, London, 1977.
- "Reliability Based Maintenance", Computational System Inc., Houston, USA, 1993.
- 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 Equations, Procedure for writing state equations, Node equations, Loop equations, Laws governing node and loop equations, Electrical equivalents for Mechanical Systems.

Analog Control Systems

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

Stability Conditions

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

Electronic Components

Switches, types, 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, others controls, CNC machines, controls of CNC machines applications.

Suggested Text Books and References:

- Cooper, W. D., and Helfrick, A. D., "Electronic Instrumentation and Measurement Techniques" ,3rd Edition, 1979.

- Benjamin, C. Kuo, " Automatic Control System", Prentice Hall, New Delhi, 1992.
- John, D. Lenk, "Complete Guide to Video Cassate Recorder: Operation and Servicing", Prentice Hall of India.
- Phillipe Coiffet and Michael Chirouze, " An Introduction to Robot Technology", McGraw Hill, 1983 .
- John, J. D. and Constantine, H. Houpis, "Linear Control Systems: Analysis and Design, Conventional and Modern", 1985.
- Theraja, B. L., " Electrical Technology", Nirja 1983.
- 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:

- 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.
- Jain, P. L., "Principles of Foundry Technology", 3rd Edition, Tata McGraw Hill Publishers Co. Ltd. New Delhi 1997.
- Beeley, P. R, "Foundry Technology", Butterworths, London, 1972.
- Dumond, T. C., "Shell Moulding and Shell Moulded Castings", Reinhold Publishers Corporation Inc. 1954.
- Doehler, E. H., "Die Casting", I Edition, McGraw Hill Book Co. New York, 1951.
- Barton, H. K., "Die Casting Processes", Odhams Press Ltd. 1957.
- Wood, R L., and Davidlee Von Lodwig, "Investment Casting for Engineers", 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 a manipulator.

Drives, Transmission and End Effectors

Robot drives, power transmission systems and control, robot drive mechanisms, hydraulic, electric, pneumatic drives, mechanical transmission method, rotary-torotary 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, touch 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, applications, 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 applications. 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:

- Richard, D. Klaftere. Thomos, A. Chmieleswki, and Michael Negin, "Robotic Engineering- An integrated Approach", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd., 1989.
- Fu, K. S., Gomaler, R. C., and Lee, C. S. G., "RaobotiCS: control Sensing, Vision, Intelligence", McGraw Hill Booj Company, 1987.
- Shuman, Y. Nof, "Handbook of Industrial Robotic", John Wiley & Sons, New York, 1985.
- 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 Modem 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 programme.

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-chart.

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:

- Lt. Gen. B. Lol. "Total Quality Management", Wiley Eastern Limited, 1990.
- Greg Bounds, "Beyond Total Quality Management" , McGraw Hill, 1994.
- Menon, B.G., "TQM in New Product Manufacturing", McGraw Hill 1992.

V ALUE 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

Projects 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 specialities.

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:

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

ENTERPRENEURSHIP DEVELOPMENT

Need, Scope and Characteristics of Entrepreneurship

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

Market Survey Techniques

Need, scope and approaches for project formulation, criteria for principles of product selection 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 & Utilisation

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

Techno-Economic, Fesability 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:

- Chandra, Prasana "Project-Preparation, AAPRAISAL and Implementation", Tata McGraw Hill, New Delhi, 1990
- Kotler, Philip "Marketing Management", Prentice Hall, 1990
- 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, dual 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,

sensitivity 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

Variables in an inventory problem, inventory problem, inventory models with penalty, storage and quantity 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 Test Books and References

- Kumar Gupta, Prern and Hira, D. 5., "Operations Research", S Chand & Company Limited, 1986.
- Swarup, Kanti. Gupta, P.K., and Manmohan, "Operations Research", Sultan Chand & Sons, New Delhi 1988.
- Srinath L.S., "PERT & CPM Principles and Applications", Affiliats 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 tables, 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 (not accounting for time value of money), accounting for time value of money, replacement policy for new and old machine with infinite 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

- James, L. Riggs, " Engineering Economics", McGraw Hill Book Co., 1982
- James, L. Pappas, and Eugene, F. Brigham, "Managerial Economics:", Holt Rinehaut and Winston Ltd., 1983.
- Norman, N. Barish., " Economic Analysis for Engineering", McGraw Hill Book Company, 1978.

- 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-l, MRPII, ERP. Information Technology Advancement: Client server technology, RDBMS.

Sales, Purchase & Inventory Control, Concepts

C1assification/ coding of material & finished goods, sales enquiry, 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 to 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 overview of man power planning and customer manufacturing planning.

Financial & Cost Accounting

Basic accounting principles, Day book-Cash, Bank, Journal, Purchase and Sales. Ledgers - 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, Materials 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:

- Joseph Orlicky, "Materials Requirement Planning, the New Way in Production and Inventory Management". McGraw Hill book company, New Delhi, 1975 .
- BaaN Student Manuals, BaaN Education Centre, Hyderabad, 1996.

INDUSTRIAL DESIGN

Introduction

A 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 applications 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 of Line and Form

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

Colour

Colour and light, colour and objects, colour and the eye, colour consistency, colour terms, reactions to colour and colour continuation, colour on engineering equipments.

Aesthetic Concepts

Concepts of Unity, concept of order with variety, concept 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:

- Mccormick, K.J, (Ed.) "Human Factors Engineering" 4th ed., McGraw hill Book Company Ltd., USA, 1992.
- Brian Shackel (Ed), " Applied Ergonomics Handbook", Butterworth Scientific, London. 1982.
- Mayall, W. H., "Industrial Design for Engineers", London Iiifee Books Ltd., 1967.
- Dale Huchingson, R., "New Horizons for Human Factors in Design", McGraw Hill Company, 1981.
- Robert, W. Bailey, "Human Performance Engineering", Prentice Hall Inc. New Jersey, 1982.

PERSONNEL MANAGEMENT

Introduction

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

Manpower Planning

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

Training and Programmed Learning Objectives

Types and methods, TWI management development-its meaning, scope and methods induction of personnel.

Functions

transfer, promotion and termination of services, developing and administering promotion plans, work environment, safety and accident prevention.

Wages and Salary Administration

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

Transactional Analysis

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

Industrial Dispute Act

Trade union movements in India, their organization structures and policies, 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:

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

FINANCIAL MANAGEMENT AND ACCOUNTING

Goals & Functions of Finance

Evolution of finance, objectives of the firm, functions 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 Dividend Policies

Capital structure of a firm, operating and financial leverage, EBIT, EP S 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 accounts, balance sheet.

Financial Ratio Analysis

Uses and nature, liquidity coverage ratios. Suggested Text Books and. References:

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

Open Electives

HUMAN VALUES

The objective of the course is an exploration of human values which go into making a "good' human being, a ' good' human society and a 'good life. The context is the 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; justice, democracy, rule of law; values in the Indian 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; ethics of 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 rights; 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. Its Three main components are:

(i) Social and Cultural history of technology,

(ii) Social and Human critiques of technology,

(iii) Engineering Ethics and Professional Ethics.

The proposed course structure is as follow:

1. Science, Technology and Engineering, as knowledge and 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. Reports of the club of Rome. Limits to growth; sustainable development.
6. Energy crisis; renewable energy resources.
7. Environmental degradation and pollution. Eco-friendly technologies.

8. Environmental regulations. Environmental ethics.
9. Technology and the arms race. The nuclear threat.
10. Appropriate technology movement Schumacher; later developments.
11. Technology and the developing nations. Problems of technology transfer. Technology assessment impact analysis.
12. Human operator in engineering projects and industries Problems of man machine interaction. Impact of assembly line and automation. Human centred technology.
13. Industrial hazards and safety. Safety regulations. Safety engineering.
14. Politics and technology. Authoritarian versus democratic control of technology. Social and ethical audit of industrial organizations.
15. 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.