

CURRICULUM

FIRST YEAR

CODE	Subject	No. of Hours				Exam Hours
		L	T	P/D	C	
EBU121T041	English	3	-	-	3	3
EBU12FT052	Algebra & Calculus	3	1	-	3	3
EBU12GT043	Applied Physics	3	1	-	3	3
EBU12HT044	Applied Chemistry	3	1	-	3	3
EBU12DT095	Basic Civil and Mechanical Engineering	4	-	-	2	3
EBU12CT056	Basic Electrical and Electronics Engineering	4	-	-	2	3
EBU12AT057	Basic Computer Science Engineering	2	-	-	2	3
EBU12DT098	Engineering Drawing	2	-	3	3	3
EBU12DT099	Environmental Science and Engineering	3	1	-	3	3
EBU12JT0210	Sanskrit & Indian Culture- I	2	-	-	1	3
EBU12GP041	Physics Laboratory	-	-	2	2	2
EBU12HP072	Chemistry Laboratory	-	-	2	2	2
EBU12AP023	Computer Laboratory	-	-	2	2	2
EBU12DP094	Workshop Practice	-	-	2	2	2
EBU12CP025	Electrical Workshop	-	-	2	2	2
	Total	29	4	13	35	

SEMESTER III

CODE	Subject	No. of Hours				Exam Hours
		L	T	P/D	C	
EBU3FTO51	Transform techniques & Complex variables	3	2	-	3	3
EBM3DTO92	Engineering Mechanics (Statics & Dynamics)	3	2	-	4	3
EBM3DTO93	Material Science & Metallurgy	3	1	-	3	3
EBM3DTO94	Engineering Thermodynamics	3	2	-	4	3
EBM3DTO95	Manufacturing Technology-I	3	1	-	3	3
EBU3ATO96	Object Oriented Programming Using C++	3	1	-	3	3
EBU3JTO27	Sanskrit & Indian Culture- II	2	-	-	1	3
EBM3DPO91	Thermal Engineering Lab	-	-	2	3	2
EBM3DPO92	Metallurgy and Metrology Lab	-	-	2	3	2
EBM3APO93	OOPS using C++ Lab	-	-	2	3	2
	Total	20	9	8	30	

SEMESTER IV

CODE	Subject	No. of Hours				Exam Hours
		L	T	P/D	C	
EBU4FTO51	Boundary value problems & statistics	3	2	-	3	3
EBM4DTO92	Fluid Mechanics & Machinery	3	1	-	3	3
EBM4DTO93	Mechanics of Solids	3	2	-	4	3
EBM4DTO94	Applied Thermodynamics	3	2	-	4	3
EBM4DTO95	Manufacturing Technology – II	3	1	-	3	3
EBM4CTO96	Electrical Technology	3	1	-	3	3
EBU4JTO27	Sanskrit & Indian Culture- III	2	-	-	1	3
EBM4DPO91	Fluid Mechanics and Machinery Lab	-	-	2	3	2
EBM4DPO92	Strength of Materials Lab	-	-	2	3	2
EBM4CPO93	Electrical Machines Lab	-	-	2	3	2
	Total	20	8	8	30	

SEMESTER V

Code	Subject	No. of Hours				Exam Hours
		L	T	P/D	C	
EBU5FTO51	Numerical methods	3	2	-	3	3
EBM5DTO92	Thermal Engineering	3	2	-	4	3
EBM5DTO93	Kinematics of Machines	3	2	-	4	3
EBM5DTO94	Instrumentation & Control Systems	3	1	-	3	3
EBM5DTO95	Machine Drawing	2	-	4	3	3
EBM5BTO96	Electronics & Microprocessor	3	1	-	3	3
EBU5JTO27	Sanskrit & Indian Culture –IV	2	-	-	1	3
EBM5DPO91	Instrumentation & Dynamics Lab	-	-	2	3	2
EBM5DPO92	Manufacturing Technology Lab	-	-	2	3	2
EBM4BPO93	Electronics & Microprocessor Lab	-	-	2	3	2
	Total	19	8	12	30	

SEMESTER - VI

Code	Subject	No. of Hours				Exam Hours
		L	T	P/D	C	
EBM6DTO91	Heat Transfer	3	2	-	4	3
EBM6DTO92	Power Plant Engineering	3	1	-	3	3
EBM6DTO93	Dynamics of Machines	3	1	-	3	3
EBM6DTO94	Design of Machine Elements	3	2	-	4	3
EBM6DTO95	Computer Aided Design	3	1	-	3	3
EBM6BTO96	Production And Operation Management	3	1	-	3	3
EBU6JTO27	Sanskrit & Indian Culture–V	2	-	-	1	3
EBM6DPO91	Heat Transfer Lab	-	-	2	3	2
EBM6DPO92	Computer Aided Design Lab	-	-	2	3	2
EBM6DPO93	Special Machines Lab	-	-	2	3	2
	Total	20	8	8	30	

SEMESTER - VII

Code	Subject	No. of Hours				Exam Hours
		L	T	P/D	C	
EBM7DTO91	Operations Research	3	2	-	4	3
EBM7DTO92	Computer Integrated Manufacturing	3	1	-	3	3
EBM7DTO93	Design of Transmission Systems	3	2	-	4	3
EBM7DTO94	Gas Dynamics & Jet Propulsion	3	2	-	4	3
EBM7DTO95	Mechatronics	3	1	-	3	3
EBM7DEO96 (A TO G)	Elective – I	3	1	-	3	3
EBM7DPO91	Computer Integrated Manufacturing Lab	-	-	3	3	2
EBM7DPO92	Mechatronics Lab	-	-	3	3	2
EBM7DPO93	Mini Project & Seminar	-	-	8	3	2
	Total	18	9	14	30	

SEMESTER VIII

Code	Subject	No. of Hours				Exam Hours
		L	T	P/D	C	
EBM8DTO91	Principles of Industrial Management	3	1	-	3	3
EBM8DTO92	Environmental Science and Engineering	3	1	-	3	3
EBM8DEO93 (A TO F)	Elective – II	3	1	-	3	3
EBM8DEO94 (G TO M)	Elective – III	3	1	-	3	3
EBM8DPO91	Project Work	-	-	16	8	3
	Total	12	4	16	20	

L : Lecture Periods;

I : Internal Assessment;

T : Tutorial Periods;

E : External Assessment;

P/D : Practical / Drawing Periods;

Tot. : Total Marks

C : Credits

LIST OF ELECTIVE SUBJECTS

VII SEMESTER ELECTIVE – I

Code	Subject
EBM7DE096A	Finite Element Analysis
EBM7DE096B	Plant layout and Material handling
EBM7DE096C	Composite Materials
EBM7DE096D	Quality control and reliability engineering
EBM7DE096E	Automobile Engineering
EBM7DE096F	Design of Jigs & Fixtures
EBM7DE096G	Turbo Machines

VIII SEMESTER ELECTIVE – II

EBM8DE093A	Design of Heat transfer Equipments
EBM8DE093B	Cryogenics
EBM8DE093C	Internal Combustion Engines
EBM8DE093D	Product Design
EBM8DE093E	Robotics
EBM8DE093F	Tribology

VIII SEMESTER ELECTIVE – III

EBM8DE094G	Vibration & Noise Control
EBM8DE094H	Refrigeration and Air-Conditioning
EBM8DE094J	Computational Fluid Dynamics
EBM8DE094K	Introduction to Nano Technology
EBM8DE094L	Work Study and Cost Estimation
EBM8DE094M	Fluid Power systems

SYLLABUS

I YEAR

EBU121T041 - ENGLISH

UNIT - I

GRAMMAR - Word Formation with Prefixes and Suffixes - deriving other forms of words from the given form - Active and Passive Voice, simple, present, present continuous, present perfect and past continuous, past perfect Tense - Gerunds, Participles - Conditional Sentences - Standard Abbreviations - Compound Nouns - Adjectives - Meaning of Words - Definitions - Punctuations - Statements of Comparison - Instructions (Use of Should and the Imperative)

Synonyms and Antonyms - Prepositions - Relative Adverbs - Pronouns - Articles - Connectives - Conjunctions - Expressions of Cause and Effect - Purpose and Means. (Based on the exercises in the Text Books)

UNIT - II

COMPREHENSION AND TRANSCODING -Test of Reading Comprehension: An unseen passage followed by
i). True or False ii). Multiple Choice iii). Sentence Completion iv).Short Answer Questions etc.,
a). A Simple Diagram b). A Simple Flow Chart c). A Simple Classification Chart d). A Simple Tree Diagram

UNIT - III

REPORT WRITING AND LETTER WRITING -Writing Laboratory Reports and Technical Reports.

Letter inviting dignitaries to preside over a function - letter accepting an invitation - declining an invitation - letter to the editor - requisition letters for practical training - application for a job with Resume etc.,

UNIT - IV

COMMERCIAL LETTERS a). Specifications of common engineering equipments, instruments and tools — calling for quotations for the supply of equipments like electrical motors, generators, transformers, lathes, tools, diesel engines and components for laboratory etc.,

b). Placing an order.

c). Asking for a Clarification

d). Letter of complaints regarding some manufacturing defects.

UNIT - V

ESSAY WRITING -Writing essays on topics of Science and Technology in 300 words.

Note: During the class hours Group Discussions, Debates, Speeches on various topics, Seminars and Conversations etc to be arranged to improve the Communication Skills. Test of Written English and English for competitive Exams like TOEFL, GRE to be practiced.

UNIT - VI

Gitanjali by R.N.Tagore, Oxford University Press

Tales from Shakespeare by Charles Lamb, Orient Longman.

Harmony Ed.Biyot K.Tripathy, Oxford University Press

(As an exercise in writing about people, facts and reviews)

TEXT BOOKS

1. English for Engineers and Technologists Vol. I & II
(Humanities and Social Sciences Division, Anna University, Chennai)
Published by Orient Longman.

REFERENCE BOOKS

1. Communication in English for Technical Students - Curriculum Development Centre, Calcutta, Orient Longman
2. Strengthen Your Writing - V.R. Narayanaswamy (Rtd) Anna University, Madras.
3. The Structure of Technical English - A.J.Hebert, Orient Longman.
4. Business letters for Different Occasions - A.N. Kapoor, S.Chand & Company Pvt. Ltd.
5. Barron's Book for TOEFL
6. Text for communication skills- Current English for Colleges – N. Krishnaswamy & T. Sriram - Mc Millan.
7. English for Science and Technology by.Prof.P.Ramani, Mc Millan

EBU12FT052 - ALGEBRA AND CALCULUS

UNIT I

INFINITE SERIES-Basic definition of Sequences - Series - Convergence - examples - General properties – Series of positive terms - Comparison tests - Integral test – D’Alembert’s ratio test - Cauchy’s root test - Alternating series : Leibnitz’s rule – Power series - convergence of Exponential, Logarithmic and Binomial series.

UNIT II

MATRIX THEORY -Types of matrices – Basic Matrix operations – Rank of a matrix – Gauss Jordon method of finding inverse - Normal form of a matrix – Computation of rank using normal forms – Consistency of linear system of equations - Linear and orthogonal transformations — Eigenvalues and eigenvectors – Properties of eigen values – Cayley Hamilton theorem (without proof) – Reduction to diagonal form – Reduction of quadratic form to canonical form - Cauchy’s root test - Complex matrices.

UNIT III

DIFFERENTIAL EQUATIONS -Definition - Complete solution - Operator D - Rules for finding complementary function - Inverse operator - Rules for finding the particular integral - Working procedure to solve the equation - Method of variation of parameters - Cauchy’s and Legendre’s linear equations - Linear dependence of solutions - Simultaneous linear equations with constant coefficients - Total differential equation: $Pdx + Qdy + Rdz = 0$.

UNIT IV

MULTIPLE INTEGRALS - Double integrals - Change of order of integration - Double integrals in polar coordinates - Areas enclosed by plane curves - Triple integrals - Volume of solids - Beta function - Gamma function - Relation between Beta and Gamma functions.

UNIT V

VECTOR CALCULUS - Differentiation of vectors - Velocity and acceleration - Scalar and vector point functions - Del applied to scalar point functions : Gradient - Del applied to vector point functions : Divergence and curl - Physical interpretation of divergence and curl - Del applied twice to point functions - Del applied to products of point functions - Integration of vectors - Line integral : circulation, work done - Surface integral : Flux - Green’s theorem in the plane (without proof) - Stoke’s theorem (without proof) - Volume integrals - Gauss divergence theorem (without proof) .

REMARKS

“THE PAPER IS NOT THEORY ORIENTED AND THE CONTENTS OF THE PRESCRIBED TEXT BOOK ARE TO BE STRICTLY FOLLOWED” “EACH UNIT IS TO BE COVERED IN 24 (20 Lecture Hrs + 4 Tutorials) PERIODS EACH OF 50 MINUTES DURATION “

PRESCRIBED TEXT BOOK:

B.S.Grewal, Higher Engineering Mathematics, Thirty Sixth Edition, Khanna Publishers, New Delhi, 2002.

Unit I Chapter 9 (9.1-9.9 , 9.11-9.12 , 9.14-9.15).

Unit II Chapter 2 (2.5-2.7 , 2.9-2.11 , 2.13-2.20)

Unit III Chapter 13 Full (Except 13.8 II) Chapter 15 (15.8).

Unit IV Chapter 7(7.1 - 7.6, 7.14 - 7.16).

Unit V Chapter 8 (8.1, 8.3 - 8.16)

REFERENCES

1. Erwin Kreyszig, Advanced Engineering Mathematics, Eighth Edition, John Wiley & Sons, 1999.
2. D.W.Jordan, D.Smith, Mathematical Techniques, Second Edition, Oxford University Press, 1999.
3. Peter V. Neil, Advanced Engineering Mathematics, Third Edition, PWS Publishing Company, Boston, 1993.
4. C.Ray Wylie, Louis C. Barrett, Advanced Engineering Mathematics, Sixth Edition, McGraw Hill Publishing Company, 1995.
5. D.A.Clarke, Mathematics for Engineering (An active learning approach), DP Publications Ltd., London, 1994.
6. Murry R. Spiegel, Mathematical Hand Book (For formulae and tables) (Schaum's Outline series), McGraw Hill Company, 1968.
7. Richard Bronson, Differential Equations, (Schaum's Outline Series), McGraw Hill Company, 1975.
8. Murry R. Spiegel, Vector Analysis, (Schaums Outline Series) McGraw Hill Company, 1974.

EBU12GT043 - APPLIED PHYSICS

UNIT I-

PROPERTIES OF MATTER – Elasticity- Stress - Strain - Hooke's law - Elastic Behaviour of Material - Factors affecting Elasticity – Young's modulus by cantilever-Uniform bending-Non-uniform bending. Torsional Pendulum - Determination of Period of Oscillation - Applications - Determination of Moment of Inertia, Determination of Rigidity Modulus- Compound Pendulum

Center of Gravity - Definition - Moment of Inertia - Theorems - Moment of Inertia of rectangular and triangular plate.

UNIT II -

TECHNICAL ACOUSTICS - Reverberation Time- Acoustics of buildings-Reverberation, echo, creep, focusing, standing wave, Principles to be observed in the Acoustical design of an Auditorium- Noise pollution-Noise control in machines- Absorption coefficient – Sabine's formula.

Ultrasonics

Generation - Piezoelectric method - Magnetostriction method - Acoustical Grating - Determination of Ultrasonic Wavelength - Applications of Ultrasonics in industries- NDT.

UNIT III-

OPTICS –Laser- Principles - Einstein theory of spontaneous and stimulated emission - Population inversion – Threshold condition- Derivation of Schawlow and Towne's condition-Different kinds of Lasers – Nd:YAG laser, CO₂ laser - Applications of Lasers in 3D Profiling, computer peripherals such as CD-ROM.

Fiber Optics

Types of Optical fibers - step index - graded index single mode - multiple mode fiber- Attenuation-Dispersion of waves through fibres - acceptance angle - Numerical aperture- applications in engineering and medicine.

UNIT IV-

MODERN PHYSICS - X - Rays - Properties - Bragg's laws - Compton effect - Applications of X- rays in medicine and industry.

Liquid Drop Model - Shell model - Nuclear fission - Bohr and Wheeler's theory - Chain reaction - Atom bomb - Nuclear reactors - Breeder reactor - Nuclear fusion - Thermo nuclear reactions - Hydrogen bomb.

UNIT V-

MATERIAL SCIENCE - Magnetism in solids

Types of Magnetism - Dia, para, ferro, Antiferro, Ferrimagnetism - properties - applications of magnetic principles in computer storage such as Floppy disks.

Dielectrics

Definition - Dielectric Breakdown - Dielectric loss - Internal field – Classius- Mossotti relation.

Superconductors

Introduction - BCS theory - Meissner effect - Type I & Type II. Superconductors-Tunneling phenomenon- Josephson effect (AC & DC) – High T_c Superconductors- applications.

TEXT BOOKS

1. Applied Engineering Physics -Rajendran & Marikani - Tata McGraw Hill publications.
2. Modern Engineering Physics - R.K. Gaur & S.L. Gupta - Dhanpat Rai publications.
3. Modern Engineering Physics - A.S. Vasudeva - S. Chand & Company Ltd.
4. Applied Physics - P. Mani - Dhanam Publications.

REFERENCE BOOKS

- | | |
|-------------------------|------------------------------------|
| 1. Properties of Matter | - D.S. Mathur.(Unit I) |
| 2. Sound | - Brijlal & Subramanian. (Unit II) |
| 3. Engineering Physics | - Ruban Kumar. (Unit II & III) |
| 4. Engineering Physics | - M.N. Avadhanulu. (Unit III) |
| 5. Fiber Optics | - R. Agarwal. (Unit III) |
| 6. Modern Physics | - R. Murugesan. (Unit IV, V) |
| 7. Superconductivity | - Kacchava. (Unit V) |

EBU12HT044 APPLIED CHEMISTRY

UNIT – I

ELECTROCHEMISTRY AND CORROSION - Galvanic cells – reversible and irreversible cells – emf and its measurements – single electrode potential – standard electrodes (H_2 and calomel electrodes) – electrochemical series – Nernst equation – problems – metal / metal ion electrode – metal / insoluble salt electrode – glass electrode – determination of pH using glass electrode – application of emf measurements – problems – concentration cells – applications – problems – Kohlrausch law of independent migration of ions – applications – conductometric titrations – polarization – overvoltage – decomposition potential.

Corrosion – principles of chemical and electrochemical corrosion – factors influencing corrosion – types of corrosion – galvanic corrosion – differential aeration corrosion – stress corrosion – soil (microbial) corrosion – corrosion control – cathodic protection – sacrificial anode – selection of materials and proper designing – corrosion inhibitors, protective coatings – paints – constituents – functions – varnishes – lacquers.

UNIT – II

THERMODYNAMICS - Thermodynamic terms – definition of system – open, closed, isolated – surroundings, properties of system – thermodynamic equilibrium – isothermal, isobaric, isochoric and adiabatic processes – internal energy – mathematical form of first law enthalpy – limitations of first law – statement of second law of thermodynamics – Clausius and Kelvin – definition of entropy – entropy change for a reversible process – entropy change for an isothermal expansion of an ideal gas – problems – definition of free energy and work function – Gibbs Helmholtz equation – applications – problems – van't Hoff isotherm and isochore – applications – problems.

UNIT – III

CHEMICAL KINETICS AND CATALYSIS - Kinetics of second order reaction – characteristics of second order reactions – half life period – examples of second order kinetics – hydrolysis of ester by sodium hydroxide – simple problems in second order kinetics – kinetics of opposing, parallel and consecutive reactions – examples of consecutive reactions – decomposition of dimethyl ether in gaseous phase – radioactive decay of polonium – examples of parallel reactions – reaction of ethyl bromide with caustic potash – examples of opposing reaction – dissociation of hydrogen iodide – effect of temperature on reaction rate – theory of absolute reaction rate – steady state principle.

Catalysis – classification – characteristics of catalysts – auto catalysis – enzyme catalysis – Michaelis menton equation – acid base catalysis.

UNIT – IV

SPECTROSCOPY - Electromagnetic spectrum – absorption of radiation – electronic transition – vibrational transition – rotational transition – intensities of spectral lines Beer Lambert's law – colorimetric analysis – estimation of concentration of a solution by colorimetry – flame photometry – theory, instrumentation and application – visible and UV spectroscopy – principles, instrumentation and simple applications – IR spectroscopy – simple applications only.

UNIT – V

WATER TREATMENT AND POLYMER CHEMISTRY - Disadvantages of hard water in industries – conditioning methods – external treatment methods – zeolite and ion exchange methods – internal treatment (colloidal, phosphate, calgon, carbonate methods) – desalination – drinking water standards – treatment of domestic water.

Monomers – functionality – polymer – degree of polymerization – effect of polymer structure on properties – addition, condensation, co-polymerization and co-ordination polymerization - mechanism of addition polymerization (free radical polymerization).

TEXT BOOKS

1. Puri B.R., Sharma L.R. and Madan S. Pathania, Principles of physical chemistry, Shoban Lal Nagin Chand & Co., Jalandhar, 2000.
2. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai & sons, New Delhi, 2001.

REFERENCE BOOKS

Kuriacose J.C and Rajaram J, Chemistry in Engineering & Technology, Vol 1, Tata McGraw-Hill publishing company, New Delhi, 1996.

EBU12DT095 - BASIC CIVIL AND MECHANICAL ENGINEERING

PART A - CIVIL ENGINEERING

UNIT - I

BUILDING MATERIALS Construction Materials and foundation Properties and uses of construction materials such as stone, bricks, cement, concrete, steel.

BUILDING COMPONENTS

Selection of site - simple foundations such as well footing- isolated footing. Combined footing. Pile foundation - foundations of machinery.

Superstructure Brick and stone masonry - beams. Columns and lintel RCC roofing - simple steel roof trusses and AC roofing - Flooring types such as granolithic. Concrete, mosaic, tile, terrazzo, marble etc., - plastering.

VALUATION

Valuation by plinth area method -simple problems.

UNIT - II

MECHANICS Units - Simple stresses and strains for uniform section - Moduli of elasticity - Factor of safety - centre of gravity and moment of inertia - simple problems.

DAMS

Selection of site - Brief idea of different types of dams - their purpose.

BRIDGES

Components of bridge - classification - slab bridge I - beam bridge.

UNIT - III

SURVEYING - Different types of surveying - chain survey - calculation of area by Simpson's rule and trapezoidal rule - compass - conversion on bearings - simple leveling - reduction of levels - simple problems.

ROAD

Classification - brief description of earthen road. Water bound macadam. Bituminous. Concrete roads - traffic signs and signals.

ENVIRONMENTAL ENGINEERING

Protected water supply - sewage treatment - septic tanks.

PART B - MECHANICAL ENGINEERING

UNIT - I

BOILERS Classification - Principles of Low pressure steam generators
– simple Vertical Boiler, Cochran Boiler, Locomotive Boiler, Lancasier Boiler,
Bop-cock Wilcox Boiler

POWER PLANTS

Layout of Steam, gas turbine, diesel, nuclear and hydropower plants.

NEW SOURCES OF ENERGY

Study of different types of alternative energy sources - Solar, Wind,
Wave, Tidal and Geo - thermal.

UNIT - II

INTERNAL COMBUSTION ENGINES- Working principles of petrol and
diesel Engines - Two stroke and four stroke cycles-Function of main
components - single jet carburetion - ignition. Cooling and lubrication systems
- fuel pump and injector.

METAL CASTING PROCESS

Patterns - Types of patterns - Pattern materials - pattern allowances -
Molding sand - Properties of molding sand - types of molding - preparation of
Green sand mould for casting - melting of cast iron in cupola only - casting
defects.

UNIT - III

METAL FORMING PROCESS- Principles of forging. Rolling-drawing
and extrusion.

METAL JOINING PROCESS

Principles of welding - fundamental of arc welding. Gas welding and
gas cutting - Brazing and soldering.

METAL MACHINING PROCESS

Types of lathes - Main components and the functions of a centre lathe -
operations - cutting tools - drilling machines.

TEXT BOOKS

1. Basic Civil Engineering- V. Ramesh Babu, Anuradha Agencies, Kumbakonam.
2. Basic Civil Engineering- K.V. Natarajan, Madras.
3. Basic Mechanical Engineering- K.Venugopal, Anuradha gencies, Kumbakonam.

REFERENCE BOOKS

1. Basic Civil Engineering - N. Arunachalam, Pratheeba Pub. Coimbatore.
2. Basic Civil and Mechanical Engineering - G. Shanmugam and M.S. Palanichamy, Tata McGraw Hill Publishing Co., 1993.

EBU12CT056 - BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

UNIT - I

CURRENT ELECTRICITY - Electric Current - Ohm's Law - Temperature coefficient of resistance - Kirchoff's Laws.

MAGNETIC EFFECTS OF CURRENT

Electro magnetic induction - Faradays's Law - Lenz law - Flemings left and right hand rules - Statically and Dynamically induced emfs - Self and mutually induced emfs - Self and mutual inductances - Hysteresis - Eddy currents - Magnetic and electric circuits.

UNIT - II

D.C. MACHINES - Elementary concepts - Generator / Motor action - parts of machines EMF Torque equation - Type of Dc Generators Motors - Characteristics - application - losses - simple problems - starting and speed control of motors.

UNIT - III

A.C. CIRCUITS -Sinusoidal functions- phasors - average effective values- R.L.C circuits - Resonance - power and power factor- poly phase circuits - star and delta connection - power and power factor measurements - advantages of polyphase systems - wiring - earthing and IE rules.

A.C. MACHINES

Transformers - Synchronous generator and motors - single phase and three phase induction motors - basic principles of operation - applications - starting of AC motors

UNIT - IV

ELECTRONIC CIRCUIT COMPONENTS Resistors - capacitors - inductors - chokes- semiconductors - devices

TRANSDUCERS

Classification - types - basic requirements

SEMICONDUCTOR DEVICES

PN junction - BJT - FET - UJT - Zener diode -SCR integrated circuits.

UNIT - V

RECTIFIERS Halfwave and fullwave - bridge rectifiers using diodes and SCRs - applications.

DIGITAL ELECTRONICS

Gates - Boolean algebra - RS - JK - Flipflops - shift registers - counters - display devices.

UNIT - VI

COMMUNICATION SERVICES Analog and digital signals - Telecommunication services - transmission paths - basic principles of modulation : AM .FM. Pulse and digital modulation - data transmission - modems communication systems Radio TV, Microwave, Satellite RADAR, Optical and ISDN.

TEXT BOOKS

1. Thyagarajan .T. Sendur Chelvi K.P. Rangaswamy T.R. Engineering Basic - Revised second edition. New Age International (P) Ltd., Publishers 1997.
2. Muraleedharan K.A. Muthusubramanian R. and Salivahanana.S., Basic Electrical and Electronics and computer Engineering Tata McGraw Hill – Revised Edition.

REFERENCE BOOKS

1. Basic Electrical and Computer Engineering - G. Nagarajan - Meenakshi Publishers - Sirkali.
2. Basic Electrical Electronics Engineering - Dr. N. Premkumar - Khanna Publications.
3. Anokh Sign ‘ Priciples of Communication Engineering’ - S. Chand and Company, 1994.

EBU12AT057 - BASIC COMPUTER SCIENCE AND ENGINEERING

UNIT – I

Introduction to digital computer – ALU – Memory Unit, Control Unit
Types of Computers.

DOS commands – Computer Languages – High Level, machine Level
and Assembly Level language – Algorithm Flow Chart.

UNIT – II

Introduction to C – Character set, Constants, Variables, Data Types –
Operators – Expression.

Decision Making statement – Looping statements, break continue, goto
functions.

UNIT – III

Arrays and its types – Functions – call by reference – storage classes
in C – Auto, Register, Static Extern – Recursive function.

UNIT – IV

Structures and Unions, Introduction to Pointer, String operations.

UNIT – V

User defined data types – Introduction to Preprocessor, Macros, Files,
Command line arguments

TEXT BOOKS

1. Let Us 'C' - Yashawant Kanetkar, (Unit 2 to 5), BPB publications.
2. Computers and Common Sense - Roger Hunt, John Shelly, PHI.

REFERENCE BOOKS

1. The Spirit of "C" - Mullish Cooper, Jayco Publishers.
2. Exploring "C" - Yashawant Kanetkar, BPB Publications
3. Programming with "C" - Byron Gotgeterfied, Tata McGraw Hill

EBU12DT098 - ENGINEERING DRAWING

UNIT – 0

BASICS OF DRAWING

(Not included for the examination)

Use of Drawing instruments - BIS conventions and specifications - size layout and folding of drawings sheets - lettering and dimensioning - studying the method of drawing ellipse, Parabola and Cycloids.

UNIT - I

PROJECTION OF POINTS

Introduction to orthographic projections - Projection of points

PROJECTION OF LINES

Projection of straight lines in the first quadrant, lines parallel to both planes - inclined to one plane and parallel to other - inclined to both planes.

PROJECTION OF SOLIDS

Projection of Simple solids like prism, pyramid, cylinder, cone and sphere - Auxiliary projections.

UNIT - II

SECTION OF SOLIDS

Section of solids like prism, pyramid, cylinder, cone and sphere in simple position - True shape of sections for the above.

ORTHOGRAPHIC PROJECTION

Conversion of pictorial views to orthographic views of simple machine members.

UNIT - III

INTERPENETRATION OF SOLIDS

Interpenetration of solids - Cylinder and cylinder, cone and cylinder

DEVELOPMENT OF SURFACES

Surfaces like - Prism, Pyramid, Cylinder, Cone and Cut solids.

UNIT - IV

ISOMETRIC PROJECTIONS

Isometric Projections of solids.

PERSPECTIVE PROJECTIONS

Perspective projections of solids.

UNIT - V

BUILDING DRAWING

Plan, elevation and section of single storied residential or office building with flat RCC. Roof and brick masonry walls having not more than three rooms (Planning / Designing is not expected in this course)

UNIT - VI

(Not for examination)

An introduction to computer aided drafting.

TEXT BOOKS

1. Engineering Drawing - K. Venugopal, Wiley Eastern Ltd., 1922.
2. A text book of Engineering Drawing - K.V. Natarajan.

REFERENCE BOOKS

1. Elementary Engineering Drawing (First Angle Projection) N.D. Bhatt, Charotar publishing Co., Anand.
2. Engineering Drawing - S.M. Sekkilar & S. Tamarai Selvi, Anuradha Agencies, Kumbakonam.
3. Engineering Drawing and Graphics - Prof. K.Venkataraman.

a) Samstrita siksha Part I

Unit I

1. Vowels, 2. Consonants, 3. Words starting with vowels, 4. Words begin with “ka” to “gna” 5. Words begin with “ta” to “na” 6. Words starting with “pa” to “ha”

Unit II

1. Words begin with “ka” to “gha” with the combination of vowels in order. 2. Words begin with “ca” to “jha” with the combination of vowels in order. 3. Words begin with “ta” to “Na” with the combination of vowels in order. 4. Words begin with “tha” to “na” with the combination of vowels in order. 5. Words begin with “pa” to “ma” with the combination of vowels in order. 6. Words with combined letters.

Unit III

Samstrita Siksha Part II Lessons 1,2,3,4

Unit IV

Samstrita Siksha Part II Lessons 5,6,7,8

Unit V

Samstrita Siksha Part II Lessons 9,10,11,12

b) Indian Culture -1

Part I (Elements of Indian Culture)

Unit I

Introduction - origin of Man and evolution of Culture and Civilization; Significance of Indian Culture, Chronology of Indian Culture; Origin and spread; General feature of Indian Culture; Unity in Diversity.

Unit II

How to reconstruct the past; Significance and necessity to reconstruct the past; major sources to reconstruct the Culture.

Archaeological sources -- Important excavated sites and material remains; Literary sources - Chronology of Indian Literature; Early Indian Literature in Sanskrit and other Languages; Foreign Writers and travelers report.

Unit III

Early cultural centers in India - from Sindh to Kaveri, Main features and important centers.

Unit IV

Early Indian Education - Gurukulas and Guru -Sishya parampara, Evaluation of script and languages; Important early scripts and writing materials; Important early educational centres(Ghattikas).

Unit V

Scientific thoughts of early Indian sages; Concept of Yajna and worship, Important manuscripts - Amsu Bhodhini, Yantrasarvasva, Krisiparasara, Sulvasutra, Lohatanfra, etc.,

REFERENCE BOOKS

1.Joshi, K, 1992 (rp). The Veda and Indian Culture. Rashtriya Veda Vidya Pratishthana, NewDelhi.

2. Majumdar, R.C. 1994 (rp) Ancient India, Motilal Banarsidas Publishers, New Delhi. 3.Patel, I.S, (ed.) 1984 Science and the Vedas, Bombay.

EBU12GP041 - PHYSICS PRACTICAL

Any 15

1. Determination of Acceleration due to Gravity 'g' using Compound Pendulum
2. Determination of Rigidity Modulus & Moment of Inertia using Torsional Pendulum
3. Determination of Young's Modulus using Cantilever Depression.
4. Determination of Wavelength of Laser light using transmission grating.
5. Determination of Coefficient of Thermal Conductivity using Lee's Disc Method.
6. Determination of Emissivity of a Surface using Spherical calorimeter.
7. Determination of refractive index of material of prism using Spectrometer i-d curve.
8. Determination of radius of curvature of the given lens using Newton's Rings.
9. Study of Forward and reverse characteristics of a PN junction diode.
10. To study the Characteristics of a NPN/PNP transistor in CE mode.
11. Basic logic gates - Verification of truth tables (AND,NOT,NOR, NAND, OR)
12. NAND & NOR as universal building blocks - Verification of Demorgan's Theorem.
13. Determination of Velocity of sound waves in liquid using Ultrasonic Interferometer.
14. Measurement of Attenuation and numerical aperture using Optical Fiber.
15. Determination of size of the particle – Laser source.
16. Determination of Conductivity of solids using Four probe method.
17. Determination of Defects in solids using Ultrasonic techniques.

REFERENCE BOOKS FOR PHYSICS PRACTICALS

1. Practical Physics - Ouseph and Rangarajan.
2. Engineering Practical Physics-K. Srinivasan.
3. Engineering Practical Physics - M.N. Avadhanulu.

EBU12HP072 - CHEMISTRY LAB

List of Experiments

- 1 Estimation of percentage of sodium carbonate in washing soda
- 2 Determination of percentage purity of caustic soda
- 3 Estimation of temporary & permanent hardness of water by O'hehners method
- 4 Estimation of Acid Value of Oil
- 5 Estimation of Aspirin
- 6 Estimation of total hardness
- 7 Estimation of calcium and magnesium in a mixture
- 8 Estimation of available chlorine in bleaching powder
- 9 Estimation of percentage of lime
- 10 Estimation of iodine value of an oil
- 11 Estimation of chloride (volhard's method)
- 12 Estimation of ferrous ion
- 13 Conductance of strong electrolyte
- 14 Solubility of sparingly soluble salt by conductometry
- 15 Conductometric titration : acid -base
- 16 Conductometric titration : precipitation
- 17 Potentiometric titration : acid-base
- 18 Potentiometric titration : redox titration
- 19 Determination of pH of a buffer / acidity of water sample
- 20 Phase rule -simple eutectic (two component system)
- 21 Determination of molecular weight (rast method)
- 22 Molecular weight of a polymer

EBU12AP023 - COMPUTER LAB

1. Evaluate the following Expression using library Function.
2. Find Sum & Average of 'N' numbers.
3. Find the Biggest among 3 numbers.
4. Find the factorial of given number.
5. Check whether the number is prime or not.
6. Find the sum of digits using (i) For loop (ii) While loop
7. Program to add the first N odd numbers and even numbers.
8. Generate the Fibonacci series and Evaluate Sine series.
9. Arithmetic operations using Switch - Case Statements.
10. Find the biggest & smallest among "N" numbers.
11. Sort "N" numbers in Ascending order.
12. Matrix addition and Multiplication.
13. Display the student information & marks using Structure.
14. Evaluate the Binomial coefficient.
15. Swapping of numbers using call by value, call by reference.

EBU12DP054 WORK SHOP PRACTICE

CARPENTRY

Names and uses of tools used in carpentry - Handling of the tools. Practice in marking, sawing, planning and chiseling to size. Making simple joints such a half lap, dovetail, mortises and Tenon joints.

FITTING

Name and uses of tools like files, chisels, hammer, tri square, calipers, hacksaw, etc., and handling of these tools. Practice in marking, chipping, fitting to size and drilling marking of simple mating, profiles such as Vee , Square, dovetail etc.,

Demonstration of the following (not included for the examination)

1. Preparation of green sand mould.
2. Study of tool in smithy shop and making a square section from circular section.
3. Arc welding Gas welding and cutting.
4. Brazing and soldering.

WELDING

Study of Arc Welding, Tools and Equipments – Simple welding exercises – Butt welding and Lap Welding.

TURNING

Study of Center Lathe, Accessories and tools – Simple turning exercises – Facing and Step turning - use of measuring Instruments for lathe work.

DRILLING

Study of drilling machines – Drills, Taps, and reamers – Demonstration of Drilling and Tapping operations.

EBU12CP025 ELECTRICAL WORK SHOP

1. Study of Electrical Tools.
2. Flourescent Tube light circuit.
3. Single KMP controlled by one way switch and 3 pin wall socket
4. Two lamps in series controlled by one way switch
5. Two lamps in parallel controlled by one way switch
6. Two lamps in controlled independently using 3 plate ceiling rose.
7. Two lamps controlled by two one way switches at the same point
8. Switch case wiring
9. Power wiring of 3 phase induction motor
10. Power wiring of single phase induction motor
11. Two lamps controlled by one way switches by Bright and Dim method.

SEMESTER III

EBU3FT051 TRANSFORM TECHNIQUES AND COMPLEX VARIABLES

UNIT I

LAPLACE TRANSFORMS - Introduction - Definition - Transforms of elementary functions - Properties of Laplace transforms - Existence conditions - Transforms of derivatives - Transforms of integrals - Multiplication by t^n - Division by t - Evaluation of integrals by Laplace transform - Inverse transforms - Note on partial fractions - Other methods of finding inverse transforms (Using Laplace transforms of derivatives and integrals) - Convolution theorem (Without proof) - Application to differential equations.

UNIT II

DIFFERENCE EQUATIONS - Introduction - Definitions – Formation of difference equations – Linear difference equations – Rules for finding Complementary Functions – Rules for finding Particular Integral– Simultaneous difference equations with constant coefficients – Application to deflection of a loaded string.

UNIT III

Z – TRANSFORMS - Definition – Some standard Z –transforms – Linear property – Damping rule – standard results – Shifting rules – Initial and final value theorems – Some useful Z –transforms – Some useful inverse Z –transforms – Convolution theorem – Convergence of Z –transforms ;Two sided Z –transform – Evaluation of inverse transforms – Application to difference equations.

UNIT IV

ANALYTIC FUNCTIONS - Introduction - Limit and continuity of $f(z)$ - Derivative of $f(z)$:Cauchy-Riemann equations – Analytic functions – Harmonic functions ; Orthogonal system – Applications to flow problems – Geometrical representation of $f(z)$ - Some standard transformations – Conformal transformation – Special conformal transformations : $e^z, z^2, z + \frac{1}{z}$.

UNIT V

COMPLEX INTEGRATION - Integration of complex functions – Cauchy's theorem – Cauchy's integral formula –Series of complex terms – Taylor's series – Laurent series – Zeros and Singularities of an analytic function – Residues – Residue theorem – Calculation of residues – Evaluation of real definite integrals.

REMARKS

"THE PAPER IS NOT THEORY ORIENTED AND THE CONTENTS OF THE PRESCRIBED TEXT BOOK ARE TO BE STRICTLY FOLLOWED"
"EACH UNIT IS TO BE COVERED IN 12(10 Lecture Hrs + 2 Tutorials) PERIODS EACH OF 50 MINUTES DURATION "

PRESCRIBED TEXT BOOK

B.S.Grewal, Higher Engineering Mathematics, Thirty Sixth Edition, Khanna Publishers, New Delhi, 2002.

Unit I	Chapter 21 (21.1-21.15).
Unit II	Chapter 26 (26.1 – 26.8)
Unit III	Chapter 26 (26.9- 26.21).
Unit IV	Chapter 20(20.1-20.9 , 20.10) Except 20.10.4
Unit V	Chapter 20 (20.12 - 20.14 , 20.16-20.20)

REFERENCES

1. Erwin Kreyszig, Advanced Engineering Mathematics, Eighth Edition, John Wiley & Sons, 1999.
2. C.Ray Wylie, Louis C. Barrett, Advanced Engineering Mathematics, Sixth Edition, McGraw Hill Publishing Company, 1995.
3. Joseph A. Edminister, Electric Circuits, (Schaum's Outline series), Second Edition, Tata McGraw Hill, 1996.
4. William H.Hayt, Jack.E.Kemmerly, Engineering Circuit Analysis, Fifth Edition, McGraw Hill Publishing Company.
5. Alan V. Oppenheim, Ronald W.Schafer, Discrete Time Signal Processing, Second Edition, Prentice Hall, New Jersey, 1999.
6. Ronald N.Bracewell, The Fourier transform and its applications, McGraw Hill Company, 1986.
7. John H.Mathews, Russel W. Howell, Complex Analysis for Mathematics and Engineering, Third Edition, Narosa Publishing House, 1998.
8. Murry R. Spiegel, Complex Variables, (Schaum's Outline Series), McGraw Hill 1981.
9. Murry R. Spiegel, Laplace Transforms, (Schaum's Outline Series), McGraw Hill Company, 1965.

EBM3DT092 - ENGINEERING MECHANICS

UNIT I

BASICS AND STATICS OF PARTICLES - Introduction – Units and Dimensions – Laws of Mechanics – Lamé's theorem, Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments – Vector operations: additions, subtraction, dot product, cross product – Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

UNIT II

EQUILIBRIUM OF RIGID BODIES Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions – Examples

UNIT III

PROPERTIES OF SURFACES AND SOLIDS - Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, - Angle section, Hollow section by using standard formula – second and product moments of plane area – Rectangle, triangle, circle from integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Mass moment of inertia – Derivation of mass moment of inertia for rectangular section, prism, sphere from first principle – Relation to area moments of inertia.

UNIT IV

DYNAMICS OF PARTICLES - Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies.

UNIT V

FRICITION AND ELEMENTS OF RIGID BODY DYNAMICS - Frictional force – Laws of Coloumb friction – simple contact friction – Rolling resistance – Belt friction-Ladder friction- Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of bodies.

TEXT BOOK

1. Beer, F.P and Johnson Jr. E.R. “Vector Mechanics for Engineers”, Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, 2006 8th edition

REFERENCES

1. Rajasekaran, S, Sankarasubramanian, G., “Fundamentals of Engineering Mechanics”, Vikas Publishing House Pvt. Ltd., (2007)3rd Edition.
2. Hibbeler, R.C., “Engineering Mechanics”, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., (2000).
3. Palanichamy, M.S., Nagam, S., “Engineering Mechanics – Statics & Dynamics”, Tata McGraw-Hill, (2001).
4. Irving H. Shames, “Engineering Mechanics – Statics and Dynamics”, IV Edition – Pearson Education Asia Pvt. Ltd.,(2008).
5. Ashok Gupta, “Interactive Engineering Mechanics – Statics – A Virtual Tutor (CDROM)”, Pearson Education Asia Pvt., Ltd., (2002).
6. Kumar, “Engineering Mechanics” Tata McGraw-hill, 2007, 3rd Edition
7. S.S. Bhaikatti, “ Engineering Mechanics”, New Age International Publishers, 2006
8. U.G. Sindhal, “ Engineering Mechanics”, Galgotia Publishers, 2004.
9. Meriam & Kraige, “ Engineering Mechanics”, Vol 2, 5th Edition, Wiley Student edition,
10. V. S. Mokhshi, “ Engineering Mechanics”, Tata McGraw-Hill, 1999.
11. R. S. Kurmi, “ Engineering Mechanics”, S. Chand Publishers, 2004.

EBM3DT093 - MATERIAL SCIENCE & METALLURGY

UNIT – I

Structure of Metal and alloys – Ionic, covalent and metallic bonding – space lattice, crystal structure, miller indices for atomic planes and direction, crystal defects – point line and plane defect, polymorphisms and allotropy grains and grain boundaries and simple problems - strengthening mechanism

Diffusion fick;s law of diffusion , solvation of fick's second lay and its applications, atomic model of diffusion an role of crystal defects, temperature dependence of diffusion co-efficient. Kirkendall effect.

UNIT – II

Mechanical Properties – Tensile test, luder's band, engineering stress – strain curve. True stress – strain curve, elastic deformation, plastic deformation – effect of mean stresses & notches. Creep test –p primary, secondary & Territory creep failure analysis & factography.

Transformations: General characteristics of martensitec reactions. Similarity to deformation twinning, bain distortion, crystallography & Kinetics of Martensitic transforming examples from ferrous and non-ferrous alloy systems. Order – disorder transformation. Examples of ordered structures, long and short range order, detection of super lattices, influence of ordering on properties.

UNIT – III

Phase diagrams – phase rules, solid solutions, inter – metallic components, cooling curves, equilibrium diagram – isomorphous, eutectic, peritectic and eutecoid types – iron – carbon equilibrium diagram. Types of steel, cast iron, slow cooling of steels, tool steel, alloy steel – phase transformation, TTT DIAGRAM, Alloys of Cu, Al, Mg, Ni.

UNIT – IV

Heat treatment of steels and non – ferrous materials annealing, normalizing, hardening, tempering – Austempering, Martempering, Case hardening techniques, Hardenability test. Powder metallurgy – processes and applications with examples.

UNIT : V

Polymer, fiber, Ceramics and composite materials – high strength alloys, super alloys, alloys of Titanium, Cobalt and their applications. Uncommon materials like Beryllium, Zirconium, Hafnium, Tantalum, Niobium and their applications. Cellular metallic materials, fusible alloy, Bearing

materials, Ferromagnetic, Paramagnetic materials. Introduction to nano materials and nano composites.

TEXT BOOKS

1. G.E. DIETER, Mechanical Metallurgy, Mc Graw Hill, ISE.
2. O.P KHANNA, Material Science and Metallurgy, Dhanpat Rai & Sons.2008, 1st Edition

REFERENCES

1. S.H.AVENER, Introduction to physical metallurgy, McGraw Hill, ISE
2. REYMOND A.HIGGINS, Engineering Metallurgy , ELBS.
3. C.SMALLMAN, Modern Physical Metallurgy. English Language Book, Butterworths, London.
4. LAWRENCE H. VANVLACK, Elements of Material science and Engineering Addition wiley Publishing Co.,
5. RAGHAVAN, Material Science and Engineering ,Prentice Hall India Ltd, 2007 5th Edition.
6. MARC ANDRE MEYERS & KRISHNAKUMAR CHAWLA, Mechanical Behaviour of Materials PHI, 1999.
7. MICHEL F. ASHBY & DAVID RH. JOFNNNS, Engineering Materials – An Introduction to their properties and Applications – 2nd ed. Butterworths.
8. ANIL KUMAR Sinha, Ferrous Physical Metallurgy, Butterworths.
9. Material Hand Book, Vol – II, III & IV, ASM, 9th ed.
10. James F. Shackel Ford, Introduction to Material Science for Engineers, 2007 6th Edition.
11. V. Rajendiran, Material Science, TMH, 2005.
12. K.R. Phaneesh, Material Science and Metallurgy, Sudha Publications, 2007. 5th Edition.

EBM3DT094 - ENGINEERING THERMODYNAMICS

UNIT I

BASIC CONCEPTS - Concept of continuum, macroscopic approach, Thermodynamics systems- Closed, open or control volume. Thermodynamic properties and equilibrium state of a system, State diagram, Path and process, Work, Modes of work, Zeroth law of thermodynamics - Concept of temperature and heat.

FIRST LAW OF THERMODYNAMICS

Application to closed and open system, Internal energy, Specific heat capacities C_v and C_p , Enthalpy, Steady flow process with reference to various thermal equipment.

UNIT II

SECOND LAW OF THERMODYNAMICS - Kelvin's and Clausius statements of second law of thermodynamics - Reversibility and irreversibility - Carnot cycle, reversed Carnot cycle efficiency, COP - Clausius inequality - Concept of entropy, Entropy of ideal gas, principle of increase of entropy - Carnot theorem.

AVAILABILITY

Reversible Work, Availability, Irreversibility for closed systems and steady state control volumes, II Law Efficiency.

UNIT III

PROPERTIES OF PURE SUBSTANCES - Thermodynamics properties of pure substance in solid and vapor phases rule - P-V, P-T, T-V, T-S, H-S, Diagrams, PVT surfaces - Steam table of thermodynamics properties - Calculation of properties, work done and heat transferred in non-flow and flow process.

UNIT IV

THERMODYNAMIC RELATIONS Gibbs and Helmholtz function – General thermodynamic relations - Exact differentials - T-ds relation - Maxwell, Clausius - Clapeyron equation - Joule Thomson coefficient. Third law of thermodynamics.

UNIT V

PSYCHROMETRY - Properties of moist air - Adiabatic saturation process - Psychrometric charts - Sensible heating and Sensible cooling - Dehumidification, Heating and dehumidification –Cooling & Humidification - Adiabatic mixing of two streams.

TEXT BOOKS

1. VANWVYLEN & SONNTAG, Classical Thermodynamics – Wiley Eastern.
2. P.K. NAG, Engineering Thermodynamics –Tata –McGraw Hill.4th Edition.

REFERENCES

1. ROGER & MAYHEW, Engineering Thermodynamics – Addison Wiley, 2007, 4th Edition
2. J.P HOLMAN, Thermodynamics – McGraw Hill, 1995
3. MARK. W. ZEMANSKY AND RICHARD H. DITTMAN, Heat and Thermodynamics, McGraw Hill.
4. T. ROY CHOUDARY, Basic Engineering Thermodynamics, 1997, TMH
5. BRIJLAL N. SUBRAHMANYAM, Heat and Thermodynamics –S. Chand & Co.,
6. SPALDING & COLE, Engineering Thermodynamics, ELBS
7. MICHAEL SAAD, Thermodynamics, Prentice Hall, 1997
8. KENNETH WORK Jr, Advanced Thermodynamics for Engineers, Mc Graw Hill, 1995.
9. M. S. YADAV, Thermodynamics, Anmol Publications Pvt Ltd, New Delhi. 2000.
10. C.P. Arora, Thermodynamics, TMH, 5th Edition.
11. S. C. Singhal, Engineering Thermodynamics, CBS Publishers, 2004, 1st Edition.
12. Y.V. C Rao, Engineering Thermodynamics, 2005 1st Edition.
13. P. L. Ballaney, Thermal Engineering, Khanna Publishers, 2007, 24th Edition.
14. R. K. Rajput, Thermal Engineering, Lakshmi Publishers, 2008, 6th Edition.

(Use of approved Thermodynamic property tables like Steam tables, Mollier chart, Psychrometric chart are permitted in all the examinations)

EBM3DTO95 - MANUFACTURING TECHNOLOGY - I

UNIT I

MECHANICAL WORKING OF METALS- Introduction to Hot and Cold Working, Classification, Rolling, Types of Rolling Mills, working principle, Roll Pass, Rolling Defects

Forging, Types, Open Die forging, Impression, Closed Die Forging, Rotary Swaging, Die Materials, Lubrication, Forgeability, Forging Defects.

Wire Drawing, Principles and construction details, Extrusion-Types-Forward, Backward & Tube Extrusion

UNIT II

SHEET METAL FORMING- Forming Operations- Blanking-blank size calculation, draw ratio, drawing force, Piercing, Punching, Trimming, Stretch Forming, Deep Drawing, Shearing, Metal Spinning, Bending, Tube bending, Tube forming -Embossing & Coining, Types of Dies, Progressive, Compound and Combination dies.

Forming Methods - Explosive Forming, Electro Hydraulic Forming, Electro Magnetic Forming, Dynapack Machine, Rubber Forming, Super Plastic Forming.

UNIT III

CASTING PROCESSES- Introduction to casting - Patterns, Types, Pattern Materials, Pattern Allowances - Moulding - types- Moulding sand, Properties and Requirements of moulding sands, Gating & Riser, Cores & Core making.

Casting Process - Shell, Investment, Die casting, Centrifugal Casting. Casting Defects

Plastic Materials & Processes - Types of Polymers, Compression Moulding- Transfer Moulding, Injection Moulding, Reaction Moulding, Blow Moulding, Expandable Bead Moulding, Calendaring and Thermoforming.

UNIT IV

METAL JOINING PROCESSES- Welding- Classifications - Welding Equipments, power requirement -Electrode Types - Specification, Gas welding - Types, Arc welding- Types, SMAW, Carbon Arc, TIG, MIG, Atomic Hydrogen, Co₂ welding, Submerged Arc welding.

Special welding Processes- Laser, Electron Beam, Plasma Arc, Ultrasonic, Electro slag, Friction welding, diffusion welding, electrical resistance welding. Soldering, Brazing. Welding Defects - welding inspection and testing.

UNIT V

METROLOGY- Line and end standard , sine bar, gauge block, angle gauges and length bars, interferometer, Interchangeability and selective assembly, limit gauges, comparators, mechanical, electrical, Electro-optical and pneumatic, surface roughness measurement methods, Auto collimator, profile projector, Co-ordinate measuring machines and its applications

Introduction to Electronic Fabrication Techniques - Components and Definitions, Fabrication of components. Photolithography in electronic fabrication, soldering system, emerging packaging technologies.

TEXT BOOKS

1. Sharma. P.C., "A Text book of Production Technology" (Manufacturing Technology) , Sixth Edition, S.Chand & Company Ltd, New Delhi, 2007
2. Rao. P.N., "Manufacturing Technology", Metal Cutting & Machine Tools , Tata McGraw Hill Publishing Co, New Delhi, 2007.
3. Chapman W.A.J., "Workshop Technology Vol I & II", Arnold Publisher, 1996
4. Serope Kalpakjian, Steven R.Schmid "Manufacturing Engineering and Technology" Fourth Edition, 2004, Pearson Education
5. Jain.R.K, "Engineering Metrology " Twentieth Edition, Khanna Publishers, 2007

REFERENCE BOOKS

1. Banga T.R, Agarwal. R.K. & Manghrani. T.M., "Foundry Engineering", Khanna Publishers, New Delhi, 1995
2. Jain.R.K. "Production Technology" Khanna Publishers, 1988
3. Bhattacharyya.A. "Metal Cutting Theory and Practice", Central Book Publishers, 1984
4. S. K. Hajra Chowdhery, & A. K. Hajra Chowdhery, Elements of Workshop Technology, Vol 1 & 2, Media Promoters and Publishers, 2007, 14th Edition.
5. C. Elanchezian, Production Technology, Easwar Press, 2005.

EBU3AT096 - OBJECT ORIENTED PROGRAMMING USING C++

Unit I

Need for object oriented programming, Characteristics of object oriented language -objects, classes, Inheritance, Reusability, creating new data types, Polymorphism and overloading C++ programming basics – Data types, Manipulators, Cin, Cout, Type conversion, arithmetic operators, Loops and decisions.

Unit II

Class and objects : A simple class, C++ Objects as physical Objects, C++ Objects as Data Types, Constructors, destructors, objects as function arguments, overloaded constructors, member functions defined outside the class, inline functions.

Unit III

Arrays: Defining & accessing Array elements, arrays as class member data, array of Objects. Operator Overloading: Overloading Unary Operators, postfix notations. Overloading Binary Operators - Arithmetic operators, Concatenating Strings, Arithmetic Assignment Operators.

Unit IV

Inheritance-Derived class and base class, derived class constructors, overriding member functions, Class Hierarchies, Abstract base class, Public and private inheritance, Levels of inheritance, Multiple inheritance. Memory management – new and delete operator, a string class using new, Pointers to Objects – An array of pointers to Objects.

Unit V

Virtual Functions – Pure virtual functions, Late Binding, Abstract Classes, Virtual base classes. Friend Functions, Static Functions, the copy constructor, the this pointer. Templates, function templates, class template.

TEXT BOOKS

1. Object Oriented Programming in Microsoft C++ - Robert Lafore,Galgotia Publication Pvt Ltd.
2. Let us C++ - Yaswant Kanitkar(used for templates) ,BPB Publication

REFERENCE BOOKS

1. Object Oriented Programming in C++ - E. Balaguruswamy, Tata Mcgraw Hill.
2. Teach yourself C++ - Herbertshildt, OSBORNE/MH

EBU3JTO27 - SANSKRIT & INDIAN CULTURE II

Part - I

Unit I

Importance of smritis & sutras ; significance of Manu's smritis & grihya sutran;

Unit II

Samskaras or Sacraments – definition & significance; Sixteen important Samskaras in due course of human life special reference to the Hindu. Four Ashrama Dharmas.

Unit III

Worship & Festivals – Worship – Personal and public worships; sixteen different kinds of *poojas*; *tantra* and *mudras* in *pooja*; significance and different types of Yajnas, utensils and requirements. important sacred places and cultural centres; significance of festivals and impact on culture.

Part - II

Unit IV

Importance and significance of Upavedas.

Unit V

Special reference to Ayurveda and Arthasastra.

REFERENCE BOOKS

1. Acharya, D. 1999. *Dharnurveda* (sub-Veda of Yajurveda). Hindi. Vijaya Kumar Govindram Harsanand. Delhi.
2. Kangle, R.P. 1992 (rp). *The Kautilya Arthasastra*. Delhi.
3. Rao, S.K.R. 1994. *Nityarchana*. Agama-kosha (Agam Encyclopaedia). Kalpatharu Research Academy Publications. Vol X. Bangalore.
4. Ray, P. (tr). 1997. *Vasistha's Dhanurveda Samhita*. J.J. Publishing House. Delhi.
5. Shalini, K. 1997. *Vedic Leguminous Plants* (Medical and Microbiological Study). Classical Publishing Company. New Delhi.

EBM3DP091 - THERMAL ENGINEERING LABORATORY

1. Performance test on single stage reciprocating air compressor
2. Performance test on constant speed centrifugal air blower
3. Valve timing diagram on single cylinder four stroke petrol engine
4. Port timing diagram on single cylinder two stroke petrol engine
5. Load test on single cylinder petrol engine
6. Performance test on high speed diesel engine with alternator loading
7. Preparation of heat balance sheet on slow speed diesel engine
8. Performance test on slow speed – diesel engine
9. Performance test on high speed – twin cylinder diesel engine
10. Performance, Noise and Smoke Measurement of computerized diesel engine.
11. Performance characteristic and Morse test on a multi cylinder petrol / diesel engine
12. Testing of fuels and lubricants using Say bolt and Redwood viscometer
13. Flash and fire point of fuels and lubricating oil.
14. Performance testing of Solar flat plate collector.
15. Performance testing of concentric (Parabolic) collector

EBM3DP092 - METALLURGY AND METROLOGY LABORATORY

Metallurgy lab

1. Preparation of specimen, macro micro etching techniques for metallographic examination
2. Study and use of metallurgical microscope, different types and their operations
3. Identification of plain and high carbon steel, quenched and tempered steel
4. Identification of stainless steel – HSS and alloy steel.
5. Identification of Grey C.I, White C.I, Malleable iron, SG iron.
6. Identification of Cu alloys, Mg alloys, Al alloys, Ni alloys, Bearings metals
7. Measurements of harden ability – Jomny end quench test
8. Grain size measurement by comparison with ASTM chart
9. Study of microstructure and hardness value before and after heat treatment such as annealing, normalizing, hardening and tempering.

Metrology Lab

1. Use precision measuring instruments and calibration – Vernier caliper – Vernier height gauge – micrometer (outside) dial gauge and depth gauge
2. Measurement of gear tooth thickness by Gear tooth Vernier
3. Measurements of angles and tapers using bevel tooth protractors, sine bar and sine centers
4. Measuring fundamental dimensions of gear using profile projector
5. Testing squareness of try square using slip gauges
6. Determination of tool angle using tool makers microscope
7. Use of electronic, pneumatic and mechanical comparator for determining – flatness
8. Use of bore gauges or measuring internal diameter
9. Measurement of thread parameters using Floating carriage micrometer
10. Taper and bore measurements using spheres
11. Checking straightness of a surface plate using Autocollimator
12. Measurement of surface roughness using roughness meter.

EBM3AP093 OBJECT ORIENTED PROGRAMMING USING C ++

1. Program to print address of an individual using setw and endl manipulators
2. Program to compute Celsius from Fahrenheit cin and cout
3. Program to display multiplication table using for loop
4. Program to do mathematical operation using “do while and while”
5. Program to display detail of material on user’s choices switch case and break statements
6. Program to count vowels in given string using if else
7. Program to carry out division by zero and to continue execution with the use of continuous statement even if the condition is false
8. Program to create a structure with the detail of students as member of structure and accept and print value of members
9. To demonstrate nested structure, dimension of typical room as one structure, length and width of the room being another structure
10. To use function to print character to specify number of items using pass by constant, value, variable, by reference and pass structure as arguments
11. To overload function for characters to print specified number of times and also to establish different numbers of arguments passing
12. Program to learn class and objects. To increment the value of two objects of the class currency
13. To add data items of two different objects of a class and store it in the third class with the use of constructor, scope resolution operator, and object passed as parameters, destructors, constructors, overloading and returning objects
14. Program to print address of individuals, A class containing arrays as class members the member function should accept address from key board and assign values to address and display address this program also demonstrates string as class members too
15. Program to print address of individuals. Programs to demonstrate array of objects
16. Program to overload + , - , * , / arithmetic operator
17. Program to demonstrate inheritance
18. Program to record experienced of individuals. This has to be added without modifying the available class by multiple inheritance
19. Program to access a virtual member function with pointer
20. Program to access the this pointer to an object and to access data in object in point to
21. Program to know about friend functions acting as a bridge between two different classes.

SEMESTER - IV

EBU4FT051 - BOUNDARY VALUE PROBLEMS AND STATISTICS

UNIT I

FOURIER SERIES - Introduction - Euler's Formulae – Condition for Fourier expansion – Functions having points of discontinuity – Change of interval – Odd and Even functions - Half-Range series – Typical waveforms - Parseval's formula – Root mean square value – Complex form of Fourier series

UNIT II

FOURIER TRANSFORMS - Fourier integrals – Fourier sine and cosine integrals - Complex form of Fourier integrals – Fourier transforms - Properties – Fourier Sine and Cosine transforms - Convolution theorem - Parseval's identity .

UNIT III

PARTIAL DIFFERENTIAL EQUATIONS - Introduction - Formation of PDE – Solution of PDE – Equations solvable by direct integration – Linear equations of first order – Non-linear equations of first order – Charpit's method - Homogeneous linear equations with constant coefficients –Rules for finding Complementary Function – Rules for finding Particular Integral – Working procedure to solve the equation - Non-Homogeneous linear equations .

UNIT IV

APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS- Introduction - Method of separation of variables – Vibration of a stretched string – D'Alembert's solution of wave equation – One dimensional heat flow equation – Two dimensional heat flow equation – Solution of Laplace equation.

UNIT V

STATISTICAL METHODS - Correlation – Scatter diagram – Coefficient of correlation – Lines of regression – Rank correlation - Linear regression – Polynomial regression – Fitting of curves: Exponential – Trigonometric – Geometric curves and hyperbola.

REMARKS

"THE PAPER IS NOT THEORY ORIENTED AND THE CONTENTS OF THE PRESCRIBED TEXT BOOK ARE TO BE STRICTLY FOLLOWED"
"EACH UNIT IS TO BE COVERED IN 12 PERIODS EACH OF 50 MINUTES DURATION "

PRESCRIBED TEXT BOOKS

1. B.S.Grewal, Higher Engineering Mathematics, thirty-sixth Edition, Khanna Publishers, New Delhi, 2002.

Unit I	Chapter 10(10.1-10.10)
Unit II	Chapter 22 (22.3-22.7)
Unit III	Chapter 17 (17.1 - 17.12)
Unit IV	Chapter 18 (18.1 - 18.7)
Unit V	Chapter 23 (23.9-23.11 , 23.13)

2. V.Rajaraman , Computer Oriented Numerical Methods, Third edition, Prentice Hall of India Pvt Ltd.,New Delhi.
Chapter 6 Full (Except 6.3)

REFERENCES

1. Erwin Kreyszig, Advanced Engineering Mathematics, Eighth Edition, John Wiley & Sons, 1999.
2. C.Ray Wylie, Louis C. Barrett, Advanced Engineering Mathematics, Sixth Edition, McGraw Hill Publishing Company,1995.
3. Alan V. Oppenheim, Ronald W.Schafer, Discrete Time Signal Processing, Second Edition, Prentice Hall, New Jercey,1999.
4. Ockendon, Howison, Lacey, Movchan, Applied Partial Differential Equations, Oxford University Press, 1999.

EBM4DT092 - FLUID MECHANICS & MACHINERY

UNIT I

Fluid Properties: Fundamental concepts of fluid flow-Viscosity-surface tension-capillarity, compressibility – buoyancy - continuity equation, energy equation and Bernoulli's equation, Flow measuring methods and instruments: Manometer - pitot tube – nozzle – venturimeter – orificemeter - Flow meter for closed conduit systems-Momentum & energy correction factors.

UNIT II

Momentum and Moment of Momentum equation – Hegan - Poiseulli's equation - Darcy-Weisbach equation - derivation & application, Navier - stoke's equation-Statement and Application - Power Transmission in pipes - Operation of pipes in series and parallel - Operation under Zero flow condition in one pipe.

UNIT III

Steady, unsteady, uniform, non-uniform, rotational and ir-rotational, laminar and turbulent flows. Source-Sink – Circulation - source or sink with circulation - Uniform flow with source or sink - Doublet - Uniform flow with source, sink and circulation - Half body- Rankine body - Streamlined body - Bluff body - Magnus effect - Lift and Drag coefficient calculations - for ideal and real fluid flow for compressible & Incompressible fluids - Different forms of drag.

UNIT IV

DIMENSIONAL ANALYSIS AND PUMPS - Dimensional analysis – Buckingham Pi – theorem - Non-dimensional numbers - Dynamic similitude - specific speed – unit quantities.

Centrifugal pump - work done - head developed - Specific energy – Priming - Minimum starting speed - net positive suction head - Performance of multistage pumps - Performance curves – cavitation - working principles and applications of reciprocating , Gear and submergible pumps.

UNIT V

HYDRAULIC TURBINES - Hydraulic turbines – Classification - working principles - Pelton wheel, Kaplan turbines - Francis turbines - velocity triangles - theory of draft tubes – Performance - Selection of turbines - governing of turbines - method of preventing hydraulic coupling - Torque converters.

TEXTBOOKS

1. H.R. VALLENTINE, Applied Hydrodynamics, S.I. Edition, ELBS, 1970.
2. J.F.DOUGLAS, J.M.GASIOREK AND J.ASWAFFIELD, Fluid Mechanics, ADDISON WILEY 1999.
3. K.L. KUMAR, Fluid Mechanics, TMH.

REFERENCES

1. VICTOR L. STREETER AND BENJAMIN WYLIE & KIETH W.BEDFORD, Fluid Mechanics, Mc Graw Hill 1999.
2. DOUGLAS, J.F, Solving Problems in Fluid Mechanics Vol I and Vol II, ELBS, 1986.
3. SHAMES, Mechanics of fluids, McGraw Hill ISE.
4. A.H CHURCH AND JAGDISH LAL, Centrifugal Pumps and Blowers, Metropolitan Book Company Pvt. Ltd., ND 1973.
5. MODI P.N SETH, Hydraulics, Fluid Mechanics & Machinery, Standard Book House. 2007, 16th Edition.
6. R.K BANSAL, Fluid Mechanics & Hydraulic Machines. 2008, 9th Edition.
7. K.SUBRAMANIA, Theory and application of Fluid Mechanics, TMH (P) Ltd., N.Delhi – 1993.
8. BISWAS, Introduction to Fluid Mechanics and Fluid Machines, TMH
9. Dr. K. R. Arora, Fluid Mechanics Hydraulics and Hydraulic Machines, Standard Publishers, 2007, 9th Edition.
10. S. K. Som, G. Biswas, Introduction to Fluid Mechanics and Fluid Machines, TMH, 2008, 2nd Edition.
11. M. K. Natarajan, Principles of Fluid Mechanics, Oxford & IBH Publishing Company P Ltd, 1999, 2nd Edition.
12. C. P. Kothandaraman, Fluid Mechanics and Machinery, New Age Publishers, 2007, 2nd Edition.

EBM4DT093 - MECHANICS OF SOLIDS

UNIT 1

Stress & Strain: Concept of stress, axial loading, normal stress, shearing stress, bearing stress, stress on an oblique plane under axial loading, components of stress, ultimate and allowable stress, factor of safety, Concept of strain, normal stress under axial loading, stress-strain diagram, Hook's law, Poission's relation, elastic constants and their relation-mechanical and thermal stresses in simple and composite members, strain energy, resilience, impact load, Saint-Venant's principle-stress concentration.

UNIT II

Bending stress in simple and composite beams, biaxial stresses, principle stress & strain, maximum shearing stress, Mohr's circle for plane stresses, Shear stress in a beam of rectangular section, I –section. Shear force and bending moment diagram for determinate beam, cantilever, simply supported and overhanging beams.

UNIT III

Slope and deflection of beams by – Double Integration method, Maculay's method, Moment area method, conjugate beam method and strain energy method for determinate beam, Cantilever, Simply supported, Over hanging beam for various types of load with and without applied moment.

UNIT IV

Torsion of circular shaft, strain energy in torsion, stress concentration in torsion, shaft under action of varying torque, hollow shafts, combined bending and twisting of shafts, equivalent bending and twisting moments. Springs: Close coiled helical springs, Open coiled helical springs, Leaf springs, Spiral springs.

UNIT V

Thin cylinder and thin spherical shells – under internal pressure, volumetric strain on capacity.

Column and struts – Combined bending and axial stresses, Euler formula for long columns. Empirical formulae for short columns – Applications.

TEXTBOOKS

1. POPOV E.P, Mechanics of Solids, PHI, New Delhi, 1976
2. BEER & JOHNSON, Mechanics of materials, SI Metric Edition, McGraw Hill, ISE
3. L.S. SRINATH, Advanced Mechanics of Solids, TMH, 2009, 3rd Edition

REFERENCE BOOKS

1. GERE AND TIMENSENKO, Mechanics of Materials, CBS, 1986.
2. JACKSON AND WIRTZ, Statics and Strength of Materials, Schaum Series, 1983.
3. S. RAMAMRUTHAM AND R. NARAYAN, Strength of Materials, Dhanpat Rai and Sons, New Delhi.2007, 15th Editon.
4. RYDER G.H. , Strength of materials by ELBS.
5. S.P. TIMOSHENKO J.N GOODIER, Theory of Elasticity, Mc Graw Hill International Edition.
6. S.M.A.KAZIMI, Solid Mechanics, Tata McGraw Hill Publishing Company Ltd.
7. TIMOSHENKO & YOUNG, Engineering Mechanics, McGraw Hill
8. REES DWA. Basic Solid Mechanics, McMillan Press, London, 1997
9. Arthur P. Borezi, Advanced Mechanics of Materials, John Wiley & Sons Ltd, 1993, 5th Edition.
10. Dr. R. K. Bansal, Strength of Materials, Lakshmi Publishers, 2007, 4th Edition.
11. J. B. K Das, Mechanics of Materials, Sapna Book House, 2007.

EBM4DT094 - APPLIED THERMODYNAMICS

UNIT I

FLOW THROUGH NOZZLE - One-dimensional flow of steam through Convergent - Divergent Nozzle - Critical pressure ratio, super saturated flow in nozzles.

UNIT II

STEAM TURBINES - Impulse and Reaction turbine Principles - Compounding – Types - Velocity diagrams for simple and multistage turbines - Speed regulations – Governors.

UNIT III

REFRIGERATION - Refrigeration cycles- Reversed Carnot cycle - Vapour compression system - Vapour absorption refrigeration system- Properties of refrigerants – Multi pressure refrigeration systems- Gas cycle refrigeration, ejector compression refrigeration systems - Refrigeration equipments – Compressors - Condensers - Expansion devices - Evaporators.

UNIT IV

RECIPROCATING AIR COMPRESSORS - Working principle – work done - Effect of clearance volume - Single and multi stage compressors, Volumetric efficiency – Intercooling in multistage compressors, calculation of power requirement – Rotary compressors.

UNIT V

AIR CONDITIONING - Principles of air-conditioning - Types of A/C Systems - Summer, Winter - Comfort and Year round air conditioners – Window & Centralised A/c - heat load calculations – Concept of GSHF – RSHF - ESHF

TEXT BOOKS

1. VANWVYLEN & SONNTAG, Classical Thermodynamics – Wiley Eastern.
2. P.K. NAG, Engineering Thermodynamics –Tata –McGraw Hill.4th Edition.
3. ROGER & MAYHEW, Engineering Thermodynamics – Addison Wiley, 2007, 4th Edition
4. J.P HOLMAN, Thermodynamics – McGraw Hill, 1995
5. Y.V. C Rao, Engineering Thermodynamics, 2005 1st Edition.
6. P. L. Ballaney, Thermal Engineering, Khanna Publishers, 2007, 24th Edition.
7. R. K. Rajput, Thermal Engineering, Lakshmi Publishers, 2008, 6th Edition.

REFERENCES

1. MARK. W. ZEMANSKY AND RICHARD H. DITTMAN, Heat and Thermodynamics, McGraw Hill.
2. T. ROY CHOUDARY, Basic Engineering Thermodynamics, 1997, TMH
3. BRIJLAL N. SUBRAHMANYAM, Heat and Thermodynamics –S. Chand & Co.,
4. SPALDING & COLE, Engineering Thermodynamics, ELBS
5. MICHAEL SAAD, Thermodynamics, Prentice Hall, 1997
6. KENNETH WORK Jr, Advanced Thermodynamics for Engineers,
7. Mc Graw Hill, 1995.
8. M. S. YADAV, Thermodynamics, Anmol Publications Pvt Ltd, New Delhi. 2000.
9. C.P. Arora, Thermodynamics, TMH, 5th Edition.
10. S. C. Singhal, Engineering Thermodynamics, CBS Publishers, 2004, 1st Edition.

(Use of approved Thermodynamic property tables like Steam tables, R & A/C Mollier chart, Psychrometric chart are permitted in all the examinations)

EBM4DT095 - MANUFACTURING TECHNOLOGY - II

UNIT I

THEORY OF METAL CUTTING - Introduction, mechanics of metal cutting – Merchant's circle, Chip formation, Types of Chips, Cutting force calculations, Torque and Power Calculations in Machining, Tool materials, Influence of tool Geometry, Tool Life, machining time calculation, Machinability – evaluating and rating, metal cutting economics, problems in Merchant's circle, tool life, and machining time.

LATHES & AUTOMATS:

Introduction, types, Specification, construction Features, mechanism and attachments for various operations, Work and Tool Holding devices.

Semi-Automatic lathe - Capstan and Turret Lathes: Indexing mechanisms, tool and loading arrangements. Automatic Lathes: Introduction, Classification, Single spindle and multi spindle mechanisms.

UNIT II

SHAPER, PLANER AND MILLING PROCESSES - Shaper, Planer and Slotter: Introduction, types, specification, mechanism - holding devices, hydraulic drives in shaper, difference between shaper and planer.

Milling Processes

Introduction, types and specifications, mechanisms, holding devices, types of milling operation. Milling tool nomenclature and its specifications, Indexing – Types-Simple, Compounding and differentials.

Drilling, Boring and broaching

Introduction, specification, Types, mechanisms, nomenclature of tools and its specification.

Surface finishing process

Grinding process – various types of grinding, work holding devices, grinding wheel -Types and specification. Honing, Super finishing, polishing, buffing, metal spraying, galvanizing and electroplating

UNIT III

Gear manufacturing processes - Casting, Rolling, Extrusion, Stamping, Powder Metallurgy. Gear Machining-Forming or Form cutting - Gear generating process-Gear shaping, Gear hobbing Gear planning, Gear broaching. Bevel gear generation.

Gear finishing process

Gear Finishing Methods – Gear Shaving, Gear Grinding, Gear lapping, Gear honing.

UNIT IV

NON TRADITIONAL MACHINING PROCESS - Introduction, Classification, Applications, Benefits, Construction and working Principle of Various Processes - Abrasive jet machining Electrical discharge machining, Wire cut EDM Process, Electro chemical machining, Electro chemical grinding, Electron beam machining, Laser beam machining, Plasma jet machining.

UNIT V

INTRODUCTION TO JIGS AND FIXTURES - Locating and Clamping devices - Principles - Elements - Mechanical, Pneumatic and Hydraulic Actuation, Types of Jigs, General consideration in Jig Design, Jig Bushing, Types- methods of construction. Types of Fixtures- Fixture for machine tools - Lathe, Milling, Boring, Broaching, Grinding. Assembly inspection of welding fixture design.

TEXT BOOKS

1. Milton C.Shaw “ Metal Cutting Principles” Oxford Science Publications, 1997
2. Juneja B.L , Fundamentals of Metal Cutting and Machine Tools, 2nd Edition, New Age Internal Publishers,2005
3. Sharma. P.C., "A Text book of Production Technology" (Manufacturing Technology) , Sixth Edition, S.Chand & Company Ltd, New Delhi, 2007
4. Serope Kalpakjian, Steven R.Schmid "Manufacturing Engineering and Technology" Fourth Edition, 2004, Pearson Education
5. Sharma.P.C. “ A Text Book of Production Engineering “ Tenth Edition, S.Chand & Company Ltd, New Delhi, 2002.

REFERENCES

1. Rao. P.N., "Manufacturing Technology", Metal Cutting & Machine Tools , Tata McGraw Hill Publishing Co, New Delhi, 2000.
2. ROY. A LINDBERG, Process and Materials of Manufacture, PHI, New Delhi.
3. PAUL RANKY, Introduction to Flexible Manufacturing Systems.
4. W. A. J CHAPMAN, Workshop Technology, Arnold publishers Vol - III
5. R.K. JAIN. Production Technology, Khanna Publishers
6. YUSUF ALTINATAS, Manufacturing An Introduction – Cambridge University Press, 2000.
7. PHILLIP F. OSTWALD, JAINO MUNOZ, Manufacturing Process and Systems, 9th edition, John Wiley & Sons, 1998.
8. M.HASTLE HURST, Manufacturing Technology, ELBS
9. Hazra Choudhury S.K & Hazra Choudhury A.K, Elements of Manufacturing Technology, Vol-II, Media Publications.
10. C. Elanchezhian, Production Technology, Easwar Press, 2005.

EBM4CTO96 - ELECTRICAL TECHNOLOGY

UNIT I

DC MACHINES - Construction – EMF and torque – circuit model – armature reaction – commutation – methods of excitation – characteristics of generators – characteristics of motors – starting and speed control – testing and efficiency – parallel operation.

UNIT II

TRANSFORMERS - Construction – principle of operation – equivalent circuit – losses – testing – efficiency and voltage regulation – auto transformer – three phase connections – parallel operation of transformers – phase conversion – tap changing.

UNIT III

INDUCTION MACHINES - Construction – types – principle of operation – equivalent circuit – torque and power output – testing – single phase induction motor – double revolving field theory – performance analysis – load characteristics – starting methods

UNIT IV

SYNCHRONOUS MACHINES - Construction – types – circuit model – synchronous reactance – voltage regulation – emf, mmf methods – armature reaction – synchronizing – parallel operation

Principle-starting-speed- torque curves-phasor diagrams- v & inverted v curves- phase modifiers - hunting in synchronous machines and its prevention - applications

UNIT V

SPECIAL MACHINES - Shaded – pole induction motor – variable reluctance motor – stepper motor – hysteresis motor – ac series motor – repulsion motor – linear motor – permanent magnet dc and ac motors.

TEXT BOOK

1. Nagrath I. J and Kothari D. P. 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 1990.
2. B.L.Theraja & A.K.Theraja, "Electrical Technology" , Vol – II, S.Chand Company Ltd, New Delhi, 2007.
3. S.L.UPALL., Electrical Power, Khanna Publishers , New Delhi.

REFERENCES

1. Fitzgerald,A.E.Charles Kingsley Jr.Stephen D.Umans, 'Electric Machinery', McGraw-Hill Book Company,1992
2. Syed A.Nassar, 'Electric Machines and Power System', Volume I, McGraw-Hill Inc., New York, 1995.
3. Nagrath,I.J.and Kothari.D.P., 'Electric Machines', T.M.H publishing Co Ltd., New Delhi 1990.

Part - I

Unit I

Religion and different philosophical Schools - evolution of religious thoughts and ritual practices; astica and nastica sets; Jaina & Buddhist philosophy.

Unit II

Bhakti Movement – evolution of trimurti tradition and Bhakti movement; Shankara, Ramanuja, Madhwa, Vellabha, Bhaskara, etc. personalities and their contribution in Indian philosophy; Alwars, Nayanmars, Kabir, Tulasi, Meera, Goswami, etc. and their role in Bhakti movement;

Unit III

Important personalities and their Contribution – Devarishies, Maharishies, Rishies, Seers and contribution of their institutions to protect the cultural heritage.

Part - II

Unit IV

Significance of Yoga in daily life.

Unit V

Vedic Mathematics, Astrology & Astronomy, Jyotism, etc. early Indian works and its importance in day to day life.

REFERENCE BOOKS

1. Datta, B. & A.N. Singh. 1962(rp). *History of Hindu Mathematics*. 2 Vols. Asian Publishing House. Bombay.
2. Jagadguru Swami Sri Bharati Krishna Tirthaji Maharaj. 1994 *Vedic Mathematics*. Motilal Banarasidas. New Delhi.
3. Kulkarni, R.P. 1983. *Geometry according to Sulba Sutra*. Samsodhana Mandal. Pune.
4. Radhakrishna, S. 1993(rp). *Indian Philosophy*. Vol I & II. Oxford University Press. Delhi.
5. Rao, J. 1960. *Principles and Practices of Medical Astrology*. Raman Publications. Bangalore.
6. Swami Satyananda Saraswati. 1997 (rp). *Asanas Pranayama Mudra Bandha*. Bihar Yoga Bharati. Bihar.

EBM4DPO91 - FLUID MECHANICS AND MACHINERY LABORATORY

1. Verification of Bernoulli's equation
2. Calibration of orifice meter and Venturi meter
3. Flow through nozzle
4. Flow through notches and weirs
5. Flow through pipes and losses in pipes
6. Buoyancy experiment – Meta centric height
7. Wind tunnel – Drag and Lift measurement
8. Performance characteristics of centrifugal pump
9. Performance characteristic of reciprocating pump
10. Performance characteristic of gear oil pump
11. Performance characteristic of deep jet valve pump
12. Performance characteristic of submersible pump
13. Performance Characteristics of reaction turbine
14. Performance Characteristics of Impulse turbine
15. Performance Characteristics of Kaplan turbine

EBM4DPO92 - STRENGTH OF MATERIALS LABORATORY

1. Tension test on MS rod and twisted bar (Electronic UTM)
2. Compression test on bricks and concrete blocks (Electronic UTM)
3. Comparison of hardness value of steel, copper and aluminium using Rockwell, Brinell and Vickers hardness measuring machines
4. Estimation of notch toughness of steel using impact testing machine
5. Fatigue test on steel
6. Compression test on wood
7. Estimation of spring constant under tension and compression
8. Tension test on MS wire (Tensile Testing Machine)
9. Double shear test (Electronic UTM)
10. Torsion test on mild steel.

EBM4CPO93 Electrical Machines Laboratory

1. Speed control of DC shunt motor
2. Load test on DC shunt motor
3. Load test on DC series motor
4. Open circuit characteristic of a separately excited DC generator
5. Open circuit characteristic curve of self excited DC shunt generator
6. Load test on DC series generator
7. Load test on three phase alternator
8. Load test on three phase CAGE INDUCTION motor
9. Load OC & SC Test on Single phase Transformer
10. Load test on single phase transformer
11. Study of AC&DC motor starters.

SEMESTER - V

EBU5FTO51 - NUMERICAL METHODS

UNIT I

ITERATIVE METHODS - Introduction - Beginning an iterative method - The method of successive bisection - The method of False position - Newton Raphson Iterative method - Secant method - The Method of successive approximation .

UNIT II

SOLUTION OF SIMULTANEOUS ALGEBRAIC EQUATIONS
Introduction – Direct methods of solution – Gauss elimination method , Gauss – Jordan method , Crout's method – Iterative methods of solution – Jacobi's method , Gauss – Seidal method – Solution of non-linear simultaneous equations – Newton–Raphson method – Determination of eigen values by iteration.

UNIT III

INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION - Finite differences – Newton's interpolation formulae – Interpolation with unequal intervals – Lagrange's formula ; Newton's divided difference formula – Inverse interpolation – Numerical differentiation – Maxima and Minima of Tabulated functions - Numerical integration – Trapezoidal rule; Simpson's $1/3^{\text{rd}}$ rule ; Simpson's $3/8^{\text{th}}$ rule.

UNIT IV

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS - Introduction – Picard's method – Taylor's series method – Euler's method – Modified Euler's method – Runge's method – Runge-Kutta method – Predictor-corrector method ;Milne's method.

UNIT V

NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS
Introduction – Classification of second order equations – Finite difference approximation to derivatives – Elliptic equations – Solution of Laplace's equation – Solution of Poisson's equation – Parabolic equations – Solution of heat equation – Hyperbolic equations – Solution of wave equation.

REMARKS

"THE PAPER IS NOT THEORY ORIENTED AND THE CONTENTS OF THE PRESCRIBED TEXT BOOK ARE TO BE STRICTLY FOLLOWED" "STUDENTS ARE NOT EXPECTED TO WRITE ALGORITHMS" "EACH UNIT IS TO BE COVERED IN 12 PERIODS EACH OF 50 MINUTES DURATION"

PRESCRIBED TEXT BOOKS

1. V.Rajaraman, Computer Oriented Numerical Methods, Third Edition, Prentice

Hall of India Pvt. Ltd., New Delhi.

Unit I Chapter 3 (3.1 - 3.7 (Except 3.5.1, 3.5.2))

2. B.S.Grewal, Higher Engineering Mathematics, thirty-sixth Edition, Khanna Publishers, New Delhi, 2002.

Unit II Chapter 24 (24.5-24.8 (Except 24.6.3))

Unit III Chapter 25 (25.1, 25.5, 25.14, 25.16 (Except 25.16.1 , 25.16.5))

Unit IV Chapter 27 (27.1-27.7 , 27.8.1)

Unit V Chapter 28 (Full)

REFERENCES

1. Ward Chenny, David Kincaid, Numerical Mathematics and Computing, Fourth Edition, Brookes and Cole Publishing Company, 1999.
2. Namir G.Shammas, C/C++ Mathematical Algorithms for Scientists and Engineers, McGraw Hill Company, 1996.
3. B.L.Agarwal, Programmed Statistics, New Age International Publishers, 1996.
4. George W. Snedecor, William G. Cochran, Statistical Methods, Eighth Edition, Affiliated East West Press, 1994.
5. C. Xavier, C Language and Numerical Methods, New Age International Publishers, 1999.

UNIT I

GAS POWER CYCLES - Air standard cycles - Otto, Diesel and Dual cycles, Brayton cycle

Vapour power cycles: Rankine cycle, reheat and regenerative cycle - Influence of superheating - Binary vapour cycle.

UNIT II

IC ENGINES - Classification – Working of SI & CI engine - analysis of thermodynamic cycle for two stroke and four stroke engine – Port timing- Valve timing diagram – carburetor – Types-Fuel supply system in CI engines - fuel injection – types of injection systems – MPFI – CRDI system – Fuel pump - Lubrication and cooling system – Ignition system – Battery coil , Magneto & Electronic ignition system – Firing order

UNIT III

COMBUSTION AND TESTING OF I.C. ENGINES - Cetane and Octane numbers of fuels - Combustion, Knocking and detonation – Scavenging - Turbo charging and supercharging - Performance testing of I.C Engines - Determination of frictional power and determination of various efficiencies - Heat balance calculations.

UNIT IV

EMISSION AND ALTERNATE FUEL - Emission – Formation mechanism in SI & CI engine – Pollution measuring instruments – Pollution control methods – Emission Standards – After treatment – EGR – Catalytic converter – Alternate fuel for IC engines – LPG – Alcohol – Hydrogen – Natural gas.

UNIT V

CRYOGENICS - Introduction, historic review, properties of cryogenic fluids, Liquefaction of Gases: Linde and Claude systems. Cryogenic refrigeration systems, Joule – Thompson, Stirling, Magnetic and dilution refrigeration systems, Air separation systems, heat exchangers, expanders, compressors. Cryogenic insulation materials, Storage devices and transfer lines, applications of Cryogenics.

TEXT BOOKS

1. RANDAL F. BARRON, Cryogenics systems, McGraw Hill, 1985.
2. V. GANESAN, IC Engines, TMH, 1995
3. KHURMI R. S & GUPTA J. K, A Text book of Thermal Engineering, S. Chand & Co.,
4. VANWVYLEN & SONNTAG, Classical Thermodynamics – Wiley Eastern.
5. P.K. NAG, Engineering Thermodynamics –Tata –McGraw Hill.4th Edition.

REFERENCE BOOKS

1. ROGER & MAYHEW, Engineering Thermodynamics – Addison Wiley, 1999
2. J.P HOLMAN, Thermodynamics – McGraw Hill, 1995
3. MARK. W. ZEMANSKY AND RICHARD H. DITTMAN, Heat and Thermodynamics, McGraw Hill.
4. T. ROY CHOUDARY, Basic Engineering Thermodynamics, 1997, TMH
5. BRIJLAL N. SUBRAHMANYAM, Heat and Thermodynamics –S. Chand & Co.,
6. SPALDING & COLE, Engineering Thermodynamics, ELBS
7. MICHAEL SAAD, Thermodynamics, Prentice Hall, 1997
8. KENNETH WORK Jr, Advanced Thermodynamics for Engineers, Mc Graw Hill, 1995.
9. M. S. YADAV, Thermodynamics, Anmol Publications Pvt Ltd, New Delhi. 2000.
10. C.P. Arora, Thermodynamics, TMH, 5th Edition.
11. S. C. Singhal, Engineering Thermodynamics, CBS Publishers, 2004, 1st Edition.
12. Y.V. C Rao, Engineering Thermodynamics, 2005 1st Edition.
13. P. L. Ballaney, Thermal Engineering, Khanna Publishers, 2007, 24th Edition.
14. R. K. Rajput, Thermal Engineering, Lakshmi Publishers, 2008, 6th Edition.

(Use of approved Thermodynamic property tables like Steam tables, Mollier chart, Psychrometric chart are permitted in all the examinations)

EBM5DT093 - KINEMATICS OF MACHINES

UNIT I

Links, Pairs, Chains, Mechanisms, Inversion of machines, Structure - Degrees of freedom, inversion, Four bar chains. Velocity and acceleration: Velocity and acceleration of simple mechanism by relative velocity method. Klein's constructions for slider crank chain oscillating cylinder and swivel bearing mechanisms. Analytical solution for slider crank mechanisms.

UNIT II

Cams: Types of cams and followers, displacement, velocity & acceleration curves for uniform velocity, uniform acceleration and retardation. SHM, cycloidal curves, lay out of profile of plate cams of the above types with reciprocating and oscillating followers – knife edge rollers and flat faced followers, cylindrical and face cams, polynomial cams, cams with special contours.

UNIT III

Theory of gearing: Toothed gears, minimum number of teeth, length of arc of contact, interference.

UNIT IV

Gear trains: Types, velocity ratio and torque calculation in epicyclic gear trains and differential gear train.

UNIT V

Belt and rope drives, single plate, multiple plate, cone clutches, power transmitted, Brakes. Lubrication: Theory of lubrication, hydrostatic and hydrodynamic bearings, frictional loss, power in bearing.

TEXTBOOKS

1. AMITABH GHOSH AND ASHOK KUMAR MALLIK, Theory of mechanism and Machines – 3rd Edition, Affiliated East West Press Limited, 2007.
2. J.E.SHIGLEY AND J.J.VICKER Jr. Theory of Machines and Mechanism, 2nd ed. Mc GrawHill ISE 1995
3. R.S. KHURMI & GUPTA .J.K, A text book of Theory of Machines, S. Chand & Co., 2008, 14th Edition.
4. G.K.GROVER, Mechanical Vibrations, New Chand and Brothers, Roorkee.

REFERENCES

1. J.HANNAH AND R.C STEPHENS ARNOLD, Mechanics of Machines – ISE 1986.
2. BEER & JOHNSTON 5TH Edition, Vector Mechanics for Engineers. McGraw Hill. ISE 1988.
3. THOMAS BEVAN – 3rd Edition, The Theory of Machines – CBS 1984.
4. P.L.BALLANEY, Theory of Machines, Khanna Publishers, 2005, 24th Edition.
5. S.S.RATTAN, Theory of Machines, TMH. 2008, 2nd Edition.
6. RAO .J.S. & DUKKIPATI. R.V. Mechanism and Machine Theory, 2nd ed. Wiley Eastern Ltd., 2007,
7. HAMILTON H. MABIE & CHARLES F. REINNOLTZ, Mechanisms and Dynamics of Machinery, 4th ed. John Wiley & Sons, 1995
8. THOMSON W.T, Theory of Vibration and Applications, PHI, 1975
9. Sadhu Singh, Theory of Machines, Pearson Education Ltd, 2007.
10. Ashok G. Ambekar, Mechanism and Machine Theory , Eastern Economy Edition. 2007.
11. John. J. Uicker, Theory of Machines and Mechanisms, Oxford University Press, 2008, 3rd Edition.

EBM5DT094 - INSTRUMENTATION AND CONTROL SYSTEMS

UNIT I

GENERAL CONCEPTS OF MECHANICAL INSTRUMENTATION, MEASUREMENTS SYSTEM: Basic detector transducer elements, Intermediate modifying systems, Terminating devices and methods. Classification of instruments as indicators, recorders and integrators -Their working principles, precision and accuracy, Measurement of error and analysis, properties of errors.

Measurements of displacements, time, speed, frequency, acceleration, vibrometer, accelerometer , etc.

UNIT II

PRESSURE MEASUREMENT: Gravitational, Bourdon, Elastic transducers, strain gauge, Pressure cells, Measurement of high and low pressure, Dynamic characteristic of pressure measuring devices.

TEMPERATURE MEASUREMENT: Bi-metallic, pressure and resistance thermometer, Thermocouples, Pyrometer and Thermistors, Calibration. Pressure and temperature measurement in rotating systems – slip rings.

FLOW MEASUREMENTS: Orifice, flow nozzle, venturi, pitot tube, rotometer, Turbine type Anemometer, Hot-wire anemometer, Magnetic flow meter, Ultrasonic flow meter - Calibration.

DENSITY MEASUREMENT: Phenometer, Hydrometer, differential bubbling, Liquid level Measurements.

VISCOSITY: Capillary tube viscometer, efflux viscometer, falling sphere viscometer, Rotating cylinder viscometer.

HUMIDITY: Sling psychrometer, Absorption hydrometer, Dew point meter.

UNIT III

STRAIN: Strain gauges, types, surfaces preparation and bonding technique, Wheatstone Circuit, Temperature compensation, Gauge rosettes, Calibration.

FORCE MEASUREMENT: Scales and balance, Elastic force meter, Strain gauge, Load cells Hydraulic and pneumatic load cells.

TORQUE MEASUREMENT: Mechanical torsion meter, Optical torsion meter, Electrical torsion meter, Strain gauge torsion meter.

UNIT IV (Control Systems)

Open and closed systems, Servomechanisms, Transfer function, Signal flow graphs, Block diagram algebra, Hydraulic and pneumatic control systems. Two-way control, proportional control, differential and integral control. Simple problems.

UNIT V

Time response of first order and second order systems. Concept of stability. Necessary Condition for stability, Routh stability constraint, Polar and Bode plots, Nyquist stability Criterion. Simple problems.

TEXTBOOKS

1. C. V.COILETE & AD. HOPE, Engineering Measurements, 2nd ed. ELBS.
2. THOMAS G. BECKWITH. N. LEWIS BUCK. ROY D. MARARGONJ, Mechanical Measurements, Narosa Publishing House 2008, 6th Edition, New Delhi.
3. I.J. NAGRATH, M. GOPAL, Control System Engineering, New Age International Publications, 2007, 5th Edition.
4. K.OGATA, Modern Control Engineering, PHI, 1996
5. J.P HOLLMAN, Experimental Methods for Engineers, 6th ed. MGH

REFERENCES

1. B.G. KUO, Automatic Control Systems, McGraw Hill, ISE.
2. D' AZZO AND HOUPIS, Feedback Control Systems - Analysis and synthesis, McGraw Hill. ISE.
3. KUMAR. D.S. Mechanical Measurements & Control, Metropolitan Book Co., 1989
4. SIROHI RS. & RADHAKRISHNAN H.C, Mechanical Measurement, New Age International (P) Ltd., 2005, 3rd Edition.
5. RANGAN C.S, SARMA G.S & MANI VSV, Instrumentation Device and Systems, TMH, 1989
6. DOEBLIN, Measurement Systems Application and Design, TMH, 1990
7. A. K. Sawhney, Mechanical Measurements and Instrumentation, Dhanpat Rai & Company (P) Ltd, 2007, 12th Edition
8. R.K. Jain, Mechanical and Industrial Measurements, Khanna Publishers, 2004, 12th Edition.
9. M. Gopal, Control Systems, TMH, 2007, 2nd Edition.
10. Dr, D. Ganesh Rao, Control Systems, Sanguine, Technical Publishers, 2006.

EBM5DT095 - MACHINE DRAWING

Indian standard code of practice for engineering drawing – General principles of presentation, Conventional representations of threaded parts, springs, gear and common features, Abbreviations and symbols for use in technical drawings, conventions for sectioning and dimensioning.

Tolerance – types – representation of tolerances on drawing, Fits – types – selection of fits – allowance.

Geometric tolerances – Form and positional tolerances – Datum, Datum features.

Maximum material principle – Symbols and methods of indicating it on drawing – Surface finish symbols – Welding symbols method of indicating it on drawing.

Preparation of working drawing for machine components like:

Fastenings-nuts, bolts-screws, keys, keyways. Riveted joints.

Joints-Cotter joint and Knuckle joint.

Connecting rod, Plummer block, Screw jack, Cross head for horizontal and vertical engines, Swivel bearing, Machine vice, Lathe tail stock, Tool head of the shaper, Stop valve, Safety valve, Relief valve.

TEXT BOOKS

1. GOPALAKRISHNAN, Machine Drawing, Subash Publishers.
2. N.D BHATT, Machine Drawing, Charotar Publishing House, Anand. 2007, 42nd Edition.
3. N.SIDDHESWAR, P.KANNIAH, & V.V.S SATRY, Machine Drawing, Tata McGraw Hill, 2008.
4. M.C.MATHUR AND R.S VAISHWANAR, Engineering Drawing and Graphics
5. Goutam Pohit, Machine Drawing with Auto CAD, Pearson Education, 2007.
6. K. L. Narayana, Machine Drawing, New Age Publication, 2007, 3rd Edition.

Revised IS codes

10711, 10713, 10714, 9609, 1165, 10712, 10715, 10716, 10717, 11663, 11666, 10968, 11669, 8043,8000.

EBM5BT096 - ELECTRONICS AND MICROPROCESSORS

UNIT I

DIODES & TRANSISTORS - Review of Semiconductors -PN junction - Zener effect- Zener diode characteristics -Half wave and full wave rectifiers - Zener Voltage regulators.Bipolar junction transistor- CB, CE, CC configuration and characteristics - Biasing circuits-Class A, B and C power amplifiers. Field effect transistor -Configuration and characteristic of FET amplifier.

UNIT II

THYRISTORS & FEED BACK CIRCUITS - SCR, Diac, Triac, UJT, Switching transistors -Characteristics and simple applications.Concept of feedback-Negative feedback- Basic feedback amplifier topologies - Application in temperature and motor speed control.Sinusoidal oscillators – Positive feed back – RC phase shift, Hartley, Colpit's, Wien bridge oscillators.

UNIT III

OPERATIONAL AMPLIFIERS AND DIGITAL ELECTRONICS - Basic operational Amplifier (IC 741) - Ideal Characteristics – Applications : Inverting & Non-Inverting amplifiers– Instrumentation Amplifier – Voltage to Current Converter - Current to Voltage Converter - Schmitt trigger circuit- Astable Multivibrator - DAC – ADC.

Binary number system - Boolean algebra -Digital Logic gates - Flip flops-Half and full adders- Shift Registers-Counters.

UNIT IV

8085MICROPROCESSOR - Block diagram of microcomputer-Architecture of 8085-Pin configuration-Instruction set- Format & Types Addressing modes-Simple programs using arithmetic and logical operations.

UNIT V

INTERFACING AND APPLICATIONS OF MICROPROCESSOR - Basic interfacing concepts - Interfacing of Input (Switches & ADC) and Output (LED & DAC) devices, Programmable Peripheral Interface IC 8255- Applications of 8085 Microprocessor : Temperature control, Stepper motor control, traffic light control – Electronic weighing system, Data Logger.

TEXT BOOKS

1. G.K Mitthal Electronic Devices and Circuits. Khanna Publications .
2. Ramesh Goankar, "Microprocessor Architecture", Programming and Applications with 8085, Wiley Eastern, 1998.

REFERENCES

1. Milman and Halkias, "Integrated Electronics", Tata McGraw-Hill publishers, 1995.
2. Roi Chowdry, Shalltain and Jain "Linear Integrated Circuits", Wiley Eastern M.Morris Mono – Digital Logic & Computer Design – PHI, II Edn, 1999.
3. Douglas V.Hall, "Microprocessor and Interfacing", Programming and Hardware, Tata McGraw-Hill, 1999.

EBU5JTO27 - SANSKRIT & INDIAN CULTURE – IV

Part - I

Unit I

Temple worship – Evolution of religious establishments; worship in temples; ritual requirements; daily rituals; symbolism of rituals.

Unit II

Temple Festivals – Daily, monthly, yearly, occasionally, etc.; different *vahanas*; *mudras* in worship; *yajna* and *yajna vedicas* for different sacrifices; other worships and programs related to religious and human welfare.

Part- II

Unit III

Significance of Gandharva veda; Evolution & development of music; Karnataka & Hindustani music; main styles; different famous personalities & their contribution. different early musical instruments.

Unit IV

Evolution & development of dance; different schools; important famous personalities.

Unit V

Different schools and contribution of music, dance and dramas to preserve cultural heritage.

REFERENCE BOOKS

1. Rao, S.R.K. 1992. *Alaya and Aradhana*. Agama-Kosha (Agama Encyclopaedia). Kalpatharu Research Academy Publications. Vol VI. Bangalore.
2. Sharma, S. 1997. *Comparative study of Evolution of Music in India and the West*. Pratibha Prakashan. Delhi.
3. Sanyal, R. 1987. *Philosophy of Music*. Somaya Publications Pvt. Ltd. Bombay

INSTRUMENTATION

1. Pressure measuring devices – pressure & vacuum gauge calibration
2. Temperature measuring devices – Thermocouples, Resistance thermometer & Thermistor
3. Speed measuring device – Stroboscope, tachometer
4. Force measuring device – load cells, proving rings
5. Torque measuring device – Rope & Prony brake arrangements
6. Strain measurement - strain gauge
7. Displacement measuring device – LVDT
8. Velocity and acceleration measurement – Accelerometer - Piezo electric accelerators
9. Vibration measurement – Vibrometer

DYNAMICS

1. Study of cutting force using lathe/drill tool dynamometer
2. Determination of critical speed of whirling of shaft
3. Static & dynamic balancing of rotors
4. Dynamic balancing of masses using computerised m/c.
5. Determination of M.I by suspension of Simple and compound pendulum method
6. Study of undamped of free vibration of equivalent spring mass system
7. Study of undamped torsional vibrations of single rotor system
8. Porter, Proell and Hartnell Governors
9. Characteristics of Hydrodynamics – journal bearing.
10. Cam and follower analysis.

FOUNDRY

1. Study of moulding tools, equipment's, and furnaces
2. Preparation of green sand moulding for cubical block, gland, bush, straight pipe, bend pipe, tee- pipe, grooved pulley, involving 2 boxes
3. Sand testings – Permeability, green sand strength and compressibility.
4. Metal casting techniques (demo only)

SMITHY

1. Study of tools and forges
2. Converting a square out of round rod
3. Making L – bend, J- hook, U- clamp
4. Making a square/hexagonal headed bolt

WELDING

1. Exercises in electric arc welding like Butt joint, Lap joint, Tee joint and fillet
2. Gas welding and gas cutting – template cutting
3. MIG and TIG welding

LATHE

1. Study of lathe – types – accessories – capabilities and process – specification
2. Lathe operation – plain & step turning, taper turning, grooving and under cutting, knurling, thread cutting (single, multistart and internal), eccentric turning
3. Exercise on drilling, reaming, boring & tapping
4. Exercise on capstan lathe/ Turret Lathe.
5. Single point tool grinding using bench grinder (DEMO).

ANALOG ELECTRONICS

1. I Characteristics of PN Junction and Zener Diodes.
2. Input & Output Characteristics of BJT.
3. Drain & Transfer Characteristics of JFET.
4. VI Characteristics of UJT / SCR.
5. Load Regulation Characteristics of Half Wave and Full Wave Rectifier.
6. Zener Voltage Regulator.
7. Inverting amplifier / Non Inverting amplifier / Schmitt trigger using IC 741
8. Instrumentation Amplifier / Astable Multivibrator using IC 741

DIGITAL ELECTRONICS

1. Study of Logic Gates.
2. Adder / Subtractor.
3. Flip Flops - RS/ D / T / JK and Counters.

8085 MICROPROCESSOR

1. 8 – Bit Addition / Subtraction / Multiplication / Division.
2. Look up table technique / Sort an array in ascending order.
3. Programming the PPI (8255 IC) in various modes
4. IO Mode (Interfacing keys, LED's and 7 segment LED)
5. BSR Mode (Square Wave Generation)
6. Stepper Motor Interface.
7. Interfacing ADC/ DAC (Includes Wave form generation)
8. Interfacing the Traffic Light controller.

SEMESTER VI

EBM6DT091 - HEAT AND MASS TRANSFER

UNIT I

CONDUCTION - Introduction to conduction heat transfer, Fourier's law of conduction, thermal conduction equation – derivation in Cartesian, cylindrical coordinates. One dimensional steady state conduction in plane wall and composite wall – thermal resistance, electrical analogy. Radial system – cylinder, sphere. Convective boundary condition, overall heat transfer coefficients, critical thickness of insulation, heat generation in plane wall, cylinder and sphere. Conduction and convective system – fins with different boundary conditions, thermal contact resistance, variable conductivity.

UNIT II

CONDUCTION IN TWO DIMENSION - Steady state conduction in two dimension, conduction shape factor numerical method of analysis, unsteady state conduction – Lumped heat capacity system, significance of Biot and Fourier numbers, transient heat flow in a semi-infinite solid, use of Heisler and Grober charts. Heat transfer in multi dimensional system,

UNIT III

CONVECTION - Review of boundary layer and thermal boundary layer. Differential and integral equation for hydrodynamic and thermal boundary layer. Similarity between heat, mass and momentum boundary layer. Significance of non-dimensional number in convection. Dimensional analysis for free and forced convection.

FORCED CONVECTION - Heat transfer from flat plate, flow through pipes, use of empirical relations.

FREE CONVECTION - Heat transfer from vertical, horizontal and inclined surfaces.

UNIT IV

RADIATION - Nature of thermal radiation, Black body concept, Grey body, Radiation shape factor, Relationship between shape factor, radiation heat transfer between two surfaces, Electrical analogy, reradiating surface, radiation shield, gas radiation, heat exchange between gas volume and enclosure.

UNIT V

HEAT EXCHANGER- Types of heat exchangers – shell and tube, one – pass, two – pass, multi-pass, double-pipe, fouling factor, overall heat transfer co-efficient, LMTD and NTU Methods

Condensation – Types – Boiling Heat transfer

MASS TRANSFER

Fick's law of diffusion, equimolar counter diffusion, mass transfer coefficient, Non-dimensional number in mass transfer, evaporation process in atmosphere.

TEXT BOOKS:

1. J.P.HOLMAN, Heat Transfer – SI Metric ed. McGraw Hill, ISE, 2002, 9th Edition.
2. NECATI M. OZISIK, Heat Transfer, McGraw Hill, ISE, 1998
3. KOTHANDARAMAN C.P, Fundamentals of Heat & Mass Transfer, New Age International, 2007, 3rd Edition.

REFERENCES:

1. CHAPMAN, Heat Transfer – Maxwell McMillan ISE, 1986.
2. BIJHON, Convective Heat Transfer – John Wiley.
3. Schaum Series, Heat Transfer, McGraw Hill, ISE
4. SACHDEVA R.C, Heat and Mass Transfer, New Age International (P) Ltd., 2007, 2nd Edition.
5. T. K. BASE, Numerical Fluid Dynamics, Narasa Publishing House, New Delhi, 1997.
6. ARTHOR P. FRAAS, Heat Exchanger Design, John Wiley & Sons, 1997.
7. Frank Kreith, Principles of Heat Transfer, Thomson India Edition, 2001.
8. S. P. Venkatesan, Heat Transfer, Ane Books, 2004.
9. Kern, Process Heat Transfer, TMH, 2007.
10. Y. V. C. Rao, Heat Transfer, University Press, 2001.
11. Domkundwar, Heat and Mass Transfer, Dhanpat Rai India Ltd, 2008, 7th Edition.

(Use of approved Heat and Mass transfer Data book & Steam Tables permitted for all examinations)

UNIT I

POWER PLANT EQUIPMENT - Essential of steam power plant equipment – power station design – characteristics of steam power plant – layout – Stokers - Types– pulverized fuel firing – principles of FBC – Types of FBC – Arrangement of different FBC plants – advantages of FBC systems – Ash handling – dust collectors – draft measurements – chimneys – calculation of chimney heights – feed water treatment – air preheater – types of superheaters, condenser, cooling towers.

UNIT II

STEAM GENERATORS - Boilers – types of modern high pressure boiler – boiler mountings and accessories – thermal efficiency of boiler – boiler performance – selection of fuel for boiler – boiler maintenance – selection of boiler – heat balance sheet for boiler – Indian boiler act.

UNIT III

POWER PLANT LAYOUTS - Gas turbine power plant layout
Classification or comparison of different types of gas turbine power plants – different arrangements of plant components – governing system for gas turbine power plant.
Diesel power plant layout
Different systems of diesel power plant – advantages & disadvantages of diesel power plant over thermal plant
Hydroelectric power plant layout
Classification – storage reservoir plants – pump storage plants – advantages of hydro-electric power plants.
MHD power plant

UNIT IV

NUCLEAR POWER PLANT - Nuclear Reactor: General components of nuclear reactors – different types of reactors – pressurized water reactor (PWR), Boiling water reactors (BWR), heavy water cooled and moderated - reactors, gas cooled reactors, liquid metal cooled reactors, fast breeder reactors, location of nuclear power plant, comparison of nuclear power plants with thermal plants. Nuclear materials – fuels – coolant – moderators & reflecting materials – control rod – shielding materials.

UNIT V

POWER PLANT ECONOMICS - Load curves – different terms & definitions – effect of variable load on power plant design & operation – requirement of peak load plants – fixed or operating cost – load diversion – tariff methods for electrical energy – comparison of economic of different types of power plants – environmental hazards of various power plants.

TEXT BOOKS

1. M. N. EI. WAKIL, Power Plant Technology, Mc Graw Hill, 1985.
2. ARCHIEW . CULP Jr., Principle of Energy Conversation, Mc Graw Hill.
3. P. K. NAG, Power Plant Engineering, TMG, 2008.3rd Edition.
4. G. R. NAGPAL, Power Plant Engineering, Khanna Publishers, 1986.

REFERENCES

1. VOPAL AND STORTZKI, Power Plant Engineering, PHI.
2. DOMKUNDWAR, Power Plant Engineering, Dhanpat Rai & Sons.2007, 5th Edition.
3. JOEL WEISMAN AND ROY ECKART, Morden Power Plant Engineering, PHI
4. G. D. RAI, Non Conventional Sources of Energy, Khanna Publishers, Delhi. 2007, 4th Edition.
5. V. Kadambi, An Introduction to Energy Conversion, New Age Publication Ltd, 2004.

EBM6DT093 - DYNAMICS OF MACHINES

UNIT I

BALANCING - Static and dynamic balancing of rotating masses in different planes, partial balancing of reciprocating masses of in – line, V, W and radial engines. Hammer blow and swaying couple in locomotive, direct and reverse crank method.

UNIT II

INERTIA FORCE - Inertia force and inertia torque calculation. Turning moment diagrams, reciprocating engine mechanisms, fluctuation of energy and speed, Weight of flywheels.

UNIT III

GOVERNORS AND GYROSCOPE - Function of governors – porter, proell and spring-loaded governors, sensitivity, stability, hunting and isochronisms, effect of friction, calculation of equilibrium speeds and ranges of speed of governors.

Gyroscope – couple and effect, in ship and motor cycle, car, aircraft and space vehicles, Gyroscope stabilization.

UNIT IV

FREE VIBRATION - Undamped free vibration of single degree of freedom system, simple pendulum, compound pendulum, inclined spring-mass system, equivalent stiffness of spring combinations – springs in series, springs in parallel, combined series and parallel springs.

Damped free vibration of single degree of freedom systems, types of damping, free vibrations with viscous damping, critically damped system, under damped system.

UNIT V

FORCED VIBRATION - Forced vibration of single degree of freedom system. Constant harmonic excitation, steady state vibration, magnification factor with frequency ratio for various damping.

Transverse vibrations of beams –natural frequency by energy method, Dunkerly method-Vibration isolation and transmissibility, whirling of shafts.

Torsional vibrations: Torsional vibrations of single and multiple rotor systems, Equivalent shafts, Geared systems, Holzer's method.

TEXTBOOKS

1. AMITABH GHOSH AND ASHOK KUMAR MALLIK, Theory of mechanism and Machines – 3rd Edition, Affiliated East West Press Limited, 2007.
2. J.E.SHIGLEY AND J.J.VICKER Jr. Theory of Machines and Mechanism, 2nd ed. Mc GrawHill ISE 1995
3. R.S. KHURMI & GUPTA .J.K, A text book of Theory of Machines, S. Chand & Co., 2008, 14th Edition.
4. G.K.GROVER, Mechanical Vibrations, New Chand and Brothers, Roorkee.

REFERENCES

1. J.HANNAH AND R.C STEPHENS ARNOLD, Mechanics of Machines – ISE 1986.
2. BEER & JOHNSTON 5TH Edition, Vector Mechanics for Engineers. McGraw Hill. ISE 1988.
3. THOMAS BEVAN – 3rd Edition, The Theory of Machines – CBS 1984.
4. P.L.BALLANEY, Theory of Machines, Khanna Publishers, 2005, 24th Edition.
5. S.S.RATTAN, Theory of Machines, TMH. 2008, 2nd Edition.
6. RAO .J.S. & DUKKIPATI. R.V. Mechanism and Machine Theory, 2nd ed. Wiley Eastern Ltd., 2007,
7. HAMILTON H. MABIE & CHARLES F. REINNOLTZ, Mechanisms and Dynamics of Machinery, 4th ed. John Wiley & Sons, 1995
8. THOMSON W.T, Theory of Vibration and Applications, PHI, 1975
9. Sadhu Singh, Theory of Machines, Pearson Education Ltd, 2007.
10. Ashok G. Ambekar, Mechanism and Machine Theory , Eastern Economy Edition. 2007.
11. John. J. Uicker, Theory of Machines and Mechanisms, Oxford University Press, 2008, 3rd Edition.
12. S. S. Rao, Mechanical Vibrations, Pearson Education, 2007, 4th Edition.
13. J. B. K. Das, Dynamics of Machinery, Sapna Book House, 2007.

EBM6DT094 - DESIGN OF MACHINE ELEMENTS

UNIT I

Introduction to design process – factor influencing the machine design, selection of material based on its physical properties. Direct, bending and torsional stress equation, impact and shock loading. Criteria of failure, stress concentration factor, size factor, surface finish factor – factor of safety, design stress, theories of failures – simple problems.

UNIT II

Variable and cyclic loads – fatigue strength and limit, S-N curve, combined cyclic stress, Soderberg and Goodman's equations. Design of helical, leaf, disc, and torsional springs under constant loads and varying loads.

UNIT III

Design of solids and hollow shaft based on strength, rigidity and critical speed. Design and drawing of keys, keyways, coupling-rigid and flexible couplings.

UNIT IV

Design and drawings of welded joints, riveted joints for pressure vessels and structure. Threaded fasteners, cotter joint, knuckle joints, and pipe joints.

UNIT V

Design and drawing of piston, connecting rod, crank shaft and fly wheel

TEXT BOOKS

1. T.V. SUNDARAJAMOORTHY AND SHANMUGAM, Machine Design,
2. JOSEPH EDWARD SHIGHLEY, Mechanical Engineering Design, McGraw Hill. 2008, 8th Edition.
3. R.S. KHURMI & GUPTA JK, A text book of Machine Design, S. Chand & Co.,
4. PANDYA & SHAH, Elements of Machine Design,
5. DONALDSON. C, Tool Design, Tata McGraw Hill & Co.

REFERENCES

1. V. DOBROVOLSKY, Machine Elements, Mir Publication, 1978.
2. A.S. HALL, A.R. HOLOWENKO, AND H.G. LAUGHLIM, Theory And Problems In Machine Design Schaum's series
3. HALL AND ALLEN. S. Machine Design, Schaum's Series. 2008, TMH.
4. M.F. Spolts, Design of Machine Elements, Pearson Education, 2005, 7th Edition.
5. Gitin M. Maitra, Hand Book of Mechanical Design, 2nd Edition.
6. J. B. K Das, Design of Machine Elements, Sapna Book House, 2007, 2nd Edition.
7. A. S. Ravindra, Design of Machine Elements, Best Publishers, 2005. 2nd Edition.
8. V. B. Bhandari, Design of Machine Elements, TMH, 2007.

Hand book

Design data book, PSG College of technology, Coimbatore.

(Use of approved data books are permitted in all the examinations)

EBM6DT095 - COMPUTER AIDED DESIGN

UNIT 1

INTRODUCTION TO CAD - Introduction to Design process, Role of Computers in design, types of devices used in design (like display devices, digitizers, light pen, plotter, etc.) and their functions. Various CAD software, Graphics Standards

UNIT 2

GRAPHICS CONCEPTS (2D & 3D) - Co-ordination System-Transformation, Translation, Scaling, Reflection, Rotation – Concatenated Transformation – Inverse Transformation, Projection – View, Orthographic, Isometric, perspective

UNIT 3

VISUALIZATION - windowing, View ports, clipping, Hidden line removal, hidden surface removal, Hidden Solid removal – shading-colouring-rendering-Animation.

UNIT 4

MODELING - Geometric modeling- type- wireframe, Surface and solid Modeling. Solid Modeling Techniques- solid entities, Half-Spaces, Boundary Representation (B-Rep) – Constructive Solid Geometry (CSG) – Sweeps- solid Manipulation.

UNIT V

FEM FUNDAMENTALS - Introduction – Steps involved in FEA- Nodes- elements and their type, shape function, Constraints, Forces and Nodal Displacements – Stiffness Matrix- solution techniques.
Analysis of Bar Elements. Simple problem involving stepped bar subject to axial loading.

TEXTBOOKS

1. NEWMAN AND SPROULL. R.F, Principles of Interactive Computer Graphics, McGraw Hill.
2. RADHAKRISHNAN. P, CAD/CAM/CIM, 3st ed. New Central Book Agency, 2008.
3. KANT VAJPAYEE, Principles of Computers – Integrated Manufacturing, 1st ed. PHI, 1995
4. Ibrahim zeid, CAD/CAM, TMH, 2007.

REFERENCES

1. BESANT C.B & LUI.C.N.K, Computer Aided Design and Manufacture, 3rd ed. East West Press.
2. MIKELL P.GROOVER AND EMORY W.ZIMMERS.Jr., Computer Aided Design and Manufacturing, PHI. 2007.
3. PETER NINGHAM, CAD systems in Mechanical and Production Engineering, East West Press.
4. ZIENKIEWIZ O.C, The Finite Element Method, McGraw Hill.
5. RAO, Features of AutoCad-2000, Wiley
6. SADHU SINGH, CAD/CAM, Khanna Publishers
7. Michael E. Mortenson, " Geometric Modeling ",John Wiley and sons,Inc,1997.
8. Rogers D.F., Adams J.A.,"Mathematical elements for computer graphics", McGraw Hill,1976.
9. Donald Hearn, M. Pauline Baker, "Computer graphics", Prentice Hall of India, New Delhi, 1997.

EMB6DE096 - PRODUCTION AND OPERATION MANAGEMENT

UNIT I

INTRODUCTION - Functional sub systems of organizations, Systems concept of production, Types of production systems, Productivity, Strategic management. Product Design and Analysis: New product development, Process Planning and Design, Value analysis and Value Engineering, Standardization, Simplification, Make or Buy decisions, Ergonomic considerations in Product design. Capacity Planning and Investment Decisions: Capacity planning and strategies, Investment formulas and comparisons of alternatives

UNIT II

FORECASTING AND FACILITY LOCATION AND LAYOUT- Forecasting: Introduction, Nature and use of forecasting, Measures of Forecasting, factors affecting forecasting, Types and models of forecasting. Facility Location and Lay out: Factors influencing plant location, location evaluation methods, Different types of lay outs for operations and production, arrangement of facilities within the department, CRAFT, ALDEP, CORELAP etc.,

UNIT III

MPS AND INVENTORY CONTROL - Aggregate Planning and Master Production Scheduling: Nature of aggregate planning, Methods of aggregate planning, Approaches to aggregate planning - graphical, empirical and optimization, Development of MPS, MRPI and MRPII. Inventory Analysis and Control: Definitions, ABC inventory systems, Inventory models, EOQ models for purchased and manufactured parts, lot sizing techniques

UNIT IV

SCHEDULING AND PROJECT MANAGEMENT - Scheduling and Controlling: Objectives in scheduling, Major steps involved, Information systems linkages in production planning and control, Production control in repetitive, batch / flow shop and job shop scheduling environment - SPT, EDD, WMFT. Project Planning and Management: Phases of project planning, Evolution of network planning techniques - Critical Path Method (CPM) and Project Evolution and Review Technique (PERT), Crashing of project network, Project scheduling with constrained resources - RLT & RAT, Graphical Evolution and Review Technique (GERT), Project monitoring, Line balance.

UNIT V

MODERN PRODUCTION MANAGEMENT TOOLS - Just In Time(JIT)
- Introduction, elements, pull and push method, KANBAN systems, Small lot size, quick inexpensive set up, Continuous improvement, optimized production technology, CIM and FMS, Benefits and Scope of TQM, Factors affecting quality and Quality control activities in product cycle and ISO 9000 series - Scope and Benefits

REFERENCE BOOKS

1. Panneerselvam. R., 'Production and Operations Management', Prentice Hall India, 2001
2. Vollman.T.E., 'Manufacturing Planning & Control Systems', Galgotia publication (p) ltd, New Delhi, 1998
3. Dilworth. B. James., 'Operations Management - Design, Planning and Control for Manufacturing and services', Mc Graw Hill Inc., New Delhi, 1992
4. Bedworth D.D., 'Integrated Production Control Systems' - Management, Analysis, Design, John Wiley & sons, New York, 1982

Part - I

Unit I

Art forms as cultural expression; technology & aesthetics; their relation to the social structure.

Unit II

Evolution of religious structures & architecture in Indian; different early schools and art centers; important other secular structures.

Unit III

Development of regional styles in Indian art & architecture; important features of Nagara, Dravida & Vesara styles in temple architecture. Sculpture, Iconography and Paintings – different centers and contribution on Indian culture.

Part - II

Unit IV

Significance of Stapatya veda; Silpa and Vastu Sastra – significance of vastu in architecture. Vishvakarma, Mayamata, Manasara, Samarangana, Stapatya, etc., personalities and their contribution in Indian Architecture.

Unit V

The decorative art & craft; precious stones & metal; textiles & carpets; calligraphy & other important works;

REFERENCE BOOKS

1. Banerji, J.N. 1941. *The Development of Hindu Iconography*. University of Calcutta. Calcutta.
2. Gopinath Rao, T.R. 1914. *Elements of Hindu Iconography*. Vol I & II.
3. Meister, M.W. (ed) 1983. *Encyclopaedia of Indian Temple Architecture*. American Institute of Indian Studies. University of Pennsylvania Press. Philadelphia.
4. Sukla, D.N. 1993. *Vastu-Sastra. Hindu Science of Architecture*. Munshiram Manoharlal Publishers Pvt. Ltd. New Delhi.

EMB6DP091 - HEAT TRANSFER LABORATORY

1. Thermal conductivity of insulating powder
2. Heat transfer through composite wall
3. Heat transfer under natural convection
4. Heat transfer under forced convection
5. Heat transfer through a pin fin
6. Parallel / counter flow heat exchanger
7. Stefan – Boltzman apparatus
8. Thermal conductivity of metal bar
9. Emissivity measurement
10. Heat transfer through lagged pipe
11. Performance analysis of vapour Compression Refrigeration system
12. Performance analysis of cooling tower
13. Shell & tube Heat Exchanger
14. Recirculation Type A/c.
15. Dropwise and Flimwise condensation

EMB6DP092 - COMPUTER AIDED DESIGN LAB

Introduction to computer-aided drawing – 2D drawing – Orthographic views – 2D sectional views, part drawing, assembly drawing, detailed drawing. Dimensioning annotations, symbols – welding, surface finish, & threads – exercise – knuckle joint, Gib and cotter joint, screw jack, Foot step bearing.

3D DRAWING MODELLING :- Part modeling – protrusion, cut sweep, draft and loft, Modify, edit – pattern transformation, Boolean equation. Assembly – creating assembly from parts, modify / edit – pattern. Conversion Of (3D) solid modeling to (2D) modelling. ADVANCED MODELLING – 3D HELIX, Bearing, gear – EXCERCISE – PISTON, CONNECTING ROD, UNIVERSAL JOINT, COUPLINGS, AUTOMATED DRAWING, SHEET METAL AND SURFACE MODELLING.

Note: *Any one of the 3D MODELING softwares like CATIA, UNIGRAPHICS, Autodesk Inventor , AutoCAD, Pro/E, IDEAS to be used.*

EMB6DP093 SPECIAL MACHINES LAB

1. Machining of plane and inclined surfaces, grooving, dovetail cutting using shaping machine
2. Cutting of spur, helical, bevel gear and milling of polygon surface using milling machine
3. Making of spur gear using gear Hobbing machine
4. Making of helical gear using gear Hobbing machine
5. Cutting of keyway (internal & external) using slotting machine
6. Exercises involving cylindrical grinder
7. Exercises involving surface grinder
8. Exercises involving tool & cutter grinder
9. Exercises involving center less grinder.

SEMESTER - VII

EBM7DT091 OPERATIONS RESEARCH

UNIT I

LINEAR MODEL - The phases of OR study – formation of an L.P model- graphical solution – simplex algorithm – artificial variables technique– Big M method, two phase method.

UNIT II

TRANSPORTATION PROBLEM - Optimal solution by north west corner method- least cost method – vogels approximation method – optimality test – MOBI method.

Assignment problem – formulation – Hungarian method -unbalanced assignment problem.

UNIT III

NETWORK MODELS - Shortest route – minimal spanning tree - maximum flow models – project network- CPM and PERT network-critical path scheduling.

UNIT IV

REPLACEMENT MODELS - Replacement of items that deteriorate with time – value of money changing with time –not charging with time – optimum replacement policy – individual and group replacement. Sequencing problem: models with n jobs with 2 machines – problem with n jobs with 3 machines.

UNIT V

QUEUING THEORY - Queuing models – queuing systems and structures – notation –parameter – single server and multiserver models – Poisson input – exponential service – constant rate service – infinite population.

TEXT BOOK

1. Taha H.A, “Operation Research”, Pearson Education sixth edition, 2003

REFERENCES

1. Hira and Gupta “Introduction to Operations Research”, S.Chand and Co.2002
2. Hira and Gupta “ Problems in Operations Research”, S.Chand and Co,2002.
3. Panneerselvam, ‘Operations Research” Prentice Hall of India, 2003.
4. Wagner, “Operations Research”, Prentice Hall of India, 2000.

EBM7DT092 - COMPUTER INTEGRATED MANUFACTURING

UNIT I

Introduction to Automation -Production system Facilities, Manufacturing Support Systems, Automation in Production Systems, Automated Manufacturing Systems, Types of Automation, Computerized manufacturing Support System, Reasons for Automating, Manufacturing Industries and Products, Manufacturing operations, Product / Production Relationships, Production Concepts and Mathematical Models. Basic elements of an Automated System, Advanced Automation Functions, Levels of Automation.

Industrial Control Systems-Process Industries versus Discrete Manufacturing Industries, Continuous versus Discrete Control, Computer Process Control, Forms of Computer Process Control

UNIT II

Fundamentals of CAD, CAM and CAE, CIM Definition, CIM Wheel, CIM components, Evolution of CIM - Development of computers - Needs of CIM, Benefits of CIM. CIM Hardware & Software, CIM Models.

DBMS and Network system - Data base and DBMS- requirement, features and architecture of DBMS. CIM Communications (Network) System, Communication Matrix, Network Architectures, Tools and Techniques.

UNIT III

Group Technology – Introduction - coding and classification system, Production Flow Analysis, Coding System - OPTIZ, MICLASS, Benefits of Group Technology , Machine cell design.

Process Planning- Structure of a Process Planning, Process Planning function, CAPP - Types of CAPP, Retrieval and Generative type CAPP, Concurrent engineering, Design for Manufacturing and Assembly, Advanced Manufacturing Planning.

UNIT IV

Fundamentals of NC Technology – Basic components of an NC System, NC Coordinate and Motion Control systems, Computer Numerical Control, Features of CNC, Machine Control Unit for CNC, CNC Software, DNC Machines, Application of NC machine tools Applications, Structure of CNC Machines, , CNC Controllers, NC Part Programming, Computer-Assisted Part Programming.

Features and Applications of CNC Turning Centre, CNC Milling Machine, CNC Turn-Mill Centre, CNC machining Centre, CNC Tooling system and Automatic Tool Changing System, Computer Aided Quality Control - contact, non contact inspection methods, Coordinate Measuring Machine CMM - Integration of CAQC with CAD / CAM.

UNIT V

FMS -Components of FMS, Computer control and function, FMS planning, scheduling and control, Knowledge Based Scheduling, FMS operation control, Hierarchy of computer control, supervisory control, types of software used in FMS, Applications and Benefits.

Production Support Machines and Systems -Industrial Robots, Automated Material Handling, Automatic Guided Vehicles, Automated Storage and Retrieval system.

Developments in Manufacturing Technologies- AI and Expert System, Agile manufacturing, Lean Manufacturing, Virtual Manufacturing, Simulation in Manufacturing – Factories of Future.

TEXT BOOKS

1. KANT VAJPAYEE.S, Principles of Computer- Integrated Manufacturing; 1st ed. PHI 2006.
2. MIKELL P. GROOVER, Automation, Production Systems & CIM, 2nd ed. PHI 2001.
3. James A.Rehg, Henry W.Kraebber, Computer- Integrated Manufacturing, second Edition, Pearson Education.
4. P.N. Rao, CAD/CAM Principles and Applications Second Edition, TMH 2006.

REFERENCE BOOKS

1. Radhakrishnan.P, Subramanyan. S, Raju.V, 'CAD/CAM/CIM', Second Edition, New Age International publishers, 2000
2. Daniel Hunt.V., 'Computer Integrated Manufacturing Hand Book', Chapman & Hall, 1989
3. Groover M.P, 'Computer Aided Design and Manufacturing', Prentice Hall of India, 1987
4. Yorem Koren, 'Computer Control of Manufacturing System', McGraw Hill, 1986
5. Ranky Paul. G., 'Computer Integrated Manufacturing', Prentice Hall International, 1986.
6. ROGER MANNAM, Computer Integrated Manufacturing from Concepts of Realization 1st ed. Addison Wiley, 1997.
7. P. N. Rao, Computer Aided Manufacturing, TMH, 2007, 12th Edition.

EBM7DT093 - DESIGN OF TRANSMISSION SYSTEMS

UNIT I

BEARINGS AND DRIVES - Design of sliding contact bearings using Sommerfield number – design using Mckee's equation, selection of rolling contact bearing for radial and axial load combination and for varying load cycles.

Design of flat belts and 'V' belts using manufacturer's data, introduction to continuously variable speed transmission, design of step cone pulley, design of chain drives, design of hoisting and hauling ropes.

UNIT II

BRAKES, SCREWS AND CAMS - Design of clutches – Various service factors – dry and wet clutches, design of brakes - heat generation and dissipation in brakes – force analysis in drum brakes with external shoes – permissible bearing pressure – selection of brake material – braking power – power absorbed - bearing load calculations – width of shoe, design of band brakes – simple and differential type – width and thickness design. Introduction to design of disk brakes – brake lining fade.

Design of cams for parabolic, SHM, and cycloid follower motions, undercutting in cams – torque required to drive cams – polynomial motion cams – cam size determination – inertia force calculation – contact stress calculation.

UNIT III

DESIGN OF SPUR AND HELICAL GEARS - Design of spur and helical gears – design of Geneva wheel mechanism, power rating calculations based on strength and wear considerations – gear tooth correction.

UNIT IV

DESIGN OF POWER SCREWS - Design of power screws – wear and strength considerations – design of lead screws for machine tools, design of screw jacks and toggle jacks. Design of bevel and worm gears, design of Ratchet and Pawl mechanism

UNIT V

MULTI SPEED GEAR BOXES - Design of speed reducers, design of multi speed gearboxes for Automobile - machine tools, structural and ray diagrams.

TEXT BOOKS

1. PRABHU. T.J. Design of Transmission Elements.
2. SUNDARARAJAMURTHY.T.V AND SHANMUGAM, Machine Design, Khanna Publishers.
3. JOSEPH EDWARD SHIGHLEY, Mechanical Engineering Design, McGraw Hill. 2008, 8th Edition.
4. R.S. KHURMI & GUPTA JK, A text book of Machine Design, S. Chand & Co.,
5. PANDYA & SHAH, Elements of Machine Design,
6. DONALDSON. C, Tool Design, Tata McGraw Hill & Co.

REFERENCE BOOKS

1. V. DOBROVOLSKY, Machine Elements, Mir Publication, 1978.
2. SHIGLEY, Mechanical Engineering Design, McGraw Hill.
3. PANDYA AND SHAH, Elements of Machine Design.
4. MAITRA, Handbook of Gear Design, Tata McGraw Hill.
5. A.S. HALL, A.R. HOLOWENKO, AND H.G. LAUGHLIM, Theory And Problems In Machine Design Schaum's series
6. HALL AND ALLEN. S. Machine Design, Schaum's Series. 2008, TMH.
7. M.F. Spolts, Design of Machine Elements, Pearson Education, 2005, 7th Edition.
8. Gitin M. Maitra, Hand Book of Mechanical Design, 2nd Edition.
9. J. B. K Das, Design of Machine Elements, Sapna Book House, 2007, 2nd Edition.
- 10.A. S. Ravindra, Design of Machine Elements, Best Publishers, 2005. 2nd Edition.
- 11.V. B. Bhandari, Design of Machine Elements, TMH, 2007.
- 12.A.S.HOLOWENKO, A.R., AND LAUGHLIN H.G Theory and problems in Machine Design, Hall, Schaum series.

Hand book

Design data book, PSG College of technology, Coimbatore.

(Use of approved data books are permitted in all the examinations)

EBM7DT094 - GAS DYNAMICS & JET PROPULSION

UNIT I

BASIC CONCEPTS AND ISENTROPIC FLOWS - Energy and momentum equations of compressible fluid flows - Stagnation states, Mach waves and Mach cone - Effect of Mach number on compressibility - Isentropic flow through variable area ducts - Nozzle and Diffusers - Use of Gas tables.

UNIT II

FLOW THROUGH DUCTS - Flow through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) - Variation of flow properties - Use of tables and charts - Generalised gas dynamics.

UNIT III

NORMAL AND OBLIQUE SHOCKS - Governing equations - Variation of flow parameters across the normal and oblique shocks - Prandtl - Meyer relations - Use of table and charts - Applications.

UNIT IV

JET PROPULSION - Theory of jet propulsion - Thrust equation - Thrust power and propulsive efficiency - Operation principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan & turbo prop engines – Aircraft combustors

UNIT V

SPACE PROPULSION - Types of rocket engines - Propellants - Ignition and combustion - Theory of rocket propulsion - Performance study - Staging - Terminal and characteristic velocity - Applications - Space flights.

TEXT BOOK

1. S.M. Yahya, " Fundamentals of Compressible Flow ", New Age International (P)Limited, New Delhi, 2007.

REFERENCES

1. P.Hill and C. Peterson, " Mechanics and Thermodynamics of Propulsion, Addison Wesley Publishing Company, 1992.
2. N.J. Zucrow, " Aircraft and Missile Propulsion, Vol. I & II ", John Wiley , 1975.
3. N.J. Zucrow, " Principles of Jet Propulsion and Gas Turbines ", John Wiley, New York, 1970.
4. H.Cohen, G.E.C.Rogers and Saravanamuttoo, " Gas Turbine Theory Longman Group Ltd., 1980.
5. G.P.Sutton, " Rocket Propulsion Elements ", John Wiley, 1986, New York.
6. V.Ganesan, " Gas Turbines ", Tata McGraw Hill Publishing Co., New Delhi, 2008. 2nd Edition.
7. E. Radhakrishnan, Gas Dynamics, PHI, 2000. 2nd Edition.

EBM7DT095 - MECHATRONICS

UNIT I

MECHATRONICS, SENSORS AND TRANSDUCERS - Introduction to Mechatronics Systems – Measurement Systems – Control Systems – Microprocessor based Controllers.

Sensors and Transducers – Performance Terminology – Sensors for Displacement, Position and Proximity; Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, Light Sensors – Selection of Sensors

UNIT II

ACTUATION SYSTEMS - Pneumatic and Hydraulic Systems – Directional Control Valves – Rotary Actuators. Mechanical Actuation Systems – Cams – Gear Trains – Ratchet and pawl – Belt and Chain Drives – Bearings.

Electrical Actuation Systems – Mechanical Switches – Solid State Switches – Solenoids – D.C Motors – A.C Motors – Stepper Motors.

UNIT III

SYSTEM MODELS AND CONTROLLERS - Building blocks of Mechanical, Electrical, Fluid and Thermal Systems, Rotational – Translational Systems, Electro-Mechanical Systems – Hydraulic – Mechanical Systems.

Continuous and discrete process Controllers – Control Mode – Two – Step mode – Proportional Mode – Derivative Mode – Integral Mode – PID Controllers – Digital Controllers – Velocity Control – Adaptive Control – Digital Logic Control – Micro Processors Control.

UNIT IV

PROGRAMMING LOGIC CONTROLLERS - Programmable Logic Controllers – Basic Structure – Memory - Input / Output Processing – Programming – Mnemonics – Timers, Internal relays and counters – Shift Registers – Master and Jump Controls – Data Handling – Analogs Input / Output – Selection of a PLC – PLC Applications

UNIT V

DESIGN OF MECHATRONICS SYSTEM - Stages in designing Mechatronics Systems – Traditional and Mechatronics Design - Possible Design Solutions

Case Studies of Mechatronics Systems, Pick and place robot – automatic Car Park Systems – Engine Management Systems Automatic Camera, Washing machine.

TEXT BOOKS

1. W. Bolton, "Mechatronics", Pearson Education, 3rd Edition, 2007.
2. HMT Ltd, Mechatronics, TMH, 2007.

REFERENCES

1. Michael B. Histan and David G. Alciatore, " Introduction to Mechatronics and Measurement Systems", McGraw-Hill International Editions, 2007. 3rd Edition
2. Bradley D. A., Dawson D., Buru N.C. and. Loader A.J, "Mechatronics", Chapman and Hall, 1993.
3. Dan Neculesu, "Mechatronics", Pearson Education Asia, 2002 (Indian Reprint).
4. Lawrence J. Kamm, "Understanding Electro – Mechanical Engineering", An Introduction to Mechatronics, Prentice – Hall of India Pvt., Ltd., 2000.
5. Nitaigour Premchand Mahadik, "Mechatronics", Tata McGraw-Hill publishing Company Ltd, 2003
6. Prof. C. R. Venkataramana, Mechatronics, Sapna Book House, 2003.

ELECTIVE - I

EBM7DE096A - FINITE ELEMENT ANALYSIS

UNIT I

INTRODUCTION - Historical background – Matrix approach – Application to the continuum – Discretisation – Matrix algebra – Gaussian elimination – Governing equations for continuum – Classical Techniques in FEM – Weighted residual method – Ritz method

UNIT II

ONE DIMENSIONAL PROBLEMS - Finite element modeling – Coordinates and shape functions- Potential energy approach – Galarkin approach – Assembly of stiffness matrix and load vector – Finite element equations – Quadratic shape functions – Applications to plane trusses

UNIT III

TWO DIMENSIONAL CONTINUUM - Introduction – Finite element modelling – Scalar valued problem – Poisson equation – Laplace equation – Triangular elements – Element stiffness matrix – Force vector – Galarkin approach - Stress calculation – Temperature effects

UNIT IV

AXISYMMETRIC CONTINUUM - Axisymmetric formulation – Element stiffness matrix and force vector – Galarkin approach – Body forces and temperature effects – Stress calculations – Boundary conditions – Applications to cylinders under internal or external pressures – Rotating discs

UNIT V

ISOPARAMETRIC ELEMENTS FOR TWO DIMENSIONAL CONTINUUM - The four node quadrilateral – Shape functions – Element stiffness matrix and force vector – Numerical integration - Stiffness integration – Stress calculations – Four node quadrilateral for axisymmetric problems.

TEXT BOOKS

1. Chandrupatla T.R., and Belegundu A.D., "Introduction to Finite Elements in Engineering", Pearson Education 2002, 3rd Edition.
2. David V Hutton "Fundamentals of Finite Element Analysis" 2004. McGraw-Hill Int. Ed.
3. Rao S.S., "The Finite Element Method in Engineering", Pergammon Press, 1989

REFERENCES

1. Logan D.L., "A First course in the Finite Element Method", Third Edition, Thomson Learning, 2002.
2. Robert D.Cook., David.S, Malkucs Michael E Plesha, "Concepts and Applications of Finite Element Analysis" 4 Ed. Wiley, 2003.
3. Reddy J.N., "An Introduction to Finite Element Method", McGraw-Hill International Student Edition, 1985
4. O.C.Zienkiewicz and R.L.Taylor, "The Finite Element Methods, Vol.1", "The basic formulation and linear problems, Vol.1", Butterworth Heineman, 5th Edition, 2000.
5. C. S. Krishnamoorthy, Finite Element Analysis, TMH, 2007, 2nd Edition.
6. K. J. Bathe, Finite Element Procedures, PHI, 2006,
7. Desai/ Abel, Introduction to Finite Element Method, CBS Publishers, 2005.
8. S. M. Murigendrappa, Fundamental of Finite Element Method, Interline Publishing, 2006.

EBM7DE096B - PLANT LAYOUT AND MATERIAL HANDLING

UNIT I

PLANT LOCATION & PHYSICAL FACILITIES - Introduction - Factors to be considered - Selection of plant site - Consideration in facilities planning and layout – Installation and implementation of layout

Equipment required for plant operation - Classification of equipment - Main factors for selection of equipment - Capacity Integration of equipment and capacity – Serviceability – Flexibility - Analysis in selection of equipment - Space requirements - Man Power Requirements.

UNIT II

PLANT LAYOUT - Introduction - Need for Layout – Factors influencing Plant Layout – Product or Line Layout - Process or Functional Layout – Fixed Position Layout – Combination Layout – Tools and Techniques for developing Layout – Process Chart – Flow Diagram – String Diagram – Template – Scale models – Layout Planning Procedure – Visualization of Layout – Revision and improving existing Layout - Line balancing – Fabrication line balancing – Assembly Line balancing.

UNIT III

MATERIAL HANDLING - Introduction – Importance – Scope – Principles of Material handling – Planning Principle – Operation Principle – Equipment Principle – Costing Principle – Types of Material Handling System – Factors Influencing the Selection of Material Handling Devices – Common Material Handling Devices in use – Specification of material handling equipment

UNIT IV

ANALYSIS OF MATERIAL HANDLING & PACKAGING - Factors involved – Motion Analysis – Safety Analysis – Need for Safety – Equipment – Cost analysis – Palletization Analysis – Analysis of operation – Material Handling Surveys – Need for Survey – Types of Surveys - Reasons for Bad Material Handling.

Packing of Material – Importance of Packaging – Layout of Packaging – Package Machineries – Types – Wrapping and Packing of Materials – Cushion Materials.

UNIT V

MATERIAL HANDLING SYSTEM - Flexible hoisting appliances like ropes and chains- welded load chains- roller chains- selection of chains hemp rope and steel wire rope- selection of ropes- fastening of chains and ropes- different types of load suspension appliances- fixed and movable pulleys- different types of pulley systems- multiple pulley systems- chain and rope sheaves and sprockets

TEXT BOOK

1. James M Apple "Plant Layout And Material Handling" John Willey & Sons, New york, Third Edition, 1983.

REFERENCE

1. Mikell .p. Groover "Automation Production System and Computer Integrated Manufacturing", Prentice Hall of India Pvt. Ltd, First edition, 1987
2. Govindan K.R. "Plant Layout And Material Handling", Anuradha Agencies, First Edition, 1997

EBM7DE096C - COMPOSITE MATERIALS

UNIT I

INTRODUCTION TO COMPOSITES - Fundamentals of composites - need for composites – Enhancement of properties - classification of composites – Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) – Reinforcement – Particle reinforced composites, Fibre reinforced composites. Applications of various types of composites.

UNIT II

POLYMER MATRIX COMPOSITES - Polymer matrix resins – Thermosetting resins, thermoplastic resins – Reinforcement fibres – Rovings – Woven fabrics – Non woven random mats – various types of fibres. PMC processes - Hand lay up processes – Spray up processes – Compression moulding – Reinforced reaction injection moulding - Resin transfer moulding – Pultrusion – Filament winding – Injection moulding. Fibre reinforced plastics (FRP), Glass fibre reinforced plastics (GRP).

UNIT III

METAL MATRIX COMPOSITES - Characteristics of MMC, Various types of Metal matrix composites Alloy vs. MMC, Advantages of MMC, Limitations of MMC, Metal Matrix, Reinforcements – particles – fibres. Effect of reinforcement - Volume fraction – Rule of mixtures. Processing of MMC – Powder metallurgy process - diffusion bonding – stir casting – squeeze casting.

UNIT IV

CERAMIC MATRIX COMPOSITES - Engineering ceramic materials – properties – advantages – limitations – Monolithic ceramics - Need for CMC – Ceramic matrix - Various types of Ceramic Matrix composites- oxide ceramics – non oxide ceramics – aluminium oxide – silicon nitride – reinforcements – particles- fibres- whiskers. Sintering - Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing).

UNIT V

ADVANCES IN COMPOSITES - Carbon / Carbon composites – Advantages of carbon matrix – limitations of carbon matrix Carbon fibre – chemical vapour deposition of carbon on carbon fibre perform. Sol gel technique. Composites for aerospace applications – Introduction to Nano composite.

TEXT BOOKS

1. Mathews F.L. and Rawlings R.D., "Composite materials: Engineering and Science", Chapman and Hall, London, England, 1st edition, 1994.
2. Chawla K.K., "Composite materials", Springer – Verlag, 1987

REFERENCES

1. Clyne T.W. and Withers P.J., "Introduction to Metal Matrix Composites", Cambridge University Press, 1993.
2. Strong A.B., "Fundamentals of Composite Manufacturing", SME, 1989.
3. Sharma S.C., "Composite materials", Narosa Publications, 2000.
4. "Short Term Course on Advances in Composite Materials, Composite Technology Centre, Department of Metallurgy", IIT- Madras, December 2001.
5. Madhu jit Mukho Padhyay, Mechanics of Composite Materials and Structures, University Press, 2004.

EBM7DE096D - QUALITY CONTROL AND RELIABILITY ENGINEERING

UNIT I

INTRODUCTION AND PROCESS CONTROL FOR VARIABLES - Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality cost-Variation in process- factors – process capability – process capability studies and simple problems – Theory of control chart- uses of control chart – Control chart for variables – X chart, R chart and σ chart – six sigma concept.

UNIT II

PROCESS CONTROL FOR ATTRIBUTES - Control chart for attributes –control chart for proportion or fraction defectives – p chart and np chart – control chart for defects – C and U charts, State of control and process out of control identification in charts.

UNIT III

ACCEPTANCE SAMPLING - Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – O.C. curves – producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts-standard sampling plans for AQL and LTPD- uses of standard sampling plans.

UNIT IV

LIFE TESTING – RELIABILITY - Life testing – Objective – failure data analysis, Mean failure rate, mean time to failure, mean time between failure, hazard rate, system reliability, series, parallel and mixed configuration – simple problems. Maintainability and availability – simple problems. Acceptance sampling based on reliability test – O.C Curves.

UNIT V

QUALITY AND RELIABILITY - Reliability improvements – techniques-use of Pareto analysis – design for reliability – redundancy unit and standby redundancy – Optimization in reliability – Product design – Product analysis – Product development – Product life cycles.

Note : Use of approved statistical table permitted in the examination.

TEXT BOOKS

1. GRANT, EUGENE.L “Statistical Quality Control”, McGraw-Hill, 1996.
2. L.S.SRINATH, “Reliability Engineering”, Affiliated East west press, 1991.

REFERENCES

1. MONOHAR MAHAJAN, "Statistical Quality Control", Dhanpat Rai & Sons, 2001.
2. R.C.GUPTA, "Statistical Quality control", Khanna Publishers, 1997.
3. BESTERFIELD D.H., "Quality Control", Prentice Hall, 1993.
4. SHARMA S.C., "Inspection Quality Control and Reliability", Khanna Publishers, 1998.
5. DANNY SAMSON, "Manufacturing & Operations Strategy", Prentice Hall, 1991
6. CONNOR, P.D.T.O., "Practical Reliability Engineering", John Wiley, 1993.

EBM7DE096E - AUTOMOBILE ENGINEERING

UNIT I

Vehicle construction – chassis and body – integral and chassis mounted body – specifications, engine – types – construction – power and torque requirements – cylinder arrangement, operation, road performance under different speed and load conditions – choice of engine for different applications – engine trouble shooting, pollution and control – Indian emission standards.

UNIT II

Principle of steering – steering geometry and wheel alignment– steering linkages – power steering, wheels and tyres– construction– type and specification– tyre wear and causes, front and rear axle– types– sub-axles.

Suspension systems – need of types – independent – coil and leaf spring and air suspensions, torsion bar, shock absorbers.

UNIT III

Clutches – need – types – single and multi-plate-diaphragm clutch – over-running clutch – fluid coupling.

Gear boxes – manual and automatic – epi-cyclic and hydromatic transmission, universal joint, propeller shaft, hotchkiss drive, torque tube drive, differential – need and types – construction – four wheel drive.

UNIT IV

Brakes - need – types – mechanical, hydraulic and pneumatic – details of components, redundancy in brake systems, trouble shooting in brake system, power brake.

Alternative fuels – hydrogen – compressed natural gas (CNG) – liquefied petroleum gas (LPG), alternative power plants – electric – hybrid vehicle – fuel cells.

UNIT V

Carburetors, electronic fuel injection systems – mono point and multi point types, principles of modern electrical systems – battery, dynamo, alternator, starting motor, lighting and ignition (battery and electronic types) – automobile air conditioning, turbo charging.

TEXTBOOKS

1. JOSEPH HEITNER, Automotive Mechanics, Affiliated East West Pvt. Ltd.

2. KIRPAL SINGH, Automobile Engineering. Vol- I & II, Standard Publications. 2006,
3. R. B. GUPTA, Automobile Engineering, Satya Prakashan, New Delhi 1993.

REFERENCES

1. WILLIAM. H. CROUSE, Automotive Mechanics. Mc Graw Hill.
2. BENNET, Engine: Fuel And Computerized Management. 1999.
3. HOLLEMBEAK, Automotive Electricity, Electronics And Computer Control, 1999.
4. NEWTON. K & STEEDS. W. GARRET T. K, Motor Vehicle, Butterworth, IE,1989.
5. R. P. Sharma, A Course in Automobile Engineering, Dhanpat Rai & Sons, 2003.

EBM7DE096F - DESIGN OF JIGS & FIXTURES

UNIT I

PRINCIPLES OF LOCATION AND CLAMPING - Locating and clamping methods and devices. Objectives of Jigs design – principles of Jig. Types of drill and their design – Module design – chip control, drill bushings.

UNIT II

FIXTURES - Objectives of Fixture design – Fixtures and economics, Types of Fixtures, Grinding Fixtures, Milling Fixtures, Shaping Fixtures, Welding Fixtures, and Assembly Fixture.

Clamping force calculations, errors in location and clamping, Design and drawing.

UNIT III

SHEET METAL - Power press types – Press specification, material handling, Equipment cutting action in punch and Die operations, die clearance, cutting forces in blanking, Piercing and shearing, punch and die mounting, stripping force, press tonnage.

UNIT IV

Pilot, Stripper, Pressure pad and automatic stop – Strip layout and material calculations. Selection of Die sets – Designing of simple, progressive and compound die sets.

UNIT V

FORMING DIE DESIGN - Bending methods, bend radius, bend allowance, spring back, bending pressure. Design of bending die, metal flow in drawing, single and double action die, development of blank reduction factor, drawing forces, blank diameter calculation, Design of drawing die. Principles of forging and extrusion dies. Defects and remedies.

TEXT BOOKS

1. DONALDSON. C, Tool Design, Tata McGraw Hill Co Ltd.
2. HOFFMAN. G, Fundamentals of Tool Design, SMF Publishers.

REFERENCES

1. KEMPSTER, Introduction to tool design and jigs and fixtures.
2. KORASAKOW, Fundamentals of Jigs and Fixtures, MIR Pub.
3. JOSHI. P.H. Jigs and Fixtures, Tata McGraw Hill Co Ltd.
4. Hiram E. Grant, Jigs and Fixtures, TMH, 2006.

EBM7DEO96G - TURBOMACHINES

UNIT I

BASIC CONCEPT OF TURBO MACHINES- Definition and classification of turbo machines, specific work, T-S and H-S diagram, equation of energy transfer. Losses – Total-to-total efficiency, total to static efficiency, infinitesimal stage efficiency, effect of reheat, preheat.

Aero-foil section, cascading of compressor and turbine blades, energy transfer in terms of lift and drag coefficient for compressor and turbine blades, variation of lift, deflection and stagnation pressure loss with incidence.

UNIT II

CENTRIFUGAL FANS, BLOWERS - Construction details, induced, backward and radial blades, diffuser, volute casing stage work, stage pressure rise, stage pressure coefficient, stage efficiency, degree of reaction, various slip factors

AXIAL FLOW FANS: stage velocity triangles, blade loading and flow coefficient, static pressure rise H-S diagram, degree of reaction, work done factor, Free and forced vortex, performance

UNIT III

CENTRIFUGAL COMPRESSOR - Construction – Stage velocity triangles h-s diagram – Slip factor – Diffuser – Volute casing – Stage losses – performance characteristics.

UNIT IV

AXIAL TURBINE - Stage velocity triangle, work, single impulse turbine, speed ratio, maximum utilization factor, multistage, velocity compound impulse, multistage pressure, compound impulse, degree of reaction, zero reaction stages, fifty percent reaction stages, hundred percent reaction, negative reaction, free and forced vortex flow.

Inward flow radial turbine stage, 90 degree IFR turbine H-S diagram, degree of reaction, steam turbine governing

UNIT V

INTRODUCTION TO CFD - One-Dimensional computations by finite difference methods, Finite element methods, finite volume methods, Neumann boundary conditions, Dirichlet boundary conditions, Governing equations, Navier stokes system of equations. Finite differences, discretization, consistency, stability. Fundamentals of fluid flow modeling. Finite difference applications an heat conduction and convection.

TEXTBOOKS

1. S.M YAHYA, Turbine, Fans and Compressor, TMH.
2. S.M YAHYA, Fundamentals of Compressible flow with Aircraft and Rocket Propulsion, New Age International, 1996
3. GANESAN. V, Gas Turbines, TMH, 1999
4. T. J. CHUNG, Computational Fluid Dynamics, Cambridge University Press, 2003.

REFERENCES

1. ASCHER .H. SHAPORO, The Dynamics and Thermodynamics of Compressible Flow VOL I and VOLII The Ronald Press. Co, NY 1995.
2. JHON D.ANDERSON Jr. Introduction to Flight, III Edition, Mc – Graw Hill ISE 1989.
3. ALAN J. CHAPMAN, WILLIAM.F.WALKER, HOLT, Introduction to gas dynamics, Rinehart and winston, 1971
4. DR.SL. SOMASUNDRAM, Gas dynamics and jet propulsion.
5. A.H.CHURCH ND.JAGDISH LAL, Centrifugal Pumps and Blower, Metropolitan Book Co. PVT Ltd.
6. HILL D. PETERSON C. Mechanics & Thermodynamics of Propulsions, Addison Wiley, 1999
7. SULTON GP. Rocket Propulsion elements, John Wiley, New York, 1986
8. COHEN H. REC ROGERS & SRAVANAMUTOO, Gas Turbine Theory, Addison Wiley, 1987
9. GOPALAKRISHNAN G. & PRITHVIRAJ D, Treatise on Turbo machines, Jupiter Publications, 2000
10. DAVID M. EGGLESTON and FOREST S. STODDARD, Wind Turbine Engineering Design, Van Nostrand, 1987
11. SHEPERD DG. Theory of Turbo machines, McMillan, 1969
12. KADHAMBHI V. MANOHAR PRASAD, Introduction to Energy Conversions, Vol – III, Turbo machines, Wiley Eastern, 1997
13. JAGDISHLAL, Centrifugal Pumps and Blowers, Metropolitan Press (P) Ltd., 1973
14. K. KURALIDHAR, T. SUNDARARAJAN, Computational Fluid Flow and Heat Transfer, Narosa Publishing House, New Delhi, 2003.

EBM7DPO91 COMPUTER INTEGRATED MANUFACTURING LAB

A) COMPUTER AIDED MANUFACTURING (CAM)

1. MANUAL PART PROGRAMMING (Using G and M Codes) in CNC lathe

- 1.1 Part programming for Linear and Circular interpolation, Chamfering and Grooving
- 1.2 Part programming using standard canned cycles for Turning, Facing, Taper turning and Thread cutting

2. MANUAL PART PROGRAMMING (using G and M codes) in CNC milling

- 2.1 Part programming for Linear and Circular interpolation and Contour motions.
- 2.2 Part programming involving canned cycles for Drilling, Peck drilling, and Boring.

B) SIMULATION AND NC CODE GENERATION

NC code generation using CAD / CAM softwares - Post processing for standard CNC Controls like FANUC, Hiedenhain etc.

C) ADVANCED MANUFACTURING SYSTEM

- i) Introduction to Flexible manufacturing system - **FMS** setup.
- ii) Introduction to Coordinate Measuring Machine – **CMM**
- iii) Introduction to Robot simulation software, motion and dynamic control of educational Robot

Note: Any one of the CAM softwares like EdgeCAM, MasterCAM, SpiritCAM, can be used for practicing the above

EBM7DPO92 MECHATRONICS LABORATORY

LIST OF EXPERIMENTS

1. Design and testing of fluid power circuits to control
(i) velocity (ii) direction and (iii) force of single and double acting actuators
2. Design of circuits with logic sequence using Electro pneumatic trainer kits.
3. Simulation of basic Hydraulic, Pneumatic and Electric circuits using software.
4. Circuits with multiple cylinder sequences in Electro pneumatic using PLC.
5. Servo controller interfacing for open loop
6. Servo controller interfacing for closed loop
7. PID controller interfacing
8. Stepper motor interfacing with 8051 Micro controller
(i) full step resolution (ii) half step resolution
9. Modeling and analysis of basic electrical, hydraulic and pneumatic systems using LAB VIEW
10. Computerized data logging system with control for process variables like pressure flow and temperature.

SEMESTER - VIII

EBM8DT091 - PRINCIPLES OF INDUSTRIAL MANAGEMENT

UNIT I

MANAGEMENT AND ITS ENVIRONMENT - Management – definition – functions, evolution of modern management, scientific management movement, development of management thoughts, different schools of management, forms of organization – individual ownership – partnership – companies – public sector undertakings, corporate framework – share holders – board of directors – committees – chief executive – line and functional managers, constraints – environmental – financial – legal – trade unions – technology - cooperative enterprises.

UNIT II

MANAGEMENT OF ORGANISATION - Planning – nature and purpose – objectives – strategies – policies and planing premises – decision making, Organising - nature and process – premises – departmentalization – line and staff – decentralisation – organisational culture, Staffing – selection and training – placement – performance appraisal – career strategy, Leading – managing human factor – motivation, leadership – communication, Controlling – system and process of controlling – controlling techniques.

UNIT III

Industrial Behavior - Organisational behavior – definition – managerial role and functions – organisational approaches, individual behavior – causes – environmental effect – behavior and performance, perception – organisational implications, personality – contributing factors – dimension - motivation – need theories – process theories – job satisfaction, learning and behavior – learning curves, work design and approaches.

UNIT IV

GROUP BEHAVIOR - Groups – contributing factors – group norms, communication – process – barriers to communication – effective communication, managerial grid – leadership styles – group decision making – leadership role in group decision, group conflict.

Formal and informal – organisational structures, organisational change and development – change process – resistance to change – O.D. programme – culture and ethics.

UNIT V

MODERN MANAGEMENT CONCEPTS - Management by objectives (MBO) – Principles and steps – advantages and disadvantages, management by exception (MBE), strategic management, planning for future direction – SWOT analysis – evolving development strategies, information technology in management – decision support systems –electronic commerce/business, newer concepts – business process reengineering (BPR) - enterprise resource planning (ERP) – supply chain management (SCM) – activity based management (ABM).

TEXTBOOKS

1. HARROLD KOONTZ AND HEINZ WEIHRICH, Essentials Of Management, Mc Graw Hill

REFERENCES

1. Jit. S. CHANDRAN, Organisational Behaviors, Vikas publishing House Pvt. Ltd., New Delhi
2. ERNEST DALE, Management Theory And Practice, International edition, Mc Graw Hill.

EBM8DT092 - TOTAL QUALITY MANAGEMENT

UNIT I

INTRODUCTION - Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT II

TQM PRINCIPLES - Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT III

TQM TOOLS - Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

UNIT IV

QUALITY SYSTEMS - Quality Auditing - Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, TS 16949, ISO 14000 – Concept, Requirements and Benefits.

UNIT V

STATISTICAL PROCESS CONTROL (SPC) - The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

TEXT BOOK

1. Dale H. Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.

REFERENCES

1. James R.Evans & William M.Lindsay, "The Management and Control of Quality", (5th Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).
2. Oakland.J.S. "Total Quality Management", Butterworth – Hcinemann Ltd., Oxford. 1989.
3. Narayana V. and Sreenivasan, N.S. "Quality Management – Concepts and Tasks", New Age International 1996.
4. Zeiri. "Total Quality Management for Engineers", Wood Head Publishers, 1991.

ELECTIVE - III

EBM8DE093A DESIGN OF HEAT TRANSFER EQUIPMENTS

UNIT I

Thermal and hydraulic design – inner pipes – annulus, Hair pin heat exchangers – base inner tube – finned inner multitubes – parallel and series arrangements, pressure drop, constructional features.

Heat pipes – structures – applications – basic relations – performance characteristics – effects of working fluid and operating temperature, wick – selection of material – pore size.

UNIT II

Basic components – shell – tube bundles – baffles – types and geometry. Design procedure – preliminary estimation of size, pressure drop and heat transfer calculations – shell and tube sides – Kenn method – Bell – Delaware method.

UNIT III

Compact heat exchangers – types – constructional features, heat transfer and pressure drop calculation – finned plate and tube.

Gasketed – plate heat exchangers – constructional features – plate pack and frame – operational characteristics – flow arrangement, heat transfer and pressure drop calculation, performance analysis, comparison with other types of heat exchangers.

UNIT IV

Shell and tube condensers – horizontal & vertical types – design and operational consideration, plate condensers, air cooled and direct contact types, condenser for refrigeration, evaporative condensers.

Evaporation for refrigeration & air conditioning – chillers, air coolers – thermal analysis – Shah Kandhkar and Ghngor and Wintertom correlations, standard types.

UNIT V

Cooling towers – types – basic relation – heat balance and heat transfer – characteristics, effects of – packings – geometry, spray design, selection of – pumps, fans. Testing, maintenance, environmental effects, wind loads, typical installations.

TEXTBOOK

1. ARTHUR P. FRAAS, Heat Exchanger Design, John Wiley & Sons, 1997.

REFERENCE BOOKS

1. SADIK KAKAC & HONGTAN LIN, Heat Exchangers, CRC Press, London, 1998.
2. KENN D, Process Heat transfer, Tata McGraw Hill, 1997.
3. WALKER, Industrial Heat Exchangers, McGraw Hill, 1980.
4. HOLGER MARTIN, Heat Exchangers, Hemisphere Publishing Corporation, London, 1982.

EBM8DE093B - CRYOGENICS

UNIT I

INTRODUCTION - Cryogenic Engineering – properties of cryogenic fluids – oxygen, Nitrogen, Argon, Neon, Fluorine, Helium, Hydrogen. Properties of solids – mechanical, thermal and electrical – superconductivity.

UNIT II

CRYOGENIC REFRIGERATION - Principle – Joule Thompson expansion, cascade processes, Ortho Para Hydrogen conversion, cold gas refrigerators, Linde Hampson cycles, Claude & Cascaded system, magnetic cooling, sterling cycle cryocoolers.

UNIT III

CRYOGENIC REQUIREMENTS - Cryogenic – heat exchangers, compressors, expanders, effect of various parameters in performance and system optimization. Insulation and storage equipment's for cryogenic fluids, industrial storage and transfer of cryogenic fluids.

UNIT IV

GAS SEPARATION & PURIFICATION - Ideal gas, mixture characteristic – composite diagrams. Gas separation – principles of rectification, flash calculation, rectification column analysis – air separation, gas purification.

UNIT V

CRYOGENIC INSTRUMENTATION - Properties and characteristic of instrumentation, strain, displacement, pressure, flow, liquid level, density and temperature measurements in cryogenic range.

TEXT BOOKS

1. SCOTT, Cryogenic Engineering, Van Nostrand Co.. 1985

REFERENCES

1. RANDAL F. BARRON, Cryogenic Systems, McGrawHill, 1985.
2. FLYNN T.M. Cryogenic Engineering Maxwell Dekker, 1997.

EBM8DE093C- INTERNAL COMBUSTION ENGINES

UNIT I

Spark ignition engine – mixture requirements – feed back control carburetors – petrol injection systems – normal and abnormal combustion – factors affecting knock – shape of combustion chambers in SI engines.

UNIT II

Normal and abnormal combustion in CI engines, direct and indirect ignition systems, combustion chambers – air movements in CI engines – fuel spray structure, spray generation and evaporation –turbo charging in IC engines.

UNIT III

Alternate fuels – alcohol – hydrogen – natural gas – liquefied petroleum gas – suitability, engine modifications, merits and demerits as IC engine fuels.

UNIT IV

Pollutants from IC engines – formation of NOX, CO and hydrocarbon, emission mechanism, particulate emission – method of controlling emissions – catalytic convectors and particulate traps – methods of measurements of emission and driving cycles.

UNIT V

Stratified charge spark ignition engine – lean burn engines, dual fuel engine – multi point fuel injection gasoline engines – homogeneous charge compression ignition engines – plasma ignition, electric /hybrid vehicles.

TEXT BOOKS

1. GANESAN V. Internal Combustion Engines, TMH, 2008, 3rd Edition.
2. GILL SMITH & ZURICH, Fundamentals of IC Engines.
3. MATHUR R.B AND SHARAM. R.B, Internal Combustion Engines, Dhanpat Rai & Sons, 1994.

REFERENCE BOOKS

1. DOMKUNDWAR V.M, Internal Combustion Engines, Dhanpat Rai & Sons, 1999
2. JOHN B. HEYWOOD, Internal Combustion Engine Fundamentals, McGraw Hill, 1988
3. P. L. Ballaney, Internal Combustion Engines, Khanna Publishers, 2006, 6th Edition

EBM8DE093D - PRODUCT DESIGN

PART A TOLERANCE AND ALLOWANCES

Geometric dimensioning and tolerancing, surface, features, datum feature – data planes – datum axis.

Fits – allowances – maximum material condition form control, orientation control and location control – Tolerancing of making parts.

PART B DESIGN OF ASSEMBLIES

Design of all parts of the following assemblies.

Clutch assembly

Two stage spur helical gear assembly

Worm reducer – Bevel gear box assembly

Two stage planetary gear assembly

Internally expanding brake shoe assembly.

Winch for certain capacity and speed

Single cylinder diesel engine

Centrifugal pump assembly

REFERENCE BOOKS

1. JUVINALL C. ROBERT & KURT .M MARSHALL, Fundamentals of Machines Components Design, John Wiley, 1999
2. NORTON, Machine Design, McGraw-Hill, 1998.
3. SHIGLEY, Mechanical Engineering Design, McGraw-Hill.

(Use approved data books are permitted in all examinations and examination will be 4 Hours)

UNIT I

INTRODUCTION - History of robotics – Configuration of manipulator – Arm and wrist - Work volume and spatial resolution – Linkage and joints of manipulators, drive systems, feedback devices, Concepts of degrees of freedom, types of end effectors – Basic sensors in robotics including machine vision

UNIT II

COORDINATE FRAMES AND TRANSFORMATION - Coordinate frames – Description of objects in space – Various types of transformations of vectors – Basic transformation matrices – Forward and inverse kinematic equations – Denavit and Hartenberg representation – Inverse kinematic solution

UNIT III

DIFFERENTIAL MOTION OF MANIPULATORS - Differential relationships, Jacobian of manipulator – Inverse Jacobian, Static analysis

UNIT IV

DYNAMIC FORCES AND TRAJECTORY PLANNING - Lagrangian mechanics, Dynamic equations for multi degree of freedom manipulators – Inverse dynamics – Joint space planning – Cartesian space planning – Linear feedback control, Decoupling control – Force control strategies

UNIT V

ROBOT PROGRAMMING AND APPLICATIONS - Methods of robots programming – lead and teach method - Explicit languages, task level languages – Introduction – Workcell design and control, Robot cycle time analysis Industrial Applications – machining – welding – assembly – material handling – loading and unloading – hostile and remote environments – Economics of robots.

TEXTBOOKS

1. MIKELL P. GROOVER, Industrial Robotics, MGH, 1996.
2. MOHSEN SHAHINPOOR, A Robot Engineering Text Book, Harper & Row, 1987.

REFERENCE BOOKS

1. JOHN J. CRAIG, Introduction to Robotics, Addison Wesley, ISE, 1999
2. ARTHUR CRICHLLOW, Introduction to Robotics, Macmillan, 1985.
3. YORAM KOREN, Robotics for Engineers, MGH, 1985.
4. FRANCIS N. NAGY, Engineering Foundation of Robotics, Addison Wesley, 1987.

EBM8DE093F - TRIBOLOGY

UNIT I

DRY FRICTION - Dry friction – topography of surfaces – contact between surfaces – sliding friction – energy dissipation. Theory of molecular attraction – fretting corrosion and prevention – variables in dry friction – present concept of friction – boundary friction – oiliness – variables of boundary friction – friction characteristics of metals and non-metals– rolling friction – sources of measurement of friction.

UNIT II

Wear – types – mechanism – factors affecting wear. Adhesive wear – abrasive wear, fatigue wear – corrosive wear – brittle fracture wear. Delamination – wear measurement.

UNIT III

Fundamentals of viscosity and flow – Petroff's equation – friction torque – viscosity measurement – factors affecting viscosity. Principle of hydrostatic lubrication – hydrostatic step bearing – multi recess bearing – design problems – different types of compensation and their effect on bearing, parameters – hydrostatic lift, simple problems – hydrostatic journal bearing, simple problems – hydrostatic squeeze films.

UNIT IV

HYDRODYNAMIC LUBRICATION - Solution of Reynolds equation – application to tilting pad thrust bearing – design of hydrodynamic journal bearings – force feed of oil flow with various types of grooves – dynamic bearings and rotor systems – brief discussion, lubrication systems, bearing materials – gas bearings – brief discussion – elastohydrodynamic lubrication – brief discussion.

UNIT V

LUBRICANTS AND MAINTENANCE - Lubricants – types-solids ,and liquid-properties-additives-testing-reclamation of lubricants, surface treatment-phosphating of metal surface, Teflon coating. Predictive maintenance-signature analysis and condition monitoring-basic principles-instrumentation.

TEXT BOOKS

1. HUTCHINGS. M, Tribology, Friction and Wear of Engg. Materials, Edward Arnold, London, 1992.
2. MAJUMDAR, Introduction of Tribology of Bearings, A.H.Wheeler & Co., 1986.

REFERENCES

1. NCALC, NEWNCS, Tribology Handbook, Butterworths, 1975.
2. DUDLEY D.FULLER, Theory and Practice of Lubrication for Engineers, John Wiley & Sons, 1984.
3. CAMERON.A, Basic Lubrication Theory, Wiley Eastern Ltd., 1987.
4. BHARAT BHUSAN & B.K.GUPTA, Handbook of Tribology, McGraw Hill Inc., 1991.
5. (APPROVED HAND BOOK MAY BE USED IN THE EXAMINATION)

ELECTIVE - IV

EBM8DE094G- VIBRATION AND NOISE CONTROL

UNIT I

SINGLE AND TWO DEGREES OF FREEDOM VIBRATION - Review of single degree of freedom systems – free damped vibration – linear and torsion vibrations, seismometer, accelerometer. Two degrees of freedom – vibration absorbers – undamped and damped, vibration isolation.

UNIT II

MULTI DEGREE FREEDOM VIBRATIONS - Multi degree vibration system – free vibration – close coupled and far coupled systems, eigen value problems, Orthogonality of mode shapes, modal analysis, forced vibration modal analysis, numerical methods – Dunkerley, Rayleigh and Holzer methods.

UNIT III

BALANCING - Rotor balancing methods – rigid & flexible rotor balancing, modal balancing – analytical developments – application to balancing, advantage and limitations of modal balancing, influence coefficient balancing, analytical developments balancing – procedure – advantages and limitations. Unified balancing approach – analytical development- balancing procedure – experimental comparison of various methods.

UNIT IV

VIBRATION MONITORING - Experimental methods in vibration analysis – vibration exciters measurements devices, analyzer, condition based maintenance of monitoring and analysis – case studies.

UNIT V

NOISE CONTROL - Sound wave characteristic – levels and decibels – directivity, source of noise, estimation of noise source, acoustics of walls – enclosures barriers, sound absorbing materials duct noise, mufflers.

TEXT BOOKS

1. RAO J.S AND GUPTA K, Theory and Practice of Mechanical, John Wiley
2. TIMOSHENKO, S. YOUNG D.H & WEAVER W, Vibration Problems in Engineering 4th ed. John Wiley & Sons, 1967.
3. KEWAL K. RUJARA, Vibrations and Noise for Engineering, Dhanpat Rai & Sons.

REFERENCE BOOKS

1. ASHOK KUMAR MALLIK, Principle of Vibration Control, Affiliated East West Press, 1993
2. GROVER. G.K, Mechanical Vibration, New Chand Bros., Roorkee (UP), 1989.
3. MARK S, DARLOW, Balancing of High Speed Machinery, Springer Verlag

EBM8DE094H - REFRIGERATION AND AIR CONDITIONING

UNIT I

Review of thermodynamics, principle of refrigeration, refrigeration cycle: air cycle system, Bell – Coleman cycle system. VAPOUR COMPRESSION REFRIGERATION: Analysis of Vapour compression refrigeration, uses of P.H charts, performance test, Vapour absorption refrigeration, absorption cycle, Claude system, cascade system, comparison of performance & COP.

UNIT II

Compressor – reciprocating, rotary (elementary treatment). Condenser – evaporator –cooling tower. Refrigerant- properties – selection of refrigerants, refrigeration plant operation and controls - testing and charging of refrigeration units.

APPLICATION: Ice plant, food storage plants, milk chilling plant, refrigeration cargo ships, cryogenic in medicine & biological uses.

UNIT III

Review of fundamental properties of psychrometry use of psychometric charts, psychometric processes, grand and room sensible heat factor, by pass factor, requirements of comfort air conditioning, comfort and comfort chart, factor governing optimum effective temperature recommended design conditions, ventilation standards.

UNIT IV

Cooling load calculations, types of load design, space cooling load, heat transmission through building, solar cooling & heating, solar radiation, infiltration heat source (sensible & latent) Outside air & fresh air load, estimation of total load, design of air conditioning system.

UNIT V

AIR CONDITONING SYSTEMS: Commercial & industry stores and public building A/C, ventilation, air conditioning equipment, air cleaning and air filters, humidifiers, dehumidifiers- air washer, condenser, cooling tower and spray pounds, elementary treatment of duct design, air distribution system.

TEXTBOOKS

1. ARORA C.P, Refrigeration and Air Conditioning, TMH, New Delhi, 1988.
2. P.L BALLANY, Refrigeration and Air conditioning

REFERENCES

1. ARORA S.C AND DOMKUNDWAR S, Refrigeration & Air Conditioning, Dhanpat Rai and Sons Publishers, 1990
2. MANOHAR PRASAD, Refrigeration and Air Conditioning, Wiley Eastern Ltd, 1983
3. ROY J. DOSSAT, Principles of Refrigeration, SI version, Wiley Eastern Ltd, 1985
4. STOEKER, Refrigeration & Air Conditioning, McGraw Hill

EBM8DE094J - COMPUTATIONAL FLUID DYNAMICS

UNIT I

Introduction to CFD Form of mass, energy and momentum equations, description of terms; boundary conditions and simple solution examples.

UNIT II

Static Features of CFD code: FLUENT Modeling for steady incompressible flow, pressure drop and heat transfer.

UNIT III

Solution Methods Solution algorithms, discretisation schemes, solution convergence, divergence and residuals.

UNIT IV

Model Formulation Geometry and grid design, boundary conditions of the domain, choice of physical models for turbulence and heat transfer, modeling of fluid properties.

UNIT V

Case Study Examples modeling pressure drop and heat transfer in a range of engineering examples.

TEXTBOOKS

1. FLETCHER, C.A.J, Computational Techniques for Fluid Mechanics, Springer-Verlag, 1991
2. SHAW, C.T, Using Computational Fluid Dynamics, Prentice Hall, 1992

REFERENCES

1. J.D.ANDERSON, Computational Fluid Dynamics.
2. NK BOSE, Computer Numerical Methods for Fluid Mechanics.

EBM8DE094K - INTRODUCTION TO NANO TECHNOLOGY

UNIT I

INTRODUCTION TO PHYSICS OF SOLID STATE - Intermolecular forces: thermodynamic aspects - Quantum Mechanical Treatment of the Many-Particle Problem - Potential Energy Surface - Pair Potential Approximation - Advantages and Limitations of the Pair Potential Approximation - Phenomenological Potentials - Pseudo-Potentials - Many-Body Potentials.

UNIT II

FUNDAMENTALS OF NANOSCIENCE - Size dependence of properties - Particle size determination - Bulk to nano transition - Semiconducting nanoparticles - Carbon nanostructures - Mechanical properties (hardness, ductility, elasticity) - Optical properties of nanotubes - Electrical properties of nanotubes.

UNIT III

PREPARATION OF NANOSYSTEMS - Introduction to nanolithography - Carbon nanotubes: preparation - Synthesis and preparation of nanomaterials (crystalline and thinfilm) - Physical and chemical methods - Control and stability (size, shape, composition).

UNIT IV

CHARACTERIZATION OF NANOSYSTEMS - Thermal Stability - Basic Material Properties - Mean Mean Values and Correlation Functions - X-ray diffraction - Scanning Electron Microscopy - Scanning Tunneling Microscopy - Electron Microscopy - X-ray absorption spectroscopy – Photoelectron emission spectroscopy.

UNIT V

NANO-ENGINEERING: APPLICATIONS - Nanotubes, nanowires, and nanodevices-introduction - Functional Nanostructures – Introduction to molecular electronics - Field emission and Shielding - Applications in Computers - Applications in fuel cells - Applications in chemical sensors - Applications in mechanical reinforcement - Microelectromechanical systems (MEMs) - Nanoelectromechanical systems (NEMs) - Molecular and Supramolecular Switches.

TEXT BOOKS

UNIT I AND II

1. Charles P. Poole and Frank J Owens. *Introduction to nanotechnology*. Wiley Interscience, 2003.
2. Crandall, B. C. and Lewis, James (Eds.) *"Nanotechnology: Research and Perspectives"* MIT Press, 1992.

UNIT III AND IV

3. P E J Flewitt, R K Wild. *Physical Methods for Materials Characterization. 2nd Edition*, Institute of Physics Publishing, UK. 2004.
4. Gottstein, Günter. (2004) *Physical Foundations of Material Science*. Springer Verlag.

UNIT V

5. Cleland, Andrew N. (2003). *Foundations of Nanomechanics: From Solid-State Theory to Device Applications*. Springer Verlag.

REFERENCES

1. J M Vail, Winnipeg. *Topics in the Theory of Solid Materials*. Institute of Physics Publishing, UK. 2004.
2. M W Barsoum. *Fundamentals of Ceramics*. Institute of Physics Publishing, UK. 2004.
3. A S Edelstein, R C Cammarata, *Nanomaterials: Synthesis, Properties and Applications*. IOP Publishing, UK, 1998.
4. Bhushan, Bharat (Ed.) (2004) *Springer Handbook of Nanotechnology* (With CD-ROM) ISBN: 3-540-01218-4
5. Awschalom, D.D.; Loss, D.; Samarth, N. (Eds.) (2002)
6. *Semiconductor Spintronics and Quantum Computation*. Springer Verlag. ISBN: 3-540-42176-9
7. Vincenzo Balzani. *Molecular Devices and Machines : A Journey into the Nanoworld* Wiley VCH, 2003,
8. Peidong Yang. *Chemistry of Nanostructured Materials*. World Scientific, 2004.
9. Andrzej W. Miziolek et. al., *Defense Applications of Nanomaterials* American Chemical Society, 2004.
10. Liming Dai. *Intelligent Macromolecules for Smart Devices: From Materials Synthesis to Device Applications (Engineering Materials and Processes)*. Springer Verlag 2004.
11. Michael Rieth. *Nano-engineering in Science and Technology: An Introduction to the World of Nano-Design*, World Scientific, 2003.
12. Hari Singh Nalwa. *Handbook of nanostructured materials and nanotechnology*. 5 volume set, Academic Press, 2000.

EBM8DE094L - WORK STUDY AND COST ESTIMATION

UNIT I

WORK STUDY AND PRODUCTIVITY - Need, Aim and Scope of Work Study, Techniques of Work Study and their relationship, Basic Procedure of Work Study, Productivity and the Standard of Living, Productivity in the individual enterprise, Management techniques to reduce work content and ineffective time, Human Factors in the application of Work Study. Job Evaluation, Merit Rating and Wage Incentive Plans.

UNIT II

METHOD STUDY - Introduction, Basic Procedure, Factors involved in Selection of Jobs, Recording Techniques – Charts and Diagrams, Questioning Techniques, Developing improved method.

Principles of Motion Economy, Therbligs, Two Handed process chart, Micromotion and Macromotion Study, SIMO Chart, Design of Work Place Layout, types of Plant Layout, Flow Diagram, String Diagram, Use of Templates and Scale Models, Multiple Activity Chart, Travel Chart.

UNIT III

WORK MEASUREMENT -General remarks on Work Measurement, Time Study equipment, Selecting the Job to be studied and making a Time Study, Rating Factors Involved, Allowances to Standard Time, setting Time Standards for Work.

Other Techniques of Work Measurement – Production Study, Activity Sampling, Synthesis – Synthesized Time Standards, Analytical Estimating, Predetermined Motion Time Systems, MTM, Work Factor, Standard Data and its uses.

UNIT IV

HUMAN FACTORS IN WORK DESIGN - Ergonomics, work Physiology, human performance, anthropometry, Design of Work Station, Design of Displays and Control. Fatigue and its effects.

Organization of Work Study Department – Place of Work Study Department in the Organization, Structure of Work Study Department, Selection and Training of Work Study Personnel.

UNIT V

COST ESTIMATION - Introduction, Definition, Purpose of Cost Estimation, Cost Estimation Vs Cost Accounting, Components of Cost, Direct Cost, Indirect Cost, Overhead Expenses, Estimation of cost elements, set up,

operation, tool change and inspection costs, performance factors, Overheads, different methods of apportioning overheads, Data required for Cost Estimating, Steps in making a cost estimate, Simple Problems - Estimation of production cost of simple components.

TEXT BOOKS

1. I.L.O – Introduction to work study, 3rd ed. Universal Publishing Corporation, Bombay.
2. GUPTA AND PATEL, Work Study, Khanna Publishers.

REFERENCE BOOKS

1. Mundel, "Motion and Time Study", Prentice Hall of India, New Delhi, 1995.
2. Ralph M. Barnes, "Motion and Time Study", John Wiley and sons, 1990.
3. Niebel Benjamin. W., "Motion and Time Study", Richard D. Irwin Inc., 1982.
4. Dalela. S, "Work Study and Ergonomics", Standard Publishers Distributors, New Delhi, 1999.
5. Singh .C.K., "Mechanical Costing, Estimation and Project Planning", Standard Publishers Distributors, New Delhi, 1996.
6. G.B.S.Narangh, V.Kumar, " Production and Costing" Khanna Publishers, New Delhi, 1980.
7. Banga, Sharma, "Mechanical Estimating and Costing" Khanna Publishers, New Delhi, 1976.
8. Bridger, R.S., " Introduction to Ergonomics", McGraw Hill, 1995.

EBM8DE094M - FLUID POWER SYSTEMS

UNIT I

INTRODUCTION - Introduction to fluid power – review of fundamentals principles of fluid power – construction, operation and characteristics of gear pump, vane pump, variable displacement pump, piston pump. Fluid power actuators – linear and rotary – computation of force – flow requirements – cushioning – cylinder mountings – relative merits – selection criteria for specific application – power pack design.

UNIT II

CONTROL SYSTEM COMPONENTS AND ACCESSORIES - Valves – non return valve for pressure control, direction control and flow control – servo valves and proportional control valves – valve actuation techniques – pressure, electrical, limit switch or sensor based. Relief valve- brake valve – counter balance valve. Fluid power maintenance – filter – seals- reservoirs. Selection of accumulator, hoses and couplings – safety regulation as per BIS.

UNIT III

HYDRAULIC CIRCUITS - Fluid power symbols, hydraulic circuit – regenerative – intensifier – metering out – bleed off. Design of circuits for specific applications – Vehicle suspension system – hydraulic press – low cost automation. Programmable logic control. Electrical control for fluid power circuits, Temperature control in Hydraulic circuits.

UNIT IV

HYDRAULIC CIRCUIT DESIGN - Design of circuits and selection of components with specification for the following applications – hydraulic or pneumatic system for shapers – lift hydraulic press – automatic reciprocating system – shock absorber – conveyor feed system – hydraulic cranes and earth moving equipment's.

UNIT V

PNEUMATIC SYSTEMS - Basic principles of pneumatic circuits – merits and demerits over hydraulic system, pneumatic conditioners – filters – regulators – lubricator – mufflers – air dryers. Types of air compressed – pneumatic actuators – control of pneumatic circuits – valves. Introduction to pneumatic logic controls- pneumo-hydraulic circuits.

TEXTBOOKS

1. ANTHONY ESPOSITO, Fluid Power with Applications, Prentice Hall, 1980
2. PIPPENGER, Industrial Hydraulics, TMH

REFERENCES

1. PRINCHES. M.J. & ASHBY JOHN, Power Hydraulics, Prentice Hall, 1989
2. SULLIVAN JAMES .P, Fluid Power Theory and Application, Prentice Hall.

EBM7DP093 - MINI PROJECT AND SEMINAR

MINI PROJECT

The objective of this project is to provide opportunity for the students to implement their skills acquired in the previous semesters to practical problems.

The students in convenient groups of not more than 4 members have to take one small item for design and fabrication. Every project work shall have a guide who is the member of the faculty of the institution.

The item chosen may be small machine elements (Example-screw jack, coupling, machine vice, cam and follower, governor etc), attachment to machine tools, tooling (jigs, fixtures etc), small gear box, automotive appliances, agricultural implements, simple heat exchangers, small pumps, hydraulic /pneumatic devices etc.

The students are required to design and fabricate the chosen item in the college and demonstrate its working apart from submitting the project report. The report should contain assembly drawing, parts drawings, process charts relating to fabrication.

SEMINAR

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for a duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.

Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models. This will enable them to gain confidence in facing the placement interviews.

EBM8DP091 - PROJECT WORK

OBJECTIVE

The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.

Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines. The continuous assessment shall be made as prescribed in the regulations