

ANNA UNIVERSITY TIRUCHIRAPPALLI
Tiruchirappalli 620024

B.E. (PART TIME) MECHANICAL ENGINEERING

Regulations 2007

Curriculum

SEMESTER I

S.No.	Subject Code	Subject	L	T	P	Max. Marks
Theory						
1	MA4101	Mathematics 1	3	0	0	100
2	HS4101	Physical Sciences	3	0	0	100
3	ME4101	Engineering Mechanics	3	0	0	100
4	CS4104	Fundamentals of Computing	3	0	0	100
5	EE4104	Basic Electrical Engineering	3	0	0	100

SEMESTER II

S.No.	Subject Code	Subject	L	T	P	Max. Marks
Theory						
1	MA4151	Mathematics II	3	0	0	100
2	GE4151	Environmental Science and Engineering	3	0	0	100
3	ME4151	Manufacturing Technology I	3	0	0	100
4	CE4151	Fluid Mechanics and Machinery	3	0	0	100
5	CE4152	Strength of Materials	3	0	0	100

SEMESTER III

S.No.	Subject Code	Subject	L	T	P	Max. Marks
Theory						
1	GE4201	Professional Ethics in Engineering	3	0	0	100
2	ME4201	Engineering Thermodynamics	3	0	0	100
3	ME4202	Kinematics of Machines	3	0	0	100
4	ME4203	Manufacturing Technology II	3	0	0	100
Practical						
5	ME4204	CAD Laboratory	0	0	3	100

SEMESTER IV

S.No.	Subject Code	Subject	L	T	P	Max. Marks
Theory						
1	ME4251	Thermal Engineering I	3	0	0	100
2	ME4254	Hydraulics and Pneumatics Engineering	3	0	0	100
3	ME4252	Dynamics of Machines	3	0	0	100
4	ME4253	Design of Machine Elements	3	0	0	100
Practical						
5	ME4255	Thermal Engineering Laboratory I	0	3	0	100

SEMESTER V

S.No.	Subject Code	Subject	L	T	P	Max. Marks
Theory						
1	ME4301	Design of Jigs, Fixtures and Press Tools	3	0	0	100
2	ME4302	Thermal Engineering II	3	0	0	100
3	ME4303	Design of Transmission Systems	3	0	0	100
4	ME4304	Engineering Metrology and Measurements	3	0	0	100
5	EC4305	Microprocessors and Interfacing	3	0	0	100

SEMESTER VI

S.No.	Subject Code	Subject	L	T	P	Max. Marks
Theory						
1	MG4352	Total Quality Management	3	0	0	100
2	ME4351	Automobile Engineering	3	0	0	100
3	ME4352	Heat and Mass Transfer	3	0	0	100
4	E1****	Elective I	3	0	0	100
5	E2****	Elective II	0	3	0	100

SEMESTER VII

S.No.	Subject Code	Subject	L	T	P	Max. Marks
Theory						
1	ME4451	Power Plant Engineering	3	0	0	100
2	ME4452	Mechatronics	3	0	0	100
3	E3****	Elective III	3	0	0	100
4	E4****	Elective IV	3	0	0	100
Practical						
5	ME4405	Project Work	0	0	3	100

LIST OF ELECTIVES

S.No.	Subject Code	Subject	L	T	P	Max. Marks
Theory						
1	ME4001	Newer Machining Processes	3	0	0	100
2	ME4002	Theory of Metal Forming	3	0	0	100
3	ME4003	Turbo Machining	3	0	0	100
4	ME4004	Design of Pressure Vessels and Piping	3	0	0	100
5	ME4005	Engineering Economics and Cost Analysis	3	0	0	100
6	ME4006	Entrepreneurship Development	3	0	0	100
7	ME4007	Mechanical Vibration	3	0	0	100
8	ME4008	Advanced Welding and Casting Processes	3	0	0	100
9	ME4009	Refrigeration and Air-Conditioning	3	0	0	100
10	MG4002	Marketing and Management	3	0	0	100
11	ME4010	Design of Heat Exchanger	3	0	0	100
12	MG4003	Operation Research	3	0	0	100
13	ME4011	Industrial Tribology	3	0	0	100
14	ME4012	Energy Conservation and Management	3	0	0	100
15	ME4013	Cryogenic Engineering	3	0	0	100
16	ME4014	Computational Fluid Dynamics	3	0	0	100
17	ME4015	New and Renewable Energy Sources	3	0	0	100
18	ME4016	Advanced Internal Combustion Engineering	3	0	0	100
19	ME4017	Flexible Manufacturing Systems	3	0	0	100
20	ME4018	Design for Manufacture	3	0	0	100
21	EC4028	Electronic Manufacturing Technology	3	0	0	100
22	ME4019	Rapid Prototyping	3	0	0	100
23	EC4025	Robotics	3	0	0	100
24	CS4029	Artificial Intelligence	3	0	0	100
25	CS4030	Computer Simulation	3	0	0	100
26	ME4020	Quality Control and Reliability Engineering	3	0	0	100
27	MA4001	Numerical Methods	3	0	0	100

TEXT BOOK

1. Grewal, B.S., "Higher Engineering Mathematics", Thirty eighth Edition, Khanna Publishers, New Delhi, 2005.

REFERENCES

1. Glyn James., "Advanced Modern Engineering Mathematics", Third Edition, Pearson Education Ltd, New Delhi, 2004.
2. Venkataraman. M. K., "Engineering Mathematics", Volume I and II Revised enlarged Fourth Edition, The National Publishing Company, Chennai, 2004.
3. Veerarajan. T., "Engineering Mathematics (for first year)", Fourth Edition, Tata McGraw - Hill Publishing Company Limited, New Delhi, 2005.
4. V. Sundaram, R. Balasubramanian, K.A. Lakshminarayanan, "Engineering Mathematics", Fifth Edition, Vikas Publishing house Pvt. Ltd., New Delhi, 2006.

HS4101 – PHYSICAL SCIENCES

L	T	P
3	0	0

UNIT I PROPERTIES OF MATTER AND HYDRODYNAMICS 9

Properties of matter: Stress - Strain - Hooke's Law - Types of moduli of elasticity - Torsional pendulum - Determination of Rigidity modulus of a wire - Bending of beams - Expression for bending moment - Measurement of Young's modulus by uniform and Non-uniform bending.

Hydrodynamics: Stream line flow - Turbulent flow - Poiseuille's formula for flow of liquid through a capillary tube - Determination of coefficient of viscosity of a liquid.

UNIT II OPTICS AND PHOTOELASTICITY 9

Interference: Air Wedge - Testing of Flat surfaces - Michelson's Interferometer - Types of fringes - Applications: Wavelength determination - Thickness of a transparent medium.

Optical Instruments: Metallurgical microscope and Scanning electron microscope - Applications.

Photo elasticity: Theory of photo elasticity - Stress optic law - Isoclinic and Isochromatic fringes - Photoelastic bench and its use.

UNIT III SEMICONDUCTING AND SUPERCONDUCTING MATERIALS 9

Intrinsic Semiconductor: Expressions for the carrier concentration - Calculation of density of holes and electrons - Fermi level and its variation with temperature - Determination of band gap energy.

Extrinsic Semiconductors: Carrier concentration in n-type and p-type semiconductors (no derivation - qualitative) - Variation of Fermi level with temperature and impurity concentration - Hall effect - Determination of Hall coefficient.

Super Conductors: Superconductivity - Properties - Meissner effect - Type I and Type II Superconductors - High temperature Super conductors - Applications - Magnetic levitation - Josephson effect - SQUID

UNIT IV WATER TREATMENT PROCESS 9

Hardness of water - CaCO_3 equivalents - Ethylene Diamine Tetra-acetic Acid (EDTA) method of estimation of hardness - Troubles of boiler feed water - Demineralization - Zeolite process - Desalination - Reverse osmosis - Electro dialysis - Water conditioning (Colloidal, Phosphate, Calgon, Carbonate) - Treatment of domestic water (UV and ozone).

UNIT V THERMODYNAMICS 9

Thermodynamic processes - First law of thermodynamics - Limitations - Second law of thermodynamics - Clausius and Kelvin statement - Entropy - Mathematical expressions - Changes in entropy for isothermal expansion - Reversible and irreversible processes - Free energy - Gibbs Helmholtz equation - Application and simple problems - Van't Hoff isotherm and isochore - Simple problems.

Total: 45

TEXT BOOK

1. Avadhanulu M.N. and Kshirsagar P.G., "A Text Book of Engineering Physics", S.Chand & Company Ltd., 7th Enlarged Revised Ed., 2005.
2. Gaur R.K. and Gupta S.L., "Engineering Physics", Dhanpat Rai Publishers, New Delhi, 2001.
3. P.C. Jain and Monika Jain, "Engineering Chemistry", 13th Edition, Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2004.

REFERENCES

1. Pillai S.O., "Solid State Physics", New Age International Publications, New Delhi, 6th Edition, 2005.
2. Arumugam M., "Engineering Physics", Anuradha Agencies, Kumbakonam, 2nd Edition, 2005.
3. Palanisamy P.K., "Physics for Engineers", Scitech Publications (India) Pvt. Ltd., Chennai, Second Edition, 2005.
4. J.C. Kuriakose and J. Rajaram, "Chemistry in Engineering and Technology", Vol.1 & 2, Tata Mcgraw Hill Publishing Company (P) Ltd., New Delhi, 1996.
5. B.K. Sharma, "Engineering Chemistry", Krishna Prakasam Media (P) Ltd., Meerut, 2001.

ME4101 – ENGINEERING MECHANICS

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3	0	0

UNIT I **BASICS AND STATICS OF PARTICLES** **9**

Introduction - Units and Dimensions - Laws of Mechanics — Lame's theorem - Parallelogram and triangular Law of forces — Vectors — Vectorial representation of forces and moments — Vector operations: addition, 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** **9**

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** **9**

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 -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** **9**

Displacements - Velocity and acceleration - Their relationships — 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** **9**

Frictional force — Laws of Coloumb friction — simple contact friction — Rolling resistance — Belt friction - Translation and Rotation of Rigid Bodies — Velocity and acceleration — General Plane motion

Total: 45

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, 1997.

REFERENCES

1. Hibbeler, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000
2. Ashok Gupta, Interactive Engineering Mechanics — Statics — A Virtual Tutor (CDROM), Pearson Education Asia Pvt., Ltd., 2002
3. Palanichamy, M.S., Nagan, S., Engineering Mechanics — Statics & Dynamics, Tata McGraw-Hill, 2001.
4. Irving H. Shames, Engineering Mechanics - Statics and Dynamics, IV Edition - Prentice Hall of India 2003.
5. Rajasekaran.S, Sankarasubramanian.G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., 2000.

CS4104 – FUNDAMENTALS OF COMPUTING

L	T	P
3	0	0

UNIT I INTRODUCTION 9

Introduction - Characteristics of Computers - The Evolution of Computers -The Computer Generation - Classification of Computers - Basic Computer organization - Number Systems

UNIT II COMPUTER ARITHMETIC AND SOFTWARE 9

Computer Codes - Computer Arithmetic - Binary Arithmetic - Addition - Subtraction - Multiplication - Division - Computer Software - Types of Software - Logical System Architecture - Software Development Steps

UNIT III PROBLEM SOLVING AND OFFICE AUTOMATION 9

Planning the Computer Program - Purpose - Algorithm - Flowcharts -Pseudocode - Application Software Packages - Word Processing - Spreadsheet - Graphics - Personal Assistance.

UNIT IV INTRODUCTION TO C 9

Overview of C - Constants, Variables and Data Types - Operators and Expression - Managing input and output Operators - Decision Making and Branching - Decision Making and Looping.

UNIT V FUNCTIONS AND POINTERS 9

Arrays - Handling of Character Strings - User-Defined Functions - Structures and Unions - Pointers - The Preprocessor - Developing a C Program: Some Guidelines

Total : 45

TEXT BOOKS

1. Pradeep K.Sinha and Priti Sinha, "Computer Fundamentals: Concepts, Systems and Applications", BPB Publications, 2003.
2. E.Balagurusamy, "Programming in ANSI C", TMH, New Delhi, 2002.

REFERENCES

1. Allen B.Tucker et.al, "Fundamentals of Computing I", TMH New Delhi, 1998.
2. V.Rajaraman, "Fundamentals of Computers", Prentice - Hall of India, 2002.
3. Herbert Schidt. "C Made Easy", McGraw Hill.

EE4104 – BASIC ELECTRICAL ENGINEERING

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3	0	0

UNIT I **CIRCUIT AND THEOREMS** **9**

Fundamentals of Electrical Engineering - Ohm's Law - Kirchhoff's laws - Mesh and Nodal Analysis - Super position Theorem - Thevenin's Theorem - Norton's Theorem - Reciprocity Theorem - Maximum Power Transfer Theorem - Star -Delta Transformations.

UNIT II **A.C. CIRCUIT** **9**

Magnetic Circuits - Electromagnetic Induction - Faraday's Law, Lenz's law - Self and Mutual Inductances - production of Alternating Voltage - RMS value -Average value - Form factor - Peak factor - Phase difference - Phasor diagram - RL, RC, RLC Circuits

UNIT III **D.C. MACHINES AND TRANSFORMER** **9**

Fundamentals of DC Machines - emf equation - Types of Generators - Load characteristics - D.C. Motors, types and characteristics - Torque equation -Starters - Speed control - Single Phase Transformer - emf equation - O.C & S.C. Tests - efficiency and regulation.

UNIT IV **A.C. MACHINES** **9**

Introduction - Construction and principle of operation of A.C. Machines - Alternators - Three Phase and Single Phase Induction motors - Types - characteristics - O.C & S.C. Tests - Applications - Synchronous motor -starting.

UNIT V **MEASURING INSTRUMENTS** **9**

Indicating Instruments - Moving coil - Moving Iron - Instrument Transformer - Measurement of Electronic components - Q-meter - Frequency measurements -Phase measurements - Digital Instruments - Electrodynamicometer type wattmeter - Induction Type Energy meter - Megger - Multimeter.

Total: 45

TEXT BOOK

1. Basic Electrical Engineering , V.N. Mittle, Arvind Mittal, Second edition, Tata McGraw Hill Publishing Company, New Delhi.

REFERENCE BOOKS

1. Basic Electrical Engineering, D.P. Kothari, I.J. Nagrath, Tata McGraw Hill Publishing Company New Delhi.
2. Electrical Engineering Fundamentals, Del Toro, 2nd edition, Prentice Hall Publishers, New Delhi.
3. Basic Electrical Engineering, V.K Mehta, Rohit Mehta, S.Chand & Company Ltd, New Delhi.

II SEMESTER

MA4151 – MATHEMATICS II

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UNIT I **MULTIPLE INTEGRALS** **9**

Double integration - Cartesian and Polar Co-ordinates - Change of order of integration - Area as a double integral - Change of variables between Cartesian and Polar Coordinates - Triple integration - Volume as a triple integral.

UNIT II **VECTOR CALCULUS** **9**

Gradient, Divergence and Curl - Directional derivative - Irrotational and Solenoidal vector fields - Vector integration - Problem solving using Green's theorem, Gauss divergence theorem and Stoke's theorem - Simple applications and verifications.

UNIT III **FOURIER SERIES AND TRANSFORMS** **9**

Dirichlet's conditions - General Fourier series - Odd and even functions - Half range sine series and cosine series. Fourier transform pair - Sine and Cosine transforms - Properties -Transforms of simple functions - Parseval's identity for series and transforms.

UNIT IV **COMPLEX INTEGRATION** **9**

Problems solving using Cauchy's integral theorem and integral formula - Taylor's and Laurent's expansions - Residues - Cauchy's residue theorem - Contour integration over unit circle -Semicircular contours with no pole on real axis.

UNIT V **LAPLACE TRANSFORMS** **9**

Transforms of elementary functions - Basic properties - Transforms of derivatives and integrals -Initial and final value theorems - Inverse Laplace transforms - Convolution theorem - Solution of Ordinary Differential Equations with constant coefficients using Laplace transforms.

Total: 45

TEXT BOOK

1. Grewal, B.S., "Higher Engineering Mathematics", Thirty eighth Edition, Khanna Publishers, New Delhi, 2005.

REFERENCES

1. Glyn James., "Advanced Modern Engineering Mathematics", Third Edition, Pearson Education Ltd, New Delhi, 2004.
2. Venkataraman, M.K., "Engineering Mathematics", Volume I and II Revised enlarged Fourth Edition, The National Publishing Company, Chennai, 2004.
3. Veerarajan. T., "Engineering Mathematics (for first year)", Fourth Edition, Tata McGraw - Hill Publishing Company Limited, New Delhi, 2005.
4. V. Sundaram, R. Balasubramanian, K.A. Lakshminarayanan, "Engineering Mathematics", Fifth Edition, Vikas Publishing house Pvt, Ltd., New Delhi, 2006.

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 10

Definition, scope and importance - Need for public Awareness - Forest resources: Use and over - exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people _ Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer - pesticide problems, water logging, salinity, case studies

- Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies - Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification - Role of an individual in conservation of natural resources - Equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets - river / forest / grassland / hill / mountain.

UNIT II ECOSYSTEMS AND BIODIVERSITY 14

Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) - Introduction to biodiversity - Definition: genetic, species and ecosystem diversity - Biogeographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, National and local levels - India as a mega _ diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - Endangered and endemic species of India - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Field study of common plants, insects, birds

Field study of simple ecosystems - pond, river, hill slopes, etc.

UNIT III ENVIRONMENTAL POLLUTION 8

Definition - Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards

- Soil waste management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Pollution case studies - Disaster management: floods, earthquake, cyclone and landslides.

Field study of local polluted site - Urban / Rural / Industrial / Agricultural.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

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

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations - Population explosion - Family welfare programme - Environment and human health - Human rights - Value education - HIV / AIDS-Women and child welfare - Role of information technology in environment and human health -Case studies.

Total: 45

TEXT BOOKS

1. Gilbert M.Masters, 'Introduction To Environmental Engineering And Science', Pearson Education Pvt., Ltd., Second Edition, Isbn 81-297-0277-0, 2004.
2. T.G. Jr. Miller,' Environmental Science',Wadsworth Publishing Co.
3. Townsend C., Harper J And Michael Begon, 'Essentials Of Ecology', Blackwell Science.
4. R.K. Trivedi And P.K. Goel, 'Introduction To Air Pollution', Techno-Science Publications.

REFERENCES

1. Bharucha Erach, 'The Biodiversity Of India', Mapin Publishing Pvt., Ltd., Ahmedabad India.
2. Trivedi R.K., 'Handbook Of Environmental Laws, Rules, Guidelines, Compliances And Standards', Vol. I And II, Enviro Media.
3. Cunningham, W.P.Cooper, T.H.Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
4. Wager K.D., 'Environmental Management', W.B., Saudners Co., Philadelphia, USA, 1998.

CE4151 – FLUID MECHANICS AND MACHINERY

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UNIT I FLUID FLOW CONCEPTS 12

Fluid mechanics - Introduction- difference between fluids and solids-properties of fluid-fluid pressure & its measurement. Flow characteristics-system and control column-continuity equation-one dimensional and three-dimensional-Euler equation-Bernoulli equation-assumption-momentum equation and applications.

UNIT II FLOW THROUGH CIRCULAR CONDUITS 12

Laminar flow through circular pipes and annuli- hydraulic and energy gradient line-pipe roughness-Darcy Equation- Friction factor- Moody diagram- minor losses- flow through in series and parallel- boundary layer concepts & thickness of boundary layer.

UNIT III DIMENSIONAL ANALYSIS 6

Units and dimensions- dimensional analysis- method of dimensional analysis-dimensionless numbers- similitude- types of similitude- model analysis- application of dimensionless numbers.

UNIT IV ROTODYNAMICS MECHANICS 10

Impact of jets- Euler equation-velocity triangle-theory of rotodynamics mechanics-turbines-classification-efficiencies-tangential flow, radial flow & axial flow turbines- work done-velocity components at entry and exit of the rotor- centrifugal pump-work done by the impeller-specific speed of the rotodynamic machines-special pumps for mining.

UNIT V POSITIVE DISPLACEMENT MACHINES 5

Reciprocating pump- working principle- classification- indicator diagram-work saved by air vessels-rotary pump- classification- working-advantages of rotary pumps.

Total: 45

TEXT BOOKS

1. Bansal R. K., Fluid mechanics and hydraulic mechanics, New Delhi.
2. Modi P.N. & Seth S.M., Hydraulics and fluid mechanics, Standard Book House, New Delhi.

REFERENCES

1. K. L. Kumar, Engineering Fluid Mechanics, Eurasia Publishing House (P) Ltd., New Delhi, 1999
2. Streeter, V.L & Wylie E.B., Fluid Mechanics - McGraw-Hill Book Co., International Edition.
3. Ronald V. Giles, Jack B. Evelt and Cheng Liv., Scaww's, "Outlin Theory and Problems of Fluid Mechanics and Hydraulics", McGraw Hill Book Company International Edition, 1995

TEXT BOOKS

1. Popov E.P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, 1997.
2. Beer F. P. and Johnston R, "Mechanics of Materials", McGraw-Hill Book Co, Third Edition, 2002.

REFERENCES

1. Nash W.A, "Theory and problems in Strength of Materials", Schaum Outline Series, McGraw-Hill Book Co, New York, 1995.
2. Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co, New Delhi, 1981.
3. Ryder G.H, "Strength of Materials", Macmillan India Ltd., Third Edition, 2002.
4. Ray Hulse, Keith Sherwin & Jack Cain, "Solid Mechanics", Palgrave ANE Books, 2004.
5. Singh D.K "Mechanics of Solids" Pearson Education 2002.
6. Timoshenko S.P, "Elements of Strength of Materials", Tata McGraw-Hill, New Delhi 1997.

III SEMESTER

GE4201 – PROFESSIONAL ETHICS IN ENGINEERING

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UNIT I ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' -Variety of moral issues -Types of inquiry -Moral dilemmas - Moral Autonomy -Kohlberg's theory -Gilligan's theory -Consensus and Controversy - Professions and Professionalism - Professional Ideals and Virtues -Uses of Ethical Theories.

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation -Engineers as responsible Experiments - Codes of Ethics - Industrial Standards -A Balanced Outlook on Law -The Challenger Case Study

UNIT III ENGINEER'S RESPONSIBILITY FOR SAFETY 9

Safety and Risk - Assessment of Safety and Risk - Risk Benefit Analysis -Reducing Risk - The Government Regulator's Approach to Risk — Chernobyl Case Studies and Bhopal

UNIT IV RESPONSIBILITIES AND RIGHTS 9

Collegiality and Loyalty - Respect for Authority - Collective Bargaining - Confidentiality - Conflicts of Interest - Occupational Crime - Professional Rights - Employee Rights - Intellectual Property Rights (IPR) - Discrimination

UNIT V GLOBAL ISSUES 9

Multinational Corporations - Business Ethics - Environmental Ethics - Computer Ethics - Weapons Development - Engineers as Managers - Consulting Engineers -Engineers as Expert Witnesses and Advisors - Moral Leadership - Sample Code of Conduct

Total: 45

TEXT BOOKS

1. Govindarajan M., Natarajan. S and Senthil Kumar V.S. - Professional Ethics - PHI - 2004.
2. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, 2005.
3. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics Concepts and Cases", Thompson Learning, 2000.

REFERENCES

1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999.
2. The Economist, "Business Ethics -Facing Up To The Issues", Viva Books Private Limited,New Delhi. 2004.
3. Chakraborty S K, "Values and Ethics for Organizations -Theory and Practice", Oxford India Paperbacks, 1998
4. Chakraborty S K, "Ethics in Management -Vedantic Perspectives, Oxford India Paperbacks,1996
5. David Emlann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, 2003

ME4201 – ENGINEERING THERMODYNAMICS

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3	0	0

UNIT I BASIC CONCEPTS AND FIRST LAW 10

Basic definitions — Microscopic and macroscopic approaches — Concept of continuum — Extensive and intensive, total and specific quantities — Point and path functions — Types of systems and processes — Concept of thermodynamic equilibrium — Quasi-static process — Zeroth Law — First Law applied to closed systems and control volume — Steady and unsteady flow processes — Limitations of I law of thermodynamics.

UNIT II SECOND LAW, ENTROPY AND AVAILABILITY 12

Kelvin-Planck and Clausius statements— Heat engines and heat pumps — Efficiency and COP — Corollaries of II Law — Carnot cycle. Entropy — Principle of entropy increase — PV and T-S diagrams. Available and unavailable energy — Availability in closed and open systems —Irreversibility.

UNIT III PROPERTIES OF STEAM, PSYCHROMETRY 6

Steam formation — Use of steam tables and Mollier chart — PVT surface — dryness fraction measurement, Psychrometric properties — Simple psychrometric processes and use of charts.

UNIT IV IDEAL AND REAL GASES AND THERMODYNAMIC RELATIONS 12

Equation of state — Vander walls, Dieterici, Berthelot, Redlick-Kwang equations — Virial expansions. Compressibility factor — Principle of corresponding states — Generalized compressibility chart. Properties of ideal gas mixtures. Maxwell's equations — Relations for internal energy, enthalpy and entropy, Cp and Cv and Joule-Thomson Coefficient — Clapeyron equation.

UNIT V FUELS AND COMBUSTION 5

Types of fuels — Properties of fuel — Concept of enthalpy of reaction, combustion and formation — Calculation of heating values and adiabatic flame temperature. Combustion equations — Stoichiometric air requirements — Air fuel ratio — Excess air ratio — Flue gas analysis — Air-fuel ratio from exhaust gas composition.

Total: 45

TEXT BOOKS

1. Jayachandran K, "Applied Thermodynamics", Anuradha Agencies, 2003.
2. Nag P.K., Engineering Thermodynamics, 2nd Edition, Tata McGraw Hill, 2003.
3. Yunus A. Cengel and Michael A. Boles, Thermodynamics — An Engineering Approach, 4th Edition, Tata McGraw Hill Co. Ltd., 2003.

REFERENCES

1. Kenneth Wark, J.R. & Donald E. Richards, Thermodynamics, 6¹ Edition, McGraw Hill Co.Ltd., 1999.
2. Robert Balmer, Thermodynamics, M/s. Jaico Publishing Co., 1998.
3. Arora, C.P., Thermodynamics, TMH, 2002.

ME4203 – MANUFACTURING TECHNOLOGY II

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UNIT I THEORY OF METAL CUTTING 8

The mechanics of Chip formation, single point cutting tool, forces in machining, thermal aspects of chip formation. Orthogonal Metal Cutting, Cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability,

UNIT II CENTRE LATHE AND SPECIAL PURPOSE LATHES 10

Centre Lathe, Constructional Features, Specification, Cutting Tools, Nomenclature, Various operations -Taper Turning Methods, Thread Cutting Methods, Special Attachments, Machining time and power estimation. Capstan and Turret Lathes — Tool layout, Automatic Lathes : Semi Automatics — Single Spindle: Swiss Type, Automatic Screw Type — Multi Spindle:

UNIT III RECIPROCATING MACHINES, MILLING MACHINES AND GEAR CUTTING 12

Reciprocating Machine Tools : Shaper, Planer, Slotter, Milling: Types, Milling Cutter, attachments, change gear calculations, Machining Time Calculation, Operations. Hole Making: Drilling, Reaming, Boring, Tapping, Machining Time Calculations. Gear Cutting: forming, Generation, Shaping, Planning and Hobbing — Tool and cutter grinders.

UNIT IV ABRASIVE PROCESS, BROACHING 8

Abrasive Processes : Grinding Wheel — Specifications and Selection, Types of Grinding Process -Cylindrical Grinding, Surface Grinding, Centreless Grinding, Internal Grinding — Honing, Lapping, Super Finishing, polishing and Buffing, Abrasive jet Grinding.

Broaching Machines: Broach Construction — Push, Pull, Surface and Continuous Broaching Machines.

UNIT V CNC MACHINETOOLS AND PART PROGRAMMING 7

Numerical Control (NC) Machine Tools — CNC Types, Constructional Details, Special Features.

Part Programming Fundamentals — Manual Programming — Computer Assisted Part Programming — APT Language.

Total: 45

TEXT BOOKS

1. Rao.P.N. "Manufacturing Technology", Metal Cutting and Machine Tools, Tata McGraw —Hill, New Delhi, 2003.
2. Richard R. Kibbe, John E. Neely, Roland O. Merges and Warren J. White. "Machine Tool Practices", Prentice Hall of India, 2003

REFERENCES

1. HMT — Production Technology, Tata McGraw Hill, 1998.
2. Hajra Choudry, Elements of Workshop Technology — Vol. II, Media Promoters.

ME4204 – COMPUTER AIDED DRAWING LABORATORY

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UNIT I **BASICS OF CAD** **8**

Concepts - Loading AutoCAD - Main menu operations - Drawing editor usage - Data entry - Coordinates - Absolute, Relative, Polar - Pointing - Keyboard - Using cursor control keys-numeric values - angles - displacements - Modifiers - Filename - Special Input Formats -Variables - Arithmetic expressions.

UNIT II **UTILITY COMMANDS** **8**

Draw commands-Point, Line, Circle, Arc, Trace, Pline, Solid, Text, Shapes - Modifying commands - Erase, Oops, Move, Copy, Mirror, Break, Fillet, Chamfer, Array, Repeat, Endrep, Pedit, List, Oblist, Dist, Id, Area, Zoom, Pan, View, Redraw, Regen, Auto, Fill, Qtext modes-blip, Drag.

UNIT III **ADVANCED UTILITY COMMANDS** **7**

Dimensioning - Angular, Diameter, Radius - Utility Commands - Centre, Exit, Leader, Redraw, Status, Undo, Dimvariables, Hatching - Pattern - Slide - Mslide - Attributes - Attdisp, Atteit, Atttext - Advanced Features - Table Sketch.

UNIT IV **LAYERS AND ISOMETRIC DRAWING** **6**

Colours - Line types - LT Scale - Drawing aids - Snap, Grid, Axis, Isoplane, Osnap, Aperture, Block, Insert, Base - Simple practices on Isometric drawing.

UNIT V **3D MODELING** **7**

Slice - 3D Rotate - Union - Mass Properties of 3D Solids - Creation of Objects Like Spheres, Box, Cylinder, Cone, Torus - Intersection of Solids - Intersection of Cylinder and Cylinder, Cone and Cylinder, Prism and Prism, Cylinder and Prism.

Total : 36

TEXT BOOK

1. George Omura, "Mastering AUTOCAD 2000", BPB Publications, New Delhi, 2002.

REFERENCES

1. Michael E. Beall and Bill Burchard, "AUTOCAD 14 INSIDE", Techmedia, New Delhi, 1997.
2. N. Poleshchuk, "AUTOCAD Developer's Guide to Visual LISP", Eswar Press, Chennai, 2003.

SEMESTER IV

ME4251 – THERMAL ENGINEERING I

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UNIT I GAS POWER CYCLES 9

Otto - Diesel - Dual - Brayton cycles-Calculation of mean effective pressure and air standard efficiency - Actual and theoretical PV diagram of Four stroke engines- Actual and theoretical PV diagram of two stroke engines.

UNIT II STEAM TURBINES 9

Type - Impulse and reaction principles-compounding-velocity diagrams for simple and multistage turbines-speed regulations-governors and nozzle governors.

UNIT III INTERNAL COMBUSTION ENGINES 9

Classification of IC engine components and functions-Valve timing diagram and port timing diagram-Comparison of two stroke and four stroke engines-Fuel supply systems-Ignition Systems - Lubrication Systems-Principles of Turbo-charging.

UNIT IV INTERNAL COMBUSTION ENGINES TESTING AND PERFORMANCE 9

Performance calculation - Comparison of petrol & diesel engine - Fuels - Air-fuel ratio calculation - Knocking and Detonation - Lubrication system and cooling system - Exhaust gas analysis - pollution control norms

UNIT V GAS TURBINES 9

Open and closed cycles - Regeneration - Inter-cooling and Reheating - Materials - Types -Performance

Total 45

TEXT BOOKS

1. Rajput, "Thermal Engineering", S.Chand Publishers, 2000
2. Rudramoorthy R, "Thermal Engineering", Tata Mc-Graw Hill, 2003

REFERENCES

1. Kothandaraman, C.P., Domkundwar.S and A.V. Domkundwar., "A course in Thermal Engineering"
2. Holman .J.P., "Thermodynamics", McGraw Hill, 1985.
3. Rogers, Meyhew, "Engineering Thermodynamics", ELBS, 1992.
4. Arora . C.P., "Refrigeration and Air conditioning", TMH, 1994.
5. Sarkar B.K, "Thermal Engineering", Tata Mc-GrawHill, 1998.

ME4254 – HYDRAULICS AND PNEUMATICS ENGINEERING

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UNIT I FLUID POWER PRINCIPLES AND FUNDAMENTALS (REVIEW) 3

Introduction to Fluid power - Advantages and Applications - Fluid power systems - Types of fluids - Properties of fluids - Basics of Hydraulics - Pascal's Law - Principles of flow -Work, Power and Torque - Properties of air - Perfect Gas Laws

UNIT II HYDRAULIC SYSTEM AND COMPONENTS 13

Sources of Hydraulic power: Pumping Theory - Pump Classification - Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criterion of Linear, Rotary - Fixed and Variable displacement pumps. Hydraulic Actuators: Cylinders - Types and construction, Hydraulic motors. Control Components: Direction control, Flow control and Pressure control valves - Types, Construction and Operation - Applications - Types of actuation. Accessories: Reservoirs, Accumulators, Intensifiers, Pressure Switches -Applications - Fluid Power ANSI Symbol.

UNIT III HYDRAULIC CIRCUITS 9

Industrial hydraulic circuits - Regenerative, Pump Unloading, Double-pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-safe, Speed control, Hydrostatic transmission, Accumulators, Electro hydraulic circuits, Mechanical Hydraulic servo systems.

UNIT IV PNEUMATIC SYSTEMS 8

Compressors - Filter, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust valves, Pneumatic actuators, Servo systems - Introduction to Fluidics, Pneumatic logic circuits

UNIT V DESIGN OF HYDRAULIC AND PNEUMATIC CIRCUITS 12

Designing the components of hydraulic system for Drilling, Planning, Shaping, Punching, Press - Selection, fault finding and maintenance of hydraulic components - Sequential circuit design for simple application using cascade method, Electro pneumatic circuits. Selection criteria of pneumatic components - Installation, fault finding and maintenance of pneumatic components - Microprocessor and PLC - Applications in Hydraulic and Pneumatics - Low cost Automation - Hydraulic and Pneumatic power packs - case studies.

Total: 45

TEXT BOOK

1. Anthony Esposito, "Fluid Power with Applications", Prentice Hall of India, 2007.

REFERENCE BOOKS

1. Majumdar S.R., "Oil Hydraulics", Tata McGraw Hill, 2000
2. Majumdar S.R., "Pneumatic Systems— Principles and Maintenance", Tata McGraw Hill, 1995.
3. Michael J, Pinches and Ashby J.G., "Power Hydraulics", Prentice Hall, 1989.
4. Dudelyt, A Pease and John J Pippenger, "Basic Fluid Power", Prentice Hall, 1987.
5. Harry. L, Stewart D.B., "Practical Guide to Fluid Power", Taraoeala Sons and Port Ltd., Broadey, 1976.

ME4252 – DYNAMICS OF MACHINES

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UNIT I FORCE ANALYSIS 10

Applied and constraint forces - Free body diagrams - Static equilibrium conditions - Two, three & four members - Static force analysis of simple mechanisms- Dynamic force analysis - Inertia force and Inertia torque - D'Alemberts principle - The principle of superposition - Dynamic Analysis in reciprocating engines - Gas forces - Equivalent masses - Bearing loads - Crank shaft torque - Turning moment diagrams - Fluctuation of energy -Fly Wheels - Engine shaking forces - Cam-dynamics - Unbalance, Spring, Surge and Windup.

UNIT II BALANCING 9

Static and dynamic balancing - Balancing of rotating masses - Balancing a single cylinder engine - Balancing Multi-cylinder engines - Partial balancing in locomotive engines -Balancing of linkages - Balancing machines.

UNIT III FREE VIBRATION 10

Basic features of vibratory systems - Idealized models of basic elements and lumping of parameters - Degrees of freedom - single degree of freedom - Free vibration - Equations of motion - Natural frequency - Types of Damping - Damped vibration - Extending to multi degree freedom systems - Critical speeds of shafts - Torsional vibration - Torsionally equivalent shaft - two and three rotor systems.

UNIT IV FORCED VIBRATION 6

Response to periodic forcing - Harmonic disturbances - Disturbance caused by unbalance -Support motion - force transmissibility and amplitude transmissibility - Vibration isolation.

UNIT V MECHANISM FOR CONTROL 10

Governors - Types - Centrifugal governors - Gravity controlled and spring controlled centrifugal governors - Characteristics - Effect of friction - Controlling force - Other Governor mechanisms.

Gyroscopes - Gyroscopic forces and torques - Gyroscopic stabilization - Gyroscopic effects in Automobiles, ships and airplanes.

Total: 45

TEXT BOOKS

1. Rattan S.S., "Theory of machines", Tata McGraw Hill Publishing Company Ltd., 1994.
2. Shigley J.E. and Uicker J.J., "Theory of Machines and Mechanisms", McGraw Hill, Inc., 1995.

REFERENCES

1. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 1984
2. Ghosh A. and Mallick A.K., "Theory of Mechanisms and Machines", affiliated East-West Press Pvt. Ltd., 1988.
3. Rao J.S. and Dukupati R.V., "Mechanism and Machine Theory", Wiley-Eastern Limited, 1992.
4. John Hannah and Stephens R.C., "Mechanics of Machines", Viva Low-Priced Student Edition, 1999.

ME4255 – THERMAL ENGINEERING LABORATORY I

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LIST OF EXPERIMENTS

1. ENGINE LABORATORY AND FUELS LABORATORY 30

1. Valve Timing diagram in I.C Engine
2. Pot Timing diagram in I.C Engine
3. Performance Test on Single cylinder C.I Engine
4. Performance Test on twin cylinder C.I Engine
5. Performance Test on Multi-cylinder C.I Engine
6. Performance Test on Multi-cylinder S.I Engine
7. Heat Balance Test on twin cylinder C.I Engine
8. Heat Balance Test on Multi-cylinder C.I Engine
9. Smoke Test on Single cylinder C.I Engine
10. Smoke Test on Multi-cylinder C.I Engine
11. Morse Test on Multi-cylinder Petrol Engine
12. Determination of Viscosity by Red Wood Viscometer
13. Determination of Flash Point and Fire Point.
14. Performance Test on Air Compressor.

Total: 45

SEMESTER V

ME4301 – DESIGN OF JIGS, FIXTURES AND PRESS TOOLS

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UNIT I LOCATING AND CLAMPING PRINCIPLES 10

Function and advantages of Jigs and fixtures – Basic elements – principles of location – Locating methods and devices – redundant location – Principles of clamping – Mechanical actuation – pneumatic and hydraulic actuation Standard parts – Drill bushes and jig buttons – Tolerances and materials used.

UNIT II JIGS AND FIXTURES 5

Types of jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs – General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – modular fixtures – Quick change fixtures.

UNIT III PRESS WORKING TERMINOLOGIES AND ELEMENTS OF CUTTING DIES 10

Press Working Terminologies – operations – Types of presses – press accessories – Computation of press capacity – Strip layout – Material Utilization – Shearing action – Clearances – Press Work Materials – Design of various elements of dies – Die block – Punch holder, Die set, guide plates – Stops – Strippers – Pilots – selection of standard parts – design and preparation of four standard views of simple blanking, piercing, compound and progressive dies.

UNIT IV BENDING FORMING AND DRAWING DIES 10

Difference between bending, forming and drawing – Blank development for above operations – Types of Bending dies – Press capacity – Spring back – knockout – direct and indirect – pressure pads – Ejectors – variables affecting Metal flow in drawing operations – draw die inserts – beads ironing – Design and combination dies – blank development for axisymmetric, rectangular and elliptic parts – Single and double action dies.

UNIT V MISCELLANEOUS TOOLS AND TOPICS 10

Bulging- - Swaging – Embossing – coining – curling – holeflanging, shaving and sizing- assembly, fine Blanking dies – computer Aids for sheet metal forming Analysis – basic introduction . Course could be supplemented with visits to atleast 3 industries.

Total : 45

TEXT BOOKS

1. Joshi, P.H."Jigs and Fixtures", Second Edition, Tata McGraw Hill Publishing Co., Ltd.,New Delhi, 2004.
2. Donaldson, Lecain and Goold "Tool Design", IIIrd Edition Tata McGraw Hill, 2000

REFERENCES

1. KeMPSTER, "Jigs and Fixture Design", Hoddes and Stoughton- Third Edition 1974.
2. Joshi, P.H."Press Tools" – Design and Constructor", Wheels publishing, 1996.
3. K. Venkataraman, "Design of jigs Fixtures & Press Tools ", Tata McGraw Hill.
4. Hoffman"Jigs and Fixture Design" – Thomsan Delmar learning Singapore, 2004.
5. ASTME fundamentals of Tool Design Prentice hall of India.
6. Design Data Hand Book, PSG College of Technology, Coimbatore.

ME4302 – THERMAL ENGINEERING II

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UNIT I STEAM NOZZLES 9

Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow.

UNIT II AIR COMPRESSOR 9

Classification and working principle – work of compression with and without clearance. Volumetric efficiency, Isothermal efficiency and isentropic efficiency of reciprocating air compressors. Multistage air compressor and inter cooling – work of multistage air compressor., Problems in single and two stage air compressors. Various types of compressors.

UNIT III REFRIGERATION AND AIR-CONDITIONING 9

Vapour compression refrigeration cycle – super heat, sub cooling, performance calculations. Working principle of vapour absorption, Air Cycle, Ejector, Steam, Thermoelectric refrigeration systems, Psychrometry, Psychrometric chart, Instrumentation, Cooling load calculations and air circulating systems, Concept of RSHF, GSHF,ESHF – air conditioning systems.

UNIT IV BOILERS 9

Types, Rankine cycle – analysis – Thermal calculations – heat balance – Accessories – Types of boilers – Boiler code.

UNIT V COGENERATION AND WASTE HEAT RECOVERY 9

Cogeneration Principles – Cycle analysis – Applications – Source and Utilization of waste heat – Systems – Heat exchangers – Economic analysis.

Total: 45

TEXT BOOK

1. Rajput, 'Thermal Engineering', S. Chand publishers, 2000.
2. Rudramoorthy R, "Thermal Engineering", Tata Mc Graw Hill, New Delhi, 2003

REFERENCES

1. Kothandaraman, C.P., Domkundwar.S.and A.V.Domkundwar., "A course in Thermal Engineering", Dhanpat Rai & Sons, Fifth edition, 2002
2. Holman.J.P., "Thermodynamics", McGraw Hill. 1985.
3. Arora.C.P., "Refrigeration and Air conditioning", TMH, 1994
4. Charles H Butler; "Cogeneration" NcGraw Hill. 1984
5. Sydney reiter "Industrial and commercial heat recovery systems "Van Nostrand Reinhold, 1985.
6. David Gunn, Robert Horton, Industrial Boilers – Longman Scientific & technical Publication, 1986.

ME4303 – DESIGN OF TRANSMISSION SYSTEMS

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UNIT I DESIGN OF TRANSMISSION SYSTEMS FOR FLEXIBLE ELEMENTS 9

Selection of V belts and pulleys – selection of Flat belts and pulleys – wire ropes and pulleys – Selection of Transmission chains and Sprockets. Design of pulleys and sprockets.

UNIT II SPUR GEARS AND PARALLEL AXIS HELICAL GEARS 9

Gear Terminology – Speed ratios and number of teeth – Force analysis – Tooth stresses – Dynamic effects – Fatigue strength – factor of safety – Gear materials – Module and face Width-power rating calculations – based on strength and wear considerations – Parallel axis Helical Gears – Pressure angle in the normal and transverse plane – Equivalent number of teeth-forces and stresses. Estimating the size of the helical gears.

UNIT III BEVEL, WORM GEARS AND CROSSED HELICAL GEARS 9

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits and demerits – Terminology . Thermal Capacity, Materials-forces and stresses, efficiency , estimating the size of the worm gear pair . Crossed-helical Terminology – helix angles – Estimating the size of the pair of Crossed-helical gears.

UNIT IV DESIGN OF GEAR BOXES 9

Geometric progression – Standard step ratio – Ray diagram, kinematic layout – Design of sliding mesh gear box – Design of multi speed gear box.

UNIT V DESIGN OF CAM, CLUTCHES AND BRAKES 9

Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses.

Design of plate clutches – axial clutches-internal expanding rim clutches-internal and external shoe brakes.

Total: 45

Design Data Books

1. PSG Design Data Book
2. Machine Design data Hand Book, Vol.1 & VOL.2, by Dr.K.Lingaiah.

TEXT BOOKS

1. Juvinal R.C. Manshek K.m., Fundamentals of Machine Component Design – John Wiley & Sons Third Edition 2002.
2. Bhandari, V.B., Design of machine Elements, Tata McGraw Hill Publishing Company Ltd., 1994

REFERENCES

1. Maitra G.M. Prasad L.V., Hand book of Mechanical Design, II Edition, Tata McGraw-Hill Book Co., 2004
2. Shigley, J.E., and Mischke C.R., Mechanical Engineering Design , McGraw Hill International Editions, 1989.
3. Norton R.L. Design of Machinery, McGraw-Hill Book Co., 2004.
4. Hamrock B.J., Jacobson B., Schmid S.R., Fundamentals of Machine Elements, McGraw Hill Book Co., 1999.

STANDARDS

1. IS 4460; Parts 1 to 3; 1995, Gears – Spur and Helical gears – Calculation of Load Capacity.
2. IS 7443:2002, Methods of Load Rating of Worm gears.
3. IS 15151: 2002, Belt Drives – Pulleys and V-Ribbed belts for Industrial applications – PH, PJ, PK, P1 and PM Profiles: Dimensions.
4. IS 2122: Part 1: 1973, Code of practice for selection, storage, installation and maintenance
5. IS 2122: Part 2: 1991, Code of practice for selection, storage, installation and maintenance of belting for power transmission: Part 2V-Belt drives

ME4304 – ENGINEERING METROLOGY AND MEASUREMENTS

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UNIT I BASICS OF METROLOGY 5

Introduction to Metrology – Need – Elements – Work piece, Instruments - Persons – Environment – their effect on Precision and Accuracy – Errors – Errors in Measurements - Types – Control – Types of standards.

UNIT II LINEAR AND ANGULAR MEASUREMENTS 10

Linear Measuring Instruments – Evolution – Types – Classification – Limit gauges – gauge design – terminology – procedure – concepts of interchange ability and selective assembly – Angular measuring instruments – Types – Bevel protractor clinometers, angle gauges, spirit levels sine bar – Angle alignment telescope – Autocollimator – Applications.

UNIT III ADVANCES IN METROLOGY 12

Basic concept of lasers Advantages of lasers – laser Interferometers – types – DC and AC Lasers interferometer – Applications – Straightness – Alignment. Basic concept of CMM – Types of CMM – Constructional features – Probes – Accessories – Software – Applications – Basic concepts of Machine Vision System – Element – Applications.

UNIT IV FORM MEASUREMENT 10

Principles and Methods of straightness – Flatness measurement – Thread measurement, gear measurement, surface finish measurement, roundness measurement – Applications.

UNIT V MEASUREMENT OF POWER, FLOW AND TEMPERATURE 8

Force, torque, power- mechanical, Pneumatic, Hydraulic and Electrical type. Flow measurement: Venturimeter, Orifice meter, rotameter, pitot tube – Temperature: bimetallic strip, thermocouples, electrical resistance thermometer – Reliability and Calibration – Readability and Reliability

Total: 45

TEXT BOOK

1. Shotbolt Metrology for Engineers Mc. Grawhill

REFERENCES

1. Jain R.K. Engineering Metrology, Khanna Publishers 1997
2. K.J.Hume Engineering Metrology
3. Beckwith T.G and N.Kewis Buck, Mechanical Measurements, Addison Wesley, 1991.

SEMESTER VI

MG4352 – TOTAL QUALITY MANAGEMENT

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UNIT I GENESIS AND PHILOSOPHY 9

Dimensions of Quality – Evolution – Quality Control – Quality Assurance – TQM – CWQC – Definition of quality teachings of quality Gurns, Deming, Cross-by, Juran, Taguchi concepts – Role of Senior management – Quality council – Quality statements TQM implementation – Barriers to TQM Implementation.

UNIT II TQM PRINCIPLES AND TOOLS 10

Customer satisfaction – Customer Perception of Quality – Customer complaints – feed back methods – Service Quality – Customer Retentions Employee involvement – motivation – Empowerment Recognition and Reward Teams – Types – Characteristics – Stages – common problems Supplier partnership – partnering – sourcing – selection – Rating – Relationship Development Performance measures – objective – Typical Managements – Strategy Quality Tools – Simple seven tools – Types – Applications – Examples New Seven Tools – Types – Application examples.

UNIT III STATISTICAL AND OTHER TOOLS 9

Statistical Quality Control – X,R,P and C charts – Construction and applications – problems Statistical process control – capability index – difference between Cp and Cpk values – Applications – problems Six sigma – Quality Function Deployment – Concept – House of Quality – Construction – Examples – Problems – Benefits Failure mode effect Analysis – Concept – Methodology – Examples – Problems

UNIT IV TOM TECHNIQUES 9

Total productive maintenance – Types of maintenance – TPM principles – Basic Steps – Six major losses – Overall Equipment Effective – Problem – Autonomous work group – Activities – Advantages Bench marking – concept – Bench marking process – examples – Applications Continuous improvement – PDCA – KAIZEN – Methodology – Examples Workplace improvement – 5S – Types – Advantages – Applications – Concept – Examples – POKA YOKE – Concept – Examples.

UNIT V QUALITY SYSTEMS 8

Quality Circle – Structure – Methodology – Benefits Quality Systems – ISO 9000 2000 – Elements – Certification process – Documentations Quality manual Quality Auditing – Example ISO 14000 – Requirements – Benefits other Quality Systems – QS 9000.

Total: 45

TEXT BOOKS

1. Dale H. Bester filed, et al., “Total Quality Management”, Pearson Education, Asia, 1999.
2. James R. Evans and William M. Lindsay, “The Management and Control of Quality, 6th Edition, South-Western, 2004.

REFERENCES

1. Suganthi Anand L. and Samuel A., “Total Quality Management”, Prentice Hall of India, 2004.
2. Jens J. Dahlgaard, Kai Kristensen, Gopal K. Kanji, “Fundamentals of Total Quality Management”, Nelson Thornes ltd., 2004
3. Amitava Mitra., “Fundamentals of Quality Control and Improvement”, Prentice Hall of India 2001.
4. Narayana. V and Sreenivasan .N.S., “Total Quality Management – concepts and Tasks”, New Age International 1996.
5. Zeiri., “Total Quality Management for Engineers”, Wood Head Publishers, 1991.

ME4351 – AUTOMOBILE ENGINEERING

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UNIT I VEHICLE STRUCTURE AND ENGINES 10

Vehicle construction, chassis, frame and body – Engine: Performance and balancing – Engine trouble shooting – Gas turbines – Air pollution – Pollution standards – Pollution control methods

UNIT II ENGINE AUXILIARY SYSTEMS 10

Carburetors – Electronic fuel injection systems – Monopoint and multipoint systems, electrical systems – Battery, generator, starting motor, lighting and ignition (Battery, magnets and electronic types)

UNIT III TRANSMISSION SYSTEMS 8

Clutch – Types and construction – Fluid flywheel – Gear boxes – Manual and automatic – Overdrives – Propeller shaft – Differential and rear axle.

UNIT IV RUNNING SYSTEMS 10

Wheel and tyres – Steering geometry – Power steering and types – Types of rear and front axle – Suspension systems – Air and hydraulic systems – Breaking systems.

UNIT V ALTERNATIVE FUELS / POWER PLANTS 7

Use of Hydrogen, Natural Gas, LPG and Hydrogen in automobiles as fuels – Introduction to electric and hybrid vehicles – Fuel cell.

Total: 45

TEXT BOOKS

1. Gupta R.B., “Automobile Engineering”, Satya Prakashan, 1993.
2. Ramalingam K.K., “Automobile Engineering”, Scitech Publications, 2002.

REFERENCES

1. William Crouse, “Automobile Engineering Series”, Mc Graw Hill, 1988.
2. Newton and Steeds, “Motor Vehicles”, ELBS, 1985.
3. Duffy Smith, “Auto Fuel Systems”, The Good Heat Willcox Company Inc. 1987.
4. Osamu Hirao and Richard K.Pefley., “Present and Future Automotive Fuels”, John Wiley and Sons, 1988.

ME4352 – HEAT AND MASS TRANSFER

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UNIT I CONDUCTION

11

Basic concepts – Mechanism of heat transfer – Conduction, convection and radiation – General differential equation of heat conduction – Fourier law of conduction – Cartesian and cylindrical coordinates – One dimensional steady state heat conduction – Conduction through plane wall, cylinders and spherical systems – Composite systems – Conduction with internal heat generation – Extended surfaces – Unsteady heat Conduction – Lumped analysis – Use of Heislers chart.

UNIT II CONVECTION

10

Basic concepts – Convective heat transfer coefficients – Boundary layer concept – Types of convection – Forced convection – Dimensional analysis – External flow – Flow over plates, Cylinders and spheres– Internal flow – Laminar and turbulent flow – Combined laminar and turbulent – Flow over bank of tubes – Free convection – Dimensional analysis – Flow over vertical plate, horizontal plate, Inclined plate, cylinders and spheres.

UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS

9

Nusselts theory of condensation – Pool boiling and condensation – Types of heat exchangers – LMTD method of heat exchanger analysis – Effectiveness – NTU method of heat exchanger analysis – Overall heat transfer coefficient – Fouling factors, exchanger analysis – Overall heat transfer coefficient – Fouling factors.

UNIT IV RADIATION

8

Basic concepts, laws of radiation – Stefan Boltzman Law, Kirchoff Law – Black body radiation – Grey body radiation – Shape factor algebra – Electrical analogy – Radiation shields – Introduction to gas radiation.

UNIT V MASS TRANSFER

7

Basic concepts – Diffusion mass transfer – Fick's law of diffusion – Steady state molecular diffusion – Convective mass transfer – Momentum, heat and mass transfer analogy – Convective mass transfer correlations.

Total: 45

TEXT BOOKS

1. Sachdeva, R.C., "Fundamentals of Engineering Heat and Mass Transfer", New Age International, 1995.
2. Yadav, R., "Heat and Mass Transfer", Central Publishing House, 1995.

REFERENCES

1. Ozisik, M.H., "Heat Transfer", Tata Mc Graw Hill Book Co., 1994
2. Nag, P.K., "Heat Transfer", Tata Mc Graw Hill, New Delhi, 2002
3. Holman, J.P., "Heat and Mass Transfer", Tata Mc Graw Hill, 2000
4. Kothandaraman, C.P., "Fundamentals of Heat and Mass Transfer", New Age International, New Delhi, 1998.
5. Frank P. Incropera and David P. Dewitt, "Fundamentals of Heat and Mass Transfer", John Wiley and Sons, 1998.
6. Velraj, R., "Heat and Mass Transfer", Ane Books, New Delhi, 2004

SEMESTER VII

ME4451 – POWER PLANT ENGINEERING

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UNIT I INTRODUCTION TO POWER PLANTS AND BOILERS 9

Layout of Steam, hydel, diesel, MHD, nuclear and gas turbine power plants combined power cycles – Comparison and selection, load duration curves steam boilers and cycles – High pressure and super critical boilers – Fluidised bed boilers.

UNIT II STEAM POWER PLANT 9

Fuel and ash handling – Combustion equipment for burning coal – Mechanical stokers – Pulveriser – Electrostatic precipitator – Draught – Different types – Surface condenser types – Cooling towers.

UNIT III NUCLEAR AND HYDEL POWER PLANTS 9

Nuclear energy – Fission – Fusion reaction – Types of reactors – Pressurized water reactor, boiling water reactor, waste disposal and safety, hydel power plant – Essential elements – Selection of turbines – Governing of turbines – Micro hydel developments.

UNIT IV INSTRUMENTATION & CONTROLS 9

Measurements of temperature – Pressure and flow – Flue gas analyzers – Automatic control for feed water, steam, flow air supply and combustion

UNIT V OTHER POWER PLANTS AND ECONOMICS POWER PLANTS 9

Geo thermal – OTEC – Wave energy and pumped storage power plants – Tidal power Plant – Solar thermal central receiver system power plant – Cost of electric energy – Fixed and operating costs – Energy rates – Types of tariffs – Economics of load sharing – Comparison of economics of various power plants.

Total: 45

TEXT BOOKS

1. Arora, S.C. and Domkundwar S., “A Course in Power Plant Engineering”, Dhanpatrai, 2001.
2. Nag P.K., “Power Plant Engineering”, Tata McGraw Hill, 1998.

REFERENCES

1. Nagpal G.R., “Power Plant Engineering”, Hanna Publishers, 1998.
2. Ramalingam K.K., “Power Plant Engineering”, Sci-tech Publications, 2002
3. Raj G.D., “Introduction to Power Plant Technology”, Khanna Publishers, 1995
4. Rajput R.K., “Power Plant Engineering”, Laxmi Publications, 1995
5. Frank D. Graham, “Power Plant Engineers Guide”, D.B.Taraporevala Sons and Co., New Delhi, 1993
6. Morse Frederick T., “Power Plant Engineering”, Prentice Hall of India, 1998

ME4452 – MECHATRONICS

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UNIT I INTRODUCTION 5

Introduction to mechatronics – Systems – Concepts of mechatronics approach – Need for mechatronics – Emerging area of mechatronics – Classification of mechatronics

UNIT II SENSORS AND TRANSDUCERS 12

Introduction – Performance Terminology – Potentiometers – LVDT – Capacitance sensors – Strain gauges – Eddy current sensor – Hall effect sensor – Temperature sensors – Light sensors – Selection of sensors – signal processing.

UNIT III MOTION CONTROL AND MEASUREMENT SYSTEM 12

Control system – Open loop and feedback control – Measurement system – Drives and actuators – Control devices – Servo systems – Motion converters

UNIT IV PROGRAMMABLE LOGIC CONTROLLERS 8

Introduction – Basic structure – Input and output processing – Programming – Mnemonics – Timers, counters and internal relays – Data handling – Selection of PLC.

UNIT V DESIGN OF MECHATRONICS 8

Design process – Stages of design process – Traditional and mechatronics design concepts – Case studies of mechatronics systems – Pick and place robot – Automatic car park barrier.

Total: 45

TEXT BOOK

1. Bolton.W, “Mechatronics”, 2nd Edition, Pearson education, fifth Indian Reprint, 2003.

REFERENCES

1. Devados Shetty and Richard Kolk A., “Mechatronics Systems Design”, PWS Publishing Company 2001
2. Nitaigour Premchand Mahalik, “Mechatronics Principles, Concepts and Applications”, Tata McGraw-Hill Publishing Company Limited, 2003
3. Michael B.Histand and Davis G.Alciatore, “Introduction to Mechatronics and Measurement Systems”, McGraw hill International Edition, 1999.
4. Braadley D.A, Dawson. D, Buru N.C and Loader A.J., “Mechatronics” Chapmand Hall, 1993.
5. Dan Necsulescu, “Mechatronics”, Pearson Education, 2002.
6. Newton C.Braga, “Mechatronics Sourcebook”, Thomson Delmar Learning, Eswar Press, 2003

ME4455 – PROJECT WORK

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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 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 per specified guidelines.

The continuous assessment shall be made as prescribed in the regulations (vide clause 10.3 of Regulations 2004 for B.E., B.Tech. programmes)

LIST OF ELECTIVES

ME4001 – NEWER MACHINING PROCESSES

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UNIT I INTRODUCTION 7

The Need of Newer Machining Processes – Classification Based on energy, Physical Parameters, Material, Shape and Capability – Introduction to AJM, CHM, ECM, ECG, EDM, IBM, LBM, PAM USM and WJM

UNIT II ULTRASONIC, ABRASIVE JET AND WATER JET MACHINING 10

Ultrasonic Machining: Principle, Transducer Types – Concentrators – Abrasive Slurry – Process Parameters – Tool Feed Mechanism – Advantages and Limitations – Applications – Recent Developments – Abrasive Jet Machining: Process – Principle – Process Variables – material Removal Rate – Advantages and Limitations – Applications – Water jet Machining: Principle – Process Variables – Advantages and Limitations – Practical Applications

UNIT III ELECTRICAL DISCHARGE MACHINING AND ELECTRICAL DISCHARGE WIRE CUT 10

Electrical Discharge Machining: Spark Erosion Machining Principle – Mechanism of Metal Removal – Dielectric Fluid – Electrode Materials - Spark Erosion Generators – Electrode Feed System – Material Removal rate – Process Parameters – Tool Electrode Design – Characteristics of spark Eroded Surfaces – Advantages And Limitations – Practical applications. Electrical Discharge Wire Cut: Principle – Wire feed System- Advantages and Limitations – Practical Applications. Electrical Discharge Grinding: Principle – Wire Feed System – Advantages and Limitations – Applications

UNIT IV CHEMICAL, ELECTRO CHEMICAL MACHINING AND GRINDING 10

Chemical Machining: Principle – Process Parameters – Advantages and Limitations – Applications – Electro Chemical Machining: Principle – Electrolyte and their Properties – Material Removal rate – Tool Material – Tool Feed System- Design For Electrolyte Flow – Process Variables – Advantages and Limitations – Applications – Electro Chemical Grinding – Principle - Advantages and Limitations – Applications – Electrochemical Honing and Electro Chemical Deburring

UNIT V ELECTRON BEAM, LASER BEAM AND PLASMA ARC MACHINING 8

Electron Beam Machining – Principle –Mechanism – Advantages and Limitations – Applications – Laser Beam Machining – Principle Solid and Gas Laser Application – Thermal Features of LBM - Advantages and Limitations – Applications – Plasma Arc Machining – Principle – Mechanism of Material Removal – Types of Torches – Process Parameters - Advantages and Limitations – Applications

Total: 45

TEXT BOOK

1. Pandey P.C and Shan H.S., “Modern Machining Process”, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2003

REFERENCES

1. Dr. Amitadha Bhattacharyya, “New Technology”, The Intuition of Engineers, 2001.
2. Jain V.K, “Advanced Machining Process”, Allied Publishers PVT Limited 2003.

ME4002 – THEORY OF METAL FORMING

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UNIT I THEORY OF PLASTICITY 9

Theory of plastic deformation – Engineering stress and strain relationship – Stress tensor – Strain tensor – Yield criteria – Plastic stress strain relationship – Plastic work.

UNIT II CONSTITUTIVE RELATIONSHIPS AND INSTABILITY 7

Uniaxial tension test – Mechanical properties – Work hardening, Compression test, bulge test, plane strain compression stress, plastic instability in uniaxial tension stress, plastic instability in biaxial tension stress.

UNIT III ANALYSIS OF METAL FORMING PROBLEMS 12

Slab analysis – Slip line method – Upper bound solutions – Numerical methods – Contact problems – Effect of friction – Thermo elastic elasto plasticity – Elasto visco plasticity – Analysis of forging – Rolling, extrusion and wire drawing processes – Cold and hot forging.

UNIT IV SHEET METAL FORMING 8

Sheet metal forming methods – Bending – Drawing – Deep drawing – Stretch forming – tooling and applications – Analysis of sheet metal forming – HERF techniques – Principles and process parameters – Super plastic forming

UNIT V SPECIAL METAL FORMING PROCESSES 9

Orbital forging – Isothermal forging – Warm forging – Hot and Cold isotropic pressing – High speed extrusion – Rubber pad forming – Micro blanking – Over-view of Power Metal techniques – Power rolling.

Total: 45

TEXT BOOK

1. Narayanaswamy. R, “Theory of Metal Forming and Plasticity”, Narosa Publishers, 1999

REFERENCES

1. Wagoner. R H. and Chenot, J.J., “Metal Forming Analysis”, Cambridge University Press, 2002.
2. Slater, R.A.C., “Engineering Plasticity – Theory and Applications to Metal Forming”, John Wiley and Sons, 1987.
3. Shiro Kobayashi, Altan. T., “Metal Forming and Finite and Element Methods”, Oxford University Press, 1989.
4. Hosford. W.F and Caddell. RM., “Metal Forming Mechanics and Metallurgy”, Prentice Hall Eaglewood Cliffs, 1993.

ME4003 – TURBO MACHINERY

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UNIT I PRINCIPLES

9

Energy transfer between fluid and rotor – Classification of fluid machinery – Dimensionless parameters – Specific speed – Applications – Stage velocity triangles – Work and efficiency for compressors and turbines.

UNIT II CENTRIFUGAL FANS AND BLOWERS

9

Types – Stage and design parameters – Flow analysis in impeller blades – Volute and diffusers – Losses – Characteristics curves and selection – Fan drives and fan noise.

UNIT III CENTRIFUGAL COMPRESSOR

9

Construction details – Types – Impeller flow losses – Slip factor – Diffuser analysis – Losses and performance curves.

UNIT IV AXIAL FLOW COMPRESSOR

9

Stage velocity diagrams – Enthalpy – Entropy diagrams – Stage losses and efficiency – Work done factor – Simple stage design problems and performance characteristics.

UNIT V AXIAL AND RADIAL FLOW TURBINES

9

Stage velocity diagrams – Reaction stages – Losses and coefficients – Blade design principles – Testing and performance characteristics.

Total: 45

TEXT BOOK

1. Yahya, S.H., “Turbines, Compressor and Fans”, Tata McGraw Hill Publishing Company, 1996.

REFERENCES

1. Bruneck, Fans, Pergamom Press, 1973.
2. Eari Logan, Jr., “Hand book of Turbo machinery”, Marcel Dekker Inc., 1992
3. Dixon, “S.I. Fluid Mechanics and Thermodynamics of Turbo machinery”, Pergamom Press, 1990.
4. Shepherd, D.G., “Principles of Turbo machinery”, Macmillan, 1969.
5. Stepanpff, A.J., “Blowers and Pumps”, John Wiley and Sons Inc. 1965.
6. Ganesan, V., “Gas Turbines”, Tata McGraw Hill Pub. Co., New Delhi, 1999

ME4004 – DESIGN OF PRESSURE VESSELS AND PIPING

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UNIT I INTRODUCTION

3

Methods for determining stresses – Terminology and ligament efficiency – Applications

UNIT II STRESSES IN PRESSURE VESSELS

15

Introduction – Stresses in a circular ring, cylinder – Membrane stress analysis of vessel shell components – Cylindrical shells, tori-spherical heads and conical heads – Thermal stresses – Discontinuity stresses in pressure vessels.

UNIT III DESIGN OF VESSELS

15

Design of tall cylindrical self supporting process columns – Supports for short vertical vessels – Stress concentration – At a variable Thickness transition section in a cylindrical vessel, about a circular hole, elliptical openings – Theory of Reinforcement – pressure vessel design

UNIT IV BUCKLING AND FRACTURE ANALYSIS IN VESSELS

8

Buckling phenomenon – Elastic buckling of circular rings and cylinders or tubes under external pressure – Effect of supports on elastic buckling of cylinders – Buckling under combined external pressure and axial loading

UNIT V PIPING

4

Introduction – Flow diagram – Piping layout and piping stress analysis

Total: 45

TEXT BOOK

1. John F. Harvey, “Theory and Design of Pressure Vessels”, CBS Publishers and Distributors

REFERENCES

1. Henry H. Bender, “Pressure Vessels, Design Hand Book”, CBS publishers and Distributors, 1987.
2. Stanley, M.Wales, “Chemical Process Equipment, Selection and Design”, Buterworths series in Chemical Engineering, 1988.

UNIT I INTRODUCTION TO ECONOMICS**8**

Introduction to Economics – Flow in an economy – Law of supply and demand – Concept of Engineering Economics – Engineering efficiency – Economic efficiency – Scope of engineering economics – Element of costs – Marginal cost – Marginal revenue – Sunk cost – Opportunity cost – Break-even analysis – V ratio – Elementary economic Analysis – Material selection for product design selection for a product – Process planning.

UNIT II VALUE ENGINEERING**10**

Make or buy decision – Value engineering – Function – Aims – Value engineering procedure – Interest formulae and their applications – Time value of money – Single payment compound amount factor – Single payment present worth factor – Equal payment series sinking fund factor – Equal payment series payment Present worth factor – Equal payment series capital recovery factor – Uniform gradient series annual equivalent factor – Effective interest rate – Examples in all the methods.

UNIT III CASH FLOW**9**

Methods of comparison of alternatives – Present worth method (Revenue dominated cash flow diagram) – Future worth method (Revenue dominated cash flow diagram – Cost dominated cash flow diagram) – Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram) – Rate of return method – Examples in all the methods.

UNIT IV REPLACEMENT AND MAINTENANCE ANALYSIS**9**

Replacement and Maintenance analysis – Types of maintenance – Types of replacement problem – Determination of economic life of an asset – Replacement of an asset with a new asset – Capital recovery with return and concept of challenger and defender – Simple probabilistic model for items which fail completely.

UNIT V DEPRECIATION**9**

Depreciation – Introduction – Straight Line method of depreciation – Declining balance method of depreciation – Sum of the years digits method of depreciation – Sinking fund method of depreciation/ Annuity method of depreciation – Service output method of depreciation – Evaluation of public alternatives – Introduction – Examples – Inflation adjusted decisions – Procedure to adjust inflation – Examples on comparison of alternatives and determination of economic life of asset.

Total: 45**TEXT BOOK**

1. Panneer Selvam, R., “Engineering Economics”, Prentice Hall of India Ltd, New Delhi, 2001

REFERENCES

1. Chan S. Park., “Contemporary Engineering Economics”, Prentice Hall of India, 2002
2. Donald G. Newman, Jerome P. Lavelle, “Engineering Economics and Analysis”, Engg. Press, Texas, 2002
3. Degarmo, E.P., Sullivan, W.G and Canada, J.R., “Engineering Economy”, Macmillan, New York, 1984.
4. Grant. E.L., Ireson. W.G., and Leavenworth, R.S., “Principles of Engineering Economy”, Ronald Press, New York, 1976.
5. Smith, G.W., “Engineering Economy”, Iowa State Press, Iowa, 1973

ME4006 – ENTREPRENEURSHIP DEVELOPMENT

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UNIT I ENTREPRENEURSHIP 9

Entrepreneur – Types of entrepreneurs – Difference between entrepreneur and intrapreneur – Entrepreneurship in economic growth – Factors affecting entrepreneurial growth.

UNIT II MOTIVATION 9

Major motives influencing an entrepreneur – Achievement motivation training, self rating, business game, thematic apperception tests – Stress management, Entrepreneurship Development programs – Need – Objectives.

UNIT III BUSINESS 9

Small enterprises – Definition – Classification – Characteristics – Ownership structures – Project formulation – Steps involved in setting up a business – Identifying – Selecting a good business opportunity, market survey and research – Techno economic feasibility assessment – Preparation of preliminary project reports – Project appraisal – Sources of information – Classification of needs and agencies.

UNIT IV FINANCING AND ACCOUNTING 9

Need – Sources of finance – Term Loans – Capital Structure – Financial Institution – management of working Capital – Costing – Break Even Analysis – Network Analysis Techniques of PERT/CPM – Taxation – Income Tax – Excise Duty – Sales Tax.

UNIT V SUPPORT TO ENTREPRENEURS 9

Sickness in small business – Concept, magnitude, causes and consequences – Corrective measures – Government policy for small scale enterprises – Growth strategies in small industry – Expansion, diversification, joint venture, merger and sub Contracting.

Total: 45

TEXT BOOKS

1. Khanka S.S., “Entrepreneurial Development”, S.Chand and Co. Ltd., Ram Nagar New Delhi, 1999.
2. Hisrich R. D. and Peters M. P., “Entrepreneurship” 5th Edition, Tata McGraw Hill, 2002.

REFERENCES

1. Rabindra N. Kanungo, “Entrepreneurship and innovation”, Sage Publications, New Delhi, 1998
2. EDII “Faculty and External Experts – A Hand Book for New Entrepreneurs”, Institute of India, Ahmadabad, 1986.

ME4007 – MECHANICAL VIBRATIONS

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UNIT I INTRODUCTION

7

Relevance and need For vibration analysis – Mathematical modeling of vibrating systems – Review of Single degree of freedom systems – Free and forced vibrations – Various Damping Models.

UNIT II TWO DEGREE OF FREEDOM SYSTEMS

8

Free and forced vibrations of damped and undamped systems – Equations of motion – Coordinate coupling and principal coordinates – Dynamic vibration absorbers – Orthogonality principle technical applications.

UNIT III MULTI DEGREE OF FREEDOM SYSTEMS

10

Equation of motion – Method of influence coefficients – Free vibration of undamped system – Natural frequencies and mode shapes – Solutions by matrix method and influence coefficients – Mode shape Orthogonality – Free vibration of damped system – Rayleigh – damping – General viscous damping – Forced vibrations of multi degrees of freedom system Harmonic excitations.

UNIT IV CONTINUOUS SYSTEMS

10

Torsional vibration of shafts – Longitudinal vibration of rods – Transverse vibrations of beams and strings – Governing equations of motion – Natural frequencies and normal modes – Energy methods – Introduction to vibrations of plates

UNIT V VIBRATION MEASUREMENTS

10

Vibration monitoring – Data acquisition – Vibration parameter selection – Vibration sensors – Accelerometers – Performance characteristics – Sensor location – Signal Preamplification – Types of Preamplifiers – Instrumentation - Tape recorders – Real Time Analysis – Digital Fourier transforms – FFT analysis – Vibration meters – Vibration signatures – Standards – Vibration testing equipment – In-Site balancing of rotors.

Total: 45

TEXT BOOK

1. Rao J.S. and Gupta K., “Introductory Course on Theory and Practice of Mechanical Vibrations”, Wiley Eastern Ltd., 1991.

REFERENCES

1. Srinivasan P., “Mechanical Vibration Analysis”, Tata Mc-Graw Hill, New Delhi, 1982
2. Grover G.K., “Mechanical Vibrations”, New Chand and Bros., Roorkee, 1989
3. Seto, “Mechanical Vibrations”, Schaum series, McGraw Hill Book Co.,
4. Rao V. Dukkipadi and Srinivas J., “Text Book of Mechanical Vibrations”, Prentice Hall of India, New Delhi. 2004

ME4008 – ADVANCED WELDING AND CASTING PROCESSES

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UNIT I DESIGN OF GATING SYSTEM 12

Solidification, gating, risering and casting design solidification process – Gating System design pouring time – Choke area – Sprue – Other Gating elements – Riser design – Caines – Modulus – Naval research Laboratory method – Feeding distances – Chills feeding Aids – Design of castings.

UNIT II FERROUS AND NON FERROUS CASTINGS 10

Steel castings – The family of cast iron – Melting of steels and cast irons – Grey iron foundry practice – Ductile iron – Malleable Iron casting design – Considerations Aluminium and Magnesium foundry practice – Aluminium and Magnesium Casting alloys.

UNIT III FOUNDRY MECHANIZATION 8

Mechanical equipments in foundry – Plant site location and layout – Plant Engineering – Maintenance – Services – Practical aspects.

UNIT IV WELDING METALLURGY 10

Weld thermal cycles – Heat Affected Zone (HAZ) – Weldability of steels – Cast iron – Stainless steel – Aluminium – Copper and titanium alloys – Hydrogen embrittlement – Pre and post weld heat treatments – Weld defects – Testing of welds.

UNIT V WELDING OF DISSIMILAR METALS 10

Friction welding process – Effect of speed and pressure – Explosive welding – Plasma arc welding – Electron beam welding – High frequency induction welding – Diffusion bonding – Cold pressure welding – Ultrasonic welding – Laser beam welding

Total: 45

TEXT BOOK

1. Rao P.N., “Manufacturing Technology”, Tata Mc Graw Hill, 2001.

REFERENCES

1. Heine, Loper and Rosenthal, “Principles of Metal Casting”, Tata McGraw Hill, 1994.
2. Rama Rao T.V., “Metal Casting Principles and Practice”, New Age International, 1996.
3. Srinivasan, N.K., “Welding Technology”, Khanna Publishers, 1994
4. Little. R.L, “Welding and Technology”, McGraw Hill, New York, 1973.

ME4009 – REFRIGERATION AND AIR CONDITIONING

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UNIT I REFRIGERATION CYCLE

7

Review of thermodynamic principles of refrigeration – Concept of air refrigeration system – Vapour compression refrigeration – Use of P.H charts – Multistage and multiple evaporator systems – Cascade system – COP comparison.

UNIT II REFRIGERANTS SYSTEM COMPONENTS AND BALANCING

10

Compressors – Reciprocating and rotary (elementary treatment) – Condensers – Evaporators cooling towers – Refrigerants – Properties – Selection of refrigerants – Cycling controls

UNIT III PSYCHROMETRY

10

Psychrometric processes use of psychrometric charts – Grand and Room Sensible Heat Factors – Bypass factor – Air washers – Requirements of comfort air conditioning – Summer and winter air conditioning.

UNIT IV AIR CONDITIONING SYSTEMS

9

Cooling load calculation working principles of – Centralised air conditioning systems – Split – Ductable split – Packaged Air conditioning – VAV & VRV Systems – Duct Design by equal friction method – Indoor Air quality concepts.

UNIT V UNCONVENTIONAL REFRIGERATION CYCLES

9

Vapor Absorption system – Ejector jet – Steam jet refrigeration – Thermo electric refrigeration.

APPLICATIONS: Ice plant – Food storage plants – Milk Chilling Plants.

Total: 45

TEXT BOOKS

1. Manohar Prasad, “Refrigeration and Air Conditioning”, Wiley Eastern Ltd., 1983.
2. Arora C.P., “Refrigeration and Air Conditioning”, Tata McGraw Hill, New Delhi, 1988.

REFERENCES

1. Roy. J. Dossat., ‘Principles of Refrigeration’, Pearson Education, 1997
2. Jordon and Priester, “Refrigeration and Air Conditioning”, Prentice Hall of India PVT Ltd., New Delhi, 1985.
3. Stoecker N.F and Jones, “Refrigeration and Air Conditioning” TMH, New Delhi, 1998.

MG4002 – MARKETING MANAGEMENT

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UNIT I CONCEPTS IN MARKETING 9

Definition – Marketing Process – Dynamics – Needs – Wants and demands – Marketing Concepts – Environment – Mix – Types – Philosophies – Selling vs Marketing – Consumer Goods – Industrial goods – Product – Hierarchy.

UNIT II BUYING BEHAVIOUR AND MARKET SEGMENTATION 9

Cultural – Demographic factors – Motives – Types – Buying decisions – Segmentation factors – Demographic – Psycho graphic and geographic segmentation – Process – Patterns.

UNIT III PRODUCT PRICING & MARKETING RESEARCH 9

Objectives – Pricing – Decisions and pricing methods – Pricing management – Introduction – Uses – Process of marketing research.

UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION 9

Components of a marketing plan – Strategy formulation and the marketing process – Implementation – Portfolio analysis – BCG – GEC – Grids

UNIT V ADVERTISING SALES PROMOTION & DISTRIBUTION 9

Characteristics – Impact – Goals – Types – Sales promotion – Point of purchase – Unique selling propositions – Characteristics – Wholesaling – Retailing – Channel design – Logistics – Modern trends in retailing.

Total: 45

TEXT BOOKS

1. Philip Kotler, “Marketing Management – Analysis, Planning, Implementation and Control”, 12th Edition, Prentice Hall of India, 2005..
2. Govindarajan, M., “Modern Marketing Management”, Narosa Publishing House, New Delhi, 1999.

REFERENCES

1. Green Paul, E. and Donald Tull, “Research for Marketing Decisions”, Prentice hall of India, 1975.
2. Ramaswamy, V.S. and Namakumari S., “Marketing Environment Planning, Implementation and Control the Indian Context’, Macmillan India, 1990.

ME4010 – DESIGN OF HEAT EXCHANGERS

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UNIT I CONSTRUCTIONAL DETAILS AND HEAT TRANSFER 8

Types – Shell and tube heat exchangers – Regenerators and recuperators – Industrial applications – Temperature distribution and its implications – Analysis of heat exchangers – LMTD and effectiveness method.

UNIT II FLOW AND STRESS ANALYSIS 9

Effect of turbulence – Friction factor – Pressure loss – Stress in tubes – Header sheets and pressure vessels – Thermal stresses – Shear stresses – Types of failures

UNIT III DESIGN ASPECTS 9

Heat transfer and pressure loss – Flow configuration – Effect of baffles – Effect of deviations from ideality – Design of double pipe – Finned tube – Shell and tube heat exchangers

UNIT IV COMPACT AND PLATE HEAT EXCHANGERS 9

Types – Merits and demerits – Design of compact heat exchangers – Plate heat exchangers – Performance influencing parameters – Limitations.

UNIT V CONDENSORS AND COOLING TOWERS 9

Design of surface and evaporative condensers – Cooling tower – Performance characteristics.

Total: 45

REFERENCES

1. Taborek T., Hewitt G.F., and Afgan N., “Heat Exchangers, Theory and Practice”, McGraw-Hill Book Co. 1980.
2. Walker., “Industrial Heat Exchangers – A Basic Guide”, McGraw Hill Book Co. 1980.
3. Nicholas Cheremistoff., “Cooling Tower”, Ann Arbor Science Pub., 1981.
4. Arthur. P. Frass., “Heat Exchanger Design”, John Wiley and Sons, 1988.

MG4003 – OPERATIONS RESEARCH

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UNIT I LINEAR MODELS 15

The phase of an operation research study – Linear programming – Graphical method – Simplex algorithm – Duality formulation – Sensitivity analyses – Transportation problems – Assignment problems – Applications to problem with discrete variables – Dynamic programming – Methods of solution – Integer programming.

UNIT II NETWORK MODELS 8

Network models – Shortest route – Minimal spanning tree – Maximum flow models – Project network – CPM and PERT networks – Critical path scheduling – Integer Programming.

UNIT III INVENTORY MODELS 6

Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

UNIT IV QUEUING THEORY 6

Queuing models – Queuing systems and structures – Notation parameter – Single server and Multi server models – Poisson input – Exponential service – Constant rate service – Infinite population - Simulation

UNIT V DECISION MODELS 10

Decision models – Game theory – Two person zero sum games – Graphical solution – Algebraic solution – Linear programming solution – Replacement models – Models based on service life – Economic life – Single / Multi variable search technique – Application of OR models – Case studies.

Total: 45

TEXT BOOK

1. Taha H.A., “Operations Research”, 7th Edition, Prentice Hall of India, 2003.

REFERENCES

1. Shennoy and Srivstava, “Operations Research for Management”, Wiley Eastern, 1994.
2. Bazara M.J and Jarvis H. Sherali, “Linear Programming and Network Flows’, John Wiley, 1990.
3. Philip and Ravindran, “Operations Research”, John Wiley, 1992.
4. Hillier and Lieberman, “Operations Research”, Holden Day 1986.
5. Frank S. Budnick, Dennis and Mc Leavy, “Principles of Operation Research for Management”, Richard D Irwin, 1990
6. Tulsian and Vishal Pasdey, “Quantitative Techniques Pearson”, Asia 2002.

UNIT I SURFACES AND FRICTION 9

Topography of engineering surfaces – Contact between surfaces – Sources of sliding friction characteristics of metals and polymers – Rolling friction – Adhesion – Ploughing – Energy dissipation mechanisms friction characteristics of metals – Friction of non metals – Friction of lamellar solids – Friction of ceramic materials and polymers – Rolling friction – Source of rolling friction – Stick slip motion – Measurements of Friction.

UNIT II WEAR 9

Types of wear – Simple theory of sliding wear mechanism of sliding wear of metals – Abrasive wear – Materials for adhesive and abrasive wear situations – Brittle Fracture wear – Wear of ceramics and polymers – Wear measurements

UNIT III LUBRICANTS AND LUBRICATION TYPES 9

Types and properties of lubricants – Testing methods – Hydrodynamics lubrication – Elasto-Hydrodynamic lubrication – Boundary lubrication – Solid lubrication – Hydrostatic lubrication.

UNIT IV FILM LUBRICATION THEORY 9

Fluid film in simple shear – Viscous flow between very close parallel plates – Shear stress Variation Reynolds equation for film lubrication – High speed unloaded journal bearings – Virtual co-efficient of friction – The Sommer-field diagram.

UNIT V SURFACE ENGINEERING AND MATERIALS FOR BEARINGS 9

Surface modifications – Transformation hardening – Surface fusion – Thermo chemical processes – Surface coatings – Plating and anodizing – Fusion processes – Vapour phase processes – Materials for rolling element bearings – Materials for fluid film bearings – Materials for marginally lubricated and dry bearings

Total: 45**TEXT BOOK**

1. Harnoy A., “ Bearing Design in Machinery”, Marcel Dekker Inc, New York,2003

REFERENCES

1. Khonsari M. M. and Booser E.R., “Applied Tribology”, John Willey and Sons, New York, 2001.
2. Bowden E.P. and Tabor D., “Friction and Lubrication,” Heinemann Educational books ltd., 1974
3. Cameron A., “Basic Lubrication Theory”, Longman, U.K., 1981
4. Neale M.J., “Tribology Handbook”, Neweews, Butter worth, Heinmann,U.K.,1995

ME4012 – ENERGY CONSERVATION AND MANAGEMENT

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UNIT I INTRODUCTION TO ENERGY AND ENVIRONMENT 9

Energy scenario – World and India – Energy gap – Potential resources for bridging energy gap – Renewable and Non Renewable fuels – Energy intensive Indian industries –Environment and energy usage

UNIT II ENERGY AUDITING 8

Energy audit – Need – Mandatory aspects – Types – Methodology – Barriers – Energy efficiency and energy conservation – Material and energy balance

UNIT III ENCON TECHNIQUES IN THERMAL /ELECTRICAL SYSTEMS 10

Boilers – Furnace – Heat recovery systems – Refrigeration systems – Air conditioners – Motors – Fans - Pumps

UNIT IV ENCON IN UTILITIES 9

Steam – Compressed air – Thermal insulation – Illumination – Power factor capacitors

UNIT V ENERGY ECONOMICS 9

Principles of economics – Discount rate – Payback period – Net present value – Internal rate of return – Life cycle costing.

Total: 45

TEXT BOOKS

1. Murphy W.R and Mc Kay G., “Energy Management”, Butterworths, London, 1982.
2. “Handbook on Energy Efficiency”, TERI, New Delhi, 2001

REFERENCES

1. Diamant, “Total Energy”, Pergamon, Oxford, 1970.
2. Hamies, “Energy Auditing and Conservation: Methods, Measurements, Management and Case study”, Hemisphere, Washington, 1980
3. Smith C B, “Energy Management Principles”, Pergamon Press, New York, 1981.
4. Trivedi, P.R., and Jolka, K.R., “Energy Management”, Common Wealth Publication, New Delhi, 1997.

ME4013 – CRYOGENIC ENGINEERING

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UNIT I INTRODUCTION 9

Introduction to cryogenic systems low temperature properties of engineering materials – Cryogenic fluids and their properties – Application in space – Food processing – Super Conductivity – Electrical power – Biology medicine – Electronics and cutting tool industry.

UNIT II LIQUEFACTION AND LOWTEMPERATURE REFRIGERATION 9

Liquefaction systems ideal system – Joule Thomson expansion – Adiabatic expansion – Linde Hampson cycle – Claude and Cascaded system – Magnetic cooling – Stirling cycle cryo coolers.

UNIT III SEPARATION AND PURIFICATION SYSTEMS 9

General characteristics of mixtures – Temperature composition diagrams – Gas separation – Principles of rectification – Flash calculations – Rectification column analysis

UNIT IV INSULATION AND VACUUM TECHNOLOGY 9

Thermal insulation and their performance at cryogenic temperatures – Super Insulations – Vacuum insulation – Powder insulation – Cryo-pumping Applications

UNIT V STORAGE AND INSTRUMENTATION 9

Cryogenic storage vessels and transportation – Transfer devices – Pressure flow – Level and temperature measurements

Total: 45

TEXT BOOK

1. Klaus D. Timmerhaus and Thomas M. Flynn, “Cryogenic Process Engineering”, Plenum Press, New York, 1989.

REFERENCES

1. Randal F.Barron, “Cryogenic Systems”, Mc Graw Hill, 1986.
2. Scoott R.B., “Cryogenic Engineering”, Van Nostrand Company Inc., 1985
3. Bell J.H., “Cryogenic Engineering”, Prentice hall Inc., 1963.

UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 9

Basic of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions – Time – Averaged equations for Turbulent Flow – Turbulence – Kinetic – Energy equations – Mathematical behaviour of PDEs on CFD Elliptic, Parabolic and Hyperbolic equations.

UNIT II DISCRETIZATIONS AND SOLUTION METHODOLOGIES 9

Methods of deriving the discretization equations – Taylor series formulation – Finite difference method – Control volume formulation – Spectral method – Solution methodologies: Direct and iterative methods, Thomas algorithm, Relaxation method and Alternating Direction Implicit method.

UNIT III HEAT CONDUCTION 9

Finite difference and finite volume formulation of steady/transient one-dimensional conduction equation – Source term linearization – Incorporating boundary conditions – Finite volume formulations for two and three dimensional conduction problems.

UNIT IV CONVECTION AND DIFFUSION 9

Finite volume formulation of steady one-dimensional convection and diffusion problems – Central, upwind, hybrid, and power-law schemes – Discretization equations for two dimensional convection and diffusion

UNIT V CALCULATION OF FLOW FIELD 9

Representation of the pressure – Gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and velocity corrections – Pressure – Correction equation, SIMPLE algorithm and its variants – Turbulence methods – Mixing length model – Two equation (k-e) models – High and low Reynolds number model.

Total: 45**TEXT BOOKS**

1. Versteeg, H.K., and Malalasekera, W., “An Introduction to Computational Fluid Dynamics: The Finite Volume Method”, Longman, 1998.
2. Ghoshdastidar, P.S., “Computer Simulation of flow and heat transfer”, Tata McGraw Hill Publishing Company Ltd., 1998.

REFERENCES

1. Patankar, S.V., “Numerical Heat Transfer and Fluid Flow”, Indian Edition, McGrawHill, 2004.
2. Muralidhar, K., and Sundarajan, T., “Computational Fluid Flow and Heat Transfer”, Narosa Publishing House, New Delhi, 1995.
3. Bose, T.K., “Numerical Fluid Dynamics”, Narosa Publishing House, 1997.
4. Muralidhar, K., and Biswas, “Advanced Engineering Fluid Mechanics”, Narosa Publishing House, New Delhi, 1996.
5. Anderson, J.D., “Computational Fluid Dynamics – The basics with Applications”, 1995.

ME4015 – NEW AND RENEWABLE SOURCES OF ENERGY

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UNIT I INTRODUCTION 7

World energy use – Reserves of energy resources – Environmental aspects of energy utilization – Renewable energy scenario in India – Potentials – Achievements – Applications.

UNIT II SOLAR ENERGY 10

Solar thermal – Flat plate and concentrating collectors – Solar heating and cooling techniques – Solar desalination – Solar Pond – Solar cooker – Solar thermal power plant – Solar photo voltaic conversion – Solar cells – PV applications.

UNIT III WIND ENERGY 10

Wind data and energy estimation – Types of wind energy systems – Performance – Details of wind turbine generator – Safety and Environmental – Social Aspects.

UNIT IV BIOMASS ENERGY 10

Biomass direct combustion – Biomass gasifier – Biogas plant – Ethanol production – Biodiesel – Cogeneration – Biomass applications

UNIT V OTHER RENEWABLE ENERGY SOURCES 8

Tidal energy – Wave energy – Open and closed OTEC Cycles – Small hydro – Geothermal energy – Fuel cell Systems.

Total: 45

TEXT BOOK

1. Rai G.D., “Non Conventional Energy Sources”, Khanna Publishers, New Delhi, 1999.

REFERENCES

1. Diamant, “Total Energy”, Pergamon, Oxford, 1970.
2. Hamies, “Energy Auditing and Conservation: Methods, Measurements, Management and Case Study”, Hemisphere, Washington, 1980.
3. Smith C.B., “Energy Management Principles”, Pergamon Press, New York, 1981.
4. Trivedi, P.R., and Jolka, K.R., “Energy Management”, Common Wealth Publication, New Delhi, 1997.

ME4016 – ADVANCED INTERNAL COMBUSTION ENGINEERING

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UNIT I SPARK IGNITION ENGINES 9

Spark ignition engine mixture requirements – Fuel – Injection systems – Monopoint, Multipoint injection, Direct injection – Stages of combustion – Normal and abnormal combustion – Factors affecting knock – Combustion chambers.

UNIT II COMPRESSION IGNITION ENGINES 9

States of combustion in C.I. Engine – Direct and indirect injection systems – Combustion chambers – Fuel spray behaviour – Spray structure, spray penetration and evaporation – Air motion – Introduction to turbo-charging.

UNIT III POLLUTANT FORMATION AND CONTROL 9

Pollutant – Sources – Formation of Carbon Monoxide, Unburnt hydrocarbon, NO_x, Smoke and Particulate matter - Methods of controlling Emissions – Catalytic converters and Particulate Traps – Methods of measurements and Introduction to emission norms and Driving cycles.

UNIT IV ALTERNATIVE FUELS 9

Alcohol, Hydrogen, Natural Gas Liquefied Petroleum Gas and Vegetable Oils – Properties, Suitability, Merits and Demerits as fuels – Engine Modifications

UNIT V RECENT TRENDS 9

Air assisted Combustion – Lean Burn Engines – Stratified charge Engines – Homogeneous charge compression ignition engines – Plasma Ignition – Measurement techniques – Laser Doppler – Anemometry.

Total: 45

TEXT BOOK

1. Ramalingam K.K., “Internal Combustion Engine Fundamentals”, Scitech Publications, 2002.

REFERENCES

1. Mathur R.B and Sharma R.P., “Internal Combustion Engines” Kanna Publications, 2002.
2. V. Ganesan, “Internal Combustion Engines”, 2nd Edition, TMH, 2002.
3. Duffy Smith, “Auto fuel Systems”, The Good Heart Willox Company Inc., 1987.

ME4017 – FLEXIBLE MANUFACTURING SYSTEM

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UNIT I PLANNING, SCHEDULING AND CONTROL OF FLEXIBLE MANUFACTURING SYSTEMS 9

Introduction – Single product – N-product – Single batch – N-Batch scheduling problem – Modeling of N operations in M machines – Knowledge based scheduling system.

UNIT II COMPUTER CONTROL AND SOFTWARE FOR FLEXIBLE MANUFACTURING SYSTEMS 10

Introduction – Composition of FMS – Hierarchy of computer control – Computer control of work center and assembly lines – FMS supervising computer control – Types of software – specification and selection – trends.

UNIT III FMS SIMULATION AND DATA BASE 10

Application of simulation – Model of an FMS – Simulation software – limitation – Manufacturing data systems – Data flow – CAD/CAM considerations in planning the FMS data base – FMS database systems – Planning for FMS database

UNIT IV GROUP TECHNOLOGY AND FMS 9

Introduction – matrix formulation – Mathematical Programming formulation – Graph Formulation – Knowledge based system for group technology – Application of possibility distribution in FMS systems justification.

UNIT V FACTORY OF THE FUTURE 7

FMS application in aerospace machining – sheet metal fabrication and prismatic component production – FMS development towards factories of the future – Artificial intelligence and Expert systems in FMS – Design Philosophy and Characteristics for Future.

Total: 45

TEXT BOOK

1. Mikell P. Groover, “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall of India Pvt. Ltd., 1989

REFERENCE

1. Nand Jha.K., “Handbook of Flexible Manufacturing Systems”, Academic Press Inc., 1991.

ME4018 – DESIGN FOR MANUFACTURING

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UNIT I DESIGN FOR MANUFACTURING APPROACH AND PROCESS 9

Methodologies and tools – Design axioms – Design for assembly and evaluation – Minimum part assessment – Taguchi method – Robustness assessment – Manufacturing process rules – Designer's tool kit – Computer Aided group Technology – Failure mode effects analysis – Value Analysis – Design for minimum number of parts – Development of modular design – Minimizing part variations – Design of parts to be multi-functional – Multi-use – Ease of fabrication – Poka Yoke principles.

UNIT II GEOMETRIC ANALYSIS 9

Surface finish – Review of relationship between attainable tolerance grades and difference machining processes – Analysis of tapers – Screw threads – Applying probability to tolerances

UNIT III FORM DESIGN OF CASTINGS AND WELDMENTS 9

Redesign of castings based on parting line considerations – Minimising core requirements – Redesigning cast members using weldments – Use of welding symbols.

UNIT IV MECHANICAL ASSEMBLY 9

Selective assembly – Deciding the number of groups – Control of axial play – Examples – Grouped datum systems – Different types – Geometric analysis and applications – Design features to facilitate automated assembly.

UNIT V TRUE POSITION THEORY 9

Virtual size concept – Floating and fixed fasteners – Projected tolerance zone – Assembly with gasket – Zero true position tolerance – Functional gauges – Paper layout gauging – Examples – Operation sequence for typical shaft type of components – Preparation of process drawings for different operations – Tolerance worksheets and centrality analysis – Examples.

Total: 45

TEXT BOOKS

1. Harry Peck, "Designing for Manufacture", Pitman Publications, 1983.
2. Matousek, "Engineering Design - A Systematic Approach", Blackie and Son Ltd., London, 1974.

REFERENCE BOOKS

1. Spotts M.F., "Dimensioning and Tolerance for Quantity Production", Prentice Hall Inc., 1983.
2. Oliver R. Wade, "Tolerance Control in Design and Manufacturing", Industrial Press Inc., New York Publications, 1967.
3. James G. Bralla, "Hand Book of Product Design for Manufacturing", McGraw Hill Publications, 1983.
4. Trucks H.E., "Design for Economic Production", 2nd Edition, Society of Manufacturing Engineers, Michigan, 1987.

EC4028 – ELECTRONIC MANUFACTURING TECHNOLOGY

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UNIT I MICROELECTRONIC PROCESSES 10

Atomic structure – Wafer preparation by growing, machining and polishing – Diffusion – Microlithography – Etching and cleaning – Energy beam processes using photon – Electron and ion – Ion implementation – Chemical vapor deposition – Physical vapor deposition – Epitaxial process – Applications to microchips and micro electrical mechanical devices.

UNIT II INTERCONNECTIONS AND PRINTED WIRING BOARD MANUFACTURE 10

Through – Hole components – Surface – mount components – Component manufacturing – Wire Bonding Technology – Tape Automated Bonding – Multiple Chip Modules – PWB types – Substrate materials – Fabrication procedures – Image Transfer – Plating – Plated – Through Holes – Etching – Solder – Masking – Multi-layer board.

UNIT II SOLDERING AND CLEANING 7

Wave soldering – Adhesive and solder paste application – Solder materials – Solder system variable Soldering temperature profile – Reflow theory and alternatives – Soldering quality and defects – Post solder cleaning and selection – Measurement of cleanliness levels.

UNIT IV AUTOMATIC ASSEMBLY FOR PCB 10

Assembly process variations – Component handling – Automated component placement/insertion – Surface Mount Technology (SMT) – Robotic marking and assembly – Placement accuracy requirements – Machine vision, X- ray and laser inspection

UNIT V INSPECTION, TEST AND REWORK FOR PCB 8

Inspection philosophy and techniques – Component placement and joining quality – Concept of yield – In-circuit test – Functional test – Environment stress screening – Design for testability – Design for reparability – Repair process – Field repair strategy.

Total: 45

TEXT BOOK

1. Chang C.Y., Sze S.M.. “VLSI technology”, McGraw- Hill, New York, 1996.

REFERENCES

1. Microchip Fabrication – a practical guide to semiconductor processing, by Peter Van Zant, 4th Edition, McGraw Hill, 2000.
2. Tomas L. Landers, “Electronics Manufacturing Processes”, Prentice Hall, 1998.
3. James W. Dally, “Packaging of Electronic Systems: A Mechanical Engineering Approach”, McGraw-Hill, 1997
4. Prasad R.P., “Surface Mount Technology: Principles and practice”, Chapman and Hall, 1997.

ME4019 – RAPID PROTOTYPING

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UNIT I INTRODUCTION

10

Basic operation – Impact of rapid prototyping and tooling on product development – Benefits – Applications

UNIT II RAPID PROTOTYPING PROCESSES

10

Introduction – Classification – Laminated object manufacturing – Fused deposition modeling – Stereolithography – Solid ground curing – Selective laser sintering – 3D printing.

UNIT II CAD PROCESSES

10

Introduction – Data requirements – Solid modeling – Surface modeling – Geometric processing – Interface formats – Model preparation – Slicing – Support structures and machine instructions.

UNIT IV MATERIALS FOR RAPID PROTOTYPING

5

Plastics – Resins – Metals – Ceramics – Selection of materials for suitable processes – Advantages – Limitations.

UNIT V RAPID TOOLING PROCESSES

10

Introduction – Classification – Indirect rapid tooling – Silicone rubber moulding – Epoxy moulding – Electro forming – Vacuum casting – Vacuum forming – Rapid tools for injection moulding – Direct rapid tooling processes – SLS rapid tool – Shape deposition manufacturing – Laser deposition lamination – Rapid tooling roots.

Total: 45

TEXT BOOK

1. Ibrahim Zeid, “CAD/CAM theory and practice”, Tata McGraw Hill, 1998.

REFERENCES

1. Paul F. Jacobs, “Rapid Prototyping and Manufacture”, Fundamentals of Stereolithography, 1995.
2. “Rapid proto typing reports”, CAD/CAM publishing, 1991
3. “Rapid News, University of Warwick”, UK, 1995.

UNIT I FUNDAMENTALS OF ROBOT 8

Robot – Definition – Robot anatomy – Co ordinate systems, work envelope types and classification – Specifications – Pitch – Yaw – Roll – Joint Notations – Speed of motion – Pay load – Robot parts and their functions – Need for Robots – Different applications.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS 9

Pneumatic drives – Hydraulic drives – Mechanical drives – Electrical drives – D.C Servo motors – Stepper motor – A.C Servo motors – Salient features – Applications and comparison of all these drives – End effectors – Grippers – Mechanical grippers – Pneumatic and hydraulic grippers – Magnetic grippers – Vacuum grippers – Two fingered and three fingered grippers – Internal grippers and external grippers – Selection and design considerations.

UNIT II SENSORS AND MACHINE VISION 10

Requirements of a sensor – Principles and applications of the following types of sensors – Position of sensors (Piezo Electric Sensor – LVDT – Resolvers – Optical Encoders – Pneumatic Position Sensors) – Range sensors(Triangulation Principle, Structured, lighting approach, Time of flight range finders, Laser range meters) – Touch sensors (Binary Sensors, Analog Sensors) – Wrist Sensors – Compliance sensors – Slip sensors – Camera – Frame grabber – Sensing and digitizing image data – Signal conversion – Image storage – Lighting techniques – Image processing and analysis – Data reduction – Segmentation – Feature extraction – Object recognition – Other algorithms – Applications – Inspection – Identification – Visual serving and navigation.

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING 9

Forward kinematics – Inverse kinematics and differences – Forward kinematics and reverse kinematics of manipulators with two – Three degrees of freedom (In 2 dimension) – Four degrees of freedom (In 3 dimension) – Deviations and problems.

Lead through programming – Robot programming languages – VAL Programming – Motion commands – Sensor commands – End effector commands and simple programs.

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS 9

RGV – AGV – Implementation of robots in industries – Various steps – Safety considerations for robot operations – Economic analysis of robots – Pay back method – Euac method – Rate of return method.

Total: 45**TEXT BOOK**

1. M.P Groover, “Industries Robotics-Technology-Programming and Application”, Mc Graw Hill, 2001.

REFERENCES

1. Yoram Koren, “Robotics for Engineers:”, Mc Graw Hill Book Co., 1992
2. Janakiraman.P.A., “Robotics and Image Processing”, Tata Mc Graw Hill, 1995
3. Surender Kumar, “Industrial Robots and Computer Integrated Manufacturing”, Oxford & IBH publishing Co. Pvt. Ltd., 1991
4. S.R Deb “Robotics Technology and Flexible Automation” Tata McGraw Hill Book., 1994

CS4029 – ARTIFICIAL INTELLEGEENCE

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UNIT I INTRODUCTION 10

Definition – Pattern recognition – Criteria of success – Production systems – Control strategies – Heuristic search – Problem characteristics – Production systems Characteristics – Forward and backward reasoning – Matching indexing – Heuristic functions – Search algorithms.

UNIT II GAME PLAYING 8

Overview – Mini-max search procedure – Adding alpha – Beta cutoffs – Waiting for Quiescence – Secondary search – Using book moves.

UNIT II KNOWLEDGE REPRESENTATION 10

Use of predicate logic – Introduction to representation – Representing simple facts in logic – Augmenting the representation – Resolution – Conversion to clause form – The basis of resolution – Unification of algorithm – Question answering – Natural deduction.

UNIT IV KNOWLEDGE REPRESENTATION USING OTHER LOGICS 8

Non monotonic reasoning – Statistical and probabilistic reasoning – Techniques for dealing with a random world and deterministic world – Rule based system.

UNIT V STRUCTURAL REPRESENTATIONS OF KNOWLEDGE 9

Common knowledge structures – Level of representation – Right structures – Declarative representations – Semantic nets – Conceptual dependency – Frames – Scripts – Procedural representation – Natural language understanding – Perception – learning – Implementation A.I. Systems

Total: 45

TEXT BOOK

1. Elaine Rich, “Artificial Intelligence”, McGraw Hill Book Company, 1998.

REFERENCES

1. Richaugh M.W., “Artificial Intelligence, A Knowledge Based Approach”, PWS Rent Publishing, Boston, 1998.
2. Charniac, E and Dermott M.C., “Introduction to Artificial Intelligence”, Addison Wesley Publishing Company, 1997

CS4030 – COMPUTER SIMULATION

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UNIT I INTRODUCTION 5

Concept of simulation – Simulation as a decision making tool – Monte Carlo simulation

UNIT II RANDOM NUMBERS / VARIATES 9

Pseudo random numbers – Methods of generating random variates – Random variates for uniform, normal, binomial, Poisson, exponential distributions.

UNIT III DESIGN OF SIMULATION EXPERIMENTS 15

Problem formulation – Data collection and reduction – Logic developments – Initial conditions – Run length, tabular method of simulation – Development of models – Using higher level languages for systems like queuing – Production – Inventory and maintenance – Output analysis and interpretation – Validation

UNIT IV DISCRETE SYSTEM SIMULATION LANGUAGES 8

Need for simulation language – Comparison of simulation languages – SIMSCRIPT, GASP, SIMULA, GPSS, PROMODEL, etc. – Study of any one of the simulation language.

UNIT V CASE STUDIES USING SIMULATION LANGUAGES 8

Development of simulation models using the simulation language studied for systems like, queuing systems – Production systems – Inventory systems – Maintenance and replacement systems – Investment analysis and network.

Total: 45

TEXT BOOK

1. Gordon. G., “Systems Simulation”, Prentice Hall of India, 1987

REFERENCES

1. Jerry Banks, John S. Carson, Barry L Nelson and David M. Nicol., “Discrete event system simulation”, 4th Edition, Prentice Hall India, 2005.
2. Shannon, R. E., “Systems simulation – The art and Science”, Prentice Hall, 1975.
3. Thomas J. Schriber, “Simulation using GPSS”, John Wiley, 1991.

ME4020 – QUALITY CONTROL AND RELIABILITY ENGINEERING

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UNIT I STATISTICAL QUALITY CONTROL 9

Methods and philosophy of statistical quality control – Control charts for variables and attributes – Cumulative sum and exponentially weighted moving average control charts – Other SPC techniques – Process – Capability analysis – Six sigma accuracy.

UNIT II ACCEPTANCE SAMPLING 9

Acceptance sampling problem – Single sampling plans for attributes – Double, multiple and sequential sampling – Military standards – The Dodge roaming sampling plans.

UNIT III INTRODUCTION 9

Reliability function – MTTF – Mortality curve – Availability – Maintainability.

UNIT IV FAILURE DATA ANALYSIS 9

Repair time distributors – Exponential, normal, log normal, gamma and weibull reliability data requirements – Graphical evaluation

UNIT V RELIABILITY PREDICTION AND MANAGEMENT 9

Failure rate estimates – Effect of environment and stress – Series and parallel systems – RDB analysis – Standby systems – Complex systems – Reliability demonstration testing – Reliability growth testing – Duance curve – Risk assessment – FMEA – Fault tree.

Total: 45

TEXT BOOK

1. John Bank, “The Essence of Total Quality Management”, Prentice Hall of India Pvt. Ltd., 1995

REFERENCES

1. Mohamed Zairi, “Total Quality Management for Engineers”, Woodhead Publishing Limited, 1991.
2. Harvid Noori and Russel , “Production and Operations management – Total Quality and Responsiveness”, McGraw-Hill Inc., 1995.
3. Suresh Dalela and Saurabh, “ISO 9000 a Manual for Total Quality Management”, S.Chand and Company Ltd., 1997.

MA4001 – NUMERICAL METHODS

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UNIT I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 9

Linear interpolation methods (method of false position) – Newton’s method –Solution of linear system by Gaussian elimination and Gauss – Jordon methods – iterative methods: Gauss Jacobi and Gauss-Seidel methods – Inverse of a matrix by Gauss–Jordan method – Eigen value of a matrix by power method

UNIT II INTERPOLATION AND APPROXIMATION 9

Lagrangian Polynomials – Divided differences – Interpolating with a cubic spline – Newton's forward and backward difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9

Derivatives from difference tables – Divided differences and finite differences – Numerical integration by Trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Double integrals using trapezoidal and Simpson's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9

Single step Methods: Taylor Series method – Euler’s method – Modified and Improved Euler’s method – Fourth order Runge-Kutta method for solving first and second order equations – Multi-step methods: Milne’s and Adam’s predictor and corrector methods.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by implicit and explicit methods – one dimensional wave equation and two dimensional Laplace and Poisson equations.

L: 45 T: 15 Total: 60

TEXT BOOK

1. C.F. Gerald and P.O. Wheatley “Applied Numerical Analysis”, Sixth Edition, Pearson Education, 2005.

REFERENCES

1. M.K. Jain, S.R.K. Iyengar and R.K. Jain, “Numerical Methods for Scientific and Engineering Computation” Fourth Edition, New Age International Publishers, 2003.
2. M.K. Venkatraman, ‘Numerical Methods’, National Publication Company, 1991.
3. P. Kandasamy, K. Thilakavathy and K. Gunavathy, “Numerical Methods”, Second Edition, S.Chand & Co., 2003.