2008

REGULATIONS

MECHANICAL ENGINEERING
FULL TIME B.E.
CURRICULUM AND SYLLABI

GOVERNMENT COLLEGE OF TECHNOLOGY, COIMBATORE - 641 013

An Autonomous Institution - Anna University of Technology, Coimbatore

Curriculum & Syllabi
(I - VIII SEM)

CANDIDATES ADMITTED DURING 2008 - 2009 AND ONWARDS

CURRICULUM FOR CANDIDATES ADMITTED DURING 2008-2009 AND ONWARDS

S. No	Subject Code	Subject Name	Sessional marks	Exam final Marks	Total Marks	CREDITS			
						L	T	P	C
I SEMESTER									
1	08M1Z1	Communication Skills in English I	25	75	100	3	1	0	4
2	08M1Z2	Engineering Mathematics I	25	75	100	3	1	0	4
3	08M1Z3	Applied Physics	25	75	100	3	0	0	3
4	08M1Z4	Applied Chemistry	25	75	100	3	0	0	3
5	08M105	Engineering Mechanics	25	75	100	3	1	0	4
Practical									
6	08M106	Engineering Graphics	25	75	100	2	0	3	4
7	08M1Z7	Physics Lab	25	75	100	0	0	3	2
8	08M1Z8	Chemistry Lab	25	75	100	0	0	3	2
9		Total			800				26
II SEMESTER									
1	08M2Z1	Communication Skills in English II	25	75	100	3	1	0	4
2	08M2Z2	Engineering Mathematics II	25	75	100	3	1	0	4
3	08M2Z3	Materials Science	25	75	100	3	0	0	3
4	08M204	Environmental Science and Engineering	25	75	100	3	0	0	3
5	08M205	Basics of Electrical Sciences	25	75	100	3	0	0	3
6	08M206	Programming in C and C++	25	75	100	3	0	2	4
Practical									
7	08M207	Engineering Graphics & Drafting Lab	25	75	100	0	0	3	2
8	08M208	Workshop	25	75	100	0	0	3	2
9		Total			800				25

III SEMESTER									
1	08M3Z1	Engineering Mathematics III	25	75	100	3	1	0	4
2	08M302	Fluid Mechanics and Machinery	25	75	100	3	1	0	4
3	08M303	Engineering Metallurgy	25	75	100	3	0	0	3
4	08M304	Engineering Thermodynamics	25	75	100	3	1	0	4
5	08M305	Applied Mechanics	25	75	100	3	1	0	4
6	08M306	Manufacturing Technology I	25	75	100	3	0	0	3
Practical									
7	08M307	Machine Drawing	25	75	100	1	0	3	2
8	08M308	A)Strength of Materials Lab and Fluid Mechanics and Machinery Lab B)Computer Laboratory	12.5 12.5	37.5 37.5	50 50	0 0	0 0	3 3	1 1
9		Total			800				26
IV SEMESTER									
1	08M401	Probability and Statistics	25	75	100	3	1	0	4
2	08M402	Metrology and Measurements	25	75	100	3	1	0	4
3	08M403	Applied Electronics and Microprocessors	25	75	100	3	0	0	3
4	08M404	Electrical Machines and Drives	25	75	100	3	0	0	3
5	08M405	Kinematics of Machines	25	75	100	3	1	0	4
6	08M406	Manufacturing Technology II	25	75	100	3	0	0	3
Practical									
7	08M407	A) Electrical Engineering Lab B) Microprocessor Laboratory	12.5 12.5	37.5 37.5	50 50	0 0	0 0	3 3	1 1
8	08M408	A)Metrology Laboratory B)Manufacturing Technology Laboratory I	12.5 12.5	37.5 37.5	50 50	0 0	0 0	3 3	1 1
9		Total			800				25

V SEMESTER									
1	08M501	Engineering Economics and Management	25	75	100	3	0	0	3
2	08M502	Design of Machine Elements	25	75	100	3	1	0	4
3	08M503	Thermal Engineering	25	75	100	3	1	0	4
4	08M504	Dynamics of Machines	25	75	100	3	1	0	4
5	08M505	Turbo Machines	25	75	100	3	1	0	4
6	08M506	Hydraulic and Pneumatic Controls	25	75	100	3	0	0	3
Practical									
7	08M507	A)Dynamics Laboratory B)Instrumentation Laboratory	12.5 12.5	37.5 37.5	50 50	0 0	0 0	3 3	1 1
8	08M508	Thermal Engineering Laboratory-I	25	75	100	0	0	3	2
9		Total			800				26
VI SEMESTER									
1	08M601	Operations Research	25	75	100	3	1	0	4
2	08M602	Automobile Engineering	25	75	100	3	0	0	3
3	08M603	Design of Transmission Systems	25	75	100	3	1	0	4
4	08M604	Computer Aided Design and Manufacturing	25	75	100	3	0	0	3
5	08M605	Heat and Mass Transfer	25	75	100	3	1	0	4
6	08M606	Mechatronics	25	75	100	3	0	0	3
Practical									
7	08M607	Thermal Engineering Laboratory-II	25	75	100	0	0	3	2
8	08M608	CAD/CAM Lab	25	75	100	0	0	3	2
9		Total			800				25

VII SEMESTER									
1	08M701	Power Plant Engineering	25	75	100	3	0	0	3
2	08M702	Industrial Robotics	25	75	100	3	0	0	3
3	08M703	Finite Element Analysis	25	75	100	3	1	0	4
	08M704	Manufacturing, Planning and Control	25	75	100	3	0	0	3
5	E-I	Elective:I	25	75	100	3	0	0	3
6	E-II	Elective:II	25	75	100	3	0	0	3
Practical									
7	08M707	Modelling and Simulation Laboratory	25	75	100	0	0	3	2
8	08M708	Manufacturing Technology Lab II	25	75	100	0	0	3	2
9		Total			800				23
VIII SEMESTER									
1	E-III	Elective III	25	75	100	3	0	0	3
2	E-IV	Elective: IV	25	75	100	3	0	0	3
PRACTICAL									
3	08M801	Project Work	50	150	200	0	0	2	6
4		Total			400				12
LIST OF ELECTIVE SUBJECTS FOR VII SEMESTER									
1	08M7E0	Management Accounting	25	75	100	3	0	0	3
2	08M7E1	Soft Computing Techniques	25	75	100	3	0	0	3
3	08M7E2	Refrigeration and Air Conditioning	25	75	100	3	0	0	3
4	08M7E3	Design of Jigs,Fixtures and Press Tools	25	75	100	3	0	0	3
5	08M7E4	I C Engines	25	75	100	3	0	0	3
6	08M7E5	Numerical Methods	25	75	100	3	1	0	4
7	08M7E6	Computational Fluid Dynamics	25	75	100	3	0	0	3
8	08M7E7	Composite Materials	25	75	100	3	0	0	3
9	08M7E8	Robust Design	25	75	100	3	0	0	3
10	08M7E9	Total Quality Management	25	75	100	3	0	0	3
11	08M7EA	Welding Technology	25	75	100	3	0	0	3
12	08M7EB	Plant Layout and Material Handling	25	75	100	3	0	0	3

LIST OF ELECTIVE SUBJECTS FOR VIII SEMESTER									
1	08M8E0	Energy Engineering and Audit	25	75	100	3	0	0	3
2	08M8E1	Nano Technology	25	75	100	3	0	0	3
3	08M8E2	Knowledge Based Systems in Manufacturing	25	75	100	3	0	0	3
4	08M8E3	Machine Tool Design	25	75	100	3	0	0	3
5	08M8E4	Design For Manufacture	25	75	100	3	0	0	3
6	08M8E5	Newer Production Processes	25	75	100	3	0	0	3
7	08M8E6	Supply Chain Management	25	75	100	3	0	0	3
8	08M8E7	Industrial Tribology	25	75	100	3	0	0	3
9	08M8E8	Programming in Java	25	75	100	3	1	0	4
10	08M8E9	Precision Engineering	25	75	100	3	0	0	3
11	08M8EA	Reliabilty and Total Productive Maintenance	25	75	100	3	0	0	3
12	08M8EB	Product Development Strategies	25	75	100	3	0	0	3

08M1Z1 - COMMUNICATION SKILLS IN ENGLISH I

[COMMON TO ALL BRANCHES]

L	T	P	C
3	1	0	4

READING (09)

Reading for the purpose of skimming, scanning, guessing the meaning of words, information transfer – note making-detailed comprehension and identifying stylistic features - identifying the topic sentence in each paragraph - understanding discourse coherence.

WRITING (09)

a) Transcoding - Completion of charts - Developing hints - Making Recommendations and Expressing obligations.

b) Letter Writing:

Calling for quotations
Placing orders
Letter of complaint regarding manufacturing defects
Letter to a friend- making a few suggestions/ inviting suggestions Writing E-mails

c) Report Writing:Report on an accident in a factory/ Industrial visit - Completion of a project - Paragraph writing - Process description- Interpreting the data – Defining an object/ device/ instrument/ machine etc.

d) Process of Communication- Scientific Vocabulary - Project Report Writing.

LISTENING (09)

Listening for learning - Word Stress and Pronunciation practice - Listening for specific information - Note taking and comprehension - Listening to fill up information gaps - Listening to announcements at Railway stations, Airport etc. - Listening to News on the radio/TV - Listening to casual conversation - Listening to live speeches - Listening to American and British English.

SPEAKING (09)

Free discussion on chosen topics, introducing oneself. Offering suggestions and Recommendations - Expressing opinions (agreement /disagreement) - Giving Instructions - Role play activities based on real life situations - Discussing travel plans/Industrial visit/Instructions for performing tasks at home and at work –Discussion on debatable topics. - Verbal and Non-Verbal Communication – Accuracy - fluency and appropriateness - Formal and Informal Communication.

FOCUS ON LANGUAGE AND FUNCTION (09)

Register-Technical and General-word formation with Prefixes and Suffixes - Deriving other forms of words - Active and Passive Voices - Tenses- Conditional Sentences of certainty- Modals and degrees of probability - Compound Nouns and Expanding Nominal Compounds - Content Words - Expression of Comparison and Contrast - Definition and Classification - Framing of Questions ('Wh' pattern)

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 Hours

TEXT BOOK

1.The Humanities and Social Science Division, Anna University, ***"English for Engineers and Technologists"****, Orient Longman, Vol I & II (Combined Edition), Chennai, 2006.*

REFERENCE BOOKS

1) ***"Structure of Technical English"****, A J Herbert- The English Language Society, 1986.*

2) ***"Perform in English",*** *M.Balasubramanian & G.Anbalagan, Anuradha Publications,2007.*

*3)****" Effective English Communication",*** *Krishna Mohan & Meenakshi Raman (Language Group - BITS,Pilani) Tata McGraw Hill, 2005.*

08M1Z2 – ENGINEERING MATHEMATICS I

[COMMON TO ALL BRANCHES]

L	T	P	C
3	1	0	4

MATRICES (09)

Characteristic equation – eigen values and eigen vectors of a real matrix - properties of eigen values – Cayley –Hamilton Theorem (statement only) and applications - diagonalisation - similarity and orthogonal transformation - reduction of quadratic form to canonical form.

THEORY OF EQUATIONS, HYPERBOLIC FUNCTIONS (09)

Relation between roots and coefficients-transformation of equations-reciprocal equations-hyperbolic functions and inverse hyperbolic functions, properties.

APPLICATIONS OF DIFFERENTIAL CALCULUS (09)

Curvature - cartesian and polar coordinates - circle of curvature – involutes and evolutes - envelopes - evolute as envelope of normals **.**

FUNCTION OF SEVERAL VARIABLES (09)

Function of two variables - Taylor's expansion - maxima and minima - constrained maxima and minima by lagrangian multiplier method - jacobians - differentiation under integral sign.

INTEGRAL CALCULUS (09)

Gamma and Beta functions - Double integration - Cartesian and Polar Coordinates – change of order of integration - Area as double integral – Triple integration - Volume as triple integral - Transformation to Polar, Cylindrical and Spherical co-ordinates.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 Hours

TEXT BOOK

1.Kandasamy.P., Thilagavathy.K and Gunavathy.K. ***"Engineering Mathematics"*** *for First year, S. Chand & Co., Ram Nagar, New Delhi, 2007.*

REFERENCE BOOKS

1. Veerarajan.T., ***"Engineering Mathematics"*** *for First year,Tata Mc Graw Hill Publishing Co., New Delhi, 2007.*
2. M.K.Venkataraman, ***"Engineering Mathematics"*** *Vol I, II & IIIA,The National Publishing company, Chennai, 2006.*
3. B.S.Grewal, ***"Engineering Mathematics",*** *Khanna publishers, New Delhi, 2007.*

08M1Z3 - APPLIED PHYSICS

[COMMON TO ALL BRANCHES]

L	T	P	C
3	0	0	3

LASERS (09)

Introduction-Spontaneous emission and stimulated emission - Einstein's coefficients - Population inversion. Types of pumping – Types of Lasers - He- Ne ,CO2 , Nd-YAG, Semiconductor laser & Dye laser – Applications - Lasers in microelectronics, welding,heat treatment, cutting, holography.

FIBER OPTICS AND APPLICATIONS (09)

Principles – Modes of propagation-Numerical Aperture and acceptance angle - Classification of optical fiber based on materials, refractive index profile and Modes - Preparation of optical fiber - Crucible and Crucible technique - Splicing-fusion and multiple splices, Light sources for fiber optics. – LEDs – Detectors - PIN Photodiode, Avalanche photodiode - Fiber optical communication links - Fiber optic sensors for Temperature & displacement.

QUANTUM PHYSICS AND APPLICATIONS (09)

Introduction to Quantum theory. Dual nature of matter and radiation – de - Broglie wavelength. Uncertainty principle. Schrödinger's Time independent & Time dependent wave equations - Particle in a box - Optical microscope - Limitations of optical microscopy. Electron microscope - Scanning Electron Microscope(SEM) -Transmission Electron Microscope(TEM).

ULTRASONICS (09)

Introduction-Production: Magnetostriction effect - Magnetostriction generator – Piezoelectric effect - Piezoelectric generator - Detection of ultrasonic wave-properties – cavitation - industrial applications - Drilling, welding, soldering and cleaning – Non - destructive Testing-Pulse echo system through transmission and resonance system. Medical applications - cardiology, Ultrasonic imaging, X ray radiography.

VACUUM SCIENCE (09)

Introduction. Importance of vacuum in industries. Schematic diagram of vacuum system. Pumping speed and throughput. Types of pumps - Rotary vane type Vacuum pump(oil sealed), Diffusion Pump and Turbo Molecular Pump - Measurement of High Vacuum - McLeod Gauge - Pirani Gauge - Penning Gauge – High temp vacuum science.

TOTAL: 45 Hours

TEXT BOOK

*1.Ganesan S, Iyandurai N, **"Applied Physics",** KKS Publishers, Chennai, 2007*

REFERENCE BOOKS:

*1. Gaur R K and Gupta S L-**"Engineering Physics",** Dhanpat Rai and sons, 2002*

*2. Avadhanulu M N and Kshirsagar P G,**"A text book of Engineering Physics"** S.Chand and Company Ltd, NewDelhi, 2005*

*3. Arumugam M - **"Engineering Physics",** Anuradha Publishers, 2002*

*4. Jayakumar S, **"Engineering Physics",** RK Publishers, Coimbatore, 2003*

08M1Z4 - APPLIED CHEMISTRY

[*COMMON TO ALL BRANCHES]*

L	T	P	C
3	0	0	3

POLYMERIC MATERIALS **(09)**

Basic definitions: Monomers, functionality, degree of polymerization - Coordination polymerization-mechanism, Zeigler - Natta catalysts, applications – Glass transition temperature (Tg), crystallinity and the factors that affect these properties – Commodity and engineering plastics, polymer blends and alloys, polymer composites, fibre reinforced plastics, examples - Compounding of plastics-compounding materials, functions – Fabrication-compression, injection, extrusion, blow moulding – Conducting polymers - polyaniline, polypyrrole, mechanism of conduction.

CORROSION TECHNOLOGY

EMF series - Corrosion-mechanism of dry oxidation corrosion, nature of oxide, Pilling - Bedworth - Electrochemical corrosion-mechanism of rusting, galvanic, aeration and pitting corrosion – Factors influencing corrosion - Corrosion control-design, cathodic protection, modification of environment, use of inhibitors - Protective coating-metallic coating, anodic, cathodic, electroplating, cleansing before deposition – Organic coatingspaints, constituents of paints, mechanism of drying, varnishes, enamels, lacquers – Special paints-fire retardant, luminous, heat resistant paints.

INSTRUMENTAL METHOD OF ANALYSIS **(09)**

(Block diagram of the instrument, principle and working and application)
Types of instruments and mentioning of their applications – Absorption spectroscopy - Lambert-Beer law, absorbance, UV - visible spectroscopy, types of electronic transitions, estimation of iron by colorimetry – Atomic absorption spectroscopy, quantitative estimation of nickel – Flame photometry, estimation of sodium – Thermogravimetric analysis, factors affecting TG curves, applications , chromatography, gas chromatography.

INTEGRATED CIRCUITS FABRICATION **(09)**

Basic fabrication steps in Planar technology - Crystal growth, Czochralski process and float zone process neutron transmutation doping, wafer preparation – Methods of P-N junction formation, melt grown junction, alloying, solid-state diffusion, open tube furnace and evacuated sealed tube system, Ion implantation – Epitaxy (details of methods not required) — Masking and lithography-production of mask, photolithography, electron beam lithography – Etching-wet, electrochemical, sputter, plasma - Metal deposition.

PHASE RULE, ALLOYS AND POWDER METALLURGY **(09)**

Phase rule, one component water system – Reduced phase rule-two component alloy system, thermal analysis, Pb-Ag eutectic system, Cu-Ni alloy system, and Mg-Al alloy system forming a series of solid solution – Alloys-preparation, purpose of making alloys - Powder metallurgy - preparation of metal/ alloy powder, mixing and blending, compacting, pre-sintering, sintering, secondary operations, advantages and limitations. **Total: 45 Hours**

TEXT BOOKS

*1) P.C. Jain and Monika Jain**,"Engineering Chemistry",** Dhanpat Rai Publishing Co. (P) Ltd. , New Delhi.(2002)*

*2)C.Parameswara Murthy,C.V.Agarwal and Andra Naidu**,"Text Book for Engg".**Chemistry,B.S. Publications, Hyderabad (2006)*

REFERENCE BOOKS

*1) S.S. Dara, **"A Text Book of Engineering Chemistry",** S. Chand & Company, New Delhi. (2003)*

*2) B.K.Sharma**," Engineering Chemistry",** Krishna Prakasam Media (P) Ltd, Meerut (2001)*

*3) M.S.Tyagi, **"Introduction to Semiconductor Materials and Devices",** John Wiely & Sons Singapore (2000)*

08M105 ENGINEERING MECHANICS

[COMMON TO CIVIL, MECHANICAL, EEE, PRODUCTION AND EIE BRANCHES]

L	T	P	C
3	1	0	4

INTRODUCTION TO MECHANICS AND FORCE CONCEPTS (10)

Definition of mechanics – characteristics – system of forces – parallelogram, triangle and polygon of forces – resultant of a force system – resultant of a concurrent, coplanar and parallel force system – resolution and composition of forces – Lami's theorem – moment of a force – Varignon's theorem – resolution of a force into force and couple – force in space –addition of concurrent forces in space – equilibrium of a particle in space.

FRICTION (08)

Frictional resistance – angle of friction – angle of repose – laws of friction – cone of friction – equilibrium of a body on a rough inclined plane – non-concurrent force system - ladder friction – rope friction – wedge friction. Simple machines friction – efficiency of machines – mechanical advantages – velocity ratio - lifting machines.

GEOMETRICAL PROPERTIES OF SECTION (08)

Introduction – concept of first moment – definition of centroid – centroid of an area – centroid of simple figures - composite sections – moment of inertia – theorem of moment of inertia – moment of inertia of composite sections – principle moment of inertia - radius of gyration.

BASICS OF DYNAMICS (10)

Definition – kinematics and kinetics – Types of motion – Rectilinear motion of a particle with uniform velocity, uniform acceleration, varying acceleration – motion curves – motion under gravity – relative motion – curvilinear motion of a particle – projectiles – angle of projection – range – time of flight and maximum height.

Newton's second law of motion – linear momentum – D'Alembert's principle, Dynamics equilibrium – Equations of motion – work and energy – law of conservation of energy – principle of work and energy.

IMPULSE MOMENTUM AND IMPACT OF ELASTIC BODIES (09)

Impulsive force – Impulse – linear impulse and momentum – Equations of momentum – principle impulse and momentum – impulsive motion – conservation of momentum.

Definition – Time of compression, restitution, collision – law of conservation of momentum – Co-efficient of restitution – types of impact – collision of elastic bodies by direct central impact and oblique impact – collision of small body with a massive body – loss of kinetic energy.Introduction to rigid body dynamics – general plane motion.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 Hours

TEXT BOOKS

1. *S.S. Bhavikatti and K.G. Rajasekarappa,* ***"Engineering Mechanics",*** *New Age International (P) Ltd. 1999.*
2. *S.C. Natesan,* ***"Engineering Mechanics",*** *Umesh Publications, 5-B north market, Naisarak, Delhi – 110006, 2002.*

REFERENCE BOOKS

1. *F.B. Beer and E.R. Johnson,* ***"Mechanics for Engineers",*** *Tata Mc.Graw Hill publishingLtd, 1996.*
2. *S. Timoshenko and Young,* ***"Engineering Mechanics",*** *Mc.Graw Hill, 4th Edition, 1995.*
3. *Irving shames,* ***"Engineering Mechanics",*** *Prentice Hall of India Ltd, Delhi, 1980.*

08M106 - ENGINEERING GRAPHICS

[COMMON TO CIVIL, MECH, EEE, ECE, PRODN, EIE, CSE AND IT BRANCHES]

L	T	P	C
2	0	3	4

OBJECTIVE

To develop graphic skills for communicating concepts, ideas and design of engineering products and to give exposure to standards relating to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination) (06)

Importance of Engineering Drawing - Visualization, Communication, Documentation - B.I.S Conventions- Drafting tools - (Construction of curves like ellipse, parabola, cycloid and involute - concept of free hand sketching.)

ORTHOGRAPHIC PROJECTIONS (09)

Introduction to Orthographic Projection - Conversion of pictorial views to orthographic views. Projection of solids (inclined to one plane only) - Auxiliary projections.

SECTION OF SOLIDS AND DEVELOPMENT (06)

Section of solids - when the axis of the solid is vertical and cutting plane inclined to one plane.Development of surfaces (solids and models)

INTERPENETRATION OF SOLIDS (06)

Cylinder and cylinder, cone and cylinder only

PICTORIAL VIEWS (12)

Isometric projections - Perspective projections - oblique projection (Simple objects and combination of simple objects) Conversion of orthographic views to pictorial views (simple objects).

FREE HAND SKETCHING OF BASIC MACHINE COMPONENTS AND THEIR APPLICATIONS (12)

Rivet Head, Riveted Joints, Keys, Cotters, Couplings, Stuffing Box, Cotter joint, Knuckle joint and Plummer block.

COMPUTER GRAPHICS (21)

Computer Aided Drafting and dimensioning
To create 2D drawings for machine components
To create 3D Model for simple machine components
To generate 2D drawings from 3D models

LECTURE: 30 PRACTICAL:45 TOTAL:75 Hours

REFERENCE BOOKS

1. *K.Vengopal,"**Engineering Graphics",** New Age International (P) Limited, 2007.*
2. *Dhananjay.A.Jolhe, **"Engineering Drawing",** Tata McGraw Hill Publishing Co., 2007.*
3. *K.V.Nataraajan **'A text book of Engineering Graphics",** Dhanalakshmi Publishers, Chennai, 2006.*
4. *M.B.Shah and B.C. Rana**,"Engineering Drawing",** Pearson Education,2005.*
5. *Luzadder and Duff**," Fundamentals of Engineering Drawing"** Prentice Hall of India Pvt Ltd, XI Edition – 2001.*
6. *K.R.Gopala Krishnan **"Machine Drawing",** Subhas Publishers, 1995.*

08M1Z7 - PHYSICS LABORATORY

(COMMON TO ALL BRANCHES)

L	T	P	C
0	0	3	2

LIST OF EXPERIMENTS

1. Spectrometer - Diffraction Grating Normal Incidence Method
2. Air wedge
3. Youngs modulus – Cantilever Bending Koening's Method
4. Particle Size Determination
5. Thermal Conductivity of The Bad Conductor - Lee's Disc Method
6. Ammeter and Voltmeter Calibration – Low Range
7. Resistance of The Given Coil Of Wire – Carey Foster's Bridge
8. Torsional Pendulum
9. Young's Modulus - Non Uniform Bending
10. Transistor Characteristics

TOTAL: 45 Hours

08M1Z8 - CHEMISTRY LABORATORY

(COMMON TO ALL BRANCHES)

L	T	P	C
0	0	3	2

1. Estimation of hardness of water by EDTA method
2. Estimation of alkalinity of water sample
3. pH titration
4. Potentiometric titration
5. Conductometric titration
6. Estimation of ferric ion by spectrophotometry
7. Determination of dissolved oxygen in sample water
8. Determination of calcium in lime water.
9. Determination of emf of an unknown cell and single electrode potential
10. Determination of degree of dissociation of weak electrolyte
11. Estimation of barium in Barium Chloride solution
12. Estimation of Calcium by permanganometry

REFERENCE BOOKS:

1. Arthur L. Vogel, ***" A text book of Quantitative Inorganic Analysis"****, ELBS (1971)*
2. A. Ravikrishnan, ***"Practical Engineering Chemistry",*** *Sri Krishna Publications, Chennai (2002)*

TOTAL: 45 Hours

08M2Z1 - COMMUNICATION SKILLS IN ENGLISH II

(COMMON TO ALL BRANCHES)

L	T	P	C
3	1	0	4

READING (09)

Intensive reading, Extensive reading – Understanding the Organization of texts – Discourse cohesion – Evaluating Style – Inferring meaning – Interpreting tables, flow charts – Close reading.

WRITING (09)

a) Cause and Effect analysis – Stating a Choice and Justifying it – Safety Instructions – Preparation of Check Lists – Notices – Agenda – Minutes –Memoranda /M.O.U .
b) Letter writing
- Letter to the Editor of a Newspaper regarding a public cause.
- Seeking permission for in plant training.
- Asking for Certificates.

c) Technical Structure, Style and International conventions – Presentation of Technical Papers/Articles – Analysis of Advertisements – Slogan writing.

LISTENING (09)

Listening practice – Listening to Speech segments (Accent and Vocabulary) – Listening to Recorded Telephonic Conversation, TV/Radio news in English (both American and British English) – Listening to short and long conversations in different domains of activity.

SPEAKING (09)

Describing processes – Pronunciation Practice(Word Stress , Consonant Cluster –Homonyms) Conversational Eloquence – Group Discussions – Mock Interviews – Seminar Presentation-Making Speeches(Comparing , Introducing a Guest to the Audience , Welcome Address and Proposing Vote of Thanks)- Preparing for a Call – Handling a Call.

FOCUS ON LANGUAGE (09)

Synonyms and Antonyms – Preposition-Numerical Expression-Rules for writing SI units-Language of Instructions – Cause and Effect , Result , Purpose and Means, Time and Contracted Time Statements-Subject and Verb agreement- Phrasal Verbs , Commonly Confused Words – Common Errors in English – Discourse Markers – American and British English – Correction and Editing.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 Hours

TEXT BOOK

1.The Humanities and Social Science Division, Anna University, ***"English for Engineers and Technologists",*** *Orient Longman, Vol I & II (Combined Edition), Chennai, 2006.*

REFERENC BOOKS

*1) "**Structure of Technical English**", A J Herbert, The English Language Society, 1986.*
*2) **"Perform in English",** M.Balasubramanian & G.Anbalagan, Anuradha Publications, 2007.*
*3**)" Effective English Communication",** Krishna Mohan-Meenakshi Raman, (Language Group-BITS,Pilani) Tata McGraw Hill, 2005.*

08M2Z2 - ENGINEERING MATHEMATICS II

[COMMON TO ALL BRANCHES]

L	T	P	C
3	1	0	4

ORDINARY DIFFERENTIAL EQUATIONS (09)

Linear equations of Second and Higher order with constant coefficients when RHS is x^n , e^{ax} ,sin ax, cos ax, e^{ax} f(x), x^n f(x) – simultaneous first order linear equations with constant coefficients - Homogeneous Linear differential equations of Euler-Cauchy type ,Legendre type - method of variation of parameters.

VECTOR CALCULUS (09)

Gradient, divergence, curl – line, surface & volume integrals –Green's theorem in a Plane,Gauss Divergence and Stoke's theorems (Statements only) – verifications and applications.

LAPLACE TRANSFORMS (09)

Transform of standard functions – shifting theorems–Transforms of derivatives and integrals – initial and final value theorems–periodic functions – inverse Transform–convolution Theorem – solution of ordinary linear differential equations upto second order with constant coefficients and integral equations.

COMPLEX DIFFERENTIATION (09)

Cauchy - Riemann equations in cartesian and polar coordinates –properties of analytic functions - construction of analytic functions - conformal mapping: w = z + a , az ,1/z , z^2 , e^z , cos z , sin z - bilinear transformation.

COMPLEX INTEGRATION (09)

Cauchy's integral theorem-Cauchy's integral formula –Taylor's and Laurent's expansions-(statements only) - Poles and Residues – Cauchy's Residue theorem – Contour integration – Circular and semi circular contour (Excluding poles on the real axis)

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 Hours

TEXT BOOK

1. *Kandasamy.P., Thilagavathy.K and Gunavathy.K.* ***"Engineering Mathematics"*** *for first year and Vol. III, S.Chand & Co., Ram Nagar, New Delhi, 2007.*

REFERENCE BOOKS

1. *Veerarajan.T.,* ***"Engineering Mathematics"*** *for First year and for third Semester , Tata Mc Graw Hill Publishing Co., New Delhi. 2007.*
2. *M.K.Venkataraman,* ***"Engineering Mathematics"*** *Vol I, II & IIIA, The National Publishing Company, Chennai, 2006.*
3. *B.S.Grewal,* ***"Engineering Mathematics"*** *Khanna publishers, New Delhi. 2007.*

08M2Z3 - MATERIALS SCIENCE

[COMMON TO ALL BRANCHES)

L	T	P	C
3	0	0	3

SEMICONDUCTING MATERIALS AND DEVICES (09)

Elemental and compound semiconductors. Intrinsic and extrinsic semiconductors – Properties - Carrier concentration in intrinsic and extrinsic semiconductors - Variation of Conductivity with temperature in intrinsic and extrinsic semiconductors - Hall effect-Hall coefficient in extrinsic semiconductors, experimental determination of Hall coefficient. Application of Hall coefficient.

MAGNETIC MATERIALS (09)

Classification of Magnetic material- Dia, para, ferro and ferric magnetic materials, anti ferro magnetism- Properties. Heisenberg and domain theory of ferromagnetism. Hysteresis- Experiment to draw Hysteresis loop- Hard and Soft magnetic materials. Ferrides- structure and applications. Devices and applications- The Transformer core-Magneto optical recording- Magnetic Valve

SMART MATERIALS (09)

Shape Memory alloys (SMA)-Characteristics, properties of NiTi alloy, application, advantages and disadvantages of SMA. Superconductivity - BCS theory of superconductivity(qualitative), Types of superconductors- properties – High Critical temperature superconductors, Application of superconductors - SQUID, Cryotron, Magnetic levitation. Metallic glasses - Preparation, properties and applications.

NANOMATERIALS AND CHARACTERIZATION (09)

Fabrication methods-Top down processes-lithographics -Bottom –up process- Vapour phase deposition- physical vapour deposition(PVD) -chemical vapour deposition(CVD) methods, Molecular Beam Epitaxy(MBE) and Metalorganic Vapour Phase Epitaxy (MOVPE)- ordering of nano systems,self- assembly and self –organization.

NANODEVICES AND THEIR VARIOUS APPLICATIONS (09)

Nanomagnetic materials-Magnetostatic Energy- Anisotropy energy- Magnetostriction Energy - Particulate nanomagnets and geometrical nanomagnets - Giant Magneto Resistance(GMR) - Nanomagnetism in technology - Carbon Nanotubes(CNT) - Properties and applications of Carbon Nanotubes - Organic Field Effect Transistor(OFET), Organic Light Emitting Diodes(OLEDs) - Quantum Well Physics.

TOTAL: 45 Hours

TEXT BOOK

1.Ganesan S. Iyandurai N, ***"Materials Science",*** *KKS Publishers, Chennai, 2008*

REFERENCE BOOKS

1. Jayakumar S, ***"Materials Science",*** *RK Publishers, Coimbatore, 2004 th*

2. William D Callister Jr, ***"Materials Science and Engineering – An Introduction",*** *John Wiley and Sons Inc., 6th Edition, New York, 2003.*

3. James F Shackelford, S ***"Introduction to Materials Science for Engineers",*** *6th Edition Macmillan Publishing Company, New York, 2004.*

08M204 - ENVIRONMENTAL SCIENCE AND ENGINEERING

[COMMON TO MECH, EEE, ECE, PRODN, EIE, CSE, IT AND IBT BRANCHES]

L	T	P	C
3	0	0	3

ENVIRONMENTAL RESOURCES (09)

Forest resources- importance, deforestation - Water resources- anomalous properties of water, hydrological cycle - Food resources-effects of modern agriculture, fertilizers, pesticides - Land resources-causes and effects land degradation, desertification - Energy resources-renewable energy: wind, solar, geothermal, tidal, OTEC and nuclear.

ECOSYSTEM AND BIODIVERSITY (09)

Environment-biotic and abiotic – Ecosystem-food chain, trophic levels- Energy flow in ecosystem, ecological pyramids- Ecological succession, types- Bio diversity, types, values of bio diversity, hot spots of bio diversity, threats to bio diversity, endangered and endemic species, conservation of bio diversity.

ENVIRONMENTAL POLLUTION (09)

Air pollution-classification of air pollutants gaseous, particulates – Sources effects and control of gaseous pollutants,SO_2, NO_2, H_2S, CO, CO_2 and particulates - Control methods-cyclone separator, electrostatic precipitator, catalytic combustion- Water pollution-classification of water pollutants- Inorganic pollutants, sources, effects and control heavy metals- Organic pollutants, oxygen demanding wastes, aerobic and anaerobic decomposition, BOD and COD and experimental determination of BOD only, treatment of domestic wastes- Noise pollution-sources, effects, decibel scale.

ENVIRONMENTAL THREATS (09)

Stratosphere, troposphere, composition and activities – Acid rain, green house effect and global warming, ozone layer depletion, photo chemical smog, eutrophication, bio amplification - Disaster management-origin, effects and management of earth quake and floods- Solid waste management-solid wastes, classification, origin, effects- Treatment methods-composting, sanitary land filling-Destructive methods-incineration,
pyrolysis, recycling and reuse, co-disposal.

SOCIAL ISSUES AND ENVIRONMENT (09)

From unsustainable to sustainable development, objectives and ways of achieving it- Urban problem related to energy, energy conservation- Water conservation and management, rain water harvesting, watershed management- Waste land reclamation - Environmental ethics – Consumerism - Human population, exponential and logistic growth, variation in population among countries, population explosion, population policy, family welfare - programme and population control methods - HIV and AIDS.

TOTAL: 45 Hours

TEXT BOOKS

1. ***" Elements of Environmental Science and Engineering",*** *P.Meenakshi, Prentice- Hall of India, New Delhi (2005).*
2. ***" Text Book of Environmental Chemistry and Pollution Control",*** *S.S.Dara, S.Chand & Co, New Delhi (2002).*

REFERENCE BOOKS

1. ***" Introduction to Environmental Engineering & Science",*** *Gilbert masters, Prentice Hall of India, New Delhi (2004).*
2. ***" Environmental Science",*** *Elden D. Enger, Bradley F. Smith, WCB McGraw Hill (VI Edn).*

08M205 - BASICS OF ELECTRICAL SCIENCES

[COMMON TO MECHANICAL AND PRODUCTION BRANCHES]

L	T	P	C
3	0	0	3

FUNDAMENTALS OF ELECTRIC CIRCUITS (09)

Ohm's law & Kirchoff's laws - D.C circuits-Alternating current fundamentals - Circuit elements & phasor diagram - power – Real and Reactive power - power factor - Series, Parallel circuits - loop and nodal analysis -star delta conversion simple problems.

THREE PHASE SYSTEM AND ELECTRICAL WIRING (09)

Three phase system - star and delta connections - solutions of balanced three phase circuits - three phase power equation - power measurements - domestic and industrial wiring.

FUNDAMENTALS OF ELECTRONICS (09)

Operating principles and characteristics of PN junction diode,Zener diode,BJT,FET,UJT,SCR.- light emitting diode - Photo diode. Rectifiers - half wave,full wave and bridge rectifiers using diodes with and without filters.

FUNDAMENTALS OF COMMUNICATION ENGINEERING (09)

Principles of PAM, PWM, PPM-PCM - Transmitter and receiver-optical communication - Characteristics of optic fiber cable transmitter and receiver.Types of signals:Analog and Digital signals-spectrum of signals - telecommunication services - transmission paths. Modulation and Demodulation: basic principle of amplitude and frequency modulations - Generation and detection of AM and FM.

T.V AND RADAR COMMUNICATION SYSTEMS (09)

Radio,T.V(Black and Colour)-Interlaced systems-composite video signal - microwave, satellite,RADAR-RADAR range-pulsed RADAR system(Principles and block diagram approach only)

TOTAL: 45 Hours

TEXTBOOKS

1. *Premakumar.N.* ***"Basic Electrical engineering"****.Anuradha agencies Pub.1989*
2. *Anokh singh****,"Principles of Communication Engineering"****,S.Chand &company Ltd.,1984*
3. *Arumugam.M.and Premakumaran.N.****"Electric Circuit Theory"****. Khanna Publishers, 1989.*

REFERENCE BOOKS

1. *K.Murugesh Kumar,* ***"Basic electric science and Technology "****,Vikash Publishing House Pvt Ltd,2002.*
2. *Ashok Raj,* ***"Modern Electronic Communication Theory&Systems"****, Vol.1 Umesh Publications, 1990.*

08M206 - PROGRAMMING IN C AND C++

[COMMON TO MECHANICAL AND PRODUCTION BRANCHES]

L	T	P	C
3	0	2	4

C FUNDAMENTALS (10)

Introduction – character set – identifiers and keywords – data types – variables – operators – input/output statements – array declaration. Control statements – branching – looping – nested control structures.

FUNCTIONS,POINTERS, STRUCTURES AND UNION (10)

Function definition – accessing function – function prototypes – passing arrays to functions. Declaration of pointers – passing pointers – pointers and 1D arrays, multi dimensional arrays. Structures and Unions.

OVERVIEW OF C++ AND CLASSES (09)

Preprocessor – header files – input/output statements. Classes –declaration of classes – member functions – objects – nested classes – constructors - destructors – inline member function – friend functions – static class members – dynamic memory allocation.

INHERITANCE AND OVERLOADING (09)

Single inheritance – direct base classes – indirect base classes – types of derivation: public inheritance, private inheritance, protected inheritance – Accessing public , private and protected data. Function overloading – scoping rules for function overloading- overloading assignment operator and arithmetic operators.

POLYMORPHISM AND DATA FILE OPERATION (07)

Polymorphism –early binding – late binding – virtual functions. Opening and closing of files – reading / writing a character from a file.

LECTURE: 45 PRACTICAL: 30 TOTAL: 75 Hours

TEXT BOOKS

1. E.Balagurusamy ***"Programming in ANSI C"*** *TMH publications, 2006.*
2. D.Ravichandran ***"Programming with C++"*** *TMH publications, 2006.*

REFERENCE BOOKS

1. Byron Gottfried ***"Programming with C"*** *TMH publications, 2006.*
2. Bjarne Stroustrup ***" C++ programming language"*** *Addison Wesley publication, 2001.*
3. E.Balagurusamy ***"Programming with C++"*** *TMH publications, 2006.*
4. D.Ravichandran ***"Programming with C"*** *TMH publications, 2006.*

PRACTICAL EXPERIMENTS

C PROGRAMMING

- Operators, Expressions and IO Formatting
- Decision Making

C++ PROGRAMMING

Looping	Area calculation	Files
Switch Structure	Mark list	Matrix multiplication
Structures	Prime number	Biggest number
Uses of Classes	Switch Structure	Sorting numbers and names
Function overloading	Quadratic equation	
Inheritance	Matrix addition	

08M207 - ENGINEERING GRAPHICS AND DRAFTING LAB

[COMMON TO MECHANICAL AND PRODUCTION BRANCHES]

L	T	P	C
0	0	3	2

OBJECT CONSTRUCTION (02)

Page layout – Layers and Line types – Creating, Editing and selecting the Geometric Objects.

MECHANICS (03)

Viewing, Annotating, Hatching and Dimensioning the drawing –Creating Blocks and Attributes.

DRAFTING (20)

Create 2D drawing for machine components –Knuckle Joint, Cotter joint, Flange Coupling, Bearings and Cam Profile.

INTRODUCTION TO 3D MODELING (15)

Creating and Editing 3D objects –Creating 3D Models for simple machine components Springs, Gears, Screw threads, Bolts and Nuts – Generating 2D drawings from 3D models – Different views, Auxiliary / Sectional views.
Importing and exporting files to other CAE packages. (05)

TOTAL: 45 Hours

REFERENCE

1. *Sham Tickoo - AutoCAD 2008–A problem Solving Approach –Auto Desk Press 2007*
2. *James D.Bethune Boston University- Engineering Graphics with AutoCAD 2002 – Pearson Education*
3. *Alan Kalameja – AutoCAD 2008: A tutor for Engineering Graphics – Auto Desk Press 2007*
4. *James Leach - AutoCAD 2008 Instructor McGraw Hill – 2007*
5. *Ron House, Paul W. Richaardson, John Brooks, Dylan Vance – Special Edition using AutoCAD 2002 – Prentice Hall of India Pvt.Ltd. – 2000.*
6. *CAD Software manuals of latest version*

08M208 – WORKSHOP

[COMMON TO CIVIL, MECHANICAL, EEE, ECE, PRODUCTION, EIE, CSE AND IT BRANCHES]

L	T	P	C
0	0	3	2

Plumbing, Sheet metal and Carpentry

- Study of tools and equipment in plumbing
- Basic pipe connections involving the fittings like valves, taps, couplings, unions, reducers, elbows and other components used in household fittings
- Preparation of plumbing line sketches
- Practice in mixed pipe connections: Metal, Plastic and flexible pipes used in household appliance.
- Fabrication of Tray and Square box in sheet metal
- Preparation of simple wooden joints: Half lap, Half lap dovetail and Single dovetail joints

Welding and Foundry

- Safety precautions in welding
- Preparation of Lap, Butt and T-Joints
- Study of moulding tools and equipments
- Preparation of sand moulds for cubes, pipes and gear wheels

Electrical wiring and Electronic Circuit Practice

- Safety aspects of electrical wiring
- Wiring circuit for a lamp using single and staircase switches including calculation of power and energy
- Wiring circuit for a fluorescent lamps including calculation of power and energy
- Soldering of small electrical and electronic circuits
- Assembling of electronic components on a small PCB and testing
- Study of telephone, FM radio and low voltage power supplies

TOTAL: 45 Hours

08M3Z1 - ENGINEERING MATHEMATICS III

[COMMON TO ALL BRANCHES]

L	T	P	C
3	1	0	4

PARTIAL DIFFERENTIAL EQUATIONS (09)

Formation of PDE by elimination arbitrary constants and functions – Solutions of standard types of first order equations – Lagrange's equation – Linear partial differential equations of second and higher order with constant coefficients.

FOURIER SERIES (09)

Dirichlet's Conditions – General Fourier Series – Half range Sine and Cosine series – Parseval's Identity – Harmonic Analysis.

FOURIER TRANSFORMS (09)

Statement of Fourier integral Theorem – Fourier transform – Fourier Sine and Cosine Transforms – Properties – Transforms of Simple functions , Convolution Theorem – Parseval's Identity-Finite Fourier transforms .

BOUNDARY VALUE PROBLEMS (09)

Method of separation of variables – One dimensional wave equation – One dimensional heat equation – Steady state conditions – Zero and non-zero boundary conditions – Fourier series solution.

Z TRANSFORMS (09)

Z –transforms-Elementary properties-Inverse Z –transform-Initial and Final value theorems-Convolution theorem - Formation of difference equations - Solution to difference equations using Z – transform .

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 Hours

TEXT BOOK

1.Kandasamy.P, Thilagavathy.K and Gunavathy.K. ***"Engineering Mathematics"*** *Vol I,II & III S. Chand & Co., Ram Nagar, New Delhi, 2007*

REFERENCE BOOKS

1. Veerarajan.T., ***"Engineering Mathematics"*** *for First year and for third Semester, Tata McGraw Hill Publishing Co., New Delhi, 2007*

2. M.K.Venkataraman, ***"Engineering Mathematics"*** *Vol I, II & IIIA .The National Publishing Company, Chennai, 2006*

3. B.S.Grewal, ***"Engineering Mathematics"*** *Khanna publishers, New Delhi, 2007*

08M302 – FLUID MECHANICS AND MACHINERY
[COMMON TO MECHANICAL AND PRODUCTION BRANCHES]

L	T	P	C
3	1	0	4

FLUID PROPERTIES (08)

Units & measurement – Fluid properties – Density, Specific gravity, Viscosity, Surface tension, capillarity – Pascal's Law – pressure measurements – manometers. Fluid statics - Total pressure and centre of pressure –buoyancy and floatation- metacentre and metacentric height (definition only)

FLUID KINEMATICS AND DYNAMICS (09)

Types of flow – Types of flow line – control volume – continuity equation – one-dimensional and three dimensional – velocity potential and stream function. Energy equation – Euler and Bernoulli's equations – Applications. Flow through pipes - Laminar and Turbulent flow through pipes –Darcy Weisbach equation.

MOMENTUM PRINCIPLE (09)

Impulse momentum principle-Application of momentum principle-Impact of Jet-Force exerted by a jet on normal, inclined and curved surfaces for stationary and moving cases-Angular momentum principle-construction of velocity vector diagrams.

HYDRAULIC TURBINES (08)

Classification **–** construction, working principles and design of Pelton wheel, Francis and Kaplan Turbines-head, losses, work done and efficiency - specific speed - operating characteristics-Governing of Turbines-Selection of Turbines.

PUMPS (08)

Classification-centrifugal pump-working principle-head, discharge, efficiencies and losses - performance curves - specific speed. Reciprocating pump-components and working-slip-indicator diagram –air vessel – Jet pump – Gear pump – Submersible pump.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 Hours

TEXT BOOKS

1. *Rajput.R.K.**, "A text Book of Fluid Mechanics",** S.Chand and Company, New Delhi , 2002.*
2. *Ramamrutham.S and Narayanan.R., **"Fluid Hydraulics and Fluid Machines",** Dhanpat rai Publishing House (P) Ltd , New Delhi, 2000.*
3. *Modi.P.N. and Seth.S.M.**,"Hydraulics and Fluid mechanics, including Hydraulic machines",** Standard book house,Delhi, 2002*

REFERENCES

1. *Streeter, Victor L . and Wylie, E. Benjamin**, "Fluid Mechanics"** , McGraw – Hill Ltd., 1998.*
2. *Natarajan.M.K., **" Fluid Machines",** Anuradha Agencies, Vidayal Karuppur, Kumbakonaam, 1995.*
3. *Kumar.K.L., **"Engineering Fluid Mechanics",** Eurasia Publishing House (P) Ltd., New Delhi, 2000.*

08M303 - ENGINEERING METALLURGY

L	T	P	C
3	0	0	3

CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS (09)

Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions, Iron – Iron carbide equilibrium diagram. Classification of steel and cast Iron microstructure, properties and application.

HEAT TREATMENT AND SURFACE TREATMENT (09)

Definition – Full annealing, process annealing, stress relief, recrystallisation - spheroidizing – normalising, hardening and Tempering – austempering, martempering - . Isothermal transformation diagrams – cooling curves, TTT diagram - CCR - Hardenability, Jominy end quench test. Case hardening, carburising, nitriding, cyaniding, carbonitriding – Flame and Induction hardening.

FERROUS AND NON FERROUS METALS (09)

Plain carbon steels – alloy steels - Effect of alloying elements (Mn, Si, Cr, Mo, V , Ni,Ti & W) on properties of steel - stainless and tool steels – Gray, White malleable, spheroidal - Graphite - alloy castirons –heat resistant steels and die steels. Copper and Copper alloys – Brass, Bronze and Cupronickel – Aluminum and Al-Cu – precipitation strengthening treatment – Bearing materials, spring materials, brazing and soldering alloys.

FOUNDRY AND POWDER METALLURGY (09)

Solidification of pure metals and alloys – melting – super heating – fluxing – micro and macro segregation – hot tears – heat transfer and structural change. Production of powders, mixing, blending, compacting, sintering and hot pressing – secondary operations- application of powder metallurgy – advantages and limitations.

WELDING METALLURGY (09)

Weldability – heat distribution during welding and thermal effects on parent metals – HAZ – factors affecting HAZ- hardening , cracking , distortion and residual stresses – stress relief treatment of welds -testing and inspection of welds.

TOTAL: 45 Hours

TEXT BOOKS

1.Higgins R.A., ***"Engineering Metallurgy",*** *5th edition, EIbs, 1983.*

2.O.P.Khanna ***"Material Science And Metallurgy",*** *Edition , 1999*

3.Sydney H.Avner ***"Introduction to Physical Metallurgy"*** *McGraw Hill Book Company, 1994.*

REFERENCES

1.William D Callsber ***"Material Science and Engineering",*** *John Wiley and Sons 1997.*

2.Raghavan.V ***"Materials Science and Engineering",*** *Prentice Hall of India Pvt., Ltd., 1999.*

3.Lakhtin Yu., ***"Engineering Physical Metallurgy and Heat Treatment",*** *Mir Publisher,1985.*

4.Kenneth G.Budinski and Michael K.Budinski ***"Engineering Materials"*** *Prentice-Hall of India Private Limited, 4th Indian Reprint 2002.*

5.Richerson D.W., ***"Modern Ceramic Engineering"****, Marcel Dekker,1992.*

6.GUY.A.G. ***"Elements of Physical Metallurgy",*** *Oxford &IBH Pub.Co,1990.*

08M304 – ENGINEERING THERMODYNAMICS

L	T	P	C
3	1	0	4

CONCEPTS OF THERMODYNAMICS (09)

Basic definitions, Microscopic and Macroscopic approach, Types of systems -Thermodynamic processes - Point and Path function - Thermodynamic equilibrium - Quasi-static process. Heat and work - Zeroth law – First law of thermodynamics– Applications to closed and open systems - Steady flow processes - applications.

SECOND LAW OF THERMODYNAMICS AND ENTROPY (09)

Limitations of First law - Kelvin-Plank and Clausis statements - Heat engines -Refrigerators - heat pumps - efficiency and COP - Carnot cycle - Entropy -principle of increase in entropy - reversibility and irreversibility - applications.

IDEAL AND REAL GASES (09)

Equation of state - Ideal and Real gases - Properties calculations – Generalised compressibility chart - Vanderval's Equation - specific heats C_p and C_v - Joule-Thomson coefficient- ideal gas mixtures.

COMBUSTION (09)

Fuels-Combustion equations-Stoichiometric air-fuel ratio – Exhaust and flue gas analysis – practical analysis of combustion products- Dissociation – internal energy and enthalpy of reaction – Enthalpy of formation – Calorific value of fuels – power plant thermal efficiency – practical determination of calorific values- air fuel- vapour mixtures .

PROPERTIES OF STEAM AND VAPOUR POWER CYCLE (09)

Properties of steam - use of steam tables and mollier chart - dryness fraction calculations. Basic Rankine cycle - Rankine cycle with reheating and regeneration - applications Binary vapour cycle.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 Hours

TEXT BOOKS

*1. Nag. P.K**., "Engineering Thermodynamics",** Tata McGraw Hill Company, Third Edition, 2007.*

*2. Eastop.T.D, McConkey .A, **"Applied Thermodynamics",** Pearson Education, 2007.*

*3. Yunus Cengel**, "Thermodynamics"** Tata McGraw Hill Company, Third Edition, 2007.*

REFERENCES

*1. Kothandaraman, C.P**., "Thermal Engineering",** Dhanpat Rai & Sons.*

*2. Holman, J.P., **"Thermodynamics"** Mcgrawhill Company.*

*3. Rajput, R.K. **"Thermal Engineering"** Laxmi Publications 1993.*

*4. Ballaney P.L., **"Thermal Engineering"**, Khanna Publishers.*

08M305 – APPLIED MECHANICS

L	T	P	C
3	1	0	4

STRESS AND STRAIN (09)

Stress and strain at a point-Tension, compression, shear stresses- Hooke's law - compound bars-Relationship among elastic constants -Thermal stresses-Thin cylinders and shells

SUPPORTS AND FRAMES (09)

Types of supports –reactions at supports in two dimensional structures. Types of frames – Analysis of frames by method of joints.

SHEAR FORCE AND BENDING MOMENT (09)

Beams – Types of Beams - Types of loads - Shear force – Bending moment – shear forces and bending moment diagrams for cantilever, simply supported and over hanging beams with concentrated , uniformly distributed and uniformly varying load.

DEFLECTION OF BEAMS (09)

Determinations of deflection curve – Relation between slope, deflection and radius of curvature – Slope and deflection of beam at any section by double integration , moment area method and conjugate beam method - Macaulay's method.

THEORY OF TORSION (09)

Torsion of shafts – Torsion equation – Solid and Hollow circular shafts - Torsion rigidity -Power transmitted by the shaft – Importance of angle of Twist - Modulus of rupture – Torsional resilience Shaft couplings – Combined bending and Torsion- springs.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 Hours

TEXT BOOKS

*1. Sadhu Singh**, "Engineering Mechanics",** Oxford & IBH Publishing Co., New Delhi, 1983.*
*2. Rajput.R. K**., "Strength of Materials",** S. Chand & Company Ltd., New Delhi 1996*

REFERENCES

*1. Timoshenko S. P. and Gere J.M**, "Mechanics of Materials",** Vannos Reinhold, Newyork, 1990.*
*2. Dr.B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain., **"Mechanics of Materials",** Lakshmi Publications Pvt Ltd, New Delhi, 2002.*
*3. Junnarkar S.B**., "Applied Mechanics",** Charotar Publishing House, Anand, 1991.*

08M306 - MANUFACTURING TECHNOLOGY I

L	T	P	C
3	0	0	3

METAL CASTING PROCESSES (10)

Introduction to Concepts of Manufacturing Process -Sand casting – Sand moulds -Type of patterns – Pattern materials – Pattern allowances – Types of Moulding sand –Properties – Core making – Methods of Sand testing – Moulding machines – Types of moulding machines - Melting furnaces – Working principle of Special casting processes – Shell, investment casting – Ceramic mould – Lost Wax process – Pressure die casting –Centrifugal casting – CO2 process – Sand Casting defects – Inspection methods

FABRICATION PROCESS (10)

Fusion welding processes – Types of Gas welding – Equipments used – Flame characteristics – Filler and Flux materials - Arc welding equipments - Electrodes –Coating and specifications – Principles of Resistance welding – Spot/butt, seamwelding – Percusion welding - Gas metal arc welding – Flux cored – Submerged arc welding – Electro slag welding – TIG welding – Principle and application of special welding processes - Plasma arc welding – Thermit welding – Electron beam welding – Friction welding – Diffusion welding – Flame cutting – Weld defects – Brazing and soldering process – Methods and process capabilities – Filler materials and fluxes – Types of Adhesive bonding

BULK DEFORMATION PROCESSES (10)

Hot working and cold working of metals – Forging processes – Open and close die forging – Characteristics of the process – Types of Forging Machines – Typical forging operations – Rolling of metals – Flat strip rolling – Types of Rolling mills – Shape rolling operations – Tube piercing – Defects in rolled parts – Principles of
Extrusion – Types of Extrusion – Hot and Cold extrusion – Principle of rod and wire drawing – Equipments used

SHEET METAL FORMING PROCESSES (08)

Sheet metal characteristics - Typical shearing operations, bending and drawing operations – Stretch forming operations — Formability of sheet metal – Test methods – Working principle and application of special forming processes - Hydro forming – Rubber pad forming – Metal spinning – Explosive forming – Magnetic pulse forming – Peen forming – Super plastic forming – Process characteristics

METAL CUTTING (TURNING) PROCESS (07)

Various types of lathe: Centre lathe, facing lathe, gap-bed lathe, capstan and turret lathe, CNC lathe, Turing centre. Major sub-assemblies of a lathe: Bed, headstock, tail stock, carriage consisting of saddle, cross-slide, compound slide, tool post and apron.Work holding devices: self centering three jaw chuck, independent four jaw chuck,collets, face plates, dog carriers, centers and mandrels

TOTAL: 45 Hours

REFERENCE BOOKS

1. *Hajra Choudhury, SK **"Elements of Workshop Technology, Vol. I and II"**, Media Promotors Pvt Ltd., Mumbai, 2001*
2. *Sharma, PC **"A Text Book of Production Engineering"** Vol.1, S. Chand Publication, New Delhi, 2001.*
3. *S. Kalpakjain, "**Manufacturing Engineering and Technology (III Edition)"**- Addison Wesley.*

08M307 - MACHINE DRAWING

L	T	P	C
1	0	3	2

CONVENTIONS, ABBREVIATIONS AND SYMBOLS (06)

Interrupted views - partial views of symmetrical objects - conventional representation of intersection curves - square ends and openings, adjacent parts -common machine elements.

FITS AND TOLERANCES (09)

Description of tolerances and grades - types of fits and their description - hole basis system - selection of fits from standard tables - fits for different applications-examples-geometrical tolerances-surface finish convections.

PREPARATION OF ASSEMBLY DRAWINGS AND/OR COMPONENT DRAWINGS (30)

Cotter joint, knuckle joint, flange coupling, universal coupling, foot step bearing, plumber block, connecting rod ends, cross heads, eccentric, screw jack, lathe tailstock, stop valves, lathe chuck, safety valves, stop valves.

LECTURE: 15 PRACTICAL: 45 TOTAL: 60 Hours

REFERENCES

1.Gopalakrishna K.R., "Machine Drawing", Subhas Publishers, Bangalore, 2003.

*2.Gill. P.S.,**" Text Book Of Machine Drawing",** S.K. Kataria & Sons, Publishers & Distributors, Delhi, 1998.*

*3.Bhatt.N.D, **"Machine Drawing",** Chorotar Publishing House, 2001.*

4.PSG COLLEGE OF TECHNOLOGY, Faculty of Mechanical Engineering,Design Data Book. M/S.DPV Printers, 2004.

*5.Narayana K.L., Kannaiah. P., Venkatareddy. K., **"Machine Drawing",** New Age International Publishers, 2004.*

08M308 (A) – STRENGTH OF MATERIALS LABORATORY & FLUID MECHANICS AND MACHINERY LABORATORY

L	T	P	C
0	0	3	1

STRENGTH OF MATERIALS LABORATORY

LIST OF EXPERIMENTS

- Tension test on mild steel and torsteel rods.
- Compression Test.
- Bending Test.
- Double shear test on mild steel rod.
- Torsion test on mild steel rod.
- Test on Springs
    - Compression spring & tension spring
    - Carriage spring
- Deflection test on
    - Metal beam
    - Rolled steel joist.
- Hardness tests on metals like mild steel, brass, copper and aluminium.
- Bend test on steel rod.

FLUID MECHANICS AND MACHINERY LABORATORY:

LIST OF EXPERIMENTS:

- Determination of Darcy's friction factor.
- Calibration of Flow Meters.
- Flow through Mouth Piece / Orifice.
- Calibration of Pressure Gauges.
- Performance study on Rotodynamic pumps
- Performance study on positive displacement pumps.
- Performance study on Jet Pump.
- Load test on Pelton Wheel.
- Load test on Francis turbine.

TOTAL: 45 Hours

08M308 (B) - COMPUTER LABORATORY

L	T	P	C
0	0	3	1

EXERCISES ON USING COMMON SOFTWARE PACKAGES

Word - preparation of documents-letters-reports – formatting - attaching charts. Excel – creation of tables – charts. Power point – preparation of slides for presentation of reports – importing images.

USE OF THE FOLLOWING SOFTWARES/SIMILAR PACKAGES

MATLAB – basics – use of various modules – programming – charts creation. MINITAB – basics – use of various options – processing data - charts creation – models creation – study and use of similar packages.

PROGRAMMING FOR CURVE FITTING, NUMERICAL INTEGRATION AND SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS USING FORTRAN/C/C++

Flow charting and writing program segments for ; curve fitting by the method of least squares, single, double interpolation and area and volume integrals – flow charting and writing programs for the solution of algebraic and transcendental equations by Newton Rapson, Gauss elimination and Gauss Seidel techniques - programs for solution of simultaneous equations

PROGRAMMING FOR SOLUTIONS OF ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS USING FORTRAN/C/C++

Preparation and writing of program segements for the double integral solution of ordinary differential equations by Taylor series method – programs for eigen value problems – programs for the solution of ordinary and partial differential equations – Range Gutta's 4^{th} order methods – Milnes predictor and corrector method

TOTAL: 45 Hours

08M401 - PROBABILITY AND STATISTICS

L	T	P	C
3	1	0	4

PROBABILITY AND RANDOM VARIABLES (09)

Sample spaces – Events - Probability Axioms – Conditional Probability – Independent Events – Baye's Formula. Random Variables **:** Distributions Functions – Marginal Distributions – Conditional Distributions – Expectation – Conditional Expectation and Conditional Variance – Moments - Moment Generating Functions.

PROBABILITY DISTRIBUTION (09)

Binomial , Poisson , Geometric , Uniform , Exponential , Normal , Gamma , Weibull (Mean , Variance , Moment Generating function and Simple problems). Chebyshev's inequality (Simple problems).

TEST OF HYPOTHESIS (09)

Tests for Means , Variances and proportions – Tests for Means , Variances and Attributes using t , F , Chi – Square distribution – Interval estimation for mean , Standard deviation – Proportion.

ANALYSIS OF VARIANCE (09)

One way classification, Two way classification and Latin square design (Only problems).

STATISTICAL QUALITY CONTROL AND CORRELATION ANALYSIS (09)

Statistical basis for control charts – Control limits – Control charts for variables : $\overline{X}$, R Charts – Control chart for defective : p , np Chart - Control chart for defects : c charts. Correlation – Regression – Multiple and Partial Correlation – Partial Regression
(Problems Only)

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 Hours

TEXT BOOKS

1. *S.C. Gupta and V. K. Kapoor,* ***"Fundamentals of Mathematical Statistics",*** *Sultan Chand&Sons, New Delhi – 1999.*
2. *S. P. Gupta,****"Statistical Methods"*** *, Sultan Chand & Sons, New Delhi – 1999.*

REFERENCE

1. *K. S. Trivedi,* ***"Probability and Statistics with Reliability",*** *Queuing and Computer Science Applications, Prentice Hall of India Ltd., New Delhi.*
2. *T. Veerarajan,Probability ,* ***"Statistics and Random Process"*** *, Tata Mc Graw Hill Publishing Company Ltd., New Delhi – 2003.*
3. *P. Kandasamy, K.Thilagavathy and K.Gunavathy****, "Probability and Random Process",*** *S.Chand & Co. Ltd., New Delhi – 2003*

08M402 – METROLOGY AND MEASUREMENTS

L	T	P	C
3	1	0	4

METROLOGY:

LINEAR AND ANGULAR MEASUREMENTS (10)

Length Standards- Length Measuring instruments - Vernier instruments - micrometer, height gauge, dial indicators, Bore gauges, Slip gauges, Comparators-Mechanical, Electrical, Electronic & Pneumatic- Angle measuring instruments-Bevel protractor, Sprit level, Sine bar, Autocollimator, angle dekkor, Interferometry

FORM MEASUREMENT (10)

Screw thread terminology- Measurement of effective diameter by two wire and three wire methods-errors in threads- Measurement of pitch, profile errors and total composite errors , Gear tooth terminology-Methods of measurements of runout, pitch, profile, lead, backlash,tooth thickness-composite method of inspection-parkinson gear tester,Measurement of surface finish-Stylus probe instruments-profilometer-Tomlinson and Talysurf instrument-Straightness, Flatness and roundness measurement - Principle- Applications – Profile projectors – Tool-maker's microscope.

**MEASURING MACHINES AND ADVANCES IN METROLOGY ` ** (05)

Computer controlled CMM-Universal measuring machine-Automatic and multidimensional inspection machine - Computer aided inspection -Machine vision-Laser interferometer

MEASUREMENTS:

STRESS, STRAIN, FORCE, TORQUE AND PRESSURE MEASUREMENTS (10)

Electrical / Metalic Resistance Strain Gauge – Strain Gauge Ballast / Bridge circuit - Stress Strain Relationship - Load cells - hydraulic and pneumatic systems - Pressure measuring transdusers - Elastic and diaphragms - Mechanical / Hydraulic / Electric / Transmission Dynamometers.

TEMPERATURE, FLUID FLOW (10)

Bi-Metallic strips - pressure thermometers, thermocouples, pyrometry - Obstruction meters - flow meters-types - vibrometrs – accelerometers – seismic accelerometers.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 Hours

TEXT BOOKS

1. *Jain.R.K,* ***"Engineering Metrology",*** *Khanna Publishers, Delhi, 2004.*
2. *ThomasG. Beckwith,Roy D, Marangoni John H.Lienhard V.,* ***"Mechanica Mesurements",*** *Addtion Wesley Publishing Company, 2004*

REFERENCES

1. *Gupta. I.C.,* ***"Engineering Metrology",*** *Dhanpat Rai & Sons, Delhi, 4th Edition, 1998.*
2. *Holman J P.,* ***"Experimental Methods for Engineers"*** *McGrawHill Book Company, 2004*

08M403 – APPLIED ELECTRONICS AND MICROPROCESSORS

L	T	P	C
3	0	0	3

ELECTRONIC CIRCUITS (09)

Fixed and Self biasing of BJT – RC coupled and Transformer coupled amplifiers – Power amplifiers - Class A Power amplifier - Class B pushpull amplifier - Distortion in amplifiers. Oscillators - Barkhausen criterion - RC phase shift oscillator . Opamp and its Characterictics-Applications of Opamp-Inverting and non inverting amplifier-adder-subtractor-comparator.

DIGITAL ELECTRONICS (09)

Combinational circuits - Adders and subtractors - A/D and D/A converters - weighted resistor DAC - R-2R ladder DAC - servo tracking A/D - successive approximation A/D converter – Dual slope ADC. Memories - ROM - EPROM - EEPROM – RAM.

MICROPROCESSOR STRUCTURE AND PROGRAMMING (09)

Architecture of 8085A microprocessor - Instruction formats - addressing modes -instruction set of 8085A -. Instruction cycle - machine cycle - OP code fetch cycle – Timing diagram-Memory and I/O read cycle - memory and I/O write cycle - interrupt acknowledge machine cycle - Wait, Hold and Halt states- simple assembly language program for 8085A

MICROPROCESSOR INTERRUPTS AND DATA TRANSFER SCHEMES (09)

Software interrupts - Hardware Interrupts - Vectored Interrupts - Non-vectored interrupts - Priority interrupts - Data transfer schemes - synchronous transfer, asynchronous transfer, interrupt driven transfer and DMA transfer.

MICROPROCESSOR INTERFACING AND APPLICATIONS (09)

Interfacing - interfacing A/D converters - interfacing D/A converters - applications -Temperature control - traffic light control - stepper motor control.

TOTAL: 45 Hours

TEXT BOOKS

1. *Ramesh S. Gaonker,* ***"Microprocessor Architecture and Programming and Applications 8085 / 8080a****", Penram International Publishing (India) 2004*
2. *Mathur S.P., Kulshreshtha D.C., Chadha P.R.* ***"Electronic Devices and Applications and Integrated Circuits",*** *Umesh Publications, 2004*
3. *Morris Mano M.,* ***"Digital Design",*** *Prentice Hall Of India Pvt. Ltd. 2004*

REFERENCES

1. *Mathur A.P.,* ***"Introduction to Microprocessor",*** *Tata Mcgraw Hill, New Delhi 2003.*
2. *Ajit Pal,* ***"Microprocessor Principles and Applications",*** *Tata Mcgraw Hill, New Delhi 1999.*
3. *D.Roychoudhury, Shail Jain,* ***"Linear Integrated Circuits",*** *Wiley Eastern Ltd. 2004.*

08M404 - ELECTRICAL MACHINES AND DRIVES

L	T	P	C
3	0	0	3

DC MACHINES (10)

Generator principle – Parts of DC machine – EMF Equation of dc generator - Motor principle – Types - Torque and speed – Performance curves – Power stages – Speed control of shunt and series motors – Electrical braking - Necessity of starters – Brake test – Swinburne's test – Retardation test.

INDUCTION MOTOR (10)

Construction of three-phase induction motors – Principle of operation of induction motor – Torque under starting and running conditions – Condition for maximum torque –Torque vs. slip characteristics – Full-load and maximum torques - Power stages – Analogy with mechanical clutch – Circle Diagram - Starting of squirrel cage and slip-ring motors – Speed control - Single-phase motor starting – Capacitor start and run motor - Universal motor – Speed control of universal motor.

SYNCHRONOUS MOTOR (08)

Synchronous motor principle – Construction of Synchronous motor - Effect of excitation on current and power factor – Torques of synchronous motor – Hunting – Starting methods – Power factor Improvement.

SOLID STATE SPEED CONTROL (Power Circuits and Qualitative Treatment only) (09)

Control of dc drives using rectifiers and choppers – Control of 3 phase induction motor using stator voltage control – V/f control - Slip power recovery schemes

SELECTION OF DRIVES (08)

Types of electrical drives - Factors influencing the choice of electric drives - - Loading conditions and classes of duty - Determination of power rating – Selection of motor for Steel rolling mills, paper mills, sugar mills, textile mills and machine tool application.

TOTAL: 45 Hours

TEXT BOOKS

1.Theraja B.L. And Theraja A.K., ***"A Text book of Electrical Technolog"****', Volume – II, S.Chand & Co., 2005.*

2. Pillai S.K., ***"A First Course on Electric Drives",*** *New Age International Publishers., New Delhi, 1990.*

REFERENCE BOOKS

1.G.K.Dubey, ***"Fundamentals of Electrical Drives",*** *Alpha Science International Ltd., 2001.*

2.Vedam Subrahmanyam, ***"Electric Drives: Concepts and Applications",*** *McGraw Hill, 1996.*

08M405 - KINEMATICS OF MACHINES

L	T	P	C
3	1	0	4

MECHANISMS (09)

Terminology and definitions – Degree of freedom – Mobility – Grashoff's law – Kinematic inversions of four bar chain and slider crank chains – Mechanical advantage – Transmission angle – Description of mechanisms – Single, double and offset slider mechanisms – Quick return mechanisms.

KINEMATICS (09)

Displacement, velocity and acceleration analysis on simple mechanisms – Graphical method – Velocity and acceleration polygons – Instantaneous center of velocity – Coriolis component – Klein's construction for slider crank chain – Analytical solution for velocity and acceleration of slider crank chain.

FRICTION DRIVES (09)

Belt and rope drive – Open and cross belt drive – Belt materials – Creep and slip - Ratio of tensions – Effect of centrifugal force – condition for maximum power – Friction in Journal Bearing - Flat pivot bearing - Friction clutches – Single plate – Multi plate – Cone clutches-Brakes - Shoe brake and Internal Expanding brake only.

CAMS (09)

Types of cams and followers – Construction of cam profiles for SHM, uniform acceleration and retardation with reciprocating and oscillating followers – Knife-edge, roller and flat.

GEARS (09)

Types - Spur gear terminology and definitions – Pressure angle and undercutting - Law of gearing – Gear profiles – Gear tooth action - Interference – Minimum number of teeths to avoid interference - Gear trains – Simple, compound, reverted and epicyclic

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 Hours

TEXT BOOKS

*1. Shigley J.E And Uicker J.J, **"Theory of Machines and Mechanisms"**, Mcgraw Hill Inc, 1995.*

*2. P.L.Ballaney, **"Theory of Machines",** Khanna Publishers, 2000*

REFERENCES

*1. Rao.J.S. And Dukkipati .R.V. **"Mechanism And Machine Theory"**, Second Edition, Wiley Eastern Ltd., 1992.*

*2. Thomas Bevan, **"Theory of Machines",** CBS Publishers and Distributors, 2002.*

*3. Ghosh A And Mallick A.K, **"Theory of Mechanisms and Machines",** Affiliated East-West Press Pvt Ltd, New Delhi, 1998.*

*4. V.P.Singh, **"Theory of Machines",** Dhanapt Rai & Sons, 2005*

08M406 - MANUFACTURING TECHNOLOGY II

L	T	P	C
3	0	0	3

THEORY OF METAL CUTTING (09)

Mechanism of metal cutting – types – cutting force – chip formation – Merchant's circle diagram – calculations – tool geometry – machinability – tool wear – tool life – cutting tool materials – cutting fluids - types

AUTOMATS, SHAPING AND PLANNING MACHINES (09)

Capstan and turret lathes – construction -indexing mechanism - operations - working principle of single and multi-spindle automats – shaping and planning machines – types – construction - mechanism – principle of operation – different shaping operations - work holding devices

DRILLING, BROACHING AND GRINDING MACHINES (09)

Drilling machines – specifications, types - feed mechanism, operations – drill tool nomenclature-broaching –specifications, types, tool nomenclature, broaching operations - Grinding – types of grinding machines - grinding wheels, specifications -bonds-mounting and reconditioning of grinding wheels.

MILLING AND GEAR CUTTING MACHINES (09)

Milling-specifications-types-cutter nomenclature – types of cutters – milling processes – indexing – profile milling – gear forming in milling – gear generation - gear shaping and gear hobbing – specifications - cutters – cutting spur and helical gears - bevel gear generators – gear finishing methods.

NON-TRADITIONAL MACHINING (09)

Classification of machining processes – process selection -ultrasonic machining – abrasive jet machining –water jet machining - laser beam machining

TOTAL: 45 Hours

TEXT BOOKS

1. *Hajra Choudhry S.K. and Bose S.K., "**Workshop Technology Vol II"**, Media Promoters and Publishers Pvt. Ltd., Bombay, 2004*
2. *Sharma P.C., **"A Text Book of Production Technology",** S.Chand & Company Ltd., New Delhi, Fifth edition,2003*

REFERENCES

1. *Serope Kalpakjian and Steven R.Schmid, **"Manufacturing Engineering and Technology",** Addison Wesley Longman (Singapore) Pte Ltd, Delhi, 2000*
2. *Jain R.K. and Gupta S.C., **"Production Technology",** Khanna Publishers, New Delhi, 1999*
3. *HMT, **"Production Technology",** 2006*

08M407 (A) - ELECTRICAL ENGINEERING LABORATORY

(common to Mech &Prod)

L	T	P	C
0	0	3	1

LIST OF EXPERIMENTS

- O.C.C. and load-test on Separately Excited DC generator
- O.C.C. and load-test on DC shunt generator
- Swinburne's Test
- Speed control of DC shunt motor
- Load test on DC shunt motor
- Load test on DC Compound motor
- Load test on DC series motor
- Mechanical parameters of DC shunt motor
- Mechanical and Iron losses of 3-phase induction motor
- Circle Diagram of 3-phase induction motor
- Load test on 3-phase induction motor
- Load test on 1-phase induction motor
- Load test on synchronous motor
- Study of Induction motor starters

TOTAL: 45 Hours

08M407 (B) – MICROPROCESSOR LABORATORY

L	T	P	C
0	0	3	1

LIST OF EXPERIMENTS

- Conversion of Binary number to BCD
- Conversion of BCD to Binary
- Addition and subtraction of 2 , 8 bit numbers
- Sorting a series of numbers in Ascending and Descending order
- Study of Logic gates
- Study of adders and subtractors
- Multiplexer and Demulitiplexer
- Applications of operational amplifier
- Characteristics of common emitter transistor
- RC Phase shift oscillator
- RC coupled amplifier

TOTAL: 45 Hours

08M408 (A) - METROLOGY LABORATORY

L	T	P	C
0	0	3	1

LIST OF EXPERIMENTS

- Study and use of Measuring Instruments.
- Calibration of Dial Gauge, Micrometer and Vernier.
- Measurement of Angles and Internal / External tapers using Sine bar, Bevel protractor, rollers and spheres.
- Measurement of gear tooth thickness using gear tooth caliper.
- Measurement of effective diameter and pitch of screw thread using 3-wire method and pitch gauge.
- Checking straightness and flatness.
- Measurement of run out and concentricity.
- Measurement of various dimensions of the given component using Profile Projector.
- Study of surface roughness using surface roughness measuring and recording instrument.
- Study of Co-ordinate measuring machines and basic measurement using CMM.
- Study of measurement of various dimensions of any give component using measureoscope.
- Study and use of gear testing machines.

TOTAL: 45 Hours

08M408 (B) - MANUFACTURING TECHNOLOGY LABORATORY I

L	T	P	C
0	0	3	1

STUDY OF CONSTRUCTION DETAILS OF DIFFERENT TYPES OF LATHES AND TOOLS

- Gear box
- Different mechanisms

STUDY OF VARIOUS ACCESSORIES USED IN LATHE

- Chucks, face plates rests, centers

STUDY OF DIFFERENT TYPES OF TOOLS USED IN LATHE AND THE MEASURING INSTRUMENTS

- Single point cutting tool, knurling tools form tools etc
- Steel rule, Calipers, vernier caliper, pitch gauge etc.

EXERCISES ON MODELS INVOLVING

- Facing, plain turning, step turning and parting
- Groove cutting, knurling and chamfering.
- Form turning and Taper turning
- Thread cutting (Internal and external -Vee and square)
- Eccentric turning
- Drilling, reaming and counter sinking

TOTAL: 45 Hours

08M501 - ENGINEERING ECONOMICS AND MANAGEMENT

L	T	P	C
3	0	0	3

ECONOMICS (09)

Nature and Scope - law of supply and demand - production analysis – cost concepts - types and functions of money – functions of central bank and commercial banks - inflation and deflation – control measures. foreign exchange - mechanism – national income.

MANAGEMENT PRINCIPLES (09)

Evolution – principles and functions of management – planning, organizing, staffing, directing and controlling.

ORGANIZATIONAL BEHAVIOUR (09)

Individual behaviour – personality, perception, attitude, values, learning, and group behaviour – group dynamics - stages of group formation, organizational culture, change and its management.

LEGISLATION IN MANAGEMENT (09)

Factories act – provision relating to health, safety and welfare, workmen's compensation act – objectives, principles of trade union, history of trade union – trade union act.

MARKETING AND FINANCIAL MANAGEMENT (09)

Principle policies, channels of distribution, sales management, advertisement management, financial planning – national and global financial institutions

TOTAL: 45 Hours

TEXT BOOKS

1. *Dwivedi D. N.,* ***"Managerial Economics",*** *Vikas Publishing House Private Limited, New Delhi, 2001.*
2. *Bhusan Y. K.,* ***"Fundamentals of Business Organization and Management",*** *Sultan Chand and Sons, New Delhi, 2001.*
3. *Robbins S. P.,* ***"Organizational Behaviour",*** *and Prentice Hall of India Ltd... New Delhi, 2005.*

REFERENCES

1. *Harold Koontz, Heinz Weihrich,* ***"Essentials of Management",*** *McGraw Hill, 2003.*
2. *Sundharam K. P. M.,* ***"Money, Banking and International Trade",*** *Sultan Chand Sons, New Delhi, Reprint 2002.*
3. *Fred Luthans,* ***"Organizational Behaviour",*** *Tata McGrew Hill, Singapore 2000.*

08M502 DESIGN OF MACHINE ELEMENTS

(USE OF APPROVED DESIGN DATA BOOK IS PERMITTED)

L	T	P	C
3	1	0	4

BASICS OF DESIGN (08)

Design philosophy - decision making process - design principle - design procedure - types and consideration - stochastic design principle - classification and properties of engineering materials - theories of failure.

TYPES OF LOADING **(**08)

Stress in machine elements - simple stresses - compound stresses in machine parts - stress concentration – types of loading - design for static loading - design for dynamic loading - low and high cycle fatigue.

SHAFTS AND SPRINGS (10)

Design of shafts under static and fatigue loadings - design of springs - helical compression, tension, torsional and leaf springs.

JOINTS (09)

Design of permanent joints - design of riveted joints - welded joints - types and uses -design of welded joints - design of adhesive joints - design of eccentrically loaded bolt and riveted joints - design of eccentrically loaded welded joints - design of joints with variable loading.

COUPLINGS AND BEARINGS (10)

Analysis and applications of power screws and coupling - analysis of clutches and brakes - analysis and design of sliding and rolling contact bearing.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 Hours

TEXT BOOKS

1.Shigley, J.E. and Mischke, C.R., "Mechanical Engineering Design", Fifth Edition, McGraw Hill International, 1989.

2.Dr. S. S. Wadhwa, Er. S. S. Tolly, ***"Machine Design",*** *Dhanpat Rai & Co, Delhi, 2008.*

REFERENCES

*1.Deutschman.D. Michels, W.J. and Wilson, C.E****., "Machine Design Theory and Practice"****, Macmillan, 1992.*

2.Juvinal, R.C., ***"Fundamentals of Machine Component Design",*** *John Wiley,2006*

3.Khurmi. R. S, ***"Machine Design",*** *S Chand & co, 2006*

Standard Design Data Book.

08M503 – THERMAL ENGINEERING

L	T	P	C
3	1	0	4

STEAM NOZZLES AND TURBINES (09)

Flow through nozzles, shape of nozzles, effect of friction, critical pressure ratio, and supersaturated flow. Impulse and reaction turbines - compounding, velocity diagrams for single stage turbines.

THERMODYNAMIC CYCLES (09)

Air standard cycles - Otto, Diesel, Dual and Brayton cycles - air-standard efficiency- mean effective pressure – P-V and T-s diagrams. Actual cycles, working principle of 2 stroke and 4 stroke cycle - I.C Engines - valve and port timing diagrams.

I.C. ENGINES (09)

Fuel, ignition, cooling and lubrication system for spark ignition and compression ignition engines. Cetane and Octane rating of fuels - combustion, knocking and detonation, scavenging and supercharging – performance characteristics of I.C Engines.

AIR COMPRESSORS (09)

Reciprocating compressors - effect of clearance - multi stage - optimum intermediate pressure and perfect inter-cooling – rotary, centrifugal and axial flow compressors.

REFRIGERATION AND AIR CONDITIONING (09)

Air-refrigeration cycle, vapour compression refrigeration cycle – sub-cooling and superheating, vapour absorption cycles. principles of psychrometry – use of psychometric chart - principles of air-conditioning - types of air conditioning systems – cooling load calculations.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 Hours

TEXT BOOKS

1. *T. D. Eastop, A. Mcconkey;* ***"Applied Thermodynamics",*** *Pearson Education, 2007.*
2. *Ganesan.V,* ***"Internal Combustion Engines",*** *Tata McGraw Hill, New Delhi, 2003.*

REFERENCES

1. *Yunus Cengel, "****Thermodynamics",*** *Tata McGraw Hill, 2008.*
2. *Nag.P.K,* ***"Engineering Thermodynamics",*** *Tata McGraw Hill, 2007.*
3. *Domkundwar and Kothandaraman.C.P,* ***"Thermal Engineering",*** *Khanna Publishers, New Delhi 2006.*
4. *Rajput R.K.,,* ***"Thermal Engineering",*** *Laxmi Publications (P) Ltd., 2007*
5. *Ramalingam, K.K.,* ***"Internal Combustion Engines-Theory and Practice"****Scitech Publications, 2007.*

08M504- DYNAMICS OF MACHINES

L	T	P	C
3	1	0	4

FORCE ANALYSIS (09)

Free body diagrams – static equilibrium conditions – two, three and four force members – static force analysis in simple mechanisms – dynamic force analysis – inertia force and inertia torque – D'Alemberts principle – principle of superposition – dynamic analysis in reciprocating engines – gas forces – equivalent masses – bearing loads - crank shaft torque – turning moment diagrams – fly wheels

BALANCING (09**)**

Static and dynamic balancing – balancing of rotating masses – balancing of single cylinder and multi-cylinder engines – partial balancing in locomotive engines – balancing linkages – balancing machines.

FREE VIBRATION (09)

Basic features of vibratory systems – idealized models - 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 - critical speeds of simple shaft – torsional systems.

FORCED VIBRATION (09)

Response to periodic forcing – harmonic forcing – unbalanced forcing - force transmissibility and amplitude transmissibility – vibration isolation.

MECHANISM FOR CONTROL (09)

Governors – types – centrifugal governors – gravity controlled and spring controlled centrifugal governors – characteristics – effect of friction – controlling force. Gyroscopes – gyroscopic forces and torques – gyroscopic stabilization – gyroscopic effects in automobiles, ships and airplanes.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 Hours

TEXT BOOKS

1. *Shigley J.E & J.J.,* ***"Theory of Machines and Mechanisms"****, McGraw Hill Inc., 1995.*
2. *Rao J.S. and Dukkipati R.V.,* ***"Mechanisms and Machines Theory"****, Wiley-Eastern limited, New Delhi, 1992.*
3. *Rattan S.S.,****"Theory of machines",*** *Tata McGraw Hill Publishing Co.Ltd., New Delhi, 2006.*

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, 2000.*

08M505 - TURBO MACHINES

L	T	P	C
3	1	0	4

PRINCIPLES OF TURBO MACHINES (09)

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.

CENTRIFUGAL FANS AND BLOWERS (09)

Types - stage and design parameters - flow analysis in impeller blades - volute and diffusers – losses - characteristics curves and selection - fan drives and noise.

CENTRIFUGAL COMPRESSOR (09)

Construction details - types - impeller flow losses - slip factor - diffuser analysis - losses and performance curves.

AXIAL FLOW COMPRESSOR (09)

Stage velocity triangles - enthalpy - entropy diagrams - stage losses and efficiency - work done factor - simple stage design problems and performance characteristics.

AXIAL AND RADIAL FLOW TURBINES (09)

Stage velocity diagrams - reaction stages - losses and coefficients - blade design principles - testing and performance characteristics.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 Hours

TEXT BOOKS

1. *Yahya, S.M.,* ***"Turbines, Compressor and Fans",*** *Tata Mc Graw Hill Publishing Co, 2007.*
2. *Ganesan .V.* ***"Gas Turbines"****, Tata McGraw Hill Pub. Co., New Delhi, 2007.*

REFERENCES

1. *Bruneck****, "Fans",*** *Pergamom Press, 1973.*
2. *Earl 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. *Pandian.K.,* ***"TurboMachines,"****AirWalk Publishers., Chennai, 2003*

08M506 - HYDRAULIC AND PNEUMATIC CONTROLS

L	T	P	C
3	0	0	3

BASIC PRINCIPLES (09)

Hydraulic principles – hydraulic pumps – characteristics – pump selection – pumping circuits – hydraulic actuators – linear and rotary – selection – hydraulic valves – pressure, flow and direction control – hydraulic fluids – types and properties.

HYDRAULIC CIRCUITS (09)

Reciprocating –sequencing – synchronizing – accumulator circuits –regenerative circuits – pressure intensifier circuits – double pump hydraulic system – press -milling machine – planner- mechanical hydraulic servo systems

DESIGN AND SELECTION OF HYDRAULIC SYSTEMS (09)

Design of hydraulic circuits – selection of components -application of design procedure to typical hydraulic systems – troubleshooting of hydraulic systems

PNEUMATIC SYSTEMS (09)

Pneumatic fundamentals – control elements – logic circuits – position- pressure sensing-switching - electro pneumatic- electro hydraulic circuits- robotic circuits

DESIGN AND SELECTION OF PNEUMATIC CIRCUITS (09)

Design of pneumatic sequencing circuits - classic- cascade - step counter-combination-methods - programmable logic controller – microprocessors – uses. Selection criteria for pneumatic components - installation and maintenance of pneumatic system.

TOTAL: 45 Hours

TEXT BOOKS

1. *Anthony Esposito**,"Fluid Power with Applications",** Pearson Education (Singapore) Pvt Ltd, New Delhi 2004.*
2. *J.Michael, Pinches and John G.Ashby**,"Power Hydraulics",** Prentice Hall,1989*

REFERENCES

1. *Dudleyt, A.Pease and John J. Pippenger, **"Basic Fluid Power"**, Prentice Hall,1987*
2. *John J.Pippenger and Tyler G Hicks**," Industrial Hydraulics",** McGraw Hill Book Co., 1979.*
3. *Stewart H L and Storer J.M., **"Pneumatics and Hydraulics",** D B Taraporevala Sons, 1983.*
4. *Andrew Parr, **"Hydraulics and Pneumatics",** Jaico Publishing House, 1999.*

08M507 - A) DYNAMICS LABORATORY

L	T	P	C
0	0	3	1

LIST OF EXPERIMENTS

- Governors - determination of sensitivity, effort, etc. for Watt, Porter, Proell, Hartnell governors
- Drawing profile of the cam.
- Motorized Gyroscope-verification of laws -determination of gyroscopic couple.
- Whirling of shaft-determination of critical speed of shaft.
- Balancing of reciprocating masses and Balancing of rotating masses
- Vibrating system - spring mass system - determination of damping co-efficient of single degree of freedom system.
- Determination of torsional frequencies for compound pendulum and flywheel system with lumped Moment of inertia.
- System identification using dynamic response curves

TOTAL: 45 Hours

08M507 – B) INSTRUMENTATION LABORATORY

L	T	P	C
0	0	3	1

LIST OF EXPERIMENTS

- Calibration of Pressure gauges
- Calibration of Vacuum gauges.
- Calibration of Thermometers and Thermocouples.
- Determination of Flash point and Fire point.
- Determination of Viscosity – Red Wood
- Determination of Viscosity - Saybolt Viscometer
- Calibration of Rota meter.
- Calibration of Tachometer
- Determination of Calorific Value of Fuels

TOTAL: 45 Hours

08M508 - THERMAL ENGINEERING LABORATORY- I

L	T	P	C
0	0	3	2

LIST OF EXPERIMENTS

- Valve timing and port timing diagrams for single cylinder diesel engines.
- Performance test on 4 stroke Diesel Engine.
- Heat balance test on 4 strokes Diesel Engine.
- Retardation test to find Frictional Power of a Diesel Engine.
- Economical speed test on Diesel Engine.
- Performance test on Constant speed blower.
- Performance test on Variable speed blower.
- Performance test on Reciprocating Air compressor.

TOTAL : 45 Hours

08M601- OPERATIONS RESEARCH

(Use of Approved Statistical Tables Permitted)

L	T	P	C
3	1	0	4

LINEAR MODELS (09)

Phases and characteristics of operation research study – graphical method – simplex algorithm – duality – dual simplex method.

NETWORK MODELS (09)

Network models – shortest route – minimal spanning tree – maximum flow models – project network – PERT and CPM networks – critical path scheduling – sequencing models.

INVENTORY AND TRANSPORTATION MODELS (09)

Inventory models – economic order quantity models – safety stock – reorder point – lead time – quantity discount models – transportation problems – assignment problems.

QUEUING THEORY (09)

Queuing models – queuing systems and structures – notation parameter – single server and multi server models – poisson arrival – exponential service – simulation – Monte Carlo technique – use of random numbers.

DECISION MODELS (09)

Decision models – game theory – two person zero sum games – graphic solution – replacement models – replacement policies - models based on service life – economic life.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 Hours

TEXT BOOKS

1. *Sharma, S.D.* ***"Operations Research",*** *kedarNath Ram Nath & Co. Meerut, 1994.*
2. *P.K. Gupta & D.S. Hira,* ***"Problems in Operations Research"*** *(Principles & Solutions) S. Chand & Co. Ltd., 2003.*
3. *H.A. Taha,"* ***Operations Research",*** *Prentice Hall of India Pvt. Ltd., 1997.*

REFERENCES

1. *Dharani Venkatakrishnan. S.* ***"Operations Research"*** *(Principles & Problems), Keerthi Publishing House Pvt. Ltd., 1996.*
2. *Don. T. Phillips, Ravindren, A & James Solberg –* ***"Operations Research "–*** *John Wiley & Sons, 1987.*

08M602 - AUTOMOBILE ENGINEERING

L	T	P	C
3	0	0	3

AUTOMOTIVE ENGINES (09)

Types of engine – engine rating – multicylinder engines – power and mechanical balance – firing order – rotary engines – stratified charged engines – lean burn engines – turbocharged engines – CNG engines – emission and its control – euro norms.

AUTOMOTIVE FUEL SYSTEMS (09)

Fuel systems for petrol and diesel engines – carburetor types – mixture requirements – idling, metering, accelerating systems-multi point fuel injection – electronic fuel injection – electric and mechanical fuel pumps for S.I.engines – fuel pumps and fuel injectors – common rail diesel injection system - engine sensors - microprocessor control.

AUTOMOTIVE ELECTRICAL AND LUBRICATION SYSTEMS (09)

Automotive electrical circuits – electronic ignition systems – electrical circuits – engine lubrication – type of lubrication systems.

AUTOMOTIVE TRANSMISSION SYSTEMS (09)

Clutch – types and principles of operation – types of gear box – automatic and hydraulic transmission propeller shafts – rear axles and differentials.

AUTOMOTIVE CHASSIS (09)

Steering systems – components and types – power steering – caster and camber – toe in and toe out – suspension system – front and rear suspension – shock absorber – wheels and tyres – use of nitrogen - brakes – types- recent trends in automotive technology.

TOTAL: 45 Hours

TEXT BOOKS

1. *Dr. Kirpal Singh,* ***"Automobile Engineering Vol. I & II",*** *Standard Distributors Publishers, 2004*
2. *Joseph Heitner* ***"Automotive Mechanics Principles and Practice"*** *Affiliated East West Press, 1997.*

REFERENCES

1. *William H. Crouse,* ***"Automotive Mechanics",*** *McGraw Hill Book Co. 2004.*
2. *K.K. Ramalingam,* ***"Automobile Engineering – theory and Practice"*** *SciTech Publications, 2001.*
3. *Newton, K., Steeds, W., Garrett TK* ***"The Motor Vehicle"*** *The English Language Book Series, 1983.*

08M603 - DESIGN OF TRANSMISSION SYSTEMS

(Use of Approved Design data book is Permitted)

L	T	P	C
3	1	0	4

DESIGN OF POWER TRANSMISSION ELEMENTS (09)

Wire ropes, pulleys – flat belt – V belt - ribbed V belts – transmission chains and sprockets - silent chains.

SPUR AND HELICAL GEARS (09)

Kinematics - force analysis in gears – stress analysis - dynamic effects - estimating gear size - gear blank design.

BEVEL AND WORM GEARS (09)

Straight bevel gears - worm gear - force Analysis - gear design.

DESIGN OF GEAR BOX (09)

Geometric progression - standard step ratio - ray diagram, kinematic layout - design of sliding mesh and constant mesh gear box - introduction to planetary gear box.

FRICTION CLUTCHES AND BRAKES (09)

Classification and selection of friction clutches torque transmitting capacities and design of single-plate, multi-plate, cone and centrifugal clutches - internal expanding shoe brake and disc brake - concept of temperature rise in clutch and brake operation.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 Hours

TEXT BOOKS

1. *Joseph Edward Shigley and Charles, R. Mischke**, " Mechanical Engineering Design ",** McGraw Hill International Editions, 1989.*
2. *V.B. Bhandari**, "Design of Machine Elements ",** Tata McGraw Hill Publishing Co., 1994.*
3. *T.V.Sundarajamoorthy and N.Shanmugam, "**Machine Design",** Khanna Publishers, 1989.*

REFERENCES

1. *Gitin M.Maitra and L.V.Prasad, **"Hand book of Mechanical Design ",** II Edition, Tata Mc Graw Hill, 1985.*
2. *Juvinal R.C. **"Fundamentals of Machine Components Design"** John Wiely and Sons.2006*
3. *Spott's M.F. and Shoup T.E. **"Design of Machine elements",** Prentice Hall International.*
4. *"**Design Data"** – P.S.G. College of Technology, Coimbatore.*

08M604 - COMPUTER AIDED DESIGN AND MANUFACTURING

L	T	P	C
3	0	0	3

INTRODUCTION (09)

Evolution of CAD/CAM and CIM – segments of generic CIM – programmable logic controllers (PLC) – logic ladder program – timers. Flexible Manufacturing System (FMS). Computers and workstation, elements of interactive graphics, input/ output display and storage devices in cad – an overview of CIM software – 2D graphics: line drawing algorithms – 2D translation, rotation, scaling – clipping – basics of 3D graphics.

GEOMETRIC MODELING (09)

Design process – CAD process – wireframe, surface, solid modeling – b-rep, constructive solid geometry – surface of revolution, swept surfaces, ruled and developed surfaces, Bezier and B-Spline curves and surfaces – engineering analysis – design review and evaluation, automated drafting – CAD hardware and software, data presentation.

NC, CNC AND DNC (09)

Numerical control - classifications – point-to-point, straight cut and contouring – positioning – incremental and absolute systems – driving devices – feed back devices – NC part programming – manual programming for simple components – computer aided part programming- Automatically Programmed Tools (APT) programming – programming with interactive graphics – computer automated part programming.

COMPUTER AIDED SHOP FLOOR CONTROL (09)

Introduction to group technology, part classification and coding, production flow analysis, cellular manufacturing systems – computer aided material handling system – computer aided process planning – variant and generative process planning methods – artificial intelligence in process planning.

PRODUCT DATA MANAGEMENT (09)

Introduction to product data management (PDM) – CAD integration in product data management – issues related to integration of CAD with PDM – examples, tools and uses.

TOTAL: 45 Hours

TEXT BOOKS

1. *Mikell P.Groover,* ***"Automation, Production Systems and Computer-Integrated Manufacturing",*** *Pearson Education, New Delhi, 2003.*
2. *P. Radhakrishnan and S. Subramanyan, Raju. V* ***"CAD/CAM/CIM"*** *New Age International(P) Ltd, New Delhi – 2002.*
3. *Kundra T.K. , Rao P.N. and Tiwari N.K.* ***,"CNC Machine Tools and Computer Aided Manufacturing,"*** *Tata Mc Graw Hill Pub. New Delhi, 1991.*

REFERENCES

1. *Mikell P. Groover and Enory W. Zimmers Jr.* ***"CAD/CAM: Computer Aided Design and Manufacturing,"*** *Prentice Hall of India, New Delhi.2005.*
2. *Steve Krar, Arthar Gill* ***"CNC Technology and Programming",*** *McGraw Hill Pub.Company, New Delhi, 1990.*
3. *David Bedworth,* ***"Computer Integrated Design and Manufacturing",*** *TMH, New Delhi,1998.*
4. *Zeid Ibrahim,* ***"CAD/CAM Theory and Practices"****, McGraw Hill International Edition,2000.*
5. *P. Radhakrishnan and S. Subramanyan* ***"CAD/CAM/CIM"*** *Willey Eastern Limited, New Delhi, 1994.*

08M605 - HEAT AND MASS TRANSFER

L	T	P	C
3	1	0	4

CONDUCTION (09)

Fundamental differential equation of heat conduction in Cartesian coordinates -representation of general heat conduction equation in cylindrical and spherical coordinates- Fourier law of heat conduction - boundary and initial conditions - conduction analysis - plane wall and radial systems - critical thickness of insulation - conduction with thermal energy generation - heat transfer from extended surfaces-transient heat conduction.

CONVECTION (09)

Principles of convection - convection boundary layers - laminar and turbulent flow - empirical relations for external and internal forced convection flows - flat plate, cylinders, spheres - empirical relations for free convection flows - horizontal cylinders, horizontal plates, vertical planes, inclined surfaces and enclosed spaces.

RADIATION (09)

Nature of thermal radiation - radiation intensity - relation to emission, irradiation and radiosity - black body radiation - laws of radiation – emissivity - surface emission -Kirchhoff's law - gray surface - view factor - radiation exchange between black surfaces – radiation exchange between gray surfaces - electrical analogy - radiation shields.

HEAT EXCHANGERS (09)

Types - overall heat transfer coefficient - fouling factors-heat exchanger analysis using log mean temperature difference (LMTD) and effectiveness - number of transfer units (NTU) method - compact heat exchangers, methodology of a heat exchanger design calculations.

MASS TRANSFER (09)

Introduction - concentration, velocities, fluxes - mechanisms of diffusions - diffusion in a stationary and moving medium - mass convection - analogy between convective heat and mass transfer - simultaneous heat and mass transfer.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 Hours

TEXT BOOKS

1. *Sachdeva R.C.**, "Fundamentals of Engineering Heat and Mass Transfer",** New Age International Publishers, New Delhi, 2005.*
2. *Kothandaraman C.P., **"Fundamentals of Heat and Mass Transfer",** New Age International Publishers, New Delhi, 1998*

REFERENCES

1. *Frank P. Incropera and David P. DeWitt, **"Fundamentals of Heat and Mass Transfer",** John Wiley and Sons, 1998*
2. *Holman J.P., **"Heat and Mass Transfer",** Tata McGraw Hill, 2000*
3. *Yadav R., **"Heat and Mass Transfer",** Central Publishing House, Allahabad, 1995*
4. *Ozisik M.N., **"Heat Transfer",** McGraw Hill Book Co., 1994*
5. *Kern. **"Process heat transfer".** Tata McGraw Hill, 2000*

08M606 – MECHATRONICS

L	T	P	C
3	0	0	3

MECHATRONICS SYSTEMS (09)

Introduction to mechatronics – basics of actuating systems – mechanical, pneumatic, hydraulic, electrical systems – control systems – measurement systems – mechatronics approach

SENSORS AND TRANSDUCERS (09)

Introduction – performance terminology – displacement, position and proximity – velocity and motion – fluid pressure – temperature sensors – light sensors – selection of sensors

SIGNAL PROCESSING (09)

Concepts and principle – ADC – DAC -analog signal conditioning – signal level changes – linearization – conversion –filtering –digital signal conditioning

PROGRAMMABLE LOGIC CONTROLLERS (09)

Introduction – basic structure – input /output processing – programming - mnemonics – timers – internal relays and counters – data handling – analog input/output - selection of PLC

DESIGN OF MECHATRONICS SYSTEMS (09)

Stages in designing mechatronics systems – traditional and mechatronics design – possible design solutions – case studies of mechatronics systems – pick and place robot – automatic car park system – engine management system

TOTAL: 45 Hours

TEXT BOOKS

1. *W.Bolton**, "Mechatronics"** , Longman,2nd Edition,1999*
2. *S. Ramachandran, A. Sivasubramanian **"Mechatronics"**, Air Walk Publication, 2004.*
3. *Devdas Shetly, Richard A. Kolk, **"Mechatronics System Design",** Thomson, PWS publishing co, 2007.*

REFERENCES

1. *Michael B. Histand and David G.Alciatore, **" Introduction to Mechatronics and Measurement Systems",** Tata McGraw Hill, 2nd Edition,2003*
2. *D.A.Bradley,D.Dawson,N.C.Buru and A.J.Loader**, "Mechatronics"** Chapman and Hall,1993*
3. *Dan Necsulescu, **"Mechatronics",**Pearson Education Asia,2005*

08M607 - THERMAL ENGINEERING LABORATORY II

L	T	P	C
0	0	3	2

LIST OF EXPERIMENTS:

- Test on pin fin apparatus.
- Test on counter flow heat-exchanger.
- Determination of convection heat transfer coefficient.
- Determination of thermal resistance & conductivity.
- Determination of emissivity of non-black surfaces.
- Determination of transient temperature distribution.
- Performance test on cooling tower.
- Determination of COP of mechanical heat pump.
- Determination of COP of a refrigeration system.
- Determination of COP of an air-conditioning system
- Performance Test on Centrifugal Fan
- Performance Test on Axial Flow Fan
- Determination of Lift and Drag using Wind Tunnel
- Study of Boiler, steam turbine and Steam Engines

TOTAL: 45 Hours

08M608 – CAD / CAM LABORATORY

L	T	P	C
0	0	3	2

COMPUTER AIDED DESIGN (CAD) (15)

- Sketching - create, edit and dimension the sketch, constraints, datum planes, construction aids
- 3D Part modeling – protrusion, cut, sweep, draft, loft, blend, rib
- Editing – move, pattern, mirror, round, chamfer
- Assembly - creating assembly from parts - assembly constraints
- Conversion of 3D solid model to 2D drawing - different views, sections, isometric view and dimensioning
- Introduction to surface modeling
- Introduction to File Import, Export – DXF, IGES, STL, STEP formats.
- 3D modeling of machine elements like flanged coupling, screw jack etc.

Any of the 3D MODELING softwares like Pro/E, IDEAS, CATIA, UNIGRAPHICS, and AutoCAD to be used.

COMPUTER AIDED MANUFACTURING (CAM) (21)

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

- Part programming for linear and circular interpolation, chamfering and grooving.
- Part programming using standard canned cycles for turning, facing, taper turning and thread cutting.

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

- Part programming for linear and circular interpolation and contour motions.
- Part programming involving canned cycles for drilling, peck drilling, and boring.

SIMULATION AND NC CODE GENERATION USING CAM PACKAGE (09)

- NC code generation using CAD / CAM softwares - post processing for standard CNC Controllers like FANUC, Sinumeric etc.

TOTAL: 45 Hours

08M701- POWER PLANT ENGINEERING

L	T	P	C
3	0	0	3

LAYOUT OF POWER PLANT (09)

Layouts of steam, hydel, diesel, wind, magneto hydro dynamic (MHD), nuclear and gas turbine power plants – combined power cycles – co-generation – comparison, criteria for site selection for power plants.

STEAM BOILER AND CYCLES (09)

Modern high-pressure and super critical boilers – modern trends in cycle improvement – waste heat recovery-fluidized bed boilers.

FUEL, ASH HANDLING AND AIR POLLUTION (09)

Preparation and handling of coal – pulveriser – dust collector – ash removal stokers – different types – pulverised fuel burning - draught - types – selection of blowers, cooling towers – types – analysis of pollution from thermal power plant – pollution controls.

BOILERS (09)

Automatic controls for feed water, steam, fuel, air supply and combustion, boiler testing and trails – inspection and safety regulations. economics of power plant – actual load curves, fixed costs – operating cost – variable load operation.

POWER GENERATION SYSTEMS (09)

Nuclear fission and chain reaction – pressurized water reactors, boiler water reactors, and gas cooled reactors – fast breeder reactors - safety measures for nuclear power plants. Solar cell and fuel cell – ocean thermal energy - geothermal energy.

TOTAL: 45 Hours

TEXT BOOKS

1. *S.C.Arora and S.Domkundwar,**"A Course in Power Plant Engineering",**Dhanpat Rai and sons,2002.*
2. *G.R. Nagpal, **"Power Plant Engineering",** Khanna publishers, 2002.*
3. *R.K.Rajput,**"A Textbook of Power Plant Engineering",**Laxmi Publications pvt ltd, fourth edition 2007.*

REFERENCES

1. *Joel Weisman and Roy Eckart, **"Modern power Plant Engineering"**, Prentice Hall Internation Inc., 1985*
2. *Bernhardt G. Askrotzki & Willian A Vopat, **"Power Station Engineering and Economy",** Tata McGraw Hill, 1972*
3. *Frederick T. Mores, **"Power Plant Engineering",** Affiliated East – West Press Private Ltd., 1953.*
4. *P.K. Nag, **"Power Plant Engineering",** Tata McGraw Hill, 2001.*

08M702 - INDUSTRIAL ROBOTICS

L	T	P	C
3	0	0	3

FUNDAMENTALS OF ROBOT (08)

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 - robot cell.

ROBOT DRIVE SYSTEMS AND END EFFECTORS (09)

Drives - hydraulic, pneumatic, mechanical, electrical - servo motors - stepper motors - salient features, application - end effectors - grippers - mechanical grippers - pneumatic and hydraulic grippers, magnetic grippers, vacuum grippers.

SENSORS AND MACHINE VISION (10)

Requirements of sensors – principles, types and applications - introduction to machine vision - functions - image processing and analysis.

ROBOT KINEMATICS AND ROBOT PROGRAMMING (09)

Forward kinematics and reverse kinematics of manipulators - two, three degrees of freedom (in 2 dimensional) - simple problems - lead through programming, robot programming languages - VAL programming – motion commands - sensor commands - end effecter commands - simple programs.

APPLICATIONS, IMPLEMENTATION AND ROBOT ECONOMICS (09)

Application of robots in processing - assembly - inspection - material handling - loading - unloading - automobile - implementation of robots in industries - safety considerations for robot operations - economic analysis of robots - pay back method and rate of return method.

TOTAL: 45 Hours

TEXT BOOKS

1. *M.P.Groover,* ***"Industrial Robotics – Technology, Programming and Applications",*** *McGraw-Hill, 2001.*
2. *Fu.K.S. Gonzalz.R.C., and Lee C.S.G.,* ***"Robotics Control, Sensing, Vision and Intelligence",*** *Mc Graw Hill Book Co., 1987.*
3. *Richard D.Klafter, Thomas A.Chmielewski and Micheal Negin,* ***"Robotic engineering –An Integrated Approach",*** *Prentice Hall Inc, Englewoods Cliffs, NJ, USA, 2005.*

REFERENCES

1. *Janakiraman.P.A.* ***"Robotics and Image Processing",*** *Tata McGraw-Hill, 1995.*
2. *Yoram Koren,* ***"Robotics for Engineers",*** *McGraw-Hill Book Co., 1992.*
3. *A.K.Gupta and S.K.Arora,* ***"Industrial Automation and Robotics",*** *Laxmi Publications Pvt ltd, 2007.*

08M703- FINITE ELEMENT ANALYSIS

L	T	P	C
3	1	0	4

RELEVANCE OF FEM (09)

Historical background-basic concept of FEM - discrete and continuous models - boundary and initial value problems - discretization-convergence requirements - gradient and divergence theorems.

CHARACTERISTIC MATRICES AND LOAD VECTORS (09)

One dimensional governing equations - structural and heat transfer problems - variational method-variational calculus – weighted residual methods-Galerkin's method - Ritz method - generalized coordinate's approach - principle of minimization of potential energy.

ONE DIMENSIONAL PROBLEMS (09)

Derivation of shape functions-shape function characteristics-problems in axial load members, trusses, beams, heat transfer through composite walls and fins-gauss elimination and cholesky's methods of solving equations.

TWO DIMENSIONAL PROBLEMS (09)

Linear triangular and rectangular elements-constant strain triangles (cst)-derivation of shape functions for triangular and rectangular elements-Pascal's triangle-concept of plane stress and plain strain. structural and heat transfer application - introduction to dynamic and coupled field analysis.

HIGHER ORDER ELEMENTS (09)

Application of higher order elements-isoparametric elements- lagrangian and serendipity elements-jacobian transformation.

TOTAL: 45 Hours

TEXT BOOKS

1. *Larry J. Segerlind* ***,"Applied Finite element Analysis",*** *John Wiley & Sons , 1987*
2. *Singiresu.S.Rao,* ***"The Finite Element Method in Engineering",*** *ButterWorth Heinemann, 2001.*

REFERENCES

1. *J.N Reddy,* ***" Introduction to Finite Element Method",*** *McGraw Hill, Intl, Student Edition 2003.*
2. *Tirupathi R. Chandrupatla and Ashok D. Belegundu ,"****Introduction to Finite Element in Engineering",*** *Pearson Education ,2003*
3. *Chandrakant .S .Desai,* ***"Elementary Finite Element Method",*** *Prentice Hall Inc.1979.*
4. *David V.Hutton* ***"Fundamentals of finite element Analysis"*** *McGraw Hill Inc, Newyork, 2004.*

08M704 MANUFACTURING, PLANNING AND CONTROL

L	T	P	C
3	0	0	3

WORK STUDY AND ERGONOMICS (09)

Introduction - Method study – steps in method study, recording, selected recording techniques - time study – work sampling - ergonomics.

PLANT LOCATION (09)

Introduction – objective and subjective factors – break even analysis –single facility location problem – multi facility location problems – model for warehouse location problem - facility location model – Brown and Gibson model**.**

PLANT LAYOUT AND MATERIAL HANDLING (09)

Introduction – classification of layout – layout design procedures – CRAFT, ALDEP and CORELAP**.** Materials Handling – unit load concept – material handling principles – classification of material handling equipments**.**

PRODUCTION PLANNING (09)

Demand forecasting - time series forecasting models - Delphi method of forecasting -forecast errors – Material resource planning (MRP) and Enterprise resource planning (ERP)**.**

PRODUCTION CONTROL (09)

Functions of production control - product design and analysis – process planning and design – value analysis – standardization – simplification and specialization – make or buy decisions – Inventory control- need for inventory-purchase order model-model with and without shortages**.**

TOTAL: 45 Hours

TEXT BOOKS

1. *Samuel Eilon, "**Elements of Production Planning and Control**", Universal Book Corporation, 1984.*
2. *Buffa, E.S., "**Modern Production/Operations Management",** 7th edition, John Wiley sons, 1983.*

REFERENCES

1.*Barnes, **"Motion and Time study",** John Wiley, New York, 1990.*
*2.Apple, J.M. "**Plant Layout and Materials Handling",** Ronald Press Company, New York, 1977.*
*3.ILO, **"Introduction to work study",** ILO, Geneva, 1974.*
*4.Panneerselvam, R., **"Production and Operations Management",** 2nd edition, Prentice Hall of India, New Delhi, 2006.*

08M707 MODELLING AND SIMULATION LABORATORY

L	T	P	C
0	0	3	2

TWO DIMENSIONAL MECHANICAL DESIGN ANALYSIS

- Design and drawing of cam contour
- Dynamic stress and shear calculation for screw and nut.
- Force and deflection calculation for spring.
- Maximum Stress Deflection and Moments calculation on Shafts.

FINITE ELEMENT MODELLING AND ANALYSIS

- Exercises on Modeling and Meshing.
- Exercises on Solution and Post processing.
- Various types of Analysis: Structural, Elasticity, Fluid Flow, Heat Transfer, Weld assembly - Metal cutting problem.
- Exercises on Coupled Field analysis
- Introduction to Ansys Parametric Design Language 0(APDL)

KINEMATIC ANALYSIS OF SIMPLE MECHANISMS

- Modeling and analysis of hydraulic and pneumatic systems using Mat lab / lab view software

ROBOTICS

- Simulation study of work cell using IGRIP - Robot Simulation Software
- WALLI- Robot Simulation Software Simulation study of Mentor Robot
- Simulation study of Gryphon Robot
- Demonstration of ER- V Robot and Scora ER-14 Robot

TOTAL: 45 Hours

08M708 MANUFACTURING TECHNOLOGY LABORATORY II

L	T	P	C
0	0	3	2

LIST OF EXERCISES

- V-groove cutting in shaping machine.
- Drilling, tapping and surface grinding using surface grinder and Radial drilling machine
- External cylindrical grinding of shaft
- Spur gear milling
- Helical gear milling
- Gear shaping
- Gear hobbing
- Polygonal milling
- Making hexagonal hole using slotting machine
- Letter cutting in vertical milling machine

TOTAL: 45 Hours

08M7E0 - MANAGEMENT ACCOUNTING

L	T	P	C
3	0	0	3

BASICS OF MANAGEMENT ACCOUNTING (09)

Nature, scope, definitions, comparison with financial accounting and cost accounting - utility and limitations of management accounting

ANALYSIS AND INTERPRETATION OF FINANCIAL STATEMENTS (09)

Concepts and limitations of financial statements - analysis and interpretation- comparative financial statements - common size statements - trend percentages - ratio analysis

FUND FLOW AND CASH FLOW ANALYSIS (09)

Concept of funds - sources and use of funds - construction of fund flow statement -distinction of cash from funds - utility of cash flow statement - construction of cash flow statement.

BUDGETS AND BUDGETARY CONTROL (09)

Nature and objectives of budgetary control - uses and limitations - preparation of budgets.

CAPITAL BUDGETING (09)

Nature of capital expenditure - capital budgeting procedure - methods of capital budgeting – discounted and non- discounted cash flow methods.

TOTAL: 45 Hours

TEXT BOOKS

1. *Maheshwari, S.N.,* ***"Principles of Management Accounting",*** *Sultan Chand and Sons, New Delhi, 2007*
2. *Maheshwari, S.N.,* ***" Management Accounting and Financial Control",*** *Sultan Chand and Sons, New Delhi, 2006*

REFERENCES

1. *James Van Horne,* ***"Financial Management and Policy",*** *Prentice Hall of India, 2006*
2. *Khan and Jain,* ***" Financial Management",*** *Tata McGraw Hill Publishers, New Delhi,2007*

08M7E1 - SOFT COMPUTING TECHNIQUES

L	T	P	C
3	0	0	3

GENETIC ALGORITHMS (11)

Introduction to genetic algorithms (GA) - goals of optimization - differences and similarities between genetic algorithm and traditional methods - schemata - terminology of GA - strings, structure, parameter set - coding - fitness function - data structures - GA operators - algorithm.

MODERN SEARCH TECHNIQUES (6)

Simulated annealing - introduction - algorithm - applications. Tabu search - introduction - algorithm - applications. Particle swarm optimisation algorithm.

FUZZY LOGIC (09)

The concept of uncertainty and associated solutions - fuzzy sets - basic properties and characteristics of fuzzy sets - fuzzy set operations - fuzzy reasoning - applications of fuzzy logic.

ARTIFICIAL NEURAL NETWORKS (09)

Basics of artificial neural networks (ANN) – characteristics of ANN - models of neuron – topology - basic learning laws - types. Kohenon self organizing network - back propagation network - learning curves - applications of ANN to engineering problems.

NEURO – FUZZY MODELLING (08)

Neuro - Fuzzy modelling - adaptive neuro - fuzzy inference systems, neuro-fuzzy controller - feedback control, expert control, back propagation through time and real - time recurrent learning, reinforcement learning control, gradient - free optimisation.

TOTAL: 45 Hours

TEXT BOOKS

1. *Goldberg, D.E.,* ***"Genetic Algorithms in Search, Optimization, and Machine Learning",*** *Addison-Wesley, 1989.*
2. *S.Rajasekaran and A.Vijayalakshmi Pai.,* ***"Neural Networks, Fuzzy Logic and Genetic Algorithms",*** *Prentice Hall of India (P) Ltd., New Delhi, 2008.*
3. *Timothy J.Ross,* ***"Fuzzy Logic with Engineering applications",*** *Tata McGraw Hill New York, 1995.*

REFERENCES

1. *Deb, K,* ***"Optimization for Engineering Design",*** *Prentice Hall of India (P) Ltd., New Delhi, 1998.*
2. *Schalkoff, R.J.,* ***"Artificial Neural Networks",*** *McGraw-Hill Companies Inc., 1997.*
3. *Sundareswaran,K.,****"A Learner's Guide to Fuzzy Logic Systems",*** *Jaico Publishing House, 2005.*
4. *Yegnanarayanan, B.,* ***"Artificial Neural Networks",*** *Prentice Hall of India, 1999.*

08M7E2 - REFRIGERATION AND AIR CONDITIONING

[Use of Approved Refrigeration Table and Chart are Permitted]

L	T	P	C
3	0	0	3

REFRIGERATION CYCLES (09)

Air refrigeration cycles - reversed Carnot cycle, bell Coleman cycle, simple vapour compression refrigeration cycle, compound compression refrigeration cycles, and cascade refrigeration cycles.

VAPOUR ABSORPTION (09)

Properties of refrigerant, classification of refrigerants - primary and secondary refrigerants, performance analysis of aqua ammonia refrigeration system, study of lithium bromide water refrigeration system, ozone friendly refrigerants.

SYSTEM COMPONENTS (09)

Refrigerant compressors - reciprocating, rotary and centrifugal compressors, evaporators- flooded, dry expansion, shell and tube and double pipe evaporators, condensers - air cooled, water cooled and evaporative condensers, expansion devices - automatic, capillary tube and thermostatic expansion valve.

AIR HANDLING (09)

Air distribution systems - study of different types of duct systems, methods of duct design, duct insulation, air purity - air cleaning methods.

AIR CONDITIONING (09)

Psychrometry, psychrometer, psychometric processes, moist air behaviour, effective temperatures, sensible heat factor ratio and cooling load estimation for an air conditioned space.

TOTAL: 45 Hours

TEXT BOOKS

1. *Arora C.P,* ***"Refrigeration and Air Conditioning",*** *Tata McGraw Hill Publishing Company Limited, New Delhi, 2006*
2. *Jain V.K,****"Refrigeration and Air Conditioning",*** *S.Chand and co, New Delhi, 1986.*

REFERENCES

1. *Stocker,* ***"Refrigeration and Air Conditioning",*** *Tata McGraw Hill Publishing Company Limited, New Delhi,1982.*
2. *Roy J Dossat,* ***"Principle of Refrigeration",*** *Wiley Eastern Limited, Fifth Edition 2001.*
3. *Manohar Prasad, "****Refrigeration and Air Conditioning",*** *Wiley Eastern Limited, 2004.*
4. *Jordan and Prister,****" Refrigeration and Air Conditioning",*** *Prentice Hall of India Limited, New Delhi, 1985.*

08M7E3 – DESIGN OF JIGS, FIXTURES AND PRESS TOOLS

(Use of Approved Data book is permitted)
(Common to Production Engineering)

L	T	P	C
3	0	0	3

TOOL DESIGN (09)

Tool design objectives - tool design in manufacturing - planning the design - principles of supporting and locating elements - referencing, basic rules of locating - planes of movement -locating from a flat surface - locating from internal and external diameter - external profile -ejectors - principles of clamping and work holding – types - non mechanical clamping - clamping accessories - materials used in jigs and fixtures.

DESIGN OF JIGS (09)

Drill bushes – different types of jigs - plate latch, channel, box, angle plate, post, turnover, pot jigs - Automatic drill jigs - Rack and pinion operated, air operated jigs - design and development of jigs for simple components.

DESIGN OF FIXTURES (09)

General principles of boring, lathe, milling and broaching fixtures - Grinding, planning and shaping fixtures, assembly, Inspection and welding fixtures- modular fixtures - design and development of fixtures for simple component.

PRESS TOOLS (09)

Press working terminology - presses and accessories - tonnage requirements - shearing action - die and punch elements - strippers, knockouts, stops, pilots, selection of standard die sets - strip lay out calculations - design and development of progressive, combination and compound dies for blanking and piercing operations.

DESIGN OF DIES (09)

Design and development of bending dies, forming dies and drawing dies - design of forging dies - design considerations in forging - extrusion - design of thermoplastic injection moulds.

TOTAL: 45 Hours

TEXT BOOKS

1. Kempster, ***"Jigs and Fixtures Design",*** *The English Language Book Society, 1998.*
2. Joshi P.H, ***"Jigs and Fixtures",*** *Tata McGraw-Hill Publishing Company Limited, New Delhi 2004.*
3. Donaldson C, ***"Tool Design",*** *Tata McGraw-Hill, New Delhi, 2003.*
4. Elanchezhian, B. Vijayaramnath, T. Sunder selwya, ***"Design Of Jigs, Fixtures and press tools",*** *The Science and Tech Book Publishers, Chennai, 2005.*

REFERENCES

1. Edward G Hoffman, ***"Jigs and Fixture Design",*** *Thomson – Delmar Learning, Singapore, 2004.*
2. Hiram E Grant, ***"Jigs and Fixture"*** *Tata McGraw Hill, New Delhi, 2003.*
3. ***"Fundamentals of Tool Design",*** *CEEE Edition, ASTME, 1983.*

08M7E4 - IC ENGINES

L	T	P	C
3	0	0	3

SPARK IGNITION ENGINES (09)

Spark ignition engine mixture requirements - feedback control carburetors - fuel injection systems - monopoint and multipoint injection - stages of combustion - normal and abnormal combustion-factors affecting knock - combustion chambers - introduction to thermodynamic analysis S.I. engine combustion

COMPRESSION IGNITION ENGINES (09)

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 - turbo charging - introduction to thermodynamic analysis of C.I. engine combustion

POLLUTANT FORMATION CONTROL (09)

Pollutant - sources and types - formation of NOX - hydro-carbon emission mechanism - carbon monoxide formation - particulate emissions - methods of controlling emissions-catalytic converters and particulate traps methods of measurements and driving cycles.

ALTERNATIVE FUELS (09)

Alcohol, hydrogen, natural gas and liquified petroleum gas - properties, suitability, engine modifications, merits and demerits as fuels - bio fuels

RECENT TRENDS (09)

Turbine and Wankel - gasoline direct injection engine – Jatropha run engines - homogeneous charge compression Ignition - plasma Ignition - measurement techniques

TOTAL: 45 Hours

TEXT BOOKS

1. *John B. Heywood,* ***"Internal Combustion Engine Fundamentals ",*** *McGraw Hill, 1988.*
2. *Maleev* ***"Internal Combustion Engines",*** *McGraw Hill, 1989.*

REFERENCES

1. *M.L... Mathur and R.P.Sharma, "* ***Internal Combustion Engines"*** *Dhanpat Rai & Sons, New Delhi, 2005.*
2. *Rowland S.Benson and N.D.Whitehouse, "* ***Internal combustion Engines ",*** *Vol. I and II, Pergamon Press, 1983.*
3. *Duffy Smith,* ***"Auto fuel Systems ",*** *The Good Heart Willox Company, Inc., 1987.*

08M7E5 – NUMERICAL METHODS

(Common to Civil, EEE, EIE, CSE, IT)

L	T	P	C
3	1	0	4

SOLUTIONS OF EQUATIONS AND EIGEN VALUE PROBLEMS (09)

Iterative method – Newton – Raphson Method for single variable and for simultaneous equations with two variables – Solutions of Linear system by Gaussian , Gauss – Jordan , Croute's and Gauss – Seidel Methods – Relaxation Method – Eigen value of a Matrix by Power Method.

INTERPOLATION (09)

Operators – relation between the operators – Newton's divided difference formula – Langrange's and Hermite's Polynomials – Newton forward and backward difference formulae – Sterlings and Bessel's Central difference formulae.

NUMERICAL DIFFERENTIATION AND INTEGRATION (09)

Numerical differentiation with Interpolation Polynomials – numerical Integration by trapezoidal and Simpson's (Both $1/3^{rd}$ and $3/8^{th}$) rules – two and three point Gaussian quadrature formula – double integrals using trapezoidal and Simpson's Rules – difference equation.

INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS (09)

Single step methods – Taylor series , Euler and modified Euler , Runge – Kutta method of order four for first order differential equations – multistep methods – Milne and Adam's – Bashforth predictor and corrector methods.

BOUNDARY VALUE PROBLEMS FOR ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS (09)

Finite difference solutions for the second order ordinary differential equations – finite difference solutions for one dimensional heat equation (Both Implicit and Explicit) – One – dimensional wave equation and two dimensional Laplace and Poisson equations.

TOTAL: 45 Hours

TEXT BOOKS

1. *Kandasamy. P, Thilagavathy. K, Gunavathy. K.,* ***"Numerical methods",*** *S. Chand and Co., New Delhi, 2003.*
2. *Veerarajan. T and Ramachandran. T.,* ***"Numerical Methods with Programming in C",*** *Tata McGraw Hill Publishers, New Delhi, 2007.*
3. *Balagurusamy .E.* ***"Numerical Methods",*** *Tata McGraw Hill Publishers, New Delhi, 1999, reprint 2007.*

REFERENCES

1. *Grewal. B. S. and Grewal. J.S.,* ***"Numerical Methods in Engineering and Science",*** *Khanna Publishers, New Delhi, 1999.*
2. *Gerald.C.F. and Wheatley. P.O.,* ***"Applied Numerical Analysis",*** *(Fifth Edition), Addison Wesley, Singapore, 1998.*
3. *Sastry. S. S.,* ***"Introductory methods of numerical Analysis"*** *(Third edition), Prentice Hall of India, New Delhi , 1998.*

08M7E6 - COMPUTATIONAL FLUID DYNAMICS

L	T	P	C
3	0	0	3

GOVERNING EQUATIONS AND BOUNDARY CONDITIONS (09)

Basics 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 partial differential equations on computational fluid dynamics - elliptic, parabolic and hyperbolic equations.

DISCRETISATION AND SOLUTION METHODOLOGIES (09)

Methods of deriving the discretisation equations - Taylor series formulation – finite difference method – control volume formulation – spectral method. Solution methodologies - direct and iterative methods, Thomas algorithm, Relaxation method, implicit method.

HEAT CONDUCTION (09)

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

CONVECTION AND DIFFUSION (09)

Finite volume formulation of steady one-dimensional convection and diffusion problems, central, upwind, hybrid and power-law schemes - discretisation equations for two dimensional convection and diffusion.

CALCULATION OF FLOW FIELD (09)

Representation of the pressure - gradient term and continuity equation - staggered grid - momentum equations - pressure and velocity corrections – equation - simple algorithm. Turbulence models - mixing length model, two equation (k-ε) models.

TOTAL: 45 Hours

TEXT BOOKS

1. *Versteeg, H.K, and Malalasekera, W.,* ***"An Introduction to Computational Fluid Dynamics: The Finite Volume Method",*** *Longman, 2006.*
2. *Ghoshdastidar, P.S.,* ***"Computer Simulation of flow and heat transfer",*** *Tata McGraw-Hill Publishing Company Ltd., 2006.*
3. *Muralidhar, K and Sundarajan .T.* ***"Computational Fluid Flow and Heat Transfer",*** *Narosa Publishing House, New Delhi, 2005.*

REFERENCES

1. *Patankar, S.V.,* ***"Numerical Heat Transfer and Fluid Flow",*** *McGraw-Hill, 1980. Ane-Books 2007, Indian Edition.*
2. *Bose, T.K.,* ***"Numerical Fluid Dynamics",*** *Narosa publishing House, 2006.*
3. *Muralidhar, K and Biswas* ***"Advanced Engineering Fluid Mechanics",*** *Narosa Publishing House, New Delhi, 2007.*
4. *Anderson, J.D.,* ***"Computational fluid dynamics – the basics with applications",*** *2006.*

08M7E7-COMPOSITE MATERIALS

(Common to Production Engineering)

L	T	P	C
3	0	0	3

INTRODUCTION TO COMPOSITES (8)

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

POLYMER MATRIX COMPOSITES (12)

Polymer matrix resins – thermosetting resins, thermoplastic resins – reinforcement fibres – rovings – woven fabrics – non woven random mats – various types of fibres. PMC processes - hand lay up processes – spray up processes – compression moulding – reinforced reaction injection moulding - resin transfer moulding – pultrusion – filament winding – injection moulding. Fibre reinforced plastics (FRP), glass fibre reinforced plastics (GRP).

METAL MATRIX COMPOSITES (9)

Characteristics of MMC, various types of metal matrix composites alloy vs. MMC, advantages of MMC, limitations of MMC, metal matrix, reinforcements – particles – fibres. Effect of reinforcement - volume fraction – rule of mixtures. Processing of MMC – powder metallurgy process - diffusion bonding – stir casting – squeeze casting.

CERAMIC MATRIX COMPOSITES (9)

Engineering ceramic materials – properties – advantages – limitations – monolithic ceramics - need for CMC – ceramic matrix - various types of ceramic matrix composites- oxide ceramics – non oxide ceramics – aluminium oxide – silicon nitride – reinforcements – particles- fibres- whiskers. Sintering - hot pressing – cold isostatic pressing– hot isostatic pressing.

ADVANCES IN COMPOSITES (7)

Carbon /carbon composites – advantages of carbon matrix – limitations of carbon matrix carbon fibre – chemical vapour deposition of carbon on carbon fibre perform. Composites for aerospace applications.

TOTAL: 45 Hours

TEXT BOOKS

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

REFERENCES

1. *Clyne T.W. and Withers P.J.,* ***"Introduction to Metal Matrix Composites",*** *Cambridge University Press, 1993.*
2. *Strong A.B.,* ***"Fundamentals of Composite Manufacturing",*** *SME, 1989.*
3. *Sharma S.C.,* ***"Composite materials",*** *Narosa Publications, 2000.*

08M7E8 - ROBUST DESIGN

(USE OF APPROVED STATISTICAL TABLES IS PERMITTED)
(Common to Production Engineering)

L	T	P	C
3	0	0	3

INTRODUCTION TO QUALITY BY DESIGN (09)

Introduction - goal post philosophy – Taguchi loss function – comparison of philosophies - basics of quality by design - Taguchi's definition of quality- -reducing loss -classification of data types - quality characteristics - selection.

DESIGN PROCESS (09)

Introduction - comparison of the classical and Taguchi's approach - objective of engineering design - variability due to noise factors - examples of noise - role of various quality control activities - product design and quality control - prediction of the process average under optimum condition.

ORTHOGONAL ARRAYS AND MATRIX EXPERIMENTS (09)

Introduction- matrix experiments - orthogonal arrays – degrees of freedom of orthogonal arrays – interaction effects -selecting an orthogonal array – prediction of the process average – sliding levels

SIGNAL-TO-NOISE RATIO (09)

Signal-to-noise (SN) ratio for static problems - SN ratio- operating window-Relation ship between SN ratio and quality loss and its applications - simple problems in optimisation.

CONDUCTING AN EXPERIMENT (09)

Introduction to analysis of variance - classification of experimental design – randomized block design – completely randomized design – two level factorial experiments - robust Design Experiment - selection of orthogonal array – planning the experiments — analysis of signal – to - noise ratios – analysis of experiments.

TOTAL: 45 Hours

TEXT BOOKS

1. *Philip J Rose,* ***" Taguchi techniques for quality engineering",*** *Prentice Hall, 2005.*
2. *Nicolo Belavendram,* ***"Quality by Design, Taguchi techniques for Industrial experimentation",*** *Prentice Hall, 1995.*
3. *Montgomery D.C., 2001,* ***"Design and Analysis of Experiments",*** *5th Edition, John Wiley & Sons, New York.*

REFERENCES

1. *Sung H Park,* ***"Robust Design and Analysis for Quality Engineering",*** *Chapman & Hall, London, 1996.*
2. *Giani Taguchi, Elssayed A. Elsayed, Thomas C. Hsiang,* ***"Quality Engineering in Production Systems",*** *Mc Graw Hill Book Company, 1989.*
3. *Genichi Taguchi, Subir Chowdhury and Shin Taguchi,* ***"Robust Engineering",*** *McGraw Hill, New York, 2000.*

08M7E9 - TOTAL QUALITY MANAGEMENT

(Common to Production, ECE)

L	T	P	C
3	0	0	3

INTRODUCTION (09)

Definition of quality, dimensions of quality, quality planning, quality costs - basic concepts of total quality management, principles of TQM, leadership concepts - quality council, quality statements, strategic planning, Deming philosophy, barriers to TQM implementation.

TQM PRINCIPLES (09)

Customer satisfaction - customer perception of quality - customer retention, employee involvement - motivation, empowerment, performance appraisal, continuous process improvement - Juran trilogy, PDSA cycle, 5S concept, kaizen, supplier partnership - supplier rating - performance measures

STATISTICAL PROCESS CONTROL (SPC) (09)

Seven old and new tools of quality - statistical fundamentals - population and sample - normal curve - control charts for variables and attributes - process capability - concept of six sigma.

TQM TOOLS (09)

Benchmarking - benchmarking process - quality function deployment (QFD) - house of quality - Taguchi quality loss function - total productive maintenance (TPM) - Failure Mode Effective Analysis (FMEA) - stages of FMEA.

QUALITY SYSTEMS (09)

Need for ISO 9000 and other quality system - ISO 9000:2000 quality system – elements - implementation of quality system - documentation - quality auditing - QS 9000, ISO 14000 - concept, requirements and benefits.

TOTAL: 45 Hours

TEXT BOOKS

1. *Dale H.Besterfield, et al.,* ***"Total Quality Management",*** *Pearson Education Asia, 1999(Indian reprint 2002).*
2. *Subburaj Ramasamy,* ***"Total Quality Management",*** *Tata McGraw Hill, 2008.*

REFERENCES

1. *James R.Evans & William M.Lidsay,* ***"The Management and Control of Quality",*** *(5thEdition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).*
2. *Feigenbaum.A.V.* ***"Total Quality Management",*** *McGraw-Hill, 1991.*
3. *Zeiri.* ***"Total Quality Management for Engineers"*** *Wood Head Publishers, 1991.*

08M7EA - WELDING TECHNOLOGY

L	T	P	C
3	0	0	3

FUNDAMENTALS OF WELDING PROCESSES (09)

Classification and characteristics - welding processes and methods- metallurgical processes and methods - metallurgical processes occurring in welding – heat affected zone, temperature and heat flow in weldments- welding stresses and distortion

SOLID STATE WELDING (09)

Cold welding - ultrasonic welding - explosive welding- diffusion welding- friction welding.

SPECIAL WELDING PROCESSES (09)

Plasma Jet Surfacing - vacuum shielded - electron beam welding - laser beam welding, hybrid welding- brazing and soldering- wetting and spreading- joint design of soldering and brazing, brazing and soldering fluxes.

INSPECTION AND TESTING OF WELDMENTS (09)

Testing of welds - quality in weldment - computer applications in welding- expert systems in welding- weldability of stainless steel, cast iron, aluminum alloys and titanium alloys, low alloy steels and ultra high strength steels - weldability assessment and weldability tests

WELDING OF DISSIMILAR AND NON-METALLIC MATERIALS (09)

Welding of dissimilar metals - welding of ceramics, composites, micro welding of thin components - defects in weldments, mechanism- reasons and remedies of cold cracking- hot cracking- reheated cracking and lamellar tearing- NDT evaluation of weldments.

TOTAL: 45 Hours

TEXT BOOKS

1. *Parmer R.S.*, **"Welding Engineering and Technology",** *Khanna Publishers, New Delhi, 1997.*
2. *Parmer R.S.,* ***"Welding Processes and Technology",*** *Khanna Publishers, New Delhi, 1992.*

REFERENCES

1. *Nadkarni S.V.,* ***"Modern Arc Welding Technology",*** *South Asia Books, 1988.*
2. *Little R.L.,* ***"Welding and welding Technology",*** *Tata McGraw Hill Publishing Co., Ltd., New Delhi, 1989.*
3. *Davis A.C.,* ***"The Science and Practice of Welding",*** *Cambridge University Press, Cambridge, 1993*

08M7EB - PLANT LAYOUT AND MATERIAL HANDLING

L T P C
3 0 0 3

INTRODUCTION (09)

Factors to be considered for location of plant layout - physical facilities - equipments required for plant operation. Capacity, serviceability and flexibility and analysis in selection of equipments space requirements, man power requirements.

PLANT LAYOUT (09)

Plant layout - need for layout, factors influencing product, process, fixed and combination layout - tools and techniques for developing layout, process chart, flow diagram, string diagram, template and scale models - machine data. Layout planning procedure. Visualization of layout revision and improving existing layout, balancing of fabricating and assembly lines.

MATERIAL HANDLING (09)

Principles, importance and scope of material handling. Planning, operation and costing principles - types of material handling systems, factors influencing their choice.

UTILITIES (09)

Industrial buildings and utilities - centralized electrical pneumatic water line systems. Types of building, lighting heating, air-conditioning and ventilation utilities. Planning and maintenance, waste handling statutory requirements. Packing and storage of materials - layout for packaging - packaging machinery - wrapping and packing of materials, cushion materials.

ANALYSYS OF MATERIAL HANDLING (09)

Analysis of material handling - factors involved, motion analysis, flow analysis, graphic analysis, safety analysis, and equipment cost analysis, analysis of operation material handling surveys.

TOTAL: 45 Hours

TEXT BOOKS

1 *James, M. Apple.,* ***"Plant Layout and Material Handling',*** *John Wiley & Sons, INC, 1977.*
2 *Rudenko. N.,* ***"Materials handling equipment",*** *ELnvee Publishers, 1970.*

REFERENCES

1. *James, M. Moore,* ***"Plant Layout and Design",*** *Macmillan Company, NY, 1963*
2. *Muther, R.,* ***"Practical Plant Layout",*** *Mc Graw Hill Book Company, NY, 1955*

08M8E0 - ENERGY ENGINEERING AND AUDIT

L	T	P	C
3	0	0	3

ENERGY AND ENVIRONMENT (09)

Introduction - fossil fuels reserves - world energy consumption - green house effect, global warming - renewable energy sources - environmental aspects utilization - energy prizes - energy policies.

ENERGY CONSERVATION (09)

Energy conservation schemes - industrial energy use - energy surveying and auditing - energy index – energy cost - cost index - energy conservation in engineering and process industry, in thermal systems, in buildings and non-conventional energy resources scheme

ENERGY TECHNOLOGIES (09)

Fuels and consumption - boilers - furnaces - waste heat recovery systems - heat pumps and refrigerators - storage systems - insulated pipe work systems - heat exchangers.

ENERGY MANAGEMENT (09)

Energy management principles - energy resource management - energy management information systems - instrumentation and measurement - computerized energy management - energy Auditing.

ECONOMICS AND FINANCE (09)

Costing techniques - cost optimization - optimal target investment schedule - financial appraisal and profitability - project management.

TOTAL: 45 Hours

TEXT BOOKS

1. *W.R. Murphy and G.Mc KAY* ***"Energy Management "****Butterworths, London, 1982.*
2. *P.R.Trivedi, B.R.Julka,* ***"Energy Management"*** *Common wealth publishers, 1997.*

REFERENCES

1. *David Merick, Richard Marshal,* ***"Energy, present and future options, Vol. I and II ",*** *(1981) John Wiley and Sons.*
2. *Chaigier N.A.* ***"Energy Consumption and Environment ",*** *(1981), McGraw-Hill.*
3. *Ikken P.A. Swart R.J and Zwerves.S,* ***"Climate and Energy ",*** *(1989).*
4. *Ray D.A.* ***"Industrial Energy Conservation ",*** *(1980) Pergamaon Press.*

08M8E1 NANO TECHNOLOGY

L	T	P	C
3	0	0	3

FUNDAMENTAL PRINCIPLES (09)

Definition, classification of functional nanomaterials - size and scale - units, scaling laws, atoms, molecules and clusters, supra molecules - nanoscale phenomena - tunneling, chemical bonds, intermolecular forces, molecular and crystalline structure, hierarchical structures and functionalities - surfaces and interfaces, bulk to surface transition, self assembly and surface reconstruction.

PROPERTIES OF NANOMATERIALS (09)

Size dependence of properties - phenomena and properties of nanoscale - brief introduction to calculational approaches - mechanical / frictional properties, optical properties, electrical transport, magnetic properties.

NANOMATERIAL CHARACTERISATION (09)

Electron microscopy, scanning probe microscope, near field microscopy, micro and near field Raman spectroscopy, surface enhanced Raman spectroscopy, x-ray photo electron spectroscopy.

SYNTHESIS OF NANOMATERIALS (09)

Fabrication techniques: self assembly, self replication, sol - gels, Langmuir - Blodgett thin films, nano lithography - bio inspired synthesis, micro fluidic processes, chemical vapour deposition metals: colloidal gold, silver and metal clusters - semiconductors: cadmium sulphide, silicon - fullerines / carbon nanotubes, nanocomposites, nanoporous materials, biological materials.

APPLICATIONS OF NANOMATERIALS (09)

Nanoelectronics - nano sensors - environmental - biological - energy storage and fuel cells.

TOTAL: 45 Hours

TEXTBOOK

1. *Edelstein A.S. and Cammarata R.C.,* ***"Nanomaterials – Synthesis, Properties and Applications",*** *Institute of Physics Publishing, London, 1998.*
2. *Dreselhaus M.S., Dreselhaus G., and Eklund P.,* ***"Science of Fullerines and Nano Tubes",*** *Academic Press, 1996.*

REFERENCES

1. *Nalwa H.S.,* ***"Handbook of Nano Structured Materials and Nano Technology",*** *Vol. I – V, Academic Press,*
2. *Benedek G., et al.,* ***"Nano Structured Carbon for Advanced Applications",*** *Kluwer*

08M8E2 -KNOWLEDGE BASED SYSTEMS IN MANUFACTURING

L	T	P	C
3	0	0	3

ARTIFICIAL INTELLIGENCE (09)

Artificial intelligence - expert / knowledge based systems - definition - expert system architecture: software components - knowledge base - inference engine, inference sub systems.

NETWORK (09)

Hardware requirements - knowledge acquisition, knowledge base, knowledge representation - semantic networks - structures - objects, nodes - links attributes values.

EXPERT SYSTES (09)

Knowledge representation - rule based system - heuristic rules - frame based knowledge representation - inference engine components - inference strategies; modus ponens, backward and forward chaining, monotonic and non-monotonic reasoning - search strategies - expert system building tools - languages, shells.

APPLICATIONS IN MANUFACTURING (09)

Commercial software for manufacturing applications in CAD, CAPP, MRP - adaptive control of devices, robotics, process control, fault diagnosis, failure analysis etc; linking expert systems to other software such as DBMS, MIS, MDB, process control and office automation.

APPLICATIONS OF ARTIFICIAL INTELLIGENCE IN ENGINEERING (09)

Knowledge based systems, expert systems, case-based reasoning systems. - Fuzzy logic; neural networks - use of AI for problem solving - consultation and training purposes - applications of AI in engineering – decision support system - condition monitoring and maintenance.

TOTAL: 45 Hours

TEXT BOOKS

1. *Peter Jackson –**"Introduction to Expert systems",** 3rd edition, Addison Wesley Longman, 1999.*
2. *Stuart Russel Peter Norvig **"Artificial Intelligence: A Modern Approach"**- 2nd Edition (Pearson Education), 2003.*

REFERENCES

1. *Elaine Rich, Kevin Knight. **"Artificial Intelligence"** 2nd Edition (1991),(TMH)*
2. *Dan W Patterson **"Introduction to Artificial Intelligence & Expert Systems"** - (Seventh Indian Reprint 1999) (EEE) (PHI).*
3. *Rex Mauss, Jessica Keyes **"Handbook of Expert Systems in Manufacturing"** - (McGraw Hill).*

08M8E3- MACHINE TOOL DESIGN

L	T	P	C
3	0	0	3

STATIC AND DYNAMIC STIFFNESS, FORCE ANALYSIS (09)

Static stiffness and compliance – deformation caused by weight, forces – deformation caused by cutting forces – forced vibrations, self – excited vibrations. Force distribution in different parts of lathe, drilling machine, milling machine and planning machines.

DESIGN OF STRUCTURES (09)

Beds, columns and housing for maximum strength and rigidity – cast and welded construction, - CNC machine tools, - structure – main drive and feed drive – ball screws – automatic tool changers – chip conveyors – tool magazines – tool turrets.

DESIGN OF SLIDE WAYS (09)

Selection of materials – integrated and attached ways – hydro-static guide ways – aero-static guide ways – antifriction guide ways – design of friction guide ways – plastic inserted guide ways and LM guide ways.

DESIGN OF MACHINE TOOL SPINDLES AND DRIVES (09)

Design requirements – standards – selection of spindle bearings – materials for spindles – typical spindle design _ design considerations of electrical, mechanical and hydraulic drives in machine tools.

MECHINE TOOL CHATTER (09)

The dynamics of cutting process – physical causes of chatter – theory of machine tool chatter – chatter in different types of machines tools – milling machine, lathes and grinding machines – the theory of chatter with several degree of freedom – chatter suppression. Design of control mechanisms – selection of standard components – dynamic measurements of forces and vibrations in machine tools – use of vibration dampers.

TOTAL: 45 Hours

TEXT BOOKS

1. Sen and Bhattacharya, ***" Principles of Machine Tools",*** *New Central Book Agency, Calcutta, 1992.*

REFERENCES

1.Mehta .N.K, ***"Machine Tool Design"*** *Tata McGraw Hill, 1989.*
2.Koenisberger. F., ***"Design Principles of Metal cutting Machine Tools"*** *pergamon press,1964*
3.Acherkan .N. ***"Machine Tool Design",*** *Vol. 3&4, MIR Publishers, Moscow, 1968.*

08M8E4 DESIGN FOR MANUFACTURE

L	T	P	C
3	0	0	3

INTRODUCTION (5)

General design principles for manufacturability - strength and mechanical factors, mechanisms selection, evaluation method, process capability - feature tolerances geometric tolerances - assembly limits -datum features - tolerance stacks.

FACTORS INFLUENCING FORM DESIGN (13)

Working principle, material, manufacture, design- possible solutions - materials choice - influence of materials on form design - form design of welded members, forgings and castings.

COMPONENT DESIGN - MACHINING (8)

Design features to facilitate machining - drills - milling cutters - keyways - doweling procedures, counter sunk screws - reduction of machined area- simplification by separation - simplification by amalgamation - design for machinability - design for economy - design for clampability - design for accessibility - design for assembly.

COMPONENT DESIGN - CASTING (10)

Redesign of castings based on parting line considerations - minimizing core requirements, machined holes, redesign of cast members to obviate cores. Identification of uneconomical design - modifying the design - group technology.

DESIGN FOR ENVIRONMENT (9)

Introduction – environmental objectives – global issues – regional and local issues – basic design for envirinment methods – design guidelines – lifecycle assessment method – techniques to reduce environmental impact –design for energy efficiency – design to regulations and standards.

Total : 45 Hours

TEXT BOOKS

1.Robert Matousek, ***" Engineering Design- A systematic approach" ,*** *Blackie&sons ltd., 1963*
2.Harry Peck, ***"Design for Manufacture",*** *Pitman Publishers, 1983.*

REFERENCES:

1.Boothroyd, G, 1980 ***"Design for Assembly Automation and Product Design".*** *New York, Marcel Dekker.*
2.Bralla, ***"Design for Manufacture handbook",*** *McGraw hill, 1999.*

08M8E5 - NEWER PRODUCTION PROCESSES

L	T	P	C
3	0	0	3

MODERN MACHINING PROCESS (5)

New methods of production, need and capacity analysis of various processes – classification and selection of technology – mechanical processes – abrasive jet machining (AJM), water jet machining (WJM), ultrasonic machining (USM)

ELECTROCHEMICAL AND CHEMICAL METAL REMOVAL PROCESSES (8)

Electrochemical machining (ECM), electrochemical grinding (ECG), electrochemical deburring and honing – chemical machining (CHM)

THERMAL METAL REMOVAL PROCESSES (10)

Electric discharge machining (EDM), wire cut electric discharge machining (WEDM). Plasma arc machining (PAM), electron beam machining (EBM), laser beam machining (LBM), Ion Beam machining (IBM).

FORMING PROCESSES AND FOUNDRY TECHNIQUES (10)

Explosive forming, Electro – hydraulic forming, electro – magnetic forming, dynapak machine-high pressure moulding, squeeze casting, vacuum castings.

RAPID PROTOTYPING (12)

Introduction – advantages – limitations – principle – rapid prototyping systems – stereo lithography(SLA), selective laser sintering(SLS), fused deposition modeling(FDM), laminated object manufacturing(LOM), solid ground curing(SGC), three dimensional printing. Application of reverse engineering in rapid prototyping.

TOTAL: **45 Hours**

TEXT BOOKS

1. *P.C.Pandey,* ***"Modern machining processes",*** *Tata McGraw Hill publishing company Ltd. 1995.*
2. *P.C.Sharma,* ***"A text book of Production Technology",*** *S.Chand & Company Ltd. 2007*

REFERENCES

1. *Bhattacharya,* ***"New Technology",*** *Institution of Engineers, 1997.*
2. *CMTI,****"Electrochemical machining",*** *Bangalore, 1978.*
3. *Gary.F.Benedict,* ***"Nontraditional machining Processes",*** *Marcell Dekker Inc, 1987*
4. *HMT,* ***"Production Technology",*** *Tata McGraw Hill Publishers, 1992.*
5. *Ronenthal. C* ***"Principles of Metal Castings",*** *Tata McGraw Hill Publishing co. Ltd, 1996.*

08M8E6 SUPPLY CHAIN MANAGEMENT

L	T	P	C
3	0	0	3

STRATEGIC FRAME WORK (9)

Supply chain - concepts, definitions, approaches, factors affecting logistics - basic tasks of the supply chain - drivers of supply chain performance - framework for structuring drivers - the new corporate model.

SUPPLY CHAIN NETWORK (9)

The new paradigm - forward and backward, the modular company, the network relations, supply process, procurement process - the role of distribution in the supply chain - factor influencing distribution network design.

EVOLUTION OF SUPPLY CHAINS (9)

Strategy and structure - factors of supply chain - manufacturing stages - supply chain progress - model for competing through supply chain management - PLC grid - supply chain redesign -linking supply chain with customer.

SUPPLY CHAIN ACTIVITY SYSTEMS (9)

Structuring the supply chain - supply chain and new products - functional roles in supply chain - supply chain design frame - work, collaborative product commerce (CPC).

SCM ORGANISATION AND INFORMATION SYSTEM (9)

The management task - logistics organization - logistics information system - topology of sc application - MRP, ERP, warehouse management system - product data management - case studies.

TOTAL: 45 Hours

TEXT BOOKS:

1. *Ayers, J.B.,* ***"Hand book of supply chain management",*** *The St. Lencie press, 2000.*
2. *Scharj, P, B., Lasen, T.S.,* ***"Managing the global supply chain, Viva books",*** *New Delhi, 2000*

REFERENCES:

1. *Nicolas, J.N.,* ***"competitive manufacturing management – continuous improvement, Lean Production, customer focused quality",*** *McGraw Hill, 1998.*
2. *Steudel, H.J. and desruelle, P.,* ***"Manufacturing in the ninetees – How to become a mean lean and world class competitor",*** *Van Nostrand Reinhold, NY, 1992.*
3. *Rahul V Altekar,* ***"Supply Chain Management – Concepts and Cases",*** *Prentice Hall of India Pvt Ltd., New Delhi, 2005.*
4. *Sunil Chopra., Peter Meindl.,* ***"supply Chain Management, Pearson Education, Inc".*** *Second Edition, 2005.*

08M8E7 - INDUSTRIAL TRIBOLOGY

(Use of approved data book is permitted)

L	T	P	C
3	0	0	3

INTRODUCTION (09)

Introduction – Navier Stoke's equations – derivation of Reynolds equation from Navier Stoke's equations – energy equation – mechanisms of pressure development — Idealized journal bearing – Infinitely long, short and gas lubricated bearings.

LUBRICATION PRINCIPLES (08)

Lubricants and their physical properties – Lubrication Regimes – Elasto, Plasto and Magneto hydrodynamic lubrication – hydrostatic lubrication – gas lubrication.

SURFACE TOPOGRAPHY, FRICTION AND WEAR (09)

Surface interactions, surface topography, roughness measurements, Hertzian contacts, Real area of contact, Theories of friction, Friction of metals and non-metals, Temperature of sliding surfaces, Stick-slip, Rolling friction. Wear of metals, Adhesive, Abrasive and corrosive wear, erosion, fatigue and impact wear, Wear of elastomers, wear of ceramics and composite materials, Measurement of friction and wear.

FLUID FILM BEARINGS (10)

Performance characteristics – Numerical solutions – Hydrodynamic instability – Bearing design – Idealized hydrodynamic bearings - Plane slider bearings - Thrust bearings and Multi recess pad bearings - Analysis of externally pressurized Bearings.

TRIBO MEASUREMENT IN INSTRUMENTATION (07)

Surface topography measurements–Electron microscope and friction and wear measurements – Laser method – Instrumentation –International standards–Bearings performance measurements – Bearing vibration measurement.

TOTAL: 45 Hours

REFERENCES

1. *Cameron, A., "**Basic lubrication theory",** Ellis Herward Ltd, UK, 1981.*
2. *Williams, J.A., **"Engineering Tribology",** Oxford University Press, 1994.*
3. *Moore, D.F, **"Principles and Application of Tribology",** Pergamon Press, New York*
4. *Sushil Kumar Srivastava , **" Tribology in Industries",** S.Chand & Company Ltd, New Delhi*

08M8E8 - PROGRAMMING IN JAVA

L	T	P	C
3	1	0	4

INTRODUCTION TO JAVA AND OBJECTS (09)

Introduction to Java, data types, variables, arrays and operator, control statements, looping statements - break and continue statements - classes, objects, methods, constructors, garbage collections, method overloading, inheritance, polymorphism, method overriding.

PACKAGES AND STRINGS (09)

Packages and interfaces – packages statement - import statement – access protection, the interface statement – the implements statement – string handling – string buffer class – operations – character extraction – string comparison – modifying a string.

EXCEPTION HANDLING AND MULTI-THREADING (09)

Exception handling – fundamentals - exception types - try and catch - multiple catch clause - nested try statement - throw, throws and finally – multi-threading – single thread, thread priorities, synchronization - runnable interface.

JAVA APPLETS AND HTML (09)

Applets – applet class, life cycle of an applet, graphics methods, colot methods, fonts – drawstring, using font metrices – introduction to html – formatting tags – list-ordered list, unordered list – tables – pictures – creating forms.

WINDOW TOOL KIT AND TEXT HANDLING (09)

Abstract window tool kit – components – container, label, button, checkbox, checkbox group and list – text components – text components class - textfield, textarea, scrollbar, layout manager - events.

TOTAL: 45 Hours

TEXT BOOKS

1. *E.Balagurusamy* ***"Programming in the Java- A Primer",*** *Tata McGraw-Hill, New Delhi, 3rd Edition 2007.*
2. *Herbert Schild* ***"The complete Reference Java 2.0",*** *Tata McGraw Hill, 2002.*

REFERENCES

1. *Hebert Schildt* ***"The Complete Reference",*** *Tata McGraw Hill Publishing Company Ltd, New Delhi, 7th Edition 2006.*
2. *Patrick Naughton* ***"The Java Hand Book",*** *Tata McGraw Hill Publishing Company Ltd, New Delhi, Fifteenth Reprint 2003.*
3. *Deitel. H.M. and Deitel P.J. Pearson* ***"Java: How to program",*** *Education Asia, International Edition. 1997.*

08M8E9 PRECISION ENGINEERING

L	T	P	C
3	0	0	3

FUNDAMENTALS OF PRECISION ENGINEERING (08)

History of precision engineering- principles and definitions of precision machine design-prototyping and full production from ultra precision machining through micro-engineering-microelectronics and molecular manipulation- application of displacement transducers to machines and instruments-tolerance technology.

ULTRAPRECISION AND MICROMACHINING PROCESSES (10)

Atomic structure- electrical and physical properties of atoms- diamond turning, grinding and polishing- effects of tooling, material and the environment on the surface characteristics of workpieces - material removal using electron, photon, ion beams - molecular beam epitaxy, chemical and physical vapour deposition- advanced sputtering and ion-implantation- deposition techniques-process controls and film characteristics.

PRECISION MECHANISM DESIGN (10)

Fundamental concepts in designing precision machinery - metrological instrumentation, ultra-precision motion generators and precision assembly- flexure mechanisms for precision engineering-mechanics of contact, kinetic coupling, vibration isolation and material selection- actuators and sensors to control mechanisms- manufacturing of micron scale machinery and structures using non-conventional processes.

OPTICAL ENGINEERING (09)

Coherent optics - fibre optics - geometrical optics - paraxial optics, monochromatic and chromatic aberrations- computer evaluation of optical systems, spot diagrams, MTF- light sources, detectors and imaging systems- industrial laser applications and optical systems- optical interferometry - applications to precision measurement.

PRECISION OF NUMERICAL CONTROL SYSTEMS (08)

Errors due to numerical interpolation and displacement measurement system – periodic errors - errors due to velocity lags - transient response slide ways friction - feed drive stiffness – zero stability.

TOTAL: 45 Hours

TEXT BOOKS

1. *Raman. R* ***"Elements of Precision Engineering"*** *Oxford & I B H Publishing Co. 1984*
2. *Murty. R.L.* ***"Precision Engineering in Manufacturing"*** *New Age International Publishers, 1996.*
3. *Gary. F. Benedict* ***"Non-traditional Manufacturing Processes"*** *Marcel Dekker, Inc. New York, 1992.*

REFERENCES

1. *Kovan.V,* ***"Fundamentals of Process Engineering",*** *Foreign Languages Publishing House (FLPH), Moscow, 1986.*
2. *Gopel,* ***"Sensors – A comprehensive Survey"*** *Vol I to Vol VIII, Second Edition, BCH Publisher, New York, 1999.*
3. *Davidson,* ***"Handbook of Precision Engineering",*** *Vol. 1 & 2, McMillan, 1972.*
4. *Mark J Madou,* ***"Fundamentals of Micro Fabrication",*** *CRC Press, 2002.*

08M8EA RELIABILITY AND TOTAL PRODUCTIVE MAINTENANCE

L	T	P	C
3	0	0	3

INTRODUCTION (10)

Reliability function - MTBF - MTTR - mortality curve - availability -maintainability.

FAILURE DATA ANALYSIS 08)

Repair time distributions - exponential, normal, log normal, gamma, and weibull - reliability data requirements - graphical evaluation.

RELIABILITY PREDICTION (12)

Failure rate estimates - effect of environment and stress - series and parallel systems - RDB analysis – standby systems - complex systems.

RELIABILITY MANAGEMENT (05)

Reliability demonstration tests - reliability growth testing - Duane curve - risk assessment - FMEA, fault tree.

TOTAL PRODUCTIVE MAINTENANCE (10)

Causes of machine failures - downtime - maintenance policies - restorability predictions - replacement models- spares provisioning - maintenance management - cleanliness and house keepin

TOTAL: 45 Hours

TEXT BOOKS

1. *Paul Kales, Reliability for technology,* ***"Engineering and Management ",*** *Prentice Hall, New Jersey, 1998.*
2. *Modarres,* ***"Reliability and Risk Analysis ",*** *Meral Dekker Inc., 1993.*

REFERENCES

1. *Gopalakrishnan.P, and Banerji A.K.,* ***"Maintenance and Spare Parts Management ",*** *PrenticeHall of India, New Delhi, 1996.*
2. *Telsang Mertand.T,* ***"Industrial Engineering And Production Management",****S.Chand&CO., 2004*

08M8EB - PRODUCT DEVELOPMENT STRATEGIES

L	T	P	C
3	0	0	3

INTRODUCTION (09)

Product development versus design-types of design and redesign-modern production development process - reverse engineering and redesign - product development process – S-curve-new product development.

PRODUCT TEARDOWN (09)

Gathering customer needs - organizing and prioritizing customer needs-establishing product function - FAST method-establishing system functionality. Tear down method-post teardown report-benchmarking and establishing engineering specifications-product portfolios.

GENERATING CONCEPTS (08)

Information gathering-brain ball-C-sketch/6-3-5 method-morphological analysis-concept selection-technical feasibility-ranking-measurement theory- Design for Manufacture and Assembly (DFMA) - design for robustness

DESIGN FOR ENVIRONMENT (10)

Methods - life cycle assessment-weighted sum assessment method-techniques to reduce environmental impact – disassembly-recyclability-remanufacturing regulations and standards-analytical and numerical model solutions.

PHYSICAL PROTOTYPES (09)

Types of prototypes - use of prototypes-rapid prototyping technique - scale - dimensional analysis and similitude - physical model and experimentation – design of experiments-statistical analysis of experiments.

TOTAL: 45 Hours

TEXT BOOKS

1. *Karl. T. Ulrich and Stephen D. E.Pipinger,* ***"Product Design and Development",*** *McGraw Hill, New York, 1994.*

REFERENCES

Kevin Otto, Kristin Wood, ***"Product Design – Techniques in Reverse Engineering and New Product Development",*** *Pearson Education, New Delhi, 2004.*