

**2008
REGULATIONS**

**PRODUCTION ENGINEERING
FULL TIME B.E.**

CURRICULUM and SYLLABI



GOVERNMENT COLLEGE OF TECHNOLOGY, COIMBATORE—641 013

An Autonomous Institution — Anna University

**Curriculum (I - VIII SEM)
&
Syllabus (I – VIII SEM)**

CANDIDATES ADMITTED DURING 2008 - 2009 AND ONWARDS

**B.E. PRODUCTION ENGINEERING [FULL TIME]
CURRICULAM FOR CANDIDATES ADMITTED DURING 2008-2009 AND ONWARDS**

S.No	Subject Code	Course Title	Sessional Marks	Final Exam Marks	Total Marks	Credits			
						L	T	P	C
I SEMESTER									
1.	08P1Z1	Communication Skills in English – I	50	50	100	3	1	0	4
2.	08P1Z2	Engineering Mathematics - I	50	50	100	3	1	0	4
3.	08P1Z3	Applied Physics	50	50	100	3	0	0	3
4.	08P1Z4	Applied Chemistry	50	50	100	3	0	0	3
5.	08P105	Engineering Mechanics	50	50	100	3	1	0	4
Practical									
6.	08P106	Engineering Graphics	50	50	100	2	0	3	4
7.	08P1Z7	Physics Lab	50	50	100	0	0	3	2
8.	08P1Z8	Chemistry Lab	50	50	100	0	0	3	2
		Total			800				26

S.No	Subject Code	Course Title	Sessional Marks	Final Exam Marks	Total Marks	Credits			
						L	T	P	C
II SEMESTER									
1.	08P2Z1	Communication Skills in English – II	50	50	100	3	1	0	4
2.	08P2Z2	Engineering Mathematics – II	50	50	100	3	1	0	4
3.	08P2Z3	Materials Science	50	50	100	3	0	0	3
4.	08P204	Environmental Science and Engineering	50	50	100	3	0	0	3
5.	08P205	Basics of Electrical Sciences	50	50	100	3	0	0	3
6.	08P206	Programming in C and C++	50	50	100	3	0	2	4
Practical									
7.	08P207	Engineering Graphics and Drafting Lab	50	50	100	0	0	3	2
8.	08P208	Workshop	50	50	100	0	0	3	2
		Total			800				25

S.No	Subject Code	Course Title	Sessional Marks	Final Exam Marks	Total Marks	Credits			
						L	T	P	C
III SEMESTER									
1.	08P3Z1	Engineering Mathematics III	50	50	100	3	1	0	4
2.	08P302	Fluid Mechanics and Machinery	50	50	100	3	1	0	4
3.	08P303	Electrical Drives	50	50	100	3	0	0	3
4.	08P304	Electronics, Microprocessors and Microcontrollers	50	50	100	3	0	0	3
5.	08P305	Strength of Materials	50	50	100	3	1	0	4
6.	08P306	Production Technology	50	50	100	3	0	0	3
Practical									
7.	08P307	A). Electrical Engineering Lab	25	25	100	0	0	3	1
		B). Microprocessor Laboratory	25	25		0	0	3	1
8.	08P308	Production Drawing	50	50	100	1	0	3	2
		Total			800				25

S.No	Subject Code	Course Title	Sessional Marks	Final Exam Marks	Total Marks	Credits			
						L	T	P	C
IV SEMESTER									
1.	08P401	Numerical Methods & Probability	50	50	100	3	1	0	4
2.	08P402	Manufacturing Processes	50	50	100	3	0	0	3
3.	08P403	Engineering Materials and Metallurgy	50	50	100	3	0	0	3
4.	08P404	Thermal Sciences	50	50	100	3	0	0	3
5.	08P405	Mechanics of Machines	50	50	100	3	1	0	4
6.	08P406	Machine Tools and CNC Machines	50	50	100	3	0	0	3
Practical									
7.	08P407	A). Strength of Materials Lab	25	25	100	0	0	3	1
		B). Fluid Mechanics and Machinery Lab	25	25		0	0	3	1
8.	08P408	A). Metallurgy Laboratory	25	25	100	0	0	3	1
		B). Thermal Engineering Lab	25	25		0	0	3	1
		Total			800				24

S.No	Subject Code	Course Title	Sessional Marks	Final Exam Marks	Total Marks	Credits			
						L	T	P	C
V SEMESTER									
1.	08P501	Metrology and Computer Aided Inspection	50	50	100	3	0	0	3
2.	08P502	Machine Elements Design	50	50	100	3	1	0	4
3.	08P503	Production Management	50	50	100	3	0	0	3
4.	08P504	Modern Control Technology	50	50	100	3	0	0	3
5.	08P505	Theory of Metal Machining	50	50	100	3	1	0	4
6.	08P506	Fluid Power Drives and Controls	50	50	100	3	0	0	3
Practical									
7	08P507	Computer Aided Design Laboratory	50	50	100	0	0	3	2
8.	08P508	Manufacturing Technology Laboratory-I	50	50	100	0	0	3	2
		Total			800				24

S.No	Subject Code	Course Title	Sessional Marks	Final Exam Marks	Total Marks	Credits			
						L	T	P	C
VI SEMESTER									
1.	08P601	Mechatronic Systems	50	50	100	3	0	0	3
2.	08P602	Robotics and Machine Vision System	50	50	100	3	1	0	4
3.	08P603	Finite Element Techniques	50	50	100	3	1	0	4
4.	08P604	Automation and CIM	50	50	100	3	0	0	3
5.	08P605	Production of Automotive Components	50	50	100	3	0	0	3
6.	08P606	Production Planning and Control	50	50	100	3	0	0	3
Practical									
7.	08P607	Automation and Computer Aided Manufacturing Lab	50	50	100	0	0	3	2
8.	08P608	Modeling and Simulation Laboratory	50	50	100	0	0	3	2
		Total			800				24

S.No	Subject Code	Course Title	Sessional Marks	Final Exam Marks	Total Marks	Credits			
						L	T	P	C
VII SEMESTER									
1.	08P701	Statistical Quality Control and Reliability Engineering	50	50	100	3	0	0	3
2.	08P702	Design of Jigs, Fixtures and Press Tools	50	50	100	3	0	0	3
3.	08P703	Resource Management Techniques	50	50	100	3	1	0	4
4.	08P704	Unconventional Manufacturing Processes	50	50	100	3	0	0	3
5.	E I	Elective : I	50	50	100	3	0	0	3
6.	E II	Elective : II	50	50	100	3	0	0	3
Practical									
7.	08P707	Metrology and Quality Control Laboratory	50	50	100	0	0	3	2
8.	08P708	Manufacturing Technology Laboratory-II	50	50	100	0	0	3	2
		Total			800				23

S.No	Subject Code	Course Title	Sessional Marks	Final Exam Marks	Total Marks	Credits			
						L	T	P	C
VIII SEMESTER									
1.	E Iii	Elective : III	50	50	100	3	0	0	3
2.	E Iv	Elective : IV	50	50	100	3	0	0	3
Practical									
3.	08p801	Project Work	100	100	200	0	0	12	6
		Total			400				12

S.No	Subject Code	Course Title	Sessional Marks	Final Exam Marks	Total Marks	Credits			
						L	T	P	C
ELECTIVE LIST FOR E - I AND E - II : SEVENTH SEMESTER									
1.	08P7E0	Design For Manufacture and Assembly	50	50	100	3	0	0	3
2.	08P7E1	Patent System For Engineers	50	50	100	3	0	0	3
3.	08P7E2	Micro Mechatronics	50	50	100	3	0	0	3
4.	08P7E3	Computer Graphics	50	50	100	3	0	0	3
5.	08P7E4	Sensors in Manufacturing	50	50	100	3	0	0	3
6.	08P7E5	Computational Intelligence in Manufacturing	50	50	100	3	0	0	3
7.	08P7E6	Surface Engineering	50	50	100	3	0	0	3
8.	08P7E7	Composite Materials	50	50	100	3	0	0	3
9.	08P7E8	Robust Design	50	50	100	3	0	0	3
10.	08P7E9	Total Quality Management	50	50	100	3	0	0	3
11.	08P7EA	Advanced Welding Technology	50	50	100	3	0	0	3
12.	08P7EB	Plant Layout and Material Handling Techniques	50	50	100	3	0	0	3

S.No	Subject Code	Course Title	Sessional Marks	Final Exam Marks	Total Marks	Credits			
						L	T	P	C
ELECTIVE LIST FOR E - III AND E - IV : EIGHTH SEMESTER									
1.	08P8E0	Image Processing in Manufacturing	50	50	100	3	0	0	3
2.	08P8E1	Product Design and Process Engineering.	50	50	100	3	0	0	3
3.	08P8E2	Optical Metrology	50	50	100	3	0	0	3
4.	08P8E3	Risk Analysis and Risk Management	50	50	100	3	0	0	3
5.	08P8E4	Planning and Scheduling in Manufacturing	50	50	100	3	0	0	3
6.	08P8E5	Energy Management	50	50	100	3	0	0	3
7.	08P8E6	Micro and Nano Manufacturing	50	50	100	3	0	0	3
8.	08P8E7	Management Information Systems	50	50	100	3	0	0	3
9.	08P8E8	Industrial Safety Engineering	50	50	100	3	0	0	3
10.	08P8E9	Logistics and Supply Chain Management	50	50	100	3	0	0	3
11.	08P8EA	Project Management	50	50	100	3	0	0	3
12.	08P8EB	Intelligent Manufacturing Systems	50	50	100	3	0	0	3

08P1Z1 – COMMUNICATION SKILLS IN ENGLISH I
[COMMON TO ALL BRANCHES]

L T P C
3 1 0 4
(09)

READING

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)

Lecturer: 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*

08P1Z2 – 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.

Lecturer: 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 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

08P1Z3 - APPLIED PHYSICS

[COMMON TO ALL BRANCHES]

L T P C

3 0 0 3

(09)

LASERS

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 and 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 textbook of Engineering Physics" S.Chand and Company Ltd, New Delhi, 2005
3. Arumugam M- "Engineering Physics", Anuradha Publishers, 2002
4. Jayakumar S, "Engineering Physics", RK Publishers, Coimbatore, 2003

08P1Z4 - APPLIED CHEMISTRY
[COMMON TO ALL BRANCHES]

L T P C
3 0 0 3
(09)

POLYMERIC MATERIALS

Basic definitions: Monomers, functionality, degree of polymerization - Coordination polymerization-mechanism, Zeigler- Natta catalysts, applications - Glass transition temperature (T_g), 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 coatings-paints, constituents of paints, mechanism of drying, varnishes, enamels, lacquers – Special paints-fire retardant, luminous, heat resistant paints.

INSTRUMENTAL METHOD OF ANALYSIS

(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 –Thermo gravimetric analysis, factors affecting TG curves, applications, Chromatography, gas chromatography.

INTEGRATED CIRCUITS FABRICATION

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

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 Engineering 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)

08P105 - ENGINEERING MECHANICS
[COMMON TO CIVIL, MECH, EEE, PRODN AND EIE]

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 McGraw Hill publishing Ltd, 1996.*
2. S. Timoshenko and Young, *Engineering Mechanics, McGraw Hill, 4th Edition, 1995*
3. Irving shames, *Engineering Mechanics, Prentice Hall of India Ltd, Delhi, 1980*

08P106 - ENGINEERING GRAPHICS
[COMMON TO ALL BRANCHES EXCEPT IBT]

L T P C
2 0 3 4

OBJECTIVE

to develop graphic skills for communicating concepts, ideas and designs 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

(09)

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.Natarajan '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.

08P1Z7 - 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 Koenig’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.

08P1Z8 - CHEMISTRY LABORATORY
[COMMON TO ALL BRANCHES]

L T P C
0 0 3 2

LIST OF EXPERIMENTS

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.

08P2Z1 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.

Lecturer: 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*

08P2Z2 - 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 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.

08P2Z3 - 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.

NANO MATERIALS 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.

NANO DEVICES 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 Nano Tubes(CNT)-Properties and applications of Carbon Nano Tubes- 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
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 Edn. Macmillan Publishing Company, New York, 2004

08P204 - ENVIRONMENTAL SCIENCE AND ENGINEERING

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

L T P C
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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, SO₂, NO₂, H₂S, CO, CO₂ 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)

08P205 - BASICS OF ELECTRICAL SCIENCES
[COMMON TO MECHANICAL]

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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.

08P206 PROGRAMMING IN C AND C++
[COMMON TO MECHANICAL]

L T P C
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(10)

C FUNDAMENTALS

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

<input type="checkbox"/> Looping	<input type="checkbox"/> Area calculation	<input type="checkbox"/> Files
<input type="checkbox"/> Switch Structure	<input type="checkbox"/> Mark list	<input type="checkbox"/> Matrix multiplication
<input type="checkbox"/> Structures	<input type="checkbox"/> Prime number	<input type="checkbox"/> Biggest number
<input type="checkbox"/> Uses of Classes	<input type="checkbox"/> Switch Structure	<input type="checkbox"/> Sorting numbers and names
<input type="checkbox"/> Function overloading	<input type="checkbox"/> Quadratic equation	
<input type="checkbox"/> Inheritance	<input type="checkbox"/> Matrix addition	

08P207- ENGINEERING GRAPHICS AND DRAFTING LAB
[COMMON TO MECHANICAL]

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(02)

OBJECT CONSTRUCTION

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

MECHANICS

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

DRAFTING

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

INTRODUCTION TO 3D MODELING

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.

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*

08P208 - WORKSHOP
[COMMON TO CIVIL, MECH, EEE, ECE, PRODN, EIE, CSE AND IT]

L T P C
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Plumbing, Sheet metal and Carpentry

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

Welding and Foundry

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

Electrical wiring and Electronic Circuit Practice

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

TOTAL: 45 hours

08P3Z1 - ENGINEERING MATHEMATICS – III
[COMMON TO ALL BRANCHES]

L T P C
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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.

08P302 – FLUID MECHANICS AND MACHINERY
[COMMON TO MECHANICAL]

L T P C

3 1 0 4

FLUID PROPERTIES (08)

Units and 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 & floatation – metacentre and metacentric height(definition only)

FLUID KINEMATICS AND DYNAMICS (12)

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 and efficiencies and losses - performance curves - specific speed. Reciprocation 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

REFERENCE BOOKS

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.

08P303 - ELECTRICAL 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 AND SPECIAL MOTORS

(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 applications – DC and AC servomotors – Types, constructional features and principles of operation of stepper motor.

TOTAL: 45 hours

TEXT BOOKS

1. Theraja B.L. And Theraja A.K., “A Text book of Electrical Technology”, 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
3. I J Nagrath and M Gopal, “Control System Engineering”, New Age International (P) Publication Ltd., 2nd Edition

08P304 – ELECTRONICS, MICROPROCESSORS AND MICROCONTROLLERS

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 Characteristics-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 ARCHITECTURE 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 / write cycle. Software interrupts – hardware interrupts – vectored interrupts - simple assembly language program for 8085A

MICROPROCESSOR INTERFACING AND APPLICATIONS

(09)

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

INTRODUCTION TO MICROCONTROLLERS

(09)

8051 Architecture: comparison of microprocessors and microcontrollers – A microcontroller survey – 8051; Microcontroller hardware – I/O pins, ports – External memory – counters and timers – serial data I/O – interrupts. 8051 Assembly language programming: instruction set of 8051 addressing modes data transfer instructions. Arithmetic and logical instructions jump and call instruction interrupts and returns interrupt handling.

TOTAL : 45 hours

TEXT BOOKS

1. Ramesh S. Gaonker, “Microprocessor Architecture And Programming And Applications 8085 / 8080a”, Penram International Publishing (India) 2004.
2. J. B. Gupta, “Electronic Devices and Circuits”, S K Kataria and Sons, 2nd Edition, 2003
3. Morris Mano M., “Digital Design”, Prentice Hall Of India Pvt. Ltd. 2004
4. Kennath J.Ayala, “The 8051microcontroller Architecture, Programming and Applications”, Penram International publishing (India), Second Edition, Mumbai, 1996

REFERENCE BOOKS

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.
4. Robert Boylestead, “Electronic devices and Circuit theory”, PHI Publication

08P305 STRENGTH OF MATERIALS

L T P C

3 1 0 4

STRESS, STRAIN AND FRAMES

(10)

Simple stresses and strains at a point - Types of external forces — Normal and Shear stresses — Hooke's law - Compound bars - Thermal stresses — Relations between the Elastic constants — combined stresses — stresses in tensile member — Stresses due to pure shearing — two mutually perpendicular direct stresses.

Types of supports — Reactions at supports in two dimensional structures. Types of frames — Analysis of frames by method of joints.

BEAMS

(10)

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. Determinations of deflection curve — Relation between slope, deflection and radius of curvature — Slope and deflection at any section - Macaulay's method only (for sections with uniform EI only.)

BENDING AND SHEARING STRESSES

(09)

Theory of Simple Bending – Analysis of Beams for Stresses – position of neutral axis, moment of resistance, distribution of stress across the section, bending stress in symmetrical section - Combined Direct and Bending Stresses. Shearing Stress at a section in a loaded beam – distribution of shear stress – over a rectangular, circular, I, T sections.

THEORY OF TORSION

(08)

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.

THEORY OF COLUMNS, THIN & THICK CYLINDERS

(09)

Members Subjected to Axial Load and Bending Moment – Short, Medium and Long Columns – End Conditions – Buckling Load for Columns - Euler's Theory for Long Columns – Assumptions and Limitations – Rankine-Gordon Formula – Empirical Formula – Straight Line Formula – Columns Subjected to Eccentric Loading – Rankine's Method – Euler's Method. Thin Cylinders – Circumferential and Longitudinal stresses. – Wire wound thin cylindrical shells. - Thick Cylinders: Lamé's Equation - Compound Cylinders – Shrink Fit.

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

REFERENCE BOOKS

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

08P306 PRODUCTION TECHNOLOGY

L T P C

3 0 0 3

PATTERN MAKING AND MOULDING

(09)

Introduction to Foundry – Steps involved in casting, advantages, limitations and applications of casting process. Pattern types, allowances for pattern, pattern materials colour coding and storing of patterns. Moulding methods and processes – materials, equipment, moulding sand ingredients, essential requirements, sand preparation and control, testing, cores and core making. Design considerations in casting gating and risering and directional solidification in castings.

CASTING PROCESSES

(09)

Sand casting – pressure die casting – permanent mould casting – centrifugal casting – precision investment casting – shell moulding – CO₂ moulding, continuous casting Felting and finishing – Defects in casting. Foundry remelting furnaces – selection of furnace – crucibles oil fired furnaces – electric furnaces – cupola, calculation of cupola charges – Hot blast cupola – degasification – inoculation – pouring equipment – Inspection of castings. Mechanization – Typical Layout – sand reclamation techniques – material handling, pollution control in foundry. Computers in casting process.

BASIC WELDING PROCESSES

(09)

Types of welding- Gas welding-Electric Arc Welding-Gas Tungsten Arc Welding, Gas Metal Arc Welding-Metal transfer mechanism-Submerged Arc Welding- Resistance welding- Spot, Seam, Projection, Percussion, Flash Butt welding- Soldering, Brazing and Braze welding. Special Welding Processes - Electron beam and Laser beam welding-plasma arc welding-stud welding-friction welding-explosive welding-ultrasonic welding-atomic hydrogen welding-Thermit welding-electro gas welding- electro slag welding- Under Water Welding.

WELDING EQUIPMENTS AND AUTOMATION

(09)

Gas welding equipments- welding power sources and characteristics-Duty cycle of a power cycle- AC transformer- rectifiers- DC generator- safety aspects in welding- automation in welding, seam tracking, vision and arc sensing- welding robots. Weld Test And Metallurgy - Defects in welding- causes and remedies-destructive testing methods- NDT of weldments- testing of pipe, plate, boiler, drum, tank- residual stresses-distortion-relieving of stresses- weldability of Stainless steel, Aluminium Alloys.

METAL FORMING PROCESS

(09)

Theory of Plasticity – flow curves – Classification. Mechanics of Metal Forming – Effect of temperatures, speed and metallurgical microstructure on forming process. Forging process – Rolling process – Extrusion Process. Manufacturing tubes – wire drawing – blanking, piercing, bending and deep drawing. Press working – types – Drive Mechanism – Accessories – press working operations.

TOTAL : 45 hours

TEXT BOOKS

1. Banga T R., and Agarwal R L, - *Foundry Engineering*, Khanna Publishers, 1992
2. Khanna.O.P, “*A Text Book of Welding Technology*”– Dhanpat Rai Publications, 1999
3. George E. Dieter, “*Mechanical Metallurgy*”, McGraw Hill International Edition, 2004.

REFERENCE BOOKS

1. Taylor H.F. Flemings M.C. & Wulff J. *Foundry Engineering*, Wiley Eastern Limited, 1993
2. Gupta R.B., *Foundry Engineering*, Satyaprakashan 1989
3. Lal.M and Khanna O.P , *A Textbook of Foundry Technology*, Dhanpat Rai and sons, 1986
4. Parmar.R.S, “*Welding Processes and Technology*”, Khanna Publishers, 1997
5. Little, “*Welding Technology*”, Tata McGraw Hill, 1992
6. Lancaster J.F., “*Metallurgy of Welding*”, George allen and Unwin, 1991
7. Sharma.P.C., “*A Text Book of Production Engineering*”, S.Chand & Co., 2002.
8. Surendra Kumar, “*Metal Forming*”, Khanna Publishers, 1988.
9. Bawa “*Manufacturing Process – I and II*”, Mc.Graw Hill , 2007

08P307 (A) - ELECTRICAL ENGINEERING LAB
[COMMON TO MECHANICAL]

L T P C
0 0 3 1

LIST OF EXPERIMENTS

1. O.C.C. and load-test on Separately Excited DC generator
2. O.C.C. and load-test on DC shunt generator
3. Swinburne's Test
4. Speed control of DC shunt motor
5. Load test on DC shunt motor
6. Load test on DC Compound motor
7. Load test on DC series motor
8. Mechanical parameters of DC shunt motor
9. Mechanical and Iron losses of 3-phase induction motor
10. Circle Diagram of 3-phase induction motor
11. Load test on 3-phase induction motor
12. Load test on 1-phase induction motor
13. Load test on synchronous motor
14. Study of Induction motor starters

TOTAL : 45 hours

08P307 (B) - MICROPROCESSOR LAB

L T P C
0 0 3 1

LIST OF EXPERIMENTS:

1. Conversion of Binary number to BCD
2. Conversion of BCD to Binary
3. Addition and subtraction of 2 , 8 bit numbers.
4. Sorting a series of numbers in Ascending and Descending order
5. Study of Logic gates
6. Study of adders and subtractors
7. Multiplexer and Demultiplexer
8. Applications of operational amplifier
9. Characteristics of common emitter transistor
10. RC Phase shift oscillator
11. RC coupled amplifier

TOTAL : 45 hours

08P308 – PRODUCTION DRAWING

L T P C
1 0 3 2
(08)

GEOMETRICAL TOLERANCING ON TECHNICAL DRAWINGS

Limits and Fits – Single Features and Related Features – Form Tolerance, Orientation Tolerance, Location Tolerance, Run out Tolerance – Tolerance Frame and Tolerance Zone – Symbols, Indication and Interpretation for Tolerance characteristics : Straightness, Flatness, Circularity, Cylindricity, Profile of any Line / Surface, Parallelism, Perpendicularity, Angularity, Position, Concentricity and Coaxiality, Symmetry, Circular Run out and Total Run out – Maximum Material Condition – Single and Multiple Datum – Datum Features – Datum Symbols – Establishing Datum for a Straight line, Plane, Axis of a cylinder, Common axis/ plane and Perpendicular to a plane – Datum Targets – Surface Texture parameters.

TOLERANCES OF FORM AND OF POSITION FOR ENGINEERING DRAWINGS (30)

(Detailed part drawings and Assembly drawings)

Swivel Vice

1. Tail Stock of a Lathe
2. Self Centering Chuck of a Lathe
3. Tool Head of a Shaper
4. Crank Shaft
5. Drill Jig
6. Roller Bearing
7. Petrol Engine Connecting Rod Assembly
8. Gear box Assembly
9. Injection Moulding Die Assembly

COMPUTER AIDED DRAWING (07)

Computer Aided Drawing of simple members consisting of atleast three components – Bhat N.D., “Machine Drawing”, Chartotar Publishing House, Anand, 2000

LECTURE: 15 PRACTICAL: 45 TOTAL: 60 hours

TEXT BOOKS

1. IS: 8000 Part 1 : 1985 (ISO 1101 : 1983), “Tolerancing of Form, Orientation, Location and Runout and appropriate Geometrical Definitions”, Bureau of Indian Standards, New Delhi-2.
2. IS: 8000 Part 2 : 1992 (ISO 2692 : 1988), “Maximum Material Principles”, Bureau of Indian Standards, New Delhi-2.
3. IS: 8000 Part 3 : 1992 (ISO 1660 : 1987), “Dimensioning and Tolerancing of Profiles”, Bureau of Indian Standards, New Delhi-2.
4. IS: 8000 Part 4 : 1976, “Practical examples of indication on Drawings”, Bureau of Indian Standards, New Delhi-2.
5. Narayana K.L., Kanniah P., and Venkata Reddy K., “Production Drawing”, New Age International Ltd. Delhi 1996

REFERENCE BOOKS

1. Nagpal G.R., “Machine Drawing”, Khanna Publishers, New Delhi, 1994
2. Bhat N.D., “Machine Drawing”, Chartotar Publishing House, Anand, 2000

08P401 - NUMERICAL METHODS AND PROBABILITY

L T P C
3 1 0 4

INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION (09)

Finite differences – Newton’s divided difference formula – Langrange’s formula – Newton Forward and Backward difference formulae.

NUMERICAL DIFFERENTIATION with Interpolation Polynomials – Numerical Integration by Trapezoidal and Simpson’s (Both 1/3rd and 3/8th) 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.

PROBABILITY DISTRIBUTION (09)

Binomial, Poisson, Geometric, Uniform, Exponential, Normal, Gamma, Weibull (Mean, Variance - Simple problems). Chebyshev’s inequality (Simple problems)

TEST OF HYPOTHESIS AND ANALYSIS OF VARIANCES (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 VARIANCES - One way classification, Two way classification and Latin square design (Only problems).

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.
3. Kandasamy. P, Thilagavathy . K, Gunavathy . K., “Numerical methods”, S. Chand and Co., New Delhi, 2003.

REFERENCE BOOKS

1. P. Kandasamy, K.Thilagavathy and K.Gunavathy, *Probability and Random Process*, S.Chand & Co. Ltd ., New Delhi – 2003
2. Veerarajan. T and Ramachandran. T., “Numerical Methods with Programming in C”, Tata Mc.Graw Hill Publishers, New Delhi, 2007.
3. Grewal. B. S., and Grewal. J.S., “Numerical Methods in Engineering and Science”, Khanna Publishers, New Delhi, 1999.

08P402 - MANUFACTURING PROCESSES

L T P C
3 0 0 3
(09)

LATHE

Types, Specifications and Parts – Spindle / Feed Drive Mechanism – Special Attachments – Work and Tool Holding Devices – Operations. Capstan and Turret lathes: Parts, Specifications – Turret Mechanism – Tool Layout.

SEMI- AUTOMATIC AND AUTOMATIC LATHES

(09)

Classifications – Principles of operations – Single Spindle / Multi Spindle / Swiss type. Automatic – Bar Stock / Magazine Feeding Mechanism. Drilling machines types, Specifications and Parts – Spindle Drive Mechanism – Drills, Reamers and its nomenclature.

SPECIAL PURPOSE MACHINES I

(09)

Shaping, Slotting and Planning Machines: Types, Specifications, Parts and Drives – Types of work done – Tool / Work Holders. Milling Machine: Types, Parts and Specifications – Attachments – Work Holding Devices. Cutters and its nomenclature. Indexing Principle – Simple, Compound and Differential – operations with examples.

SPECIAL PURPOSE MACHINES II

(09)

Boring Machine: Types, Specifications, Parts and Operations – Work / Tool Holders – Boring Fixtures – Jig Boring Machines. Broaching Machines: Types, Specifications, Drives and Feeds – Broaching Fixtures – Key way broaching – Surface Broaching. Grinding Machines: Wheel Abrasives – Types, Selection and Designation of Grinding Wheels. Grinding Machines for cylindrical surface finishing process – Super Finishing methods – Honing , Lapping and its applications.

GEAR AND THREAD MANUFACTURING (SPUR, HELICAL, WORM AND BEVEL GEARS ONLY)

(09)

Gear Cutting by Milling, Hobbing and Shaping. Hobs and Gear Cutter – Types with Nomenclature. Gear finishing methods – Gear shaving, gear tooth grinding and rounding. Thread cutting - thread chasing – thread rolling – Die threading and tapping – thread milling – thread grinding.

TOTAL : 45 hours

TEXT BOOKS

1. HMT, “Production Technology”, Tata McGraw Hill Publishing Co. Ltd., 1996.
2. Hajra Choudry, “Elements of Workshop Technology, Volume: I”, Media promoters & Publishers Pvt.Ltd., 2004.

REFERENCE BOOKS

1. Khanna. O.P., Lal. M, “A Text Book of Production Technology, volume I and II”, Dhanpat Raj & Sons, 2006.
2. Kalpakjain. S., “Manufacturing Engineering and Technology”, Addison Wesley Inc., .
3. Chapman, W.A.J., “Workshop Technology volume II and III”, Oxford &IBH Publishing Co. Ltd., 2002
4. Begeman, M.L.,”Manufacturing Processess”, John Wiley & Sons, 1998
5. Sharma.P.C., ”A Text Book of Production Engineering”, S.Chand & Co., 2002.
6. Bawa “Manufacturing Process – I and II , Mc.Graw Hill , 2007

08P403 - ENGINEERING MATERIALS AND METALLURGY

L T P C
3 0 0 3

ENGINEERING MATERIALS

(08)

Materials – Definition – classifications – Engineering requirements of materials – Selection of materials. Identification of Metals and Alloys, Polymerisation & Types of Plastics – Rubber as Engineering Materials – Ceramic Materials – Types – Composite Materials – Smart Alloys.

FERROUS AND NON FERROUS MATERIALS

(12)

Ferrous Materials:

Introduction – Classification - Grey cast iron – Malleable cast iron – Nodular cast iron – white cast iron – Steels – Mild steel – Medium carbon steels – High carbon steels – Alloy steels – Prominent alloy steels – Tool steels – Stainless steels – High speed steel – Heat resisting steels.

Non – Ferrous Materials:

Introduction – Copper, Copper alloys – Brasses – Bronzes – Gun metal – Aluminum and its alloys – Magnesium and its alloys – Lead and its alloys – Nickel and its alloys – Tin and its alloys – Zinc and Zinc base alloys.

BASIC CONCEPTS IN METALLURGY

(08)

Crystal imperfections – phase rule and phase diagrams – Solidification of metals – cooling curves – Eutetic, Eutectoid & Peritectic reaction - Fe C equilibrium diagram – Phase structure – TTT diagram. Metallurgical microscope and micro study examination.

HEAT TREATMENT

(09)

Definition – classification of heat treatment processes – Purpose of heat treatment – Annealing, normalizing – Hardening, Tempering – Hardenability study – Jominy end quench test – surface hardening – case hardening – Nitriding, carburizing, cyaniding – modern heat treatment methods – Selection of HT processes for Standard machine tool and automobile parts.

WELDING, FOUNDRY AND POWDER METALLURGY

(08)

Effect of thermal distribution in welded joints – HAZ – factors affecting HAZ – Thermal stresses in welds – Stress relief treatment of welds – Inspection of welds – cooling and solidification in casting – heat transfer & structural change.

Powder metallurgy process – importance – characteristics and production of metal powders – applications and limitations.

TOTAL: 45 hours

TEXT BOOKS

1. Khanna . O.P., *Material Science and Metallurgy*, Edition, 2003
2. Avner S.H, *Introduction to Physical Metallurgy*, 3rd Edition, Mcgraw Hill, 1991

REFERENCE BOOKS:

1. Lakhtin Yu., *Engineering Physical Metallurgy and Heat Treatment*, Mir Publishers, 1985.
2. Higgins R.A. *Engineering Metallurgy*, 5th Edition, Elbs, 1983.
3. Arzamasov, *Material Science*, Mir Publishers, 1989.
4. William D. Callister, Jr., *Material Science and Engineering*, 3rd Edition, John Wiley & Sons, Inc. 1994.

08P404 - THERMAL SCIENCES

L T P C
3 0 0 3

BASIC THERMODYNAMIC CONCEPTS

(09)

Basic concepts - concept of continuum, macroscopic approach, thermodynamic systems - closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics – First law of thermodynamics – application to closed and open systems, internal energy, specific heat capacities, enthalpy. Second law of thermodynamics – Kelvin’s and Clausius statements of second law. Reversibility and irreversibility. Carnot cycle, efficiency, COP. Concept of entropy, Carnot theorem, absolute entropy.

AIR STANDARD CYCLES AND IC ENGINES

(09)

Otto, Diesel, Dual, Brayton cycles, Calculation of mean effective pressure and air standard efficiency, Classification of IC engine, IC engine components and functions. Valve timing diagram and port timing diagram. Comparison of two stroke and four stroke engines. Fuel supply systems, Ignition Systems, Performance calculation. Comparison of petrol & diesel engine. Lubrication system and cooling system.

BOILERS AND POWER PLANTS

(09)

Steam Boilers and Cycles – Fuel and Ash Handling, Combustion Equipment for burning coal, Mechanical Stokers, Pulveriser, Electrostatic Precipitator, Draught – different types, Surface Condenser Types, Cooling Towers; Turbines - Impulse and reaction principles, compounding, velocity diagrams for simple and multistage turbines, speed regulations-governors and nozzle governors.

REFRIGERATION AND AIR-CONDITIONING

(09)

Vapour compression Refrigeration cycle – super heat, sub cooling, performance calculations. Working principle of vapour absorption system. Comparison between vapour compression and absorption systems. Psychrometry, Psychrometric chart – processes. Air conditioning systems (Descriptive treatment only).

HEAT TRANSFER AND AIR COMPRESSORS

(09)

Mechanism of Heat Transfer – Conduction, Convection and Radiation – General Differential equation of Heat Conduction – Cartesian Coordinates – One Dimensional Steady State Heat Conduction – Conduction through Plane Wall and Cylinders.

Classification and working principle of air compressor, work of compression with and without clearance. Volumetric efficiency, Isothermal efficiency and isentropic efficiency of reciprocating air compressors. Multistage air compressor and inter cooling (Descriptive treatment only).

TOTAL: 45 hours

TEXT BOOKS

1. Kothandaraman.C.P., Domkundwar.S. and A.V.Domkundwar., “A course in Thermal Engineering”, Dhanpat Rai & Sons
2. Ballaney.P.L., “Thermal Engineering”, Khanna Publishers, New Delhi,1998.

REFERENCE BOOKS

1. Cengel, “Thermodynamics” An Engineering Approach, Third Edition – 2003, Tata Mc Graw Hill, New Delhi.
2. Nag.P.K., “Engineering Thermodynamics”, Tata McGraw-Hill, New Delhi, 1998.
3. Holman.J.P., “Thermodynamics”, 3rd Ed. McGraw-Hill, 1995.
4. Rogers, Meyhew, “Engineering Thermodynamics”, ELBS, 1992.
5. Arora.C.P., “Refrigeration and Air conditioning”, TMH, 1994.
6. Holman J.P “Heat and Mass Transfer” Tata McGraw-Hill, 2000.
7. Nag P.K, “Power plant Engineering”, Tata McGraw-Hill, 1998.
8. T.Morse Frederick, “Power Plant Engineering”, Prentice Hall of India, 1998

08P405 – MECHANICS OF MACHINES

L T P C

3 1 0 4

MECHANISMS

(09)

Machine structure-Kinematic link, pair and chain-Constrained motion- Degree of freedom- Slider crank and crank rocker mechanisms-inversion-applications-Kinematic Analysis of Simple Mechanism-Determination of velocity and acceleration-Grublers criteria.

FRICTION

(09)

Friction in pivot and collar-Thrust bearing - Plate and disc clutches - Belt (flat and V) and Rope drive-Ratio of tensions-Effect of centrifugal and initial Tension- Condition for maximum power transmission. Open and crossed belt drive.

GEARING AND CAMS

(09)

Gear profile and geometry-Nomenclature of spur and helical gears-Law of gearing- Interference - Requirement of minimum number of teeth in gears-Gear trains-Simple and compound gear trains-Determination of speed and torque in epicyclic gear train-Cam profile-Different types of followers.

BALANCING

(09)

Static and dynamic balancing - Single and several masses in different planes - Primary and secondary balancing of reciprocation masses - Single and multi cylinder engines.

VIBRATION

(09)

Free, forced and damped vibration of single degree of freedom systems - Force Transmitted to supports - Vibration isolation-Vibration absorption - Torsional vibration of shaft – Single and multi rotor systems-Critical speed of shaft.

LECTURE: 45 TUTORIAL:15 TOTAL:60 hours

TEXT BOOKS

1. Ballaney, P.L., “Theory of Machines”, Khanna Publishers, NewDelhi, 1998
2. Singh, V.P., “Theory of Machines”, Khanna Publishers, New Delhi,1998.

REFERENCE BOOKS

1. Rao, J.S. and Duggipati, R.V. “Mechanism and Machine Theory”, Second Edition, Willey Eastern Ltd., 1992.
2. Malhotra, D.R. and Gupta, H.C.,: “Theory of Machines”, Satya Prakashan, Tech India Publications, 1998
3. Gosh, A., and Mallick, A.K., “Theory of Machines and mechanisms”, Affiliated East West Press, 1989.
4. Sigley, J.E. and Uicker (K), J.J., “ Theory of Machines and mechanisms”, McGraw Hill 1980.
5. Burton Paul, “Kinematic and Dynamic of Planer Machinery”, Prentice Hall, 1979.

08P406 - MACHINE TOOLS AND CNC MACHINES

L T P C
3 0 0 3

SPECTRUM OF MACHINE TOOLS

(09)

Machining operations – methods – surfaces and path produced by machine tools Work tool combination motion – stiffness and rigidity in machine tool beds and columns – slide ways – shapes – wear adjustment of slide ways – lubrication – Hydrodynamic action in slides – roller guides – recirculating ball screws – types and recirculating path – hydrostatic and aerostatic guide ways – antifriction ways

VIBRATIONS AND MACHINE TOOL TESTING.

(09)

Effects of vibration in machine tools – cutting conditions -sources of vibrations - Eliminations of vibrations – Dampers – vibration sensors. Testing geometric accuracy of machine tools – acceptance test measuring equipments and methods – magnitude and direction of tolerances – straightness of slide ways – flatness of tables – alignment and true running of shafts

COMPUTER NUMERICAL CONTROL

(09)

Basic theory of numerical control – advantages of numerical control, open - closed loop system, classification of CNC machine tools, position control - continuous path control. Drives and control systems – feed back devices - Principles of displacement Measurement. Types of CNC machine tools. Constructional features. Applications and economics of usage of NC machines –Integration of CNC machines in computer integrated manufacturing environment.

CNC PART PROGRAMMING

(09)

Manual and computer aided part programming – G function, M Function, canned cycles, Basics of APT-APT programming for simple parts - Description of the system geometry definition – Geometry modification - machining – Tool definition – Three dimensional geometry – multi axis machining DNC link– output

TOOLING AND AUTOMATION FOR CNC MACHINES

(09)

Tooling in CNC machines - Interchangeable tooling systems – preset and qualified tools - Automatic tool changer, Automatic pallet changer, features of CNC systems for lathes and machining center. Direct Numerical control, FMS, – robotics – computer integrated manufacturing – Basic concepts of AI and expert systems for manufacturing automation. Use of CNC machines for Rapid proto typing and manufacturing.- Internet based manufacturing.

TOTAL: 45 hours

TEXT BOOKS

1. Michael P. Groover, *Automation , Production systems and Computer Aided Manufacturing*, Prentice Hall , 1980.
2. P.Radhakrishnan, *Computer numerical control machines*, New central book agency, 1996
3. G.C.Sen, A.Battachariya, “*Principles of Machine Tools*”, New central book agency, 1998

REFERENCE BOOKS

1. P.C. Sharma, *Production Engineering*, S.Chand and Company Ltd, 1993
2. SME, *Manufacturing Engineering , Hand Books*, 1994
3. S.Krar, *CNC technology and programming*, McGraw Hill 1990
4. Kundra T.K. , Rao P.N and Tiwari N.K., *CNC machine tools and computer aided manufacturing*, Tata McGraw Hill, 1991
5. Koenisberger.F, “*Design priciples of metal cutting machine tools*”, Pergamon press, 1996

08P407 (A) - STRENGTH OF MATERIALS LAB

L T P C
0 0 3 1

LIST OF EXPERIMENTS

1. Tension test on Mild steel rod & tor steel rods
2. Compression test
3. Bending test
4. Double shear test on mild steel rod
5. Torsion test on MS bar
6. Test on springs
7. compression spring & tension spring
8. carriage spring
9. Deflection test on
 - metal beam
 - rolled steel joist
10. Hardness test on metals like mild steel, brass, copper & aluminium
11. Bend test on steel rod

TOTAL: 45 hours

08P407 (B) – FLUID MECHANICS AND MACHINERY LABORATORY

L T P C
0 0 3 1

LIST OF EXPERIMENTS

1. Determination of Darcy's friction factor
2. Calibration of Flow meters
3. Flow through Mouthpiece / Orifice
4. Flow over Weirs / Notches
5. Calibration of Pressure gauges
6. Performance of Rotodynamic pumps
7. Performance of positive displacement pumps
8. Performance of Jet pumps
9. Load test on Pelton wheel
10. Load test on and Francis turbine

TOTAL: 45 hours

08P408 (A) - METALLURGY LABORATORY

L T P C
0 0 3 1

LIST OF EXERCISES

1. Study of Metallurgical Microscope
2. Specimen Preparation for Microstructure Inspection
3. Study Microstructure of materials
 - steel(low carbon steel, high carbon steel, HSS, Spheroidised steel)
 - cast iron(grey, white, SG)
 - Non Ferrous(brass, Gun metal, aluminium, silicon alloy)
4. Study of Iron carbon Equilibrium diagram
5. Study of Heat Treatment processes (Annealing, Normalizing, Hardening, Tempering)
6. Study of non- destructive tests
 - Liquid penetrant test
 - Ultrasonic Inspection
7. Determination of Hardenability by Jominy end quench test
8. Study of structure of specimen through computer monitor

TOTAL: 45 hours

08P408 (B) – THERMAL ENGINEERING LAB

L T P C
0 0 3 1

LIST OF EXPERIMENTS

1. Valve timing and Port timing diagrams for I.C. engines.
2. Engine performance evaluation using D.C generator as loading device.
3. Performance evaluation using Rope Brake dynamometer.
4. Performance evaluation of engine using Swinging field dynamometer.
5. Estimation of frictional power by fuel consumption measurement and
6. Verification by retardation test.
7. Estimation of economical load and economical speed of engine.
8. Heat balance on engine using air measurement method.
9. Heat balance on engine by using exhaust gas calorimeter.
10. Heat balance on engine by assuming volumetric efficiency.
11. Heat balance by exhaust gas analysis.
12. Test on multi cylinder petrol engine.
13. Test on reciprocating air compressor.
14. Test on constant speed air blower.
15. Fan laws verification on variable speed air blower

TOTAL: 45 hours

08P501 – METROLOGY AND COMPUTER AIDED INSPECTION
(Approved SQC Tables and Charts are permitted)

L T P C
3 0 0 3

GENERAL CONCEPTS OF MEASUREMENT

(08)

Definition-Standards of measurement – Accuracy and precision – Errors in measurement – Interchangeability and Selective assembly-Calibration of instruments. Principles of light interference– Measurements and calibration - Limits, Fits and Tolerances – Design of Gauges.

LINEAR AND ANGULAR MEASUREMENTS

(08)

Linear Measuring Instruments: Vernier instruments, Micrometers, Height gauge, Dial indicators, Bore gauges, Slip gauges, Comparators. Angle measuring instruments: Bevel protractor, Spirit level, Sine bar, Autocollimator, Angle Dekkor and Clinometers – Interferometry.

FORM MEASUREMENT

(12)

Metrology of screw threads: Terminology, measurement of major, minor and effective diameter – two wire and three wire methods – errors in threads – measurement of pitch, profile errors, Thread micrometer, Pitch measuring machine. Measurement and Testing of Gears: 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: Terminology, Stylus probe instruments – Profilometer – Tomlinson and Talysurf instrument – Measurement of Geometrical properties : Straightness, Flatness and roundness measurement – Optical Projectors and Microscopes : Profile projectors – Tool maker’s microscope.

LASER METROLOGY

(08)

Laser in engineering metrology – Methods of laser metrology – Precision instruments based on laser – Laser interferometer – Applications of laser in industry – Linear and angular measurement – Optical methods for fast non-contact online measurement – Scanning laser beam.

COMPUTER AIDED INSPECTION

(09)

Offline and online inspection – Flexible inspection systems – Non contact inspection methods – Universal measuring machine – Automatic gauging and size control systems – Co ordinate measuring machine – Non contact CMM using electro optical sensors for dimensional metrology – Non contact sensors for surface finish measurements – Machine Vision Systems and its applications in metrology.

TOTAL: 45 HOURS

TEXT BOOKS

1. Gupta.I.C., *A Text Book of Engineering Metrology*, Dhanpat Rai and Sons, Delhi.
2. Groover M.P., *Automation, Production Systems and Computer Integrated Manufacturing*, Prentice Hall India Ltd.,.

REFERENCES

1. Jain, R.K. and Gupta S.C., *Engineering Metrology*, Dhanpat Rai and Sons,
2. Gayler G.N., and Shotbolt C.R., *Metrology for Engineers*, ELBS Edn,
3. *ASTE Handbook of Industrial Metrology*, Prentice hall of India Ltd.
4. *CMM Manual*
5. Marvin J.Weber, *Handbook of LASERS*, CRC Press,
6. Jim hayes, *Fibre Optics Manual*, 2nd Edition.

08P502 - MACHINE ELEMENTS DESIGN
(Use of Approved Data Book Is Permitted)

L T P C
3 1 0 4

PRINCIPLES OF DESIGN

(09)

Selection of materials. Factor of safety. Stresses under direct loads, variable and cyclic loads, endurance limit. Stress concentration. Failure theories principal stresses. Combined bending and shear. Combined shear and axial loads. Shaft size based on critical speed.

JOINTS, COUPLING AND SPRINGS

(09)

Design of welded joints, Bolted joints (brackets), Cotter and knuckle joints. Design of flange couplings. Design of helical and leaf springs.

BEARING

(09)

Study of Hydrodynamic and Hydrostatic Bearings. Design of Journal Bearings - Sommerfeld number, and dimensionless parameters. Selection of ball and roller bearings. Selection of packing and oil seals.

DRIVES

(09)

Selection of flat and V belts and pulleys. Roller chains.

GEARS

(09)

Design of spur, helical, bevel and worm gears.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 HOURS

TEXT BOOKS

1. Shigley, J.E., and Mischke, C.R., *Mechanical Engg. Design (5th ed.)*, McGraw-Hill Book Co.
2. S.Md. Jalaludeen, *A Text Book of Machine Design*, Anuradha Publications, 3rd edition, 2006.

REFERENCES

1. Khurmi, R.S., and Gupta, J.K., *A Text book of Machine Design*, S.Chand & Company Ltd.
2. Dobrovolsky, V., and others, *Machine Elements A Text Book*, MIR Publishers.
3. Spotts, M.F., *Design of Machine Elements (6th ed.)*, Prentice Hall of India Pvt.Ltd.
4. Sharma, P.C., Aggarwal, D.K., *A Text Book of Machine Design*, Kataria & sons.

08P503 - PRODUCTION MANAGEMENT

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3	0	0	3

BASICS OF PRODUCTION MANAGEMENT (09)

History and development of Manufacturing Management - Nature, Scope, Importance and Functions. Work Study - Industrial Engineering – Historical Background. Contributions by F. W. Taylor, Frank Gilbreth. - Basic Techniques involved. Method Study - Symbols used in charting, various charts, Questioning Technique, Process Improvements. Time Study - Work Measurement, Work / Activity Sampling - Predetermined Time Standards, MTM-1, MOST – Introduction to Mini MOST and Maxi MOST.

MANAGEMENT FUNCTIONS (09)

Evolution of Management Theory - Management approach to Planning - Analysis and Control functions involved in a Production System; Production cycles - planning functions; Organisation and policies in respect of production planning and control; Product design and development - Forecasting techniques; Scheduling - Sequencing and plant loading for optimal utilization; Queuing models and line balancing - Materials Planning and Control,; Value Analysis - Productivity Analysis, Mechanics of production control.

ORGANIZATIONAL BEHAVIOUR AND ERGONOMICS (09)

Organizational Behaviour -Definition - Importance - Fundamental Concepts of OB - 21st Century corporate - Different models of OB - autocratic, custodial, supportive, collegial Personality & Attitudes - Meaning of personality - Development of personality Nature and dimensions of attitude - Job Satisfaction - Organizational Commitment. Ergonomics - Definition and importance - Human Machine Systems – interfaces. Anthropometry Need, Important Body Dimensions. Applied Anthropometry and Work Space Design & Seating.

MOTIVATION AND LEADERSHIP THEORIES (09)

Motivation - Motives - Characteristics - Classification of motives - Primary Motive, Secondary motives - Morale - Definition and relationship with productivity – Morale Indicators; Theories of Work Motivation - Maslow's theory of need hierarchy Herzberg's theory of job loading. Leadership - Definition -Importance - Leadership Styles - Models and Theories of Leadership Styles.

CONCURRENT ENGINEERING (09)

Principal concept and need. Review of Engineering Problem Solving methods, - Description of methods of Analysis - Decision Making - Creativity and Information processing and their role in engineering. Discussion of Emerging engineering strategies of Total Design, Design for Manufacturing and Assembly - Quality Function Deployment, and Constraint networks. Integrating concurrent approaches with those of conventional. Implementation of concurrent engineering in industrial environment especially those of IT and high speed computation.

TOTAL: 45 HOURS

TEXT BOOKS

1. *Eilon S: Elements Of Production Planning And Control. Universal Publishing Bombay, 2001.*
2. *Tompkins J A & White J A: Facilities Planning. New York. John Wiley & Sons, 1984.*

REFERENCE BOOKS

1. *Maynard, Industrial Engineering Handbook, Mc Graw Hill Book Company.*
2. *M. S. Sanders and Ernest J. McCormick, Human Factors Engineering and Design, McGraw Hill Inc.,*
3. *Khanna O. P., Industrial Engineering and Management, Dhanapat Rai Publications, New Delhi.*
4. *Gopalkrishnan P. and Sudarshan, Materials Management, Prentice Hall India Ltd.*
5. *Arnold J R I: Intro to Materials Management. (2) Prentice Hall Inc New Jercy, 1996.*

08P504 – MODERN CONTROL TECHNOLOGY

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INTRODUCTION TO CONTROL SYSTEMS (09)

Introduction – control systems – open loop control systems – closed loop control systems - transfer function – analog and digital control systems – classifications of control systems. Microprocessor based control : microprocessor system hardware – operation – interfacing a microprocessor controller – basics of controller programming – microprocessor based controllers.

OPERATIONAL AMPLIFIERS AND SIGNAL CONDITIONING (09)

Operational amplifiers – special interface circuits – signal transmission. Switches, relays and semi conductors: Switches – toggle switches, Push button switches, and other switches. Relays – electromechanical relays – solid state relays. Power Transistors – silicon controlled rectifiers – Triacs, Trigger devices.

MECHANICAL SYSTEMS AND ACTUATORS (09)

Behavior of mechanical components – energy – response of the whole mechanical system – gears – clutches and brakes – other power transmitting techniques. Electrical linear actuators – hydraulic systems – pneumatic systems – flow control valves.

CONTROL SYSTEM COMPONENTS (09)

Potentiometer – error detector – magnetic amplifier – hydraulic elements – synchros – stepper motors – tachogenerators – servomechanisms – modulators and demodulators – PID controllers – servo motors.

FEED BACK AND LOGIC CONTROL SYSTEMS (09)

On – off controllers – fuzzy logic controllers – Programmable logic controller: overview of PLC systems – input and output modules – power supplies – general PLC programming procedures – auxiliary commands and functions – ladder diagrams – timer functions – counter functions.

TOTAL: 45 HOURS

TEXT BOOKS

1. *Kilian, Modern Control Technology Components And Design , 2nd edition, Delmar Publication Ltd., 2008.*
2. *Sivanandam S.N., Control Systems Engineering, vikas Publishing House Pvt.Ltd., New Delhi, 2001*

REFERENCES

1. *Gopal M., Control Systems – Principles and Design , 2nd edition, Tata McGraw Hill Publishing Co.Ltd., New Delhi, 2002.*
2. *John.W.Webb and Ronald A.Reis, Programmable Logic Controllers – Principles and Applications,3rd Edition, Prentice Hall Inc., New Jersey, 1995.*

08P505 – THEORY OF METAL MACHINING

L T P C
3 1 0 4

TOOL STEREOMETRY

(10)

Machining Fundamentals – Metal Cutting – Geometry of Single Point Turning tool – significance of Rake Angle, relief Angle, cutting edge Angle and Nose Radius – Tool Angle Specification : British, American, German and ISO System – Interrelations of rake Angle Between American and German – Nomenclature of Multi Point cutting Tools : Drills, Milling Cutters and broaches – Chip Breakers – Specifications for Inserts and Tool Holders.

MECHANICS OF METAL CUTTING

(10)

Mechanism of Chip formation – Classification of Chips – Chip curl – Orthogonal Vs Oblique Cutting – Shear Plane Angle – Cutting Force and Velocity relationships – Merchant circle diagram – Stress and Strain in the chip – Ernst and Merchant's Upper bound solution – Merchant's Second solution and "Machining Constant" – Energy considerations in machining – Dynamometers for measuring forces during turning Process.

THERMODYNAMICS OF CHIP FORMATION AND CUTTING FLUIDS

(08)

Source of Heat – Shear Plane Temperature – Experimental Determination of Chip Tool interface Temperatures – Theoretical Estimation of cutting tool Temperature – Tool life equation. Effects of Cutting fluids – Functions – Characteristics – Methods of applying Cutting Fluids – Types and Selection of Cutting Fluids – Cutting Fluids for machining of various metals.

TOOL MATERIALS, TOOL WEAR, TOOL LIFE AND MACHINABILITY

(10)

Requirements of Tool Materials – HSS, Carbides, Ceramic, Composites and Diamond – Properties, Advantages and Limitations.

Causes of Wear – Wear Mechanisms : Diffusion Wear, Adhesive Wear, Abrasive wear – Flank wear and Crater Wear – Measurement of Tool Wear.

Machinability – Tool Failure criteria - Taylor's Tool Life equation – Effect of process parameters on Tool life.

ECONOMICS OF METAL MACHINING

(07)

Economic tool life – Gilbert's model – Analysis for Optimum Cutting Speed – Optimum Cutting Speed for Maximum production – Optimum cutting Speed for Minimum cost with cost as objective criterion – Theory of Chatter in machining.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 HOURS

TEXT BOOKS

1. Juneja B.L., Sekhon G.S., *Fundamentals of Metal Cutting and Machine Tools*, New Age International (P) Ltd., 1995.
2. Bhattacharya A., *Metal Cutting – Theory and Practice*, New Central Book Agency (P) Ltd., Calcutta, 1984

REFERENCES

1. Shaw M.C., *Metal Cutting Principles*, Oxford Press, 1984
2. Armarego E.J.A., Brown R.H., *The Machining of Metals*, Prentice Hall Inc.,
3. Geoffrey Boothroyd, Knight W.A., *Fundamentals of Machining and Machine Tools*, Marcel Dekker, New York, 1989
4. Venkatesh V.C., Chandrasekaran H., *Experimental Techniques in Metal Cutting*, Prentice Hall of India, 1982
5. Kuppaswamy G., *Principles of Metal Cutting*, Universities Press, 1996.

08P506 – FLUID POWER DRIVES AND CONTROLS

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BASIC PRINCIPLES (09)

Hydraulic Principles, Hydraulic pumps – Characteristics, Pump Selection. Pumping Circuits. Hydraulic Actuators – Linear, Rotary; Selection, Characteristics. Hydraulic Valves – Pressure, Flow, Direction Controls. Applications. Hydraulic Fluids. Symbols.

HYDRAULIC CIRCUITS (09)

Hydraulic circuits – Reciprocating, Quick return, Sequencing, Synchronizing. Accumulator circuits. Safety circuits. Press, Milling Machine, Planner, Fork Lift, etc.

DESIGN & SELECTION OF HYDRAULIC CIRCUITS (09)

Design of Hydraulic circuits. Regenerative circuits. Pressure intensifier circuits. Double pump hydraulic system. Mechanical hydraulic servo system. Selection of components. Trouble shooting of fluid power circuits.

PNEUMATIC SYSTEMS (09)

Pneumatic fundamentals. Control Elements. Logic Circuits. Position. Pressure Sensing Switching. Electro Pneumatic. Electro Hydraulic Circuits. Robotic Circuits.

DESIGN & SELECTION PNEUMATIC CIRCUITS (09)

Design of Pneumatic circuits – Classic, Cascade, Step counter, Combination methods. PLC, Microprocessors - Uses. Selection criteria for Pneumatic components. Installation and Maintenance of Hydraulic and Pneumatic power packs. Fault finding. Principles of Low Cost Automation. Case studies.

TOTAL: 45 HOURS

TEXT BOOKS

1. Antony Esposito, *Fluid Power with Applications*, Prentice Hall.
2. Andrew Parr, *Hydraulics and Pneumatics (HB)*, Jaico Publishing House.

REFERENCES

1. Dudley, A. Pease and Hohn J. Pippenger, *Basic Fluid Power*, Prentice Hall.
2. John J Pippenger and Tyler G Hicks, *Industrial Hydraulics*. Mc Graw Hill Book Co.
3. Stewart H L and Storer J.M., *Pneumatics and Hydraulics*, D B Taraporevala Sons.
4. J. Michael, Pinches and Hohn G.Ashby, *Power Hydraulics*, Prentice Hall.

08P507 - COMPUTER AIDED DESIGN LABORATORY

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CAD

Fundamentals of CAD

Create, Edit and Dimension the Sketch – Constraints – Datum Planes – Construction aids

Modeling

Extrude, sweep, Swept blend features

Assembly Modeling

Creating Top-down and Bottom-up assemblies – Assembling the components – Editing the components – Adding Geometric Tolerance – Analyze the assembly for interference – Simulating the motion of components – Bill of Materials – Generate, Edit, Modify and dimension the different Drawing Views.

Surface Modeling

Creating Extruded, Revolved, Sweep, Blended, Swept Blend and Helical Sweep Surface – Surface Editing – Copying, Mirroring, Moving and Trimming the Surfaces – Fill Surfaces – Create Intersect Curves – Offset Surfaces – Convert a Surface to a Solid.

3D VISUALIZATION

Exercises on modeling of mechanical components using packages like AutoCAD / Mechanical Desktop/Inventor/IDEAS/Pro Engineer/CATIA/Unigraphics etc...

1. Simple two dimensional geometry creations and modification using drafting module.
2. Detailing and documentation of a typical production drawing
3. Attributes and data extraction from a drawing
4. Creation of simple solid models using CSG and B-rep Approach
5. Surface Modeling
6. Interfacing a Programming Language with Drafting Module
7. External database connection
8. Generation of working drawings of components and preparation of assembly models of
 - Fixture assembly
 - Bench vice assembly
 - Blower assembly
 - Tool head of shaper
 - Radial engine sub-assembly
 - Pulley support assembly
 - Box type drill jig assembly by using the following techniques...
9. Generation of surfaces of revolution
10. Generation of surfaces of extrusion
11. Generation of surfaces by skinning operation
12. Generation of solid models using constructive solid geometry, method shading and rendering.

TOTAL: 45 HOURS

08P508 – MANUFACTURING TECHNOLOGY LABORATORY-I

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LIST OF EXERCISES

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

08P601 – MECHATRONIC SYSTEMS

L T P C
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MECHATRONICS SYSTEMS

(09)

Introduction to Mechatronics- Basics of actuating systems . Mechanical, pneumatic, hydraulics, electrical systems- control systems- measurements 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.

8085 MICROPROCESSOR

(09)

Introduction- architecture- pin configuration- instruction set- programming of microprocessors using 8085 instructions- interfacing input and output devices- interfacing D/A converters and A/D converters- applications- temperature controls- stepper motor control- traffic light controller.

PROGRAMMABLE LOGIC CONTROLLERS

(09)

Introduction- basic structure- input/output processing- programming- Mnemonics- timers, internal relays And counters- data handling- analog input/output- selection of a PLC.

DESIGN OF MECHATRONICS

(09)

Stages in designing Mechatronics systems- Traditional and Mechatronics design- Possible design-solutions- case studies of Mechatronics systems- pick and place robots- automatic car park systems- engine management systems.

TOTAL: 45 HOURS

TEXT BOOKS

1. W.Bolton, *Mechatronics*, Longman, Second Edition.
2. Ramesh S. Gaonkar, *Microprocessor Architecture. , Programming and Applications*, Wiley Eastern.

REFERENCES

1. Michel B. Histan and David G. Alciatore, *Introduction to Mechatronics and measurement systems.*, McGraw Hill International Editions.
2. HMT Ltd, *Mechatronics.*, Tata McGraw Hill publishing Co. Ltd.
3. D.A.Bradley, D. Dawson, N.C. Buru and A.J. Loader. *Mechatronics.*, Chapman and Hall.
4. K. Ram, *Fundamentals of Microprocessors and Microcomputers.*, Dhampat rai publications.
5. Dan Neculescu, “*Mechatronics*”, Pearson Education Asia. (Indian reprint)

08P602 – ROBOTICS AND MACHINE VISION SYSTEM

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3 1 0 4

FUNDAMENTALS OF ROBOT (09)

Robotics – Introduction – Basic structure – Classification of robot and Robotic systems – laws of robotics – work space, precision movement. Drives and Controls systems: Hydraulic systems, power supply – servo valve – hydraulic motor – DC servo motors – stepper motors – operation – selection of system – control system – servo control.

ROBOT MOTION ANALYSIS (09)

Kinematics of Robot : Introduction, Matrix Representation, homogeneous transformation, forward and inverse kinematics, Inverse kinematics Programming, Degeneracy, dexterity, velocity and static forces, Basics of trajectory planning.

GRIPPERS AND SENSORS (10)

Robot end effectors: Types of end effectors – Mechanical grippers – Types of Gripper mechanisms – Grippers force analysis – Other types of grippers – Vacuum cups – Magnetic grippers – Adhesive grippers – Robot end effectors interface. Sensors : Position sensors – Potentiometers, encoders, - LVDT, Velocity sensors, Acceleration Sensors, Force, Pressure and Torque sensors, Touch and Tactile sensors, Proximity, Range and sniff sensors.

PROGRAMMING AND APPLICATION (08)

Types of programming – programming languages sample program for different types of robots – Industrial Applications: Application of robots in processing operations – Assembly and inspections – Material handling – Loading and unloading – AI and Robotics.

MACHINE VISION (09)

Introduction – image processing Vs image analysis, image acquisition, digital images – sampling and quantization – image definition, levels of computation. Image processing Techniques: Data reduction – Windowing, digital conversion. Segmentation – Thresholding, Connectivity, Noise reduction, Edge detection, Segmentation, Region growing and Region splitting, Binary morphology and grey morphology operation – feature extraction.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 HOURS

TEXT BOOKS

1. Saeed B.Niku, *Introduction to Robotics: Analysis, Systems, Applications*, 2nd edition, Pearson Education India, PHI 2003 (ISBN 81-7808-677-8)
2. M.P.Groover, *Industrial Robotics – Technology, Programming and Applications*, McGraw-Hill, USA, 1986

REFERENCES:

1. Janakiraman P.A., *Robotics and image processing*, Tata McGraw Hill, 1995.
2. YoremKoren, *Robotics for Engineers*, McGraw-Hill, USA, 1987
3. Richard D.Klafter, Thomas A.Chmielewski and Michael Negin, *Robotic Engineering – An Integrated Approach*, Prentice Hall Inc, Englewoods Cliffs, NJ, USA, 1989.
4. Ramesh Jam, Rangachari Kasturi, Brain G.Schunck, *Machine Vision*, Tata McGraw Hill

08P603 - FINITE ELEMENT TECHNIQUES

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.

FORMULATION OF ELEMENT CHARACTERISTIC MATRICES & LOAD VECTORS

(09)

One dimensional governing equations - structural and heat transfer problems - variational method - variational calculus - functionals - Weighted residual methods. Galerkins method - Ritz method - generalized coordinates approach - Principle of minimization of potential energy.

ONE DIMENSIONAL PROBLEMS

(09)

Derivative 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 method 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 plane strain. Solution of simple problems in structural and heat transfer models.

HIGHER ORDER ELEMENTS

(09)

Applications of higher order elements - Isoparametric elements - Lagrangian and serendipity elements - Jacobian transformation.

TUTORIAL

(15)

(Usage of FEM Software Packages:Not for Examination)

FEM Packages - preprocessor, solution and post processor, Tutorials, solution of simple 1D, 2D and 3D components using ANSYS.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 HOURS

TEXT BOOK

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

REFERENCES

1. J.N.Reddy, *An Introduction to Finite Element Method*, McGraw Hill, Intl, Student Edition.
2. Tirupathi R. Chandrupatala and Ashok D. Belegundu, *Introduction to Finite Elements in Engineering*, Pearson Education.
3. Chandrakant.S.Desai, *Elementary Finite Element Method*, Prentice Hall Inc.

08P604 - AUTOMATION AND CIM

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FUNDAMENTALS OF AUTOMATION AND CIM

(09)

Concept of automation - Basic Elements of Automated system and Classification – Levels of Automation – Ten Strategies for Automation, Concept of automation in industry - mechanization and automation, classification. Evolution of CIM - CIM Hardware and Software – Data base Requirement of CIM – “Concurrent engineering” – Principles – Design and development. Automated Modelling systems – Production economics – Simulation software.

AUTOMATION IN MANUFACTURING

(09)

Automation in machine tools - Mechanical feeding and tool changing - machine tool control transfer automaton, automated flow lines - Methods of work part transport transfer - Transfer line-monitoring system (TLMS) using Line Status - Line efficiency. Simulation in assembly line - Analysis of Automated flow lines - General terminology and analysis of transfer lines - without and with buffer storage, partial automation, Implementation of automated flow lines. Buffer stock - Mechanical buffer storage control function - design and fabrication.

PRODUCTION PLANNING AND CONTROL SYSTEM

(09)

Process planning – Logical; Design of a process plan – Selection of machining process and tools – work piece holders – Sequencing of operations – selection of detailed method of production – CAPP – Retrieval and Generative systems – aggregate production planning – Production Schedules – Material Requirements Planning (MRP) – Capacity planning – Shop floor control – Computer aided Quality Control.

GROUP TECHNOLOGY AND FMS

(09)

Group Technology – Part families – Part Classification and Coding – Production flow Analysis – Cellular manufacturing – Cell design – Application considerations in Group Technology. Introduction – Concepts of FMS – Comparison with Conventional Manufacturing – Economic Justification – Basic Components of FMS – Types of Flexibility – FMS Applications and Benefits – Automated Material Handling and Storage.

CONTROL SYSTEMS

(09)

Process model formulation – control actions – Optimal control structure model of a manufacturing process – Steady state optimal control – Adaptive control – Sequence control and Programmable controllers – computer process control – computer process interface – interface Hardware – Direct Digital control.

TOTAL: 45 Hours

TEXT BOOKS

1. Mikell P Groover, “Automation, Production Systems and Computer Integrated Manufacturing”, Pearson education (Singapore) Pvt. Ltd., New Delhi, 2008
2. Radhakrishnan P & Subramaniyan S, “CAD/CAM/CIM”, New Age International (P) Ltd., 2008

REFERENCE BOOKS

1. Davi J Parish, “Flexible Manufacturing”, Butterworth – Heinemann Ltd, Cambridge, 1990.
2. James A Rehg & Henry W Kraebber, “Computer Integrated Manufacturing”, Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2005.
3. Chris McMahon, and Jimmie Browne, “CAD/CAM Principles, Practice and manufacturing Management”, Addison Wesley Longman Ltd, England, 1998.
4. Kant Vajpayee .S, “Principles of Computer Integrated Manufacturing”, Prentice Hall of India Limited, 2005.
5. Paul G Rankey. “Computer Integrated Manufacturing”. Prentice Hall 1990.

08P605 - PRODUCTION OF AUTOMOTIVE COMPONENTS

L T P C
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AUTOMOTIVE COMPONENTS (09)

Automotive engines - basic principles - cylinder blocks. Materials - production methods - dry and wet liners - cylinder head. Types, materials - production methods - production of oil pan - engine mountings.

ENGINE PARTS (09)

Piston parts - Functions - materials manufacturing methods - Piston rings - Types. Functions - production and testing methods. Piston pin types - materials. Manufacturing methods - production of connecting rod and crankshaft

VALVES AND ACCESSORIES (09)

Valve – types – Mechanisms - Materials - production methods - production of push rod, rocker arm and tappets. Camshaft- manufacturing methods - production of carburetors - king pins and propeller shaft.

FUEL AND TRANSMISSION SYSTEM (09)

Fuel system for petrol and diesel engines - production of carburetors - fuel pumps - fuel injection pumps -multipoint fuel injection systems - transmission system - gear box - clutch system - differential .steering components.

BRAKES, SUSPENSION AND ENGINE MANAGEMENT SYSTEMS (09)

Braking system - Types- manufacturing methods- suspension methods- leaf spring and shock absorbers- Manufacturing details - Construction details of wheel mounting - Application of sensors and actuators – Mechatronics in automobile - Use of robots in assembly line.

TOTAL: 45 HOURS

TEXT BOOKS

1. Kirpal Singh, *Automobile Engineering, Vol I & II, Standard Publishers.*
2. William H.Crouse & Anglin, *.Automotive Mechanics, McGraw Hill Book Co.1997.*

REFERENCES

1. Helt P.M., *High speed combustion engines, Oxford and IBM Publishers Co. 1985*
2. Newton and Steels, *.The motor vehicle. ELBS, 1980*
3. Narang G.B.S, *Automobile Engineering, Khanna Publishers.*

08P606 - PRODUCTION PLANNING AND CONTROL

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INTRODUCTION

(09)

Objectives and benefits of planning and control-Functions of production control-Types of production-job- batch and continuous-Product development and design-Marketing aspect - Functional aspects-Operational aspect-Durability and dependability aspect-aesthetic aspect. Profit consideration-Standardization, Simplification & specialization-Break even analysis-Economics of a new design.

WORK STUDY

(09)

Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study - work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.

PRODUCT PLANNING AND PROCESS PLANNING

(09)

Product planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning-Steps in process planning-Quantity determination in batch production-Machine capacity, balancing-Analysis of process capabilities in a multi product system.

PRODUCTION SCHEDULING

(09)

Production Control Systems-Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problems - Line of balance - Flow production scheduling-Batch production scheduling-Product sequencing - Production Control systems-Periodic batch control-Material requirement planning kanban –Dispatching-Progress reporting and expediting-Manufacturing lead time-Techniques for aligning completion times and due dates.

INVENTORY CONTROL AND RECENT TRENDS IN PPC

(09)

Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures.Two bin system -Ordering cycle system-Determination of Economic order quantity and economic lot size-ABC analysis-Recorder procedure-Introduction to computer integrated production planning systems-elements of JUST IN TIME SYSTEMS-Fundamentals of MRP II and ERP.

TOTAL: 45 HOURS

TEXT BOOK

1. *Martand Telsang, "Industrial Engineering and Production Management", S. Chand and Company, First edition, 2000.*

REFERENCES

1. *Samson Eilon, "Elements of production planning and control", Universal Book Corpn.1984*
2. *Elwood S.Buffa, and Rakesh K.Sarin, "Modern Production / Operations Management", 8th Ed. John Wiley and Sons, 2000.*
3. *K.C.Jain & L.N. Aggarwal, "Production Planning Control and Industrial Management", Khanna Publishers, 1990.*
4. *N.G. Nair, "Production and Operations Management", Tata McGraw-Hill, 1996.*
5. *S.N.Chary, "Theory and Problems in Production & Operations Management", Tata McGraw Hill, 1995.*

PROGRAMMABLE LOGIC CONTROLLER

- Study of Programmable Logic Controller

EXERCISES IN PLC

1. Multi cycle automation multiple cylinders using cascade method (sequence of motion: A+ B+ B- A-)
2. Operate an electrical switch to make a double acting cylinder to attain FWD stroke. (Use double solenoid valve to operate the cylinder). RET stroke should be automatic as soon as it reaches the FWD end position
3. Two Double Acting Cylinder are to be Electro pneumatically operated and their sequence is A+ B+ B- A-
4. Continuous operation of a DAC
5. Sequential operation: A+ B+ A- B-
6. Sequential multicycle operation: A+ A- B+ B-
7. Sequential multicycle operation with timer & counter: A+B+C+C-B-A-

CNC MACHINES

- Study of Basic Components of CNC
- CNC Programming:
 - Manual part programming
 - Computer aided part programming

EXERCISES IN CNC MACHINES

1. Programming and machining of parts involving facing, cleaning cut, reduction in diameter by CNC Lathe.
2. Programming and machining of parts involving longitudinal, taper and transverse turning operations in CNC Lathe.
3. Part program involving circular interpolation for machining of curved surface.
4. Part programming for milling machine operations.
5. Applications of Standard fixed cycles / Canned cycles
6. Applications of Non – Standardized fixed cycles.
7. Applications of Macros

08P608 - MODELING AND SIMULATION LABORATORY

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Modeling and Simulation

- ❖ Practice In Part Programming And Simulate The Operation On Turning Center
- ❖ Practice In Part Programming And Simulate The Operation On Machine Center
- ❖ **Cam Software:**
Creating And Editing The Geometric And Drafting Entities – Analyzing Entities- Creating And Modifying The Solid Models – Machine A Solid Model : Setting Tool, Machine And Job Parameters – Tool Path – Tool Path Parameters – Back Plotting The Tool Path – Tool Path Verification – Post Processor – Nc Code Generation.
- **Two Dimensional Mechanical Design Analysis:**
 - Design And Calculation Of Cam Contour
 - Dynamic Stress And Shear Stress Calculation Of Screw And Nut
 - Force And Deflection Calculation Springs
 - Maximum Stress Deflection And Moments Calculation On Shafts
- **Finite Element Modeling And Analysis:**
 - Exercises On Modeling And Meshing
 - Exercises On Solution And Post Processor
 - Analysis On Structural, Elasticity, Fluid Flow, Heat Transfer, Welded Assembly, Metal Cutting Problems.
 - Exercises On Coupled Field Analysis
 - Introduction To APDL
- ❖ Kinematic Analysis Of Simple Mechanisms
- ❖ Modeling And Analysis Of Hydraulic And Pneumatic Systems Using MATLAB/LABVIEW Software
 - ❖ Simulation Of Basic Hydraulic And Pneumatic Circuits Using AUTOMATION STUDIO Software
 - ❖ Design And Development Of Sensor Interface For Mechanical Systems
 - ❖ Modeling And Manufacturing Using ARENA
 - ❖ **Process Modeling, Simulation And Analysis Using Process Management Software:**
Creating A Process Model – Define Simulation Scenarios – Simulate The Process – Review The Results – Case Studies.
- ❖ **Robotics:**
 - Simulation Study Of Workcell Using IGRIP – Robot Simulation Software
 - WALLI – Robot Simulation Software
 - Simulation Study Of Mentor Robot
 - Simulation Study Of Gryphon Robot
 - Demonstration Of ER-V Robot
 - Demonstration Of Scara ER – 14 Robot

REFERENCES

- [Http://Www.Mastercam.Com](http://www.Mastercam.Com) : MASTERCAM Software
- [Http://Www.Autodesk.Com](http://www.Autodesk.Com) : AutoCAD Mechanical Software
- [Http://Www.Ansys.Com](http://www.Ansys.Com) : ANSYS Software
- [Http://Www.Automationstudio.Com](http://www.Automationstudio.Com) : AUTOMATION STUDIO Software
- [Http://Www.Igrafx.Com](http://www.Igrafx.Com) : iGrafx PROCESS 2003–Process Management software

08P701 - STATISTICAL QUALITY CONTROL AND RELIABILITY ENGINEERING

(Use of approved statistical table permitted in the examination)

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INTRODUCTION AND PROCESS CONTROL FOR VARIABLES (10)

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

PROCESS CONTROL FOR ATTRIBUTES (08)

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

ACCEPTANCE SAMPLING (09)

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

LIFE TESTING - RELIABILITY (09)

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

QUALITY AND RELIABILITY (09)

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

TOTAL: 45 HOURS

TEXT BOOKS

1. Grant, Eugene.L “Statistical Quality Control”, McGraw-Hill, 1996.
2. L.S.Srinath, “Reliability Engineering”, Affiliated East west press, 1991.

REFERENCES

1. Monohar Mahajan, “Statistical Quality Control”, Dhanpat Rai & Sons, 2001.
2. R.C.Gupta, “Statistical Quality control”, Khanna Publishers, 1997.
3. Besterfield D.H., “Quality Control”, Prentice Hall, 1993.
4. Sharma S.C., “Inspection Quality Control and Reliability”, Khanna Publishers, 1998.
5. Danny Samson, “Manufacturing & Operations Strategy”, Prentice Hall, 1991
6. Connor, P.D.T.O., “Practical Reliability Engineering”, John Wiley, 1993.

08P702 - DESIGN OF JIGS, FIXTURES AND PRESS TOOLS

[Use of Approved Data Book is permitted]

[Common to Mechanical]

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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

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.

08P703 – RESOURCE MANAGEMENT TECHNIQUES

(Use of Approved Statistical Table is permitted)

L	T	P	C
3	1	0	4

LINEAR MODELS

(09)

The phase of an operation research study . Linear programming . Graphical method. simplex Algorithm . Duality- dual simplex method . Transportation problems - Assignment problems.

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 MODELS

(09)

Inventory models. Economic order quantity models. Buffer stock. Reorder level. Quantity Discount models. Stochastic inventory models.

QUEUING THEORY

(09)

Queuing models. Queuing systems and structures. Notation parameter. Single server and Multi server models. Poisson input. Exponential services. Simulation - Monte Carlo Technique. Use of random number.

DECISION MODELS

(09)

Decision models. Game theory. Two person zero sum games. Graphic solution. Replacement Models. Models based an service life. Economic life. Markov analysis for solving marketing Problems. Equilibrium market share.

TUTORIAL: 15 LECTURER: 45 TOTAL: 60 HOURS

TEXT BOOKS

1. *P.K. Gupta & D.S. Hira, . Problems in Operations Research (Principles & Solutions) S.Chand & Co. Ltd., 2003.*
2. *Sharma,S.D. . Operation Research. Kedarnath Ram Nath & Co. Meerut.*

REFERENCE BOOKS

1. *H.A. Taha, Operation Research, Prentice Hall of India Pvt. Ltd.*
2. *Don. T. Phillips, Ravindren, A & James solberg . Operations Research . John Wiley & Sons.*

08P704 - UNCONVENTIONAL MANUFACTURING PROCESSES

L T P C
3 0 0 3

BASICS OF MODERN MACHINING PROCESSES (09)

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) Principle Energies employed in the processes - EDM, EC, USM, LBM, PAM, AJM, WJM etc.

ELECTROCHEMICAL METAL REMOVAL PROCESSES (09)

Process-principles-Equipment-Analysis of metal removal-tool material-Insulation-Process parameters. Electrochemical Machining (ECM), Electrochemical Grinding (ECG), Electrochemical Deburring and Honing-Chemical machining (CHM).

THERMAL METAL REMOVAL PROCESSES (09)

Process, operating principles-Breakdown mechanism-Dielectric fluid-Electrode material-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 (09)

Explosive forming, Electro-hydraulic forming, Electro-magnetic forming, Dynapak machine. High-pressure moulding, Squeeze casting, Rheo casting, V processes, Magnetic moulding, Flaskless moulding.

RAPID PROTOTYPING AND NANO-TECHNOLOGY (09)

Introduction-Advantages-limitation-principle-Rapid prototyping Systems-Stereo lithography (SLA), Selective Laser Sintering (SLS), Fused Deposition Modelling (FDM), Laminated Object Manufacturing (LOM), Solid Ground Curing (SGC), Three Dimensional Printing.

TOTAL: 45 HOURS

TEXT BOOKS

1. P.C.Pandey & H.S.Shan, "Modern machining processes", Tata McGraw hills publishing company Ltd.New Delhi, 1995.
2. P.K.Mishra, " Non Conventional Machining ", The Institution of Engineers (India) Text Books: Series, 1997.

REFERENCE BOOKS

1. Bhattacharya, "New Technology", institution of Engineers, 1997.
2. CMTI, "Electrochemical machining", Bangalore, 1978.
3. Gary.F.Benedict, "Nontraditional machining Processes", Marcell Dekker Inc, New York, 1987.
4. HMT, "Production Technology", Tata McGraw Hills publishers, 2002.
5. P.C.Sharma "A Text Books: of Production Engineering", 1995.

08P707- METROLOGY AND QUALITY CONTROL LABORATORY

L	T	P	C
0	0	3	2

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.
- Measurement of various dimensions of given component using Tool makers microscope.

QUALITY CONTROL

- Construction of Graphs like Histogram, Probability plot, Time series plot, Scatter plot, 3D Surface plot, etc.,
- Construction of Run chart, Pareto chart and Cause and effect diagram
- Regression analysis
- Performing an analysis of variance
- Construction of control charts for variables and attributes
- Performing Process Capability analysis.

TOTAL: 45 HOURS

REFERENCES

1. <http://www.minitab.com>: MINITAB – Statistical Software
2. <http://www.spss.com>: SPSS – Statistical Software

08P708 – MANUFACTURING TECHNOLOGY LABORATORY – II

L T P C
0 0 3 2

LIST OF EXERCISES

1. V- groove cutting in shaping machine.
2. Drilling, tapping and surface grinding using surface grinder and Radial drilling machine
3. External cylindrical grinding of shaft
4. Spur gear milling
5. Helical gear milling
6. Gear shaping
7. Gear hobbing
8. Polygonal milling
9. Making hexagonal hole using slotting machine
10. Letter cutting in vertical milling machine.

TOTAL: 45 HOURS

08P7E0 – DESIGN FOR MANUFACTURE AND ASSEMBLY

L T P C
3 0 0 3

DESIGN PRINCIPLE

(09)

Economics of process selection – general design principles of manufacturability – proper material selections – strength and mechanical factors – Geometric tolerances – Design for serviceability – Tolerance Charting Techniques. General aspects of the designers work - design factors – systematic working plan – basic design.

FORM DESIGN

(09)

Factors affecting casting design - Grey iron castings, steel castings, malleable iron castings – Non ferrous alloys: Aluminium castings – Pressure die castings – factors affecting weldment design – Gas and Arc welding.

FORMED METAL COMPONENTS AND NON-METALLIC PARTS DESIGN

(08)

Metal extrusion – cold headed parts – fine blanking – Tube and section bends – powder metal parts – thermo setting plastic parts – reinforced - plastic/composite parts.

MACHINED COMPONENTS DESIGN

(10)

Design for machinability – design for economy – design for clampability – design for accessibility. Turned parts – drilled parts – milled parts, planned, shaped and slotted parts – Ground parts – parts produced by EDM.

TECHNOLOGY REQUIREMENT AND ASSEMBLY

(09)

Product design requirements for group technology concepts and CNC machining – part family concept – mechanical assemblies – general recommendations - design rules for rivets, screw fasteners, gaskets and seals. Press and snap fits.

TOTAL: 45HOURS

TEXT BOOKS

1. James G.Bralla, *Hand book of product design for manufacture*, Mc Graw Hill Book Co, 1988.
2. Robert Matousek, *engineering Design – A systematic approach*, Blackie & Son Ltd, London.

REFERENCES:

1. Harry Peck, *Design for manufacture*, Pitman publications, 1983.
2. Trucks H.E., *Design for Economic Production*, Society of Manufacturing engineers, Michigan 2nd Edition 1987.
3. Karl T.Ulrich and Steven D Eppinger, *Product Design and Development*, Tata McGraw Hill, 2003.
4. Oliver R.Wade, *Tolerance Control in design and Manufacturing*, Industrial Press Inc., New York Publications, 1967.

08P7E1 - PATENT SYSTEM FOR ENGINEERS

L	T	P	C
3	0	0	3

BASICS OF PATENT SYSTEM

(09)

Patents as intellectual property- Trademarks –Copy rights – Trade Secrets-Patents -The evolution of a patent – 3 stages- conception to patent application-The patent application-The prosecution - The U.S. Patent System-The Canadian patent system - Importance of record-keeping .

BASIC PRINCIPLES OF PATENT SEARCHING

(09)

Patentability search-Infringement search-Validity search -Assignment search -Maintenance fee search. Searches after defining problem area -Hand search-Computer search-Literature search-Watch searches – hand searching – computer searching.

EVALUATION CRITERIA FOR PATENT SYSTEM

(09)

Patents and Innovation-**Evaluation Criteria's**: Accommodating New Technologies-Ensuring High-Quality Patents- Disseminating Technical Information- Ensuring the Timeliness and Containing the Costs of Decisions- Accessing Technologies for Research and Development- Reducing Redundancies and Inconsistencies among National Patent Systems- Maintaining a Level Field among Rights Holders.

PATENT LAW

(09)

overview: Patent – inventor benefits- patent applying procedure –approval of patent application – patent expiry –patent protection . **Definitions:** Antitrust law & patents – Bayh –Dole act – Independent and dependent claims – classification of patents – duration of patents – licensing of invention – patent application – PAD.

RECOMMENDATIONS OF PATENT SYSTEM

(09)

Seven Recommendations For A 21st-Century Patent System: Preserve a Flexible, Unitary, Open-Ended Patent System-Reinvigorate the Non-Obviousness Standard – Institute a Post-Grant Open Review Procedure-Strengthen USPTO Capabilities-Shield Some Research Uses of Patented Inventions from Infringement-Limit the Subjective Elements of Patent Litigation –Harmonize the U.S., European, and Japanese Patent

TOTAL: 45HOURS

TEXT BOOKS

1. *Thomas T. Gordon Arthur S. Cookfair, Patent Fundamentals for Scientists and Engineers, Second Edition, Lewis publishers.*

REFERENCE BOOKS

1. *Stephen A. Merrill, Richard C. Levin, and Mark B. Myers, Patent system for the 21st century.*
2. *Attorneys Stephen Elias and Richard Slim, Patent Copy right and Trademark –An intellectual property Desk Reference*

08P7E2 – MICRO MECHATRONICS

L	T	P	C
3	0	0	3

CURRENT TRENDS FOR ACTUATORS AND MICROMECHATRONICS (09)

Need for New Actuators, Conventional Methods for Micropositioning, Solid-State Actuators, Critical Design Concept.

Field-Induced Strains – Ferroelectricity, Microscopic Origins of Electric Field Induced Strains Tensor/Matrix Description of Piezoelectricity, Theoretical Description of Ferroelectric and Antiferroelectric Phenomena, Phenomenology of Magnetostriction, Ferroelectric Domain Reorientation, Grain Size and Electric Field-Induced Strain in Ferroelectric.

ACTUATOR MATERIALS (09)

Practical Actuator Materials, Figures of Merit for Piezoelectric Transducers, Temperature Dependence of the Electrostrictive Strain, Response Speed, Mechanical Properties of Actuators.

Ceramic Actuator Structures And Fabrication Methods - Fabrication of Ceramics and Single Crystals, Device Design, Electrode Materials, Commercially Available Piezoelectric and Electrostrictive Actuators.

DRIVE / CONTROL TECHNIQUES FOR PIEZOELECTRIC ACTUATORS (09)

Classification of Piezoelectric Actuators, Feedback Control, Pulse Drive, Resonance Drive, Sensors and Specialized Components for Micromechatronic Systems.

Loss Mechanisms And Heat Generation - Hysteresis and Loss in Piezoelectric, Heat Generation in Piezoelectrics, Hard and Soft Piezoelectrics.

Introduction to the Finite Element Method for Piezoelectric Structures - Background Information, Defining the Equations for the Problem, Application of the Finite Element Method.

APPLICATIONS OF SERVO DISPLACEMENT TRANSDUCER AND PULSE DRIVE MOTOR (09)

Servo Displacement Transducer - Deformable Mirrors, Microscope Stages, High Precision Linear Displacement Devices, Servo Systems, VCR Head Tracking Actuators, Vibration Suppression and Noise, Elimination Systems

Pulse Drive Motor - Imaging System Applications, Inchworm Devices, Dot Matrix Printer Heads, InkJet Printers, Piezoelectric Relays, Adaptive Suspension Systems,.

ULTRASONIC MOTOR APPLICATIONS AND THE FUTURE OF CERAMIC ACTUATORS IN MICROMECHATRONIC SYSTEMS (09)

Ultrasonic Motor - General Description and Classification of Ultrasonic Motors, Standing Wave Motors, Mixed-Mode Motors, Traveling Wave Motors, Mode Rotation Motors, Performance Comparison Among Various Ultrasonic Motors, Microscale Walking Machines, Calculations for the Speed and Thrust of Ultrasonic Motors, Elements of Designing an Ultrasonic Motor, Other Ultrasonic Motor Applications, Magnetic Motors, Reliability of Ultrasonic Motors.

Future of Ceramic Actuators in Micromechatronic Systems - Development Trends as Viewed from Patent Statistics, The Piezoelectric Actuator/Ultrasonic Motor Market, Future Trends in Actuator Design.

TOTAL: 45 HOURS

TEXT BOOKS

1. Kenji Uchino & Jayne R. Giniewicz, "Micromechatronics", Marcel Dekker Inc., New York.

REFERENCES

1. Modern Ceramic Engineering: Properties, Processing, and Use in Design: Second Edition, Revised and Expanded, *David W. Richerson*
2. Introduction to Engineering Materials: Behavior, Properties, and Selection, *G. T. Murray*
3. Fiber and Whisker Reinforced Ceramics for Structural Applications, *David Belitskus*
4. Thermal Analysis of Materials, *Robert F. Speyer*
5. Friction and Wear of Ceramics, *edited by Said Jahanmir*
6. Mechanical Properties of Metallic Composites, *edited by Shojiro Ochiai*
7. Ceramic Processing and Sintering, *M. N. Rahaman*
8. Composites Engineering Handbook, *edited by P. K. Mallick*
9. Ferroelectric Devices, *Ken / Uchino*
10. Mechanical Properties of Ceramics and Composites: Grain and Particle Effects, *Roy W. Rice*
11. Ceramic Fabrication Technology, *Roy W. Rice*

08P7E3 - COMPUTER GRAPHICS

L T P C
3 0 0 3

FUNDAMENTALS OF COMPUTER GRAPHICS (09)

Computer Graphics. Classification of applications. Graphics workstation. Interactive display devices. Input and output devices. raster and random scan. Graphic adaptors. Frame buffers. software. Line, circle and ellipse generating algorithm.

VISUAL REALISM (10)

2D and 3D Transformations- translation, rotation, scaling, shearing. projections. window to viewport coordinate transformation . Clipping algorithm. Fill algorithm. Hidden line / surface removal algorithm. Shading and colour models.

MODELLING OF CURVES AND SURFACES (09)

Representation of curves. cubic splines. Bezier curves. B splines. NURBS and β splines. Representation of surfaces. Surface patches: Bicubic, Bezier bicubic, cubic B spline, β spline and coon.s patch . Surface modeling: surface types, surface attributes and surface geometry. Solid modeling: CSG, B Rep and feature modeling.

GRAPHIC STANDARDS (08)

Graphics and computing standards. GKS, PHIGS, PEX, Hoops, OpenGL and Open Inventor . Data exchanger formats: IGES, STEP, CALS, DXF. Communication standards: LAN, WAN.

MODELING AND ANALYSIS (09)

Integration of design analysis and CAD. Feature extraction. Graphical aid for preprocessing in FEA. Mesh generation techniques. Post processing. Machining from 3D model. Generative machining. Cutter location. Tool path generation from solid models. STL formats for rapid prototyping. Slicing techniques. Introduction to fractional geometry.

TOTAL: 45 HOURS

TEXT BOOKS

1. *Chris McMhoan and jimmi Browne, .CAD / CAM Principles, practice and manufacturing management. pearson education asia Ltd.*
2. *Radhakrishnan P and Kothandraman C.P, .Computer graphicsand design. dhapat rai publication, new delhi.*
3. *Donald hearn and Pauline baker M, .Computer graphics., prentice hall inc..*

REFERENCE

1. *Ibrahim Zeid, .Mastering .CAD / CAM., Tata McGraw hill, delh.*
2. *Willian M Neumann and Robert F sproul, .Principles of computer graphics., McGraw hill book Co., Singapore.*

08P7E4 - SENSORS IN MANUFACTURING

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FUNDAMENTALS

(09)

Roles of Sensors in Manufacturing and Application Range - Principles of Sensors for Manufacturing - Basic Sensor Classification & Types - New Trends – Signal Processing and Decision Making - Sensor Fusion - Sensors in Mechanical Manufacturing - Objectives of Sensing - Requirements for Sensors and Sensing Systems - Signal Processing and Conversion - Analog Signal Processing - Digital Signal Processing - Pattern Recognition - Neural Networks - Fuzzy Reasoning - Human-Machine Interfaces

SENSORS FOR MACHINE TOOLS, ROBOTS AND WORK PIECES

(09)

Position Measurement - Sensors for Orientation - Calibration of Machine Tools and Robots - Collision Detection - Machine Tool Monitoring and Diagnosis - Macro-geometric Features - Mechanical Measurement Methods - Dial Comparators - Capacitive Displacement & Incremental Sensors - Electromechanical Measuring Methods - Optoelectronic Measurement Methods - Camera Metrology - Shadow Casting Methods - Point Triangulation - Auto focus Method - Tactile Measuring Method - Scattered Light Method - White Light Interferometry - Speckle Correlation

PROBE MEASURING METHODS

(09)

Scanning Electron Microscopy (SEM) - Scanning Tunneling Microscopy (STM) - Scanning Near-field Optical Microscopy (SNOM) - Scanning Capacitance Microscopy (SCM) - Scanning Thermal Microscopy (SThM) - Atomic Force Microscopy (AFM) - Magnetic Force Microscopy (MFM) - Lateral Force Microscopy (LFM) - Phase Detection Microscopy (PDM) - Force Modulation Microscopy (FMM) - Electric Force Microscopy (EFM) - Scanning Near-field Acoustic Microscopy (SNAM)

SENSORS FOR PROCESS MONITORING

(09)

Introduction - Sensors with Melt Contact - Sensors without Melt Contact - Mixing and Blending of Metal Powders - Compacting of Metal Powders - Sensors for the Punching Process - Sensors and Process Signals - Sensors for the Sheet Metal Forming Process - Deep Drawing Process and Signals - Sensors for the Forging Process - Sensor Application and Boundaries - Problems in Cutting and Need for Monitoring - Sensors for Process Quantities - Intelligent Systems for Cutting Processes - Acoustic Emission Sensors - Problems in Abrasive Processes and Needs for Monitoring - Sensors for micro & Macro-geometric Quantities

DEVELOPMENTS IN MANUFACTURING AND THEIR INFLUENCE ON SENSORS

(09)

Optical Scales - Laser Interferometers - Photoelectric Transducers - Inductive Sensors - Autocollimators - Ultra-precision Machining: Nanometric Displacement Sensors - Nanotechnology-Enabled Sensors: Possibilities, Realities, Applications - Wireless Sensor Networks: Principles and Applications - Individual Wireless Sensor Node Architecture - Wireless Sensor Networks Architecture - Radio Options for the Physical Layer in Wireless Sensor Networks - Power Consideration in Wireless Sensor Networks - Future Developments.

TOTAL: 45 HOURS

TEXT BOOKS

1. *H.K. Tönshoff, I. Inasaki, Sensors in Manufacturing, 2001.*
2. *Jon S. Wilson, Sensor Technology Hand Book, Elsevier Inc, 2005.*

REFERENCES

1. *Shaw, M.C., Metal Cutting Principles; Oxford: Oxford University Press, 1984.*
2. *Usher, M.J., Sensors and Transducers; London, Macmillan, 1985.*
3. *Rangwala, S., PhD Thesis; Department of Mechanical Engineering, University of California, Berkeley, CA, 1988.*
4. *Dagnall, H., Exploring Surface Texture; Leicester: Rank Taylor Hobson, 1986.*
5. *Groover, M. P., Fundamentals of Modern Manufacturing; Prentice-Hall, Englewood Cliffs, NJ, 1996.*

08P7E5 - COMPUTATIONAL INTELLIGENCE IN MANUFACTURING

L T P C
3 0 0 3

INTRODUCTION

(09)

Computational Intelligence for Manufacturing - Knowledge-Based Systems, Fuzzy Logic, Inductive Learning, Neural Networks, Genetic Algorithms, Some Applications in Engineering and Manufacture; Neural Network Applications in Intelligent Manufacturing - Modeling and Design of Manufacturing Systems, Modeling, Planning, and Scheduling of Manufacturing Processes, Monitoring and Control of Manufacturing Processes, Quality Control, Quality Assurance, and Fault Diagnosis; Holonic Metamorphic Architectures for Manufacturing: Identifying ,Holonic Structures in Multiagent Systems by Fuzzy Modeling - Agent-Oriented Manufacturing Systems, The MetaMorph Project, Holonic Manufacturing Systems, Holonic Self-Organization of MetaMorph via Dynamic Virtual Clustering, Automatic Grouping of Agents into Holonic System: Simulation

MANUFACTURING SYSTEM MODELING AND DESIGN

(09)

Neural Network Applications for Group Technology and Cellular Manufacturing - Artificial Neural Networks- A Taxonomy of Neural Network Application for GT/CM-Application of Fuzzy Set Theory in Flexible Manufacturing- A Multi Criterion Decision Making Approach for Evaluation of Scheduling Rules-Justification of Representing Objectives with Fuzzy Sets-Decision Points and Associated Rules-A Hierarchical Structure for Evaluation of Scheduling Rules- Genetic Algorithms in Manufacturing System Design-The Design of Cellular Manufacturing Systems- A Genetic Algorithm for Finding the Optimum Process Routings for Parts-A Genetic Algorithm to Cluster Machines into Machine Groups- Layout Design-A Genetic Algorithm for Layout Optimization- Intelligent Design Retrieving Systems Using Neural Networks

PROCESS PLANNING AND SCHEDULING

(09)

Soft Computing for Optimal Planning and Sequencing of-Parallel Machining Operations-A Mixed Integer Program-A Genetic-Based Algorithm- Two Reported Examples Solved by the Proposed GA- Two Reported Examples Solved by the Proposed Tabu Search-Random Problem Generator and Further Tests Application of Genetic Algorithms and Simulated Annealing in Process Planning Optimization-Modeling Process Planning Problems in an Optimization Perspective-Applying a Genetic Algorithm to the Process Planning Problem-Applying Simulated Annealing to the Process Planning Problem-Comparison between the GA and the SA Algorithm Production Planning and Scheduling Using Genetic Algorithms-Resource-Constrained Project Scheduling Problem-Parallel Machine Scheduling Problem-Job-Shop Scheduling Problem-Multistage Process Planning-Part Loading Scheduling Problem

MANUFACTURING PROCESS MONITORING AND CONTROL

(09)

Neural Network Predictive Process Models: Three Diverse Manufacturing Applications
Introduction to Neural Network Predictive Process Models Ceramic Slip Casting Application- Abrasive Flow Machining Application-Neural Network Applications to Manufacturing Processes:- Monitoring and Control-Manufacturing Process Monitoring and Control-Neural Network-Based Monitoring-Quality Monitoring Applications-Neural Network-Based Control-Process Control Applications-Computational Intelligence in Microelectronics Manufacturing-Monitoring and Diagnosing Manufacturing Processes Using Fuzzy Set Theory-A Brief Description of Fuzzy Set Theory- Fuzzy Neural Network and Wavelet for Tool Condition Monitoring-Fuzzy Neural Network-Wavelet Transforms -Identification of Tool Wear States Using Fuzzy Method-Tool Wear Monitoring with Wavelet Transforms and Fuzzy Neural Network

QUALITY ASSURANCE AND FAULT DIAGNOSIS

(09)

Neural Networks and Neural-Fuzzy Approaches in an In-Process Surface Roughness Recognition System for End Milling Operations-Methodologies-Experimental Setup and Design-The In-Process Surface Roughness Recognition Systems -Intelligent Quality Controllers for On-Line Parameter Design- Plasma Etching Process Modeling and On-Line Parameter Design-A Hybrid Neural Fuzzy System for Statistical Process Control-Statistical Process Control-Neural Network Control Charts-A Hybrid Neural Fuzzy Control Chart-Design, Operations, and Guidelines for Using the Proposed Hybrid Neural Fuzzy Control Chart-Properties of the Proposed Hybrid Neural Fuzzy Control Chart-A Prototype Rough-Set and Genetic Algorithms Enhanced Multi-Concept Classification System for Manufacturing Diagnosis

TOTAL: 45 HOURS

TEXT BOOKS

1. Wang, Jun et al "Frontmatter" *Computational Intelligence in Manufacturing Handbook* Jun Wang

REFERENCES

1. Ashiru I., Czanecki C. and Routen T., (1995), *Intelligent operators and optimal genetic-based path planning for mobile robots*, Proc. Int. Conf. Recent Advances in Mechatronics, Istanbul, Turkey, August, 1018-1023.
2. Baker J. E., (1985), *Adaptive selection methods for genetic algorithms*, Proc. First Int. Conf. Genetic Algorithms and Their Applications, Pittsburgh, PA, 101-111.
3. Bas K. and Erkmen A. M., (1995), *Fuzzy preshape and reshape control of Anthrobot-III 5-fingered robothand*, Proc. Int. Conf. Recent Advances in Mechatronics, Istanbul, Turkey, August, 673-677.
4. Bento J. and Feijó B., (1997), *An agent-based paradigm for building intelligent CAD systems*, *Artificial Intelligence in Engineering*, 11(3), 231-244.

08P7E6 - SURFACE ENGINEERING

L T P C
3 0 0 3

FUNDAMENTALS OF SURFACE ENGINEERING. (09)

Topography of Engineering surfaces - Importance and necessity of surface engineering - Contact between surfaces, Classification and scope of surface engineering in metals – ceramics - polymers and composites, Tailoring of surfaces of advanced materials. Surface protection (Physical) - Surface dependent engineering properties, viz., wear, friction, corrosion, fatigue, reflectivity, and emissivity. Common surface initiated engineering failures - mechanism of surface degradation.

VARIOUS SURFACE CLEANING PROCESSES. (09)

General cleaning process for ferrous - non ferrous metals and alloys, Classification and Selection of Cleaning processes - Acid and Alkaline - Salt bath - emulsion cleaning – Ultrasonic - Mechanical cleaning - Pickling and de-scaling Process - Abrasive bath cleaning - polishing and buffing, shot peening – Applications

SURFACE TREATMENT TECHNIQUES. (09)

Surface modification techniques - classification, principles, methods, and technology used, conventional surface engineering methods - Diffusion coatings like carburizing – nitriding – cyaniding - hot dipping – galvanizing – anodizing – Aluminizing – Phosphetising – Passivation. Thermal spraying - Vapour deposition - ion implantation, Diamond and Diamond like carbon thin films and coatings for engineering surfaces. Diffusion bonding.

THIN LAYER ENGINEERING PROCESSES. (09)

Other processes used in surface engineering - Laser and Electron Beam hardening - Effect of process variables such as power and scan speed – Physical vapor deposition (PVD) - Chemical vapor deposition (CVD) - Thermal evaporation - Arc vaporizations - Sputtering, Coating of tools, TiC, TiN, Al₂O₃ and Diamond - coating properties and applications of thin coatings. Surface engineering problems related to substrate characteristics. Plasma enhanced surface engineering

EVALUATION, TESTING AND SELECTION OF COATINGS. (09)

Measurement of mechanical properties of engineered surface in nano scale, Evaluation of tribological characteristics of engineered surface in macro - micro and nano scale, Surface geometry – characterization techniques, the quality plan - design - testing and inspection - thickness and porosity measurement - adhesion measurement – selection of coatings - Industrial applications of engineering coatings.

TOTAL HOURS: 45 HOURS

TEXT BOOKS:

1. *Bharat Bhushan, "Introduction to Tribology*
2. *K. Chopra, L. Malhotra Thin film deposition – McGraw Hill.*

REFERENCES:

1. *Frank Philip Bowden, "The Friction and Lubrication of Solids", Oxford Classic Texts*
2. *Gwidon Stachowiak, A W Batchelor, "Engineering Tribology"*
3. *ASM Hand Book, Vol. 5, "Surface Engineering".*
4. *Tool & Manufacturing Engineers Hand book, Vol.3, 'Materials Finishing and Coating*
5. *Kammeth G. Budinski, "Surface Engineering for Wear resistance" Prentice Hall,*

08P7E7 – COMPOSITE MATERIALS
[Common to Mechanical]

L T P C
3 0 0 3

INTRODUCTION TO COMPOSITES

(08)

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

(09)

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

(09)

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

(07)

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

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.

08P7E8 - ROBUST DESIGN

[Common to Mechanical]

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, NewYork.

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.

08P7E9 - TOTAL QUALITY MANAGEMENT
[Common to Mechanical and 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 BOOK

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.Lindsay, “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.

08P7EA - ADVANCED WELDING TECHNOLOGY

L T P C
3 0 0 3

SOLID STATE WELDING PROCESSES (09)

Fundamental principles, review of the various pressure welding processes and their applications. Friction, explosive, diffusion, and Ultrasonic welding – principles of operation, process characteristics and application.

HIGH ENERGY BEAM WELDING (09)

Heat generation and regulation - Equipment details in typical set-up - Electron beam welding in different degrees of vacuum - advantages and disadvantages, applications.

Laser Welding: Principles of operation, advantages, and limitations, applications.

ELECTRO SLAG WELDING (09)

Heat generation, principles of operations, wire and consumables, guide techniques, selection of current, voltage and other process variables, nature of fluxes and their selection.

Electro-gas welding: Principle and applications, Narrow gap welding,

PLASMA ARC WELDING (09)

Special features of plasma arc- transferred and non transferred arc, key hole and puddle-in mode of operation, micro, low and high current plasma arc welding and their applications, plasma cutting, surfacing and applications.

OTHER WELDING PROCESSES (09)

Adhesive bonding and Welding of plastics, Cold pressure welding, High frequency Welding, Stud welding, Under Water welding, Welding automation.

TOTAL : 45 HOURS

TEXT BOOK

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.*
3. *Little R.L., "Welding and welding Technology", Tata McGraw Hill Publishing Co., Ltd., New Delhi, 1989.*

REFERENCES

1. *Schwartz M.M. "Metals Joining Manual". McGraw Hill Books.*
2. *Tylecote R.F. "The Solid Phase Welding of Metals". Edward Arnold Publishers Ltd. London.*
3. *AWS- Welding Hand Book. 8th Edition. Vol- 2. "Welding Process"*
4. *Nadkarni S.V. "Modern Arc Welding Technology", Oxford IBH Publishers.*
5. *Christopher Davis. "Laser Welding- Practical Guide". Jaico Publishing House.*
6. *Davis A.C., "The Science and Practice of Welding", Cambridge University Press, Cambridge, 1993*

08P7EB – PLANT LAYOUT AND MATERIAL HANDLING TECHNIQUES

L	T	P	C
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PLANT LOCATION AND PHYSICAL FACILITIES (08)

Plant Location : Factors to be considered – influence of location on plant layout, selection of plant site, Consideration in facilities planning and 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 (10)

Need for layout, types of layout, factors influencing product, process, fixed and combination layout; tool and techniques for developing layout, process chart, flow diagram, string diagram, template and scale models – machine data. Layout planning procedure. Visualisation of layout, revision and improving existing layout, balancing of fabrication and assembly lines.

MATERIAL HANDLING (09)

Importance and scope. Principles of material handling. Planning, operating and costing principles – types of material handling systems, factors influencing their choice.

INDUSTRIAL BUILDINGS AND UTILITIES (09)

Centralised electrical, pneumatic water line systems. Types of buildings, lighting, heating, air-conditioning and ventilation utilities – planning and maintenance, waste handling, statutory requirements, Packing and storage of materials: Importance of packaging, layout for packaging – packaging machinery – wrapping and packing of materials, cushion materials.

ANALYSIS OF MATERIAL HANDLING (09)

Factors involved, motion analysis, flow analysis, graphic analysis, safety analysis, equipment cost analysis, palletization analysis, analysis of operation, material handling surveys.

TOTAL: 45 HOURS

TEXT BOOKS

1. James, M. Apple, *Plant layout and material handling*, Ronald, 1977.
2. Immer, I.R. *Material Handling*, McGraw-Hill Book Co, 1953.

REFERENCES

1. Shubin and Madeheim, *Plant Layout*, Prentice-Hall of India, 1965.
2. James Moore, M., *Plant Layout and Design*, the Macmillan Company, 1963.
3. Richanrd Muther, *Practical Plant Layout*, McGraw Hill Ltd, 1955.

08P8E0 - IMAGE PROCESSING IN MANUFACTURING

L	T	P	C
3	0	0	3

COMPUTER VISION (09)

Computer Imaging. Computer Vision and Image Processing. Human Visual Perception. Image Representation. Image Geometry. Sampling and Quantization. Levels of computation; Point level, Local level, Global level and object level. Digital Image Properties.

IMAGE ACQUISITION (09)

Charge coupled devices: Principle, Surface channel CCD.s, Buried channel CCD.s, sensitivity and resolution, Noise and Hot Pixels, Blooming, Image Smear, Linear CCD Sensors, Image Sensors . Line scan cameras. CMOS image sensors. Video standards. Colour images: various colour models. Other Image Sources: Ultrasound imaging devices, computer tomography, Magnetic resonance imaging. Optics: Lens equation, Image resolution, Depth of field, View volume and Exposure.

IMAGE DISTRIBUTION (09)

Frame Grabbing. Camera interfaces and protocols. Compression Techniques. Lossless compression: Run Length Encoding, Huffman coding, Arithmetic coding - Lossy compression: Discrete cosine transform, JPEG coding, Discrete wavelet transform. Image Standards: BMP, GIF, TIFF, PNG, PCX, JPG, DICOM standard.

IMAGE PROCESSING (09)

Gray scale operations: Histogram, Look up tables. Spatial Image filtering: smoothing, Gaussian, Gradient, Laplacian . Frequency Filtering: FFT, Morphology Functions: Thresholding, Binary Morphology and Gray level Morphology.

IMAGE ANALYSIS (09)

Pixel value analysis: Line profile, Quantify areas, Centroid function, Linear averages, Edge detection and enhancement, Segmentation and labeling. Quantitative analysis: Counting objects, Measuring Distances, Complex particle measurements. Image calibration. Pattern matching techniques. Character recognition. Applications in Manufacturing.

TOTAL: 45 HOURS

TEXT BOOKS

1. *Ramesh Jain., Rangachar Kasthuri, Brian Gschunch, .machine Vision., McGraw Hill International Edition.*
2. *Thomas Klinger, .Image processing with LabView and IMAQ Vision. Prentice Hall.*
3. *Scott E Umbaugh, .Computer Vision and Image Processing : A Practical approach using CVIP tools., Prentice Hall International Inc.*

REFERENCE

1. *Milan Sonka, Vaclav Hlavac, Roger Boyle, .Image Processing, Analysis & Machine Vision., PWS Publishing.*
2. *Rafeal C Gonzalez, Richard E Woods, .Digital Image Processing., Second Edition, Pearson Education.*
3. *Janaki Raman P.A., .Robotics and Image Processing., Tata McGraw Hill.*

08P8E1 - PRODUCT DESIGN AND PROCESS ENGINEERING

L T P C
3 0 0 3

PRODUCT ENGINEERING

(09)

Nature and scope of product engineering- creative and organizing for product innovation criteria for product success in life cycle of a product, maintainability engineering.

MODELLING AND SIMULATION

(09)

Modeling and simulation - The role of models in product design mathematical modeling similitude relations- Weighted property index.

MATERIAL SELECTION

(09)

Material selection- Problems of material selection - Performance characteristics of materials- the materials selection process - economics of materials - Cost versus performance relations - Weighted property index.

DESIGN CONSIDERATIONS

(09)

Functional and production design - form design - influence of basis design, mechanical loading and material on form design - form design of gray castings, malleable iron castings - Aluminum castings - Pressure die-castings, plastic moulding, welded fabrications, forging and manufacture by machining methods.

AESTHETIC AND ERGONOMIC CONSIDERATIONS

(09)

Influence of space, size, weight, etc, on form design, aesthetic and ergonomic considerations - Dimensioning and tolerancing a product - functional production and inspection datum-Tolerance analysis.

TOTAL: 45 HOURS

TEXT BOOK

1. Dieter, G.E., .*Engineering design, McGraw Hill.*
2. Robert Matousek, .*Engineering Design, Blacke & Sons Ltd.*

REFERANCE BOOKS

1. Jones J., .*Design Methods. interscience.*
2. Buhl,H.R .*Creative Engineering design. Iowa state university press.*
3. Niebel.B.W. & Draper,A.B., .*Product Design and process Engineering, McGraw Hill.*
4. Harry peck, .*Designing for Manufacturing, Sir Issac Pitman and Sons Ltd.*
5. Gladman, C.A., .*Manual for Geometric Analysis of Engineering Designs, Australian Trade publications Ltd.*
6. Oliver R Wade, *Tolerance Control in Design and Manufacture, Industrial Press, Newyork publications.*

08P8E2 - OPTICAL METROLOGY

L T P C
3 0 0 3

BASICS AND GAUSSIAN OPTICS

(09)

Introduction-the electro magnetic spectrum- The Plane Wave-Light Rays - Phase Difference - Complex Notation- Complex Amplitude -Oblique Incidence of A Plane Wave -The Spherical Wave - The Intensity - Geometrical Optics - The Simple Convex (Positive) Lens - A Plane-Wave Set-Up. Gaussian Optics: Introduction - Refraction at a Spherical Surface - The General Image-Forming System - The Image-Formation Process - Reflection at a Spherical Surface - Aspheric Lenses - Stops and Apertures - Lens Aberrations. Computer Lens Design - Standard Optical Systems.

INTERFERENCE, DIFFRACTION, LIGHT SOURCES AND DETECTORS

(09)

General Description - Interference between two Plane Waves - Laser Doppler Velocimetry (LDV) - Interference between other Waves - Interferometry - Spatial and Temporal Coherence - Optical Coherence Tomography. Diffraction: The Grating Equation- Amplitude Transmittance -The Spatial Frequency Spectrum - Fourier Optics - Optical Filtering - Practical Filtering Set-Ups - Physical Optics - Light Sources And Detectors - Radiometry and Photometry - Incoherent and Coherent Light Sources - Hologram Recording Medias - Photoelectric Detectors - The CCD Camera - Sampling - Signal Transfer.

HOLOGRAPHY, MOIR'E, TRIANGULATION AND SPECKLE METHODS

(09)

The Holographic Process-Diffraction Efficiency-Phase-Hologram - Volume Holograms -Stability Requirements- Holographic Interferometry -Holographic Vibration Analysis -Holographic Interferometry of Transparent Objects - Sinusoidal Gratings- Moir'e Between Two Angularly Displaced Gratings – Measurement methods - Reflection Moir'e - Triangulation - Speckle Methods - The Speckle Effect - Speckle Size - Speckle Photography - Speckle Correlation -Speckle-Shearing Interferometry - White-Light Speckle Photography.

PHOTOELASTICITY&POLARIZED LIGHT, DIGITAL IMAGE PROCESSING

(09)

Introduction - Polarized Light - Polarizing Filters - Unpolarized Light - -The Jones Matrix Formalism of Polarized Light-Photoelasticity -The Plane Polariscopes - The Circular Polariscopes - Detection of Isochromatics of Fractional Order - Holographic Photoelasticity - Three-Dimensional Photoelasticity -Digital Image Processing - Digital Image Representation - Camera Calibration Lens Distortion - Perspective Transformations -Image Processing - Contrast Stretching-. Convolution - Noise Suppression - Edge Detection -The Discrete Fourier Transform (DFT) and the FFT.

FRINGE ANALYSIS,COMPUTERIZED OPTICAL PROCESSES AND FIBRE OPTICS IN METROLOGY

(09)

Introduction - Intensity-Based Analysis Methods -Phase-Measurement Interferometry - Principles of TPMI -Errors in TPMI Measurements -Spatial Phase-Measurement Methods Phase Unwrapping - Computerized Optical Processes - TV Holography (ESPI) -Digital Holography -Digital Speckle Photography- Fibre Optics in Metrology-Introduction -Light Propagation through Optical Fibres -Attenuation and Dispersion.

TOTAL: 45 HOURS

TEXT BOOKS

1. Kjell J.Gasvik Spectra Vision AS, Trondheim, Norway, *Optical Metrology*, 3rd edition, John Wiley and sons Ltd, 2002.

REFERENCES

1. Born, M., and Wolf, E. *Principles of Optics*, 3rd edn, Pergamon Press, Oxford, 1999.
2. Amidror, I. *The Theory of Moir'e*, Kluwer Academic, New York, 2000.
3. Seul, M., *Practical Algorithms for Image Analysis*, Cambridge University Press, Cambridge, 2000

08P8E3 - RISK ANALYSIS AND RISK MANAGEMENT

L T P C
3 0 0 3

RISK MANAGEMENT (09)

Risk definition; Types of risk; hazards- types: Business Structures; Principles of risk management; risk factors- types; management strategies– Planning – resources- action;

IDENTIFICATION OF RISKS AND HAZARDS (09)

Identifying Risks Factors –Identifying the hazards; Risk Assessment; Risk factors; Evaluation of Risk Occurrence; Evaluation of hazards;

CONTROL OF RISKS (09)

Control of Risks – Control Measures Physical Controls, Behavioral Controls, Organizational And Procedural Controls- Systems Of Control - Employment Controls, Legislative Controls, Security Controls, Competitive Controls, Financial Controls ;Results Of Risks – Victims Of Hazards – Rating Of Potential Harm—Deciding Priorities For Action.

RISK ANALYSIS (09)

Risk analysis-definition-Types; Monte Carlo Risk Analysis – Probability Risk Analysis; uses: Economics: Applying Economic Principles to Risk: Risk–Benefit Analysis (RBA), Comparative Risk Analysis (CRA), Benefit–Cost Analysis (BCA); Uncertainty in risk analysis; advantages; limitations.

REGULATIONS AND APPLICATIONS OF RISK MANAGEMENT (09)

Use of Formal Management System Standards (MSS) - Quality MSS, Environmental MSS, OH & S Standards. Applications- Case Studies – Health Service, Engineering, Manufacture - Strategic Considerations for Case Study Firms.

TOTAL: 45 HOURS

TEXT BOOKS

1. *Risk Management 10 Principles, Jacqueline Jeynes, Buterworth Heinmann.*
2. *Fundamentals of Risk analysis and Risk management, Vlasta Molak, Lewis Publishers.*

08P8E4 - PLANNING AND SCHEDULING IN MANUFACTURING

L T P C
3 0 0 3

INTRODUCTION

(09)

Introduction - Planning and Scheduling - Role and Impact - Planning and Scheduling Functions in an Enterprise-Manufacturing Models - Jobs, Machines, and Facilities-Processing Characteristics and Constraints - Performance Measures and Objectives - Service Models-Activities and Resources in Service Settings - Operational Characteristics and Constraints -Project Planning and Scheduling - Critical Path Method (CPM) - Program Evaluation and Review Technique (PERT) - Time/Cost Trade-Offs: Linear Costs - Time/Cost Trade-Offs: Nonlinear Costs -Project Scheduling with Workforce Constraints-ROMAN: A Project Scheduling System for the Nuclear Power Industry

SCHEDULING OF FLEXIBLE ASSEMBLY SYSTEMS

(09)

Machine Scheduling and Job Shop Scheduling - Single Machine and Parallel Machine Models - Job Shops and Mathematical Programming - Job Shops and the Shifting Bottleneck Heuristic - Job Shops and Constraint Programming - Sequencing of Unpaced Assembly Systems-Sequencing of Paced Assembly Systems-Scheduling of Flexible Flow Systems with Bypass-Mixed Model Assembly Sequencing at Toyota - Economic Lot Scheduling- One Type of Item and the Economic Lot Size - Different Types of Items and Rotation Schedules- Different Types of Items and Arbitrary Schedules - More General ELSP Models - Multiproduct Planning and Scheduling at Owens - Corning Fiberglas

PLANNING AND SCHEDULING IN SERVICES

(09)

Planning and Scheduling in Supply Chains - Supply Chain Settings and Configurations- Frameworks for Planning and Scheduling in Supply Chains - A Medium Term Planning Model for a Supply Chain - Carlsberg Denmark: An Example of a System Implementation Reservations without Slack - Reservations with Slack - Reservations with Slack - Timetabling with Workforce Constraints - Timetabling with Operator or Tooling Constraints - Assigning Classes to Rooms at U.C. Berkeley - Scheduling and Timetabling in Sports and Entertainment - Scheduling and Timetabling in Sport Tournaments - Tournament Scheduling and Constraint Programming - Tournament Scheduling and Local Search - Scheduling Network Television Programs - Scheduling a College Basketball Conference

SYSTEMS DEVELOPMENT AND IMPLEMENTATION

(09)

Planning, Scheduling, and Timetabling in Transportation - Tanker Scheduling- Aircraft Routing and Scheduling - Train Timetabling - Carmen Systems: Designs and Implementations - Workforce Scheduling - Days-Off Scheduling - Shift Scheduling - The Cyclic Staffing Problem- Applications and Extensions of Cyclic Staffing - Crew Scheduling - Operator Scheduling in a Call Center- Systems Design and Implementation - Systems Architecture - Databases, Object Bases, and Knowledge-Bases - Modules for Generating Plans and Schedules - User Interfaces and Interactive Optimization - Generic Systems vs. Application-Specific Systems - Implementation and Maintenance Issues

ADVANCED CONCEPTS IN SYSTEMS DESIGN

(09)

Introduction - Robustness and Reactive Decision Making- Machine Learning Mechanisms - Design of Planning and Scheduling Engines and Algorithm Libraries- Reconfigurable Systems - Web-Based Planning and Scheduling Systems- Planning and Scheduling in Manufacturing - Planning and Scheduling in Services - Solution Methods- Systems Development

TOTAL: 45 HOURS

TEXT BOOKS

1. *T.S. Abdul-Razaq, C.N. Potts, and L.N. Van Wassenhove (1990) "A Survey of Algorithms for the Single Machine Total Weighted Tardiness Scheduling Problem", Discrete Applied Mathematics,*

REFERENCES

1. *E.H.L. Aarts and J.K. Lenstra (1997) Local Search in Combinatorial Optimization, J. Wiley, New York.*
2. *E.H.L. Aarts, P.J.M. van Laarhoven, J.K. Lenstra, and N.L.J. Ulder (1994) "A Computational Study of Local Search Algorithms for Job Shop Scheduling", ORSA*
3. *I.N.K. Abadie, N.G. Hall and C. Sriskandarajah (2000) "Minimizing Cycle Time in a Blocking Flow Shop", Operations Research,*

08P8E5 - ENERGY MANAGEMENT

L T P C
3 0 0 3

BASIC CONCEPTS OF ENERGY MANAGEMENT (09)

Background- The Value of Energy Management- The Energy Management Profession- Principles of Energy Management- **Effective Energy Management** : Introduction- Energy Management Program- Organizational Structure- Energy Policy- Planning- Audit Planning- Educational Planning- Strategic Planning- Reporting & Ownership

ENERGY CONSUMERS (09)

Boilers and Fired Systems : Introduction- Analysis of Boilers and Fired Systems- Key Elements for Maximum Efficiency- Fuel Considerations- Direct Contact Technology for Hot Water Production. **Steam and Condensate Systems** : Introduction- Thermal Properties of Steam- Estimating Steam Usage and its Value- Steam Traps and Their Application- Condensate Recovery- Condensate Recovery

ENERGY AUDITING (09)

Introduction - Energy Audit Procedures - Energy Management Programs -Energy Auditing Services -Basic Components of an Energy Audit -Specialized Audit Tools -Industrial Audits -Commercial Audits -Residential Audits -Indoor Air Quality.

ENERGY CONSERVATION & CONTROL SYSTEMS (09)

Introduction- Automatic Control- Optimization- Technology Classifications- Control Modes- Input/output Devices- Valves and Dampers- Instrument Accuracy, Repeatability, and Drift- Basic Control Block Diagrams- Key Fundamentals of Successfully Applied Automataic Controls- Operations and Maintenance- Expected Life of Control Equipment- Basic & Advanced Energy saving Control Applications- Control System Application Pitfalls to Avoid- Costs and Benefits of Automataic Control- Estimating Savings from Applied Automatic Control Systems

ENERGY EFFICIENT & STORAGE TECHNOLOGIES (09)

Introduction-Major Appliances and Space Conditioning Equipments - Efficient Designs- Overview of Storage Technologies- Principal Forms of Stored Energy- Applications of Energy Storage- Specifying Energy Storage Devices- Specifying Fuels- Direct Electric Storage- Electrochemical Energy Storage- Mechanical Energy Storage- Direct Thermal Storage- Thermochemical Energy Storage.

TOTAL: 45 HOURS

TEXT BOOKS

1. Wayne C. & Steve Doty, *Energy Management Handbook - Sixth Edition 2006, The Fairmont Press, Inc.*

REFERENCES

1. Kreith, F. and Burmeister, G. 1993. *Energy Management and Conservation. NCSL, Denver, CO.*
2. Frank Kreith & D.Yogi Goswami, *Energy Management & Conservation Handbook*

08P8E6 – MICRO AND NANO MANUFACTURING

L T P C
3 0 0 3

INTRODUCTION TO NANO MANUFACTURING

(08)

Introduction – top down approach – bottom up approach – combined approach – registration and alignment – reliability and defect control – trends in nano manufacturing – large scale surface-programmed assembly.

CARBON NANO TUBES

(10)

Fabrication of singled walled nano tube fabrics – Preparation of SWNT Solutions - Wafer Coating of SWNT Fabrics - Qualification of SWNT Fabrics with CMOS Processing – applications of SWNT Fabrics. Carbon Nanotube Synthesis - Building Organized MWNT Architectures - Mechanism of Substrate Site Selectivity of Carbon Nanotubes - Building Controlled SWNT Networks on a Large Scale - Fabrication of Hierarchically Branched Carbon Nanotubes Using Controlled Nano channels in Templates.

MICRO AND NANO FABRICATION

(09)

Introduction – Microfabrication. Nanofabrication - Nanofabrication Using Soft Lithography - Manipulative Techniques - Carbon Nanomaterials. Internal (Polymer–Polymer) Interface - Interfacial Instability in Nanolayer – Controlled Phase Separation in a Polymer. External (Polymer–Tool) Interface - Electric Field Effects on Polymer - Interfacial Effects in the Formation of Molded.

MICROFABRICATION USING X-RAY LITHOGRAPHY

(09)

Introduction - X-Ray Lithography Synchrotron Radiation (SR) - Micro fabrication Process LIGA Process - Lithography Steps - X-Ray Lithography - X-Ray Masks - Mask Materials - Single-Layer Absorber Fabrication - Alignment of X-Ray Mask to Substrate - Masks for High-Aspect Ratio Microlithography - Choice of Resist Substrate - Resist Requirements - Methods of Resist Application - Multiple Spin Coats - Commercial PMMA Sheets - Casting of PMMA - Resist Adhesion - Stress-Induced Cracks in PMMA – Exposure - Optimal Wavelength - Deposited Dose - Stepped and Slanted Microstructures - Master Micromold Fabrication Methods. Etching - Micromachining High-Aspect Ratio Microstructures – Micromolding.

PRECISION, LASER BASED MICRO NANO FABRICATION

(09)

Grinding Wheel - Conventional Grinding - Precision Grinding Processes - Ultraprecision Grinding - Nanogrinding. Laser based micro and nano fabrication : Laser Fundamentals - Beam Characteristics - Laser Optics - Laser Microfabrication - Laser Microfabrication.

LECTURE: 45 TOTAL: 45

TEXT BOOKS

1. *Ahmed Bushnaina, Nano Manufacturing Hand Book, Taylor & Francis Group, CRC press New york, 2006.*
2. *Mark J. Jackson, Microfabrication and Nanomanufacturing, Taylor & Francis Group, CRC press, New york, 2006.*

REFERENCES:

1. *Roco, M.C., Nanoscale science and engineering: unifying and transforming tools, AIChE J. 2004.*
2. *Narasimhan, J. and Papautsky, J., Micro mechanical, Micro engineering, 2004.*

08P8E7 - MANAGEMENT INFORMATION SYSTEMS

L	T	P	C
3	0	0	3

MIS AND RELATED CONCEPTS

(08)

Definition, Meaning and role of Management Information Systems (MIS) - System approach to planning and control-Creative thinking and problem solving-evolution of MIS-structure of MIS-MIS for different levels and their functions and requirements-MIS organization within the company-Global business environment and MIS-role of MIS to face increased complexity of business and management-Review of Information Technology and trends.

PLANNING, DESIGNING, IMPLEMENTATION AND EVALUATION OF INFORMATION SYSTEMS

(12)

Strategic and Project Planning-Business Planning-Grid analysis-methodologies and tools Reviewing MIS planning-sequence planning-Master program schedule-budgeting Reporting and controlling techniques-detailed design-overview of different methods and selection criteria-Structure System Analysis and Design-SLDC approach for SSAD- ER diagram-DFD-Implementation methods-evaluation-Cost/Benefit analysis-availability and control of information-security-reliability-CASE tools.

INFORMATION TECHNOLOGY AND MIS

(08)

Comparison of manual and computer based information systems-Types of computer based Application in MIS-conceptual design of computer integrated security management Information system-Modern communication-Video conferencing, Super Highway-system Configuration and selection-application of multimedia, internet and intranet technologies in MIS.

INFORMATION SYSTEMS IN BUSINESS AND MANAGEMENT

(10)

Data/Traction processing-online/real time system-batch processing-MIS for control and Decision making functions-Programmed and non programmed decision-MIS for making Programmed decisions-Integrated MIS-Office automation system-Decision support system-AI and Expert system.

DBMS PACKAGES

(07)

Information to RDBMS-core concepts of RDBMS-Introduction to packages (or any other Front end tool)-Introduction to Client/Server computing-Projection Development-Selection of Applications-Selection of CASE tools-Evaluation of design issues-Design and developments of applications.

TOTAL: 45 HOURS

TEXT BOOKS

1. James A. O .Brien, *Management Information Systems*, Galgotia Publications, 1995.
2. Robert G Murdict, *Information Systems for Modern Management*, Prentice Hall of India,1998

REFERENCES

1. *Henry C Lucas Jr., The Analysis, Design and Implementation of Information Systems, McGraw hill Company, New York, 4th edition, 1992.*
2. *Burch J.E., Strater F.R. & Grudnikshi G., Information Systems: Theory and Practice, John Wiley and Sons, New York, 1987.*
3. *Davis G.B., Management and Information Systems: Conceptual foundation Structure and Development, McGraw Hill New York, 1984.*
4. *Mcloed J.R.R., Management Information Systems, Maxwell Macmillan Intl., 4th edition, 1993.*
5. *Kroenke D, Management Information Systems- An Introduction, McGraw Hill, 1993.*

08P8E8 - INDUSTRIAL SAFETY ENGINEERING

L	T	P	C
3	0	0	3

SAFETY CONCEPT

(09)

Evolution of modern safety concept- History of safety movement- influence of environmental safety –Hazards –safety policy –safety survey, safety inspection safety culture and Behavioral safety

ACCIDENT INVESTIGATION AND REPORTING

(09)

Concept of an accident, reportable and non reportable accidents- principles of accident prevention- accident investigation and analysis- documentation of accidents- unsafe act and unsafe condition- domino sequence- role of safety committee and cost of accident.

SAFETY EDUCATION AND TRAINING

(10)

Importance of training – training methods- method of promoting safe practice-motivation-role of government agencies and private consulting agencies in safety training- Creating awareness- safety posters, safety displays ,safety pledge, safety incentive scheme , safety campaign

SAFETY MANAGEMENT

(09)

General concept of safety management-National Safety Council-OSHA,their roles in safety propagation-Evolution of modern safety concept-planning for safety for optimization of productivity-line and staff functions for safety-safety sampling.fault tree analysis.

SAFETY AUDIT AND SAFETY REGULATION

(08)

Components of safety audit, types of audit, audit methodology, non conformity reporting(NCR),audit checklist and report-review of inspection, safety measures in factories act, pollution control act for water, air, land . OSHAS18001, ISO14001

TOTAL 45 HOURS

TEXT BOOKS

1. *Heinrich H.W. "Industrial accident Prevention" McGraw-Hill company, New York, 1980.*
2. *Krishnan N.V. "safety management in Industry" jaico Puplicing House, Bombay, 1997.*

REFERENCE BOOKS

1. *Dan Petersen, "Techniques of Safety Management", Mc Graw-Hill Company, Tokyo 1981*
2. *"Accident Prevention Manual For Industrial Operations", N.S.C Chicago, 1982.*

08P8E9 - LOGISTICS AND SUPPLY CHAIN MANAGEMENT

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LOGISTICS FUNDAMENTALS

(09)

Scope of Logistics – Elements of Logistics – Logistics Engineering – system Life Cycle- Acquisition Logistics – Measures of Logistics. Logistical operation, integration, network design - logistical performance cycle, customer service global logistic - logistical resources - logistic planning.

LOGISTICS DESIGN AND DEVELOPMENT

(09)

Design process – Design principles – supplier design activities. Design integration – Design review – test and evaluation. Logistics in production – Transition from production to user operation – Logistics Management – Work break down structure (WBS) Distribution Management, Outbound logistics, Facility location, Classical location problems, Strategic planning models for location analysis, location models, multi objective analysis of location models,

SUPPLY CHAIN STRATEGIES

(09)

Evaluation of supply chain strategies - Strategy and structure - factors of supply chain - Manufacturing strategy stages, supply chain progress - Objectives of Supply Chain Management (SCM), key components of sourcing, distribution strategy, customer service strategy; supply chain. Management as Integrated logistics, generic activities, architecture of supply chain,

SUPPLY CHAIN MODELS AND ACTIVITY SYSTEM

(09)

Model for competing through supply chain management - PLC grid - supply chain redesign - Linking supply chain with customer. Structuring the supply chain - supply chain and new products, functional roles in supply chain Management - design frame work, collaborative product commerce (CPC). Supply process, Procurement process - Distribution management.

SCM ORGANISATION AND INFORMATION SYSTEM

(09)

The management task, logistics organisation, the logistics information systems -Topology of SC application - MRP, ERP, Warehouse management system, product data management - cases. IT – enabled supply chain: Electronic data interchange, enterprise resource planning (ERP).

TOTAL: 45 HOURS

TEXT BOOKS

1. Benjamin S.Blanchard “Logistics and Management” 5th Edition, Prentice-Hall International,Inc. 1998
2. Chopra, “Supply Chain Management”, Pearson Education Asia, New Delhi, 2004
3. Christopher, “Logistics and Supply Chain Management”, Pearson Education Asia, New Delhi, 2004

REFERENCES

1. Taylor and Brunt, “Manufacturing Operations and Supply Chain Management (The Lean Approach)”, Business Press Thomson Learning, NY.
2. Arjan J. Van Weele, “Purchasing and Supply Chain Management (Analysis Planning and Practice)”, Engineering, Business Press, Thomson Learning NY.
3. Donald B., “Logistic Management - The Integrated Supply Chain process”, McGraw Hill, NY
4. Scharj, P.B., Lasen, T.S., “Managing the global supply chain ”, Viva books, New Delhi, 2000.
5. Ayers, J.B., “Hand book of supply chain management ”, The St.Lencie press, 2000.

08P8EA – PROJECT MANAGEMENT

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PROJECT INTEGRATION MANAGEMENT (08)

Project Attributes - Project Management Framework - Project Management Processes and Process Groups - Implementing Project Integration Management - Developing Project Plan - Project Constraints - Managing Change Control – Project Scope Management - Project Scope Vs Product Scope - Planning, Creating, Verifying and Protecting the Project Scope - Tools and Techniques.

PROJECT TIME & PROJECT COST MANAGEMENT (10)

Project Time Management: Defining the Project Activities - Mapping the activities – Project Network Diagrams (PND): Precedence Diagramming method, Arrow Diagramming method, Conditional Diagramming method - Activity Duration Estimates - Developing the Project Schedule - Creating the Project Schedule: PERT, GERT, CPM, Calculating Float in a PND - Controlling the Project Schedule. Project Cost Management: Project Resources and Identifying Resource Requirements - Estimating and analysing of the Project Cost - Project Cost Baseline: S Curve - Implementing Cost Control - Cost Performance Index - Earned Value Management.

PROJECT QUALITY MANAGEMENT (10)

Quality Management - Quality Vs Grade - Kaizen technology - Quality Policy - Cost / Benefit Analysis - Cause and Effect Diagram - Process Flow Chart - Quality Management Plan - Quality Assurance - Quality Audit - Quality Control - Control Chart - Pareto Diagrams - Trend Analysis.

PROJECT RISK MANAGEMENT (10)

Planning for Risk Management - Stakeholder Tolerance - Work Breakdown Structure - Creating Risk Management Plan - Identifying Risks - Risk Categories - Delphi Technique - SWOT Analysis - Diagramming Techniques - Qualitative Risk Analysis - Probability Impact matrix - Quantitative Risk Analysis - Decision tree Analysis - Risk Responses - Risk Monitoring and Control.

PROJECT PROCUREMENT (07)

Project Human Resource Management - Organisational Planning - Maslow’s hierarchy - Herzberg’s Theory of motivation - McGregor’s Theory of X and Y - Ouchi’s Theory Z - Staff Management - Organizational Chart - Project Team Management. Project Communications Management - Communication Skills - Communication Matrix - Project Performance - Administrative Closure. Project Procurement - Planning for Procurement - Solicitation Planning - Contract Administration - Contract Closeout.

TUTORIALS (15)

Using Project Management Software : Create New Project Plan - Set Non working days - Project Properties - Create and Edit the Task list - Organizing Tasks into Phases - Setup Resources and Costs - Gantt Chart - Track the Progress on Tasks - Review the current tasks of the project - Create Reports.

TOTAL: 45 HOURS

TEXT BOOKS

1. *Joseph Phillips, "Project Management Professional Study Guide", McGraw-Hill, USA.*
2. *Claudia Baca, Patti Jansen, .Project Management Professional Workbook., Shreff Publishers.*

REFERENCE

1. *Ralph L. Kleim and Irwin S. Ludin, "Project Management Practitioners Handbook"*
2. *Prasanna Chandra, .Projects., Tata McGraw Hill.*
3. *Choudry S., .Project Management., Tata McGraw Hill.*
4. *Tim Pyron, .Special Edition Using Microsoft Office Project 2007", Que,*
5. *Carl Chatfield and Timothy Johnson, "Microsoft Office Project 2007 Step by Step", Microsoft Press.*
6. *Website: <http://www.pmi.org>*

08P8EB – INTELLIGENT MANUFACTURING SYSTEMS

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COMPONENTS OF EXPERT SYSTEMS (09)

Expert system concept – comparisons – stages in Expert system - Knowledge Representation – Types - comparison of Knowledge Representation Schemes – Inference engine – Inference models – Forward, backward chaining - Knowledge acquisition – Optimization and Knowledge based systems

INTELLIGENT MANUFACTURING (09)

Machine Learning - Intelligent Manufacturing – System Components – System architecture and Data flow – System operation – Flexible Assembly Systems – Tool management.

TECHNOLOGY BASED SYSTEMS (09)

Design of mechanical parts – Refinement Approach – Model based approach – Design of mechanisms – Feature based design – Knowledge based design for Automated Assembly – Process planning – Feature recognition – Machining Optimization – Knowledge Based Systems.

KNOWLEDGE BASED SYSTEM FOR GROUP TECHNOLOGY (09)

Models and Algorithms – Cluster Analysis Method – Knowledge based systems for GT – Models and Algorithms for Machine layout – Knowledge based Systems for machine layout – scheduling - Models and Algorithms – Knowledge Based Systems.

INDUSTRIAL APPLICATION AND RECENT ADVANCES (09)

Industrial application of Artificial Intelligence and Expert systems – Robotic vision systems, image processing techniques – application to object recognition and inspection - Application of Artificial Neural Networks – Fuzzy Logic and Genetic Algorithms in manufacturing – ANN for tool wear monitoring – Fuzzy control of machine tools.

TOTAL: 45 HOURS

TEXT BOOKS

1. Andrew Kusiak, “Intelligent Manufacturing Systems”, Prentice Hall, 1998.
2. Mohammed Jamshidi, “Design and Implementation of Intelligent Manufacturing systems”, Prentice Hall, 1995.

REFERENCE BOOKS

1. Mitsugen, Runweicheng, “Genetic Algorithms in Engineering Design”, JohWiley, 1997
2. Elaine Rich, “Artificial Intelligence”, TMH, 1995.
3. Ibrahim Zeid, “CAD/CAM Theory and Practice”, McGraw Hill, 1998.
4. Robert Levine et al; “A Comprehensive guide to AI and Expert Systems”, McGraw Hill Inc, 1986.