ANNA UNIVERSITY CHENNAI
CHENNAI - 600 025

UNIVERSITY DEPARTMENTS

REGULATIONS 2012

CURRICULLA AND SYLLABI FOR
I TO VIII SEMESTERS

B.E. PRODUCTION ENGINEERING
(FULL TIME)

ANNA UNIVERSITY, CHENNAI 600 025

UNIVERSITY DEPARTMENT

R - 2012

B.E.PRODUCTION ENGINEERING

I - VIII SEMESTERS CURRICULLA AND SYLLABI

SEMESTER I

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
HS 8151	Technical English - I	3	1	0	4
MA 8151	Mathematics - I	3	1	0	4
PH 8151	Engineering Physics	3	0	0	3
CY 8151	Engineering Chemistry	3	0	0	3
GE 8151	Computing Techniques	3	0	0	3
GE 8152	Engineering Graphics	2	0	3	4
PRACTICAL					
PH 8161	Physics Laboratory	0	0	2	1
CY 8161	Chemistry Laboratory	0	0	2	1
GE 8161	Computer Practices Laboratory	0	0	3	2
GE 8162	Engineering Practices Laboratory	0	0	3	2
	TOTAL	**17**	**2**	**13**	**27**

SEMESTER II

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
HS 8251	Technical English II	3	1	0	4
MA 8251	Mathematics II	3	1	0	4
PH 8251	Materials Science	3	0	0	3
GE 8251	Engineering Mechanics	3	1	0	4

ME 8251	Design Concepts in Engineering	3	0	0	3
PR 8251	Conventional Machining Processes	3	0	0	3
PRACTICAL					
PR 8263	Computer Aided Part Modeling Lab	0	0	3	2
PR 8264	Conventional Machining Processes Lab	0	0	3	2
	TOTAL	**18**	**3**	**6**	**25**

SEMESTER III

CODE NO.	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY					
MA 8353	Numerical Methods	3	1	0	4
AE 8304	Mechanics of Solids	3	0	0	3
AU 8351	Thermodynamics and Thermal Engineering	3	1	0	4
PR 8307	Electrical, Electronics and Control Systems	3	0	0	3
PR 8301	Foundry and Welding Technology	3	0	0	3
PR 8302	Metallurgy and Materials Testing	3	0	0	3
PRACTICAL					
PR 8313	Electrical, Electronics and Control Lab	0	0	3	2
PR8311	Metallurgy and Materials Testing lab	0	0	3	2
	TOTAL	**18**	**2**	**6**	**24**

SEMESTER IV

CODE NO.	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY					
GE 8351	Environmental Science and Engineering	3	0	0	3
AE 8451	Engineering Fluid Mechanics	3	0	0	3
PR 8401	Metal Cutting and CNC Machines	3	0	0	3
PR 8402	Metal Forming Processes	3	0	0	3
PR 8451	Kinematics and Dynamics of Machines	3	1	0	4
PR 8452	Machine Components Design	3	0	0	3

PRACTICAL					
PR 8411	Metal Cutting and CNC Lab	0	0	3	2
PR 8412	Metal Forming, Foundry and Welding Lab	0	0	3	2
	TOTAL	**18**	**1**	**6**	**23**

SEMESTER V

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
PR 8501	Engineering Metrology	3	0	0	3
PR 8502	Fluid Power Drives and Controls	3	0	0	3
PR 8503	Jigs, Fixtures and Press Tools	3	0	0	3
PR 8551	Quantitative Techniques in Management	3	0	0	3
	Elective I	3	0	0	3
	Elective II	3	0	0	3
PRACTICAL					
AU 8513	Dynamics and CAD Lab	0	0	3	2
PR 8511	Fluid Power Lab	0	0	3	2
PR 8512	Metrology Lab	0	0	3	2
	TOTAL	**18**	**0**	**9**	**24**

SEMESTER VI

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
AU 8651	Production of Automotive Components	3	0	0	3
PR 8601	FEA and System Simulation	3	0	0	3
PR 8651	Quality Control and Reliability	3	0	0	3
	Elective III	3	0	0	3
	Elective IV	3	0	0	3
	Elective V	3	0	0	3

PRACTICAL					
HS 8561	Employability Skills	0	0	2	1
PR 8611	Analysis and Simulation Lab	0	0	3	2
PR8612	Creativity and Innovative Project	0	0	3	2
	TOTAL	**18**	**0**	**8**	**23**

SEMESTER VII

CODE NO.	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY					
PR 8701	Computer Integrated Manufacturing	3	0	0	3
PR 8702	Manufacturing Management	3	0	0	3
PR 8703	Mechatronics for Automation	3	0	0	3
	Elective VI	3	0	0	3
	Elective VII	3	0	0	3
PRACTICAL					
PR 8711	Industrial Training	0	0	3	2
PR 8712	Management and Industrial Engineering Lab	0	0	3	2
PR 8713	Mechatronics and Robotics Lab	0	0	3	2
	TOTAL	**15**	**0**	**9**	**21**

SEMESTER VIII

CODE NO.	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY					
	Elective VIII	3	0	0	3
	Elective IX	3	0	0	3
PRACTICAL					
PR 8811	Project Work	0	0	12	6
	TOTAL	**6**	**0**	**12**	**12**

TOTAL NUMBER OF CREDITS = 179

LIST OF ELECTIVES

CODE NO.	Course Title	L	T	P	C
PR 8001	Advances in Operations Research	3	0	0	3
PR 8002	Applied Probability and Statistics	3	0	0	3
PR 8003	Computer Aided Product Design	3	0	0	3
PR 8004	Design of Casting and Weldments	3	0	0	3
PR 8005	Lean Manufacturing	3	0	0	3
PR 8006	Machine Vision	3	0	0	3
PR 8007	Maintenance Management	3	0	0	3
PR 8008	Micro Electro Mechanical Systems and Nano Technology	3	0	0	3
PR 8009	Micromachining and Fabrication	3	0	0	3
PR 8011	Modern Manufacturing Processes	3	0	0	3
PR 8012	Non Destructive Testing Methods	3	0	0	3
PR 8013	Operations Planning and Cost Estimation	3	0	0	3
PR 8014	Plant layout and Material Handling systems	3	0	0	3
PR 8015	Precision Engineering and Manufacturing	3	0	0	3
PR 8016	Processing of Polymers and Composites	3	0	0	3
PR 8017	Purchasing and Materials Management	3	0	0	3
PR 8018	Selection of Materials	3	0	0	3
PR 8071	Electronic Materials and Processing	3	0	0	3
PR 8072	Energy Management	3	0	0	3
PR 8073	Engineering Economics and Financial Management	3	0	0	3
PR 8074	Green Electronics Manufacturing	3	0	0	3
PR 8075	Robotic Engineering	3	0	0	3
PR 8076	Sensors and Control Systems in Manufacturing	3	0	0	3
PR 8077	Surface Engineering	3	0	0	3
GE 8751	Engineering Ethics and Human Values	3	0	0	3
MG 8654	Total Quality Management	3	0	0	3
ME 8081	Reliability Concepts in Engineering	3	0	0	3
PRACTICAL					
CODE NO.	**Course Title**	**L**	**T**	**P**	**C**
PR8010	Mini Project	0	0	6	3

HS 8151	TECHNICAL ENGLISH I	L T P C
	(For all branches of B.E / B.Tech programmes)	3 1 0 4

OBJECTIVES:

- To enable all students of engineering and technology develop their basic communication skills in English.
- To give special emphasis to the development of speaking skills amongst the students of engineering and technology students.
- To ensure that students use the electronic media such as interne and supplement the learning materials used in the classroom.
- To inculcate the habit of reading for pleasure.

UNIT I

Listening - Introducing learners to GIE - Types of listening - Listening to audio (verbal & sounds); **Speaking -** Speaking about one's place, important festivals etc. – Introducing oneself, one's family / friend; **Reading -** Skimming a reading passage – Scanning for specific information - Note-making; **Writing -** Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one's leisure time activities, hometown, etc.); **Grammar -** Prepositions - Reference words - Wh-questions - Tenses (Simple); **Vocabulary -** Word formation - Word expansion (root words / etymology); **E-materials -** Interactive exercises for Grammar & Vocabulary - Reading comprehension exercises - Listening to audio files and answering questions.

UNIT II

Listening - Listening and responding to video lectures / talks**; Speaking -** Describing a simple process (filling a form, etc.) - Asking & answering questions - Telephone skills – Telephone etiquette; **Reading –** Critical reading - Finding key information in a given text - Sifting facts from opinions**; Writing -** Biographical writing (place, people) - Lab descriptions (general/specific description of laboratory experiments) - Definitions - Recommendations; **Grammar -** Use of imperatives - Subject-verb agreement**; Vocabulary -** Compound words - Word Association**; E-materials -** Interactive exercises for Grammar and Vocabulary - Listening exercises with sample telephone conversations / lectures – Picture-based activities.

UNIT III

Listening - Listening to specific task - focused audio tracks; **Speaking -** Role-play – Simulation - Group interaction - Speaking in formal situations (teachers, officials, foreigners); **Reading -** Reading and interpreting visual material**; Writing -** Jumbled sentences - Coherence and cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause

& effect / compare & contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing**; Grammar -** Tenses (Past) - Use of sequence words - Adjectives**; Vocabulary -** Different forms and uses of words, Cause and effect words**; E-materials -** Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

UNIT IV

Listening - Watching videos / documentaries and responding to questions based on them**; Speaking -** Responding to questions - Different forms of interviews - Speaking at different types of interviews; **Reading -** Making inference from the reading passage - Predicting the content of a reading passage; **Writing -** Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays**; Grammar -** Adverbs **–** Tenses – future time reference; **Vocabulary -** Single word substitutes - Use of abbreviations & acronyms**; E-materials -** Interactive exercises for Grammar and Vocabulary - Sample interviews - film scenes - dialogue writing.

UNIT V

Listening - Listening to different accents, Listening to Speeches / Presentations, Listening to broadcast & telecast from Radio & TV**; Speaking -** Giving impromptu talks, Making presentations on given topics**; Reading -** Email communication - Reading the attachment files having a poem/joke/proverb - Sending their responses through email **Writing -** Creative writing, Poster making**; Grammar -** Direct and indirect speech**; Vocabulary -** Lexical items (fixed / semi fixed expressions); **E-materials -** Interactive exercises for Grammar & Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents, - Interpreting posters

Total : 60 Periods

TEXT BOOKS:

1. Mindscapes: English for Technologists and Engineers, Orient Black Swan, 2012 .
2. S.P.Dhanavel, English and Communication skills for students of science and Engineering, Orient Black Swan, Chennai, 2011.

REFERENCE BOOKS:

1. Pickett, Nell Ann, Ann A.Laster and Katherine E.Staples. **Technical English: Writing, Reading and Speaking.** New York: Longman, 2001.
2. Bailey, Stephen. **Academic Writing: A practical guide for students.** New York: Rutledge, 2011.

3. Morgan, David and Nicholas Regan**. Take-Off: Technical English for Engineering.** Reading: Garnet Publishing Limited, 2008.
4. Thorn, Michael and Alan Badrick. **An Introduction to Technical English.** Harlow**:** Prentice Hall Europe, 1993.
5. Rizvi, M.Ashraf. **Effective Technical Communication.** New Delhi: Tata McGraw-Hill PublishingCompany, 2007.

EXTENSIVE READERS

1. Murthy, Sudha. **Wise & Otherwise**. New Delhi: Penguin Books India, 2006.
2. Gates, Bill and Collins Hemingway. **Business @ the Speed of Thought: Succeeding in the Digital Economy.** New York: Warner Business Books, 2000.

WEBSITE RESOURCES

1. www.uefap.com
2. www.eslcafe.com
3. www.listen-to-english.com
4. www.owl.english.purdue.edu
5. www.chompchomp.com

MA8151 MATHEMATICS – I L T P C

(Common to all branches of B.E. / B.Tech. Programmes) 3 1 0 4

OBJECTIVES:

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I MATRICES 9+3

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Cayley-Hamilton Theorem – Diagonalization of matrices –

Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II INFINITE SERIES 9+3

Sequences – Convergence of series – General properties – Series of positive terms – Tests of convergence (Comparison test, Integral test, Comparison of ratios and D'Alembert's ratio test) – Alternating series – Series of positive and negative terms – Absolute and conditional convergence – Power Series – Convergence of exponential, logarithmic and Binomial Series.

UNIT III FUNCTIONS OF SEVERAL VARIABLES 9+3

Limits and Continuity – Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit functions – Change of variables –Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Errors and approximations – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT IV IMPROPER INTEGRALS 9+3

Improper integrals of the first and second kind and their convergence – Evaluation of integrals involving a parameter by Leibnitz rule – Beta and Gamma functions – Properties – Evaluation of integrals using Beta and Gamma functions – Error functions.

UNIT V MULTIPLE INTEGRALS 9+3

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of Solids – Change of variables in double and triple integrals – Area of a curved surface.

Total : 60 Periods

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 40th Edition, 2007.
2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2010.

REFERENCES:

1. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
2. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media

(An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.

3. Greenberg M.D., "Advanced Engineering Mathematics", Pearson Education, New Delhi, 2nd Edition, 5th Reprint, 2009.
4. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.

PH 8151 ENGINEERING PHYSICS L T P C

(Common to ALL Branches of B.E./B.Tech. Programmes) 3 0 0 3

OBJECTIVE:

To introduce the basic physics concepts relevant to different branches of Engineering and Technology.

UNIT I PROPERTIES OF MATTER 9

Elasticity - Poisson's ratio and relationship between moduli (qualitative) - Stress-strain diagram - factors affecting elasticity - bending of beams - cantilever - bending moment - theory and experiment of Young's modulus determination - Uniform and non-uniform bending - I shaped girders - twisting couple - hollow cylinder - shaft - torsion pendulum - determination of rigidity modulus- moment of inertia of a body (regular and irregular).

UNIT II ACOUSTICS AND ULTRASONICS 9

Classification of sound - loudness and intensity - Weber-Fechner Law - standard intensity and intensity level - decibel - reverberation - reverberation time - rate of growth and decay of sound intensity - derivation of Sabine's formula - absorption coefficient and its determination - factors affecting acoustics of buildings : focussing, interference, echo, Echelon effect, resonance - noise and their remedies. Ultrasonics - production - magnetostriction and piezoelectric methods - detection of ultrasound - acoustic grating - industrial applications - NDT - Ultrasonic method: scan modes and practice.

UNIT III THERMAL PHYSICS 9

Thermal expansion - thermal stress - expansion joints - bimetallic strips - thermal conductivity - conductions in solids - Forbe's and Lees' disc methods - Rectilinear flow of heat through a rod - flow of heat through a compound materials - radical flow of heat through a spherical shell - thermal insulation of buildings – Laws of blackbody radiation: Kirchoffs law, Stephens law, Wiens law, Raleigh-Jean law and Planks law (derivation). Laws of thermodynamics - Otto and diesel engines and their efficiency - entropy - entropy of Carnot's cycle - reverse Carnot's cycle - refrigerator.

UNIT IV APPLIED OPTICS **9**

Interference - Michelson interferometer: construction, working, determination of wave length and thickness - anti-reflection coating - air wedge and its application - Lasers - Einstein's coefficients - CO_2, Nd:YAG and semiconductor lasers - homo junction and hetro junction - construction and working - applications - Optical fibres - classification (index & mode based) - principle and propagation of light in optical fibres - acceptance angle and numerical aperture - fibre optic communication system - active and passive sensors.

UNIT V SOLID STATE PHYSICS **9**

Nature of bonding - growth of single crystals (qualitative) - crystal systems - crystal planes and directions - expressions for interplanar distance - coordination number and packing factor for simple structures: SC, BCC, FCC and HCP - structure and significance of NaCl, ZnS, diamond and graphite - crystal imperfections: point defects, dislocations and stacking faults - unit cell, Bravais space lattices - miller indices.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Gaur R.K., and Gupta, S.L., Engineering Physics, Dhanpat Raj Publications,2003.
2. Palanisamy, P.K., Engineering Physics, Scitech Publications (P) Ltd, 2006.
3. Arumugam, M., Engineering Physics, Anuradha Publications, 2000.

REFERENCES:

1. Sankar, B.N., Pillai.S.O., Engineering Physics, New Age International (P) Ltd., 2007.
2. Rajendran.V Engineering Physics, Tata McGraw-Hill, 2009.

CY 8151 ENGINEERING CHEMISTRY **L T P C**

(Common to all branches of Engineering and Technology) **3 0 0 3**

UNIT I CHEMICAL THERMODYNAMICS **9**

Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions; Criteria of spontaneity; Gibbs-Helmholtz equation; Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore. Chemical potential; Gibbs-Duhem equation – variation of chemical potential with temperature and pressure.

UNIT II POLYMER CHEMISTRY **9**

Introduction: Classification of polymers – Natural and Synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerisation. Types and mechanism of polymerisation: Addition (Free Radical, cationic, anionic and living); condensation and copolymerisation. Properties of polymers: Tg, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerisation: Bulk, emulsion, solution and suspension.

UNIT III KINETICS AND CATALYSIS **9**

Introduction – reaction velocity, factors affecting reaction velocity, rate constant, order of reaction, molecularity, pseudo molecular reactions, zero, first, second and third order reactions, reactions of fractional orders, determination of order of reactions. Catalysis: Auto catalysis - Enzyme Catalysis: Michaelis-Menton equation; factors affecting enzyme catalysis. Heterogeneous Catalysis: Types of adsorption isotherms: Langmuir–Hinselwood and Rideal–Eley Mechanism.

UNIT IV PHOTOCHEMISTRY AND SPECTROSCOPY **9**

Photochemistry: Laws of photochemistry - Grotthuss–Draper law, Stark–Einstein law and Lambert-Beer Law. Photoprocesses - Internal Conversion, Inter-system crossing, Fluorescence, Phosphorescence, Chemiluminescence and Photo-sensitisation. Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and rotational transitions. Width and intensities of spectral lines. Spectrophotometric estimation of iron. UV-visible and IR spectroscopy – principles, instrumentation (Block diagram) and applications.

UNIT V NANOCHEMISTRY **9**

Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: Nanocluster, nanorod, nanotube and nanowire. Synthesis: Precipitation, thermolysis, hydrothermal, solvothermal, electrodeposition, chemical vapour deposition, laser ablation; Properties and Applications. Risk discussion and Future perspectives.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. P. Kannan and A. Ravikrishnan, “Engineering Chemistry”, Sri Krishna Hitech Publishing Company Pvt. Ltd. Chennai, 2009.
2. S. Vairam, P. Kalyani and Suba Ramesh, “Engineering Chemistry”, Wiley India, 2011.

REFERENCE BOOKS

1. P.W. Atkins and de Paula Julio, "Physical Chemistry", Oxford University Press, 8th Ed., (Indian Student Edition) (2009).
2. K. K. Rohatgi-Mukherjee, "Fundamental of Photochemistry" New Age International (P) Ltd., New Delhi, 1986.
3. G.A. Ozin and A.C. Arsenault, "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.
4. V.R.Gowariker, N.V.Viswanathan and Jayadev Sreedhar, "Polymer Science", New Age International P (Ltd.,), Chennai, 2006.

GE 8151 COMPUTING TECHNIQUES L T P C

3 0 0 3

UNIT I INTRODUCTION 8

Generation and Classification of Computers- Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

UNIT II C PROGRAMMING BASICS 10

Problem formulation – Problem Solving - Introduction to ' C' programming –fundamentals – structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

UNIT III ARRAYS AND STRINGS 9

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

UNIT IV FUNCTIONS AND POINTERS 9

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

UNIT V STRUCTURES AND UNIONS 9

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

TOTAL : 45 PERIODS

TEXTBOOKS

1. Pradip Dey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, First Edition, Oxford University Press, 2009
2. Ashok N. Kamthane, “Computer programming”, Pearson Education, 2007.
3. Yashavant P. Kanetkar. “ Let Us C”, BPB Publications, 2011.

REFERENCES

1. Kernighan,B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2006
2. Byron S Gottfried, “ Programming with C”, Schaum’s Outlines, Second Edition, Tata McGraw-Hill, 2006.
3. R.G. Dromey, “How to Solve it by Computer”, Pearson Education, Fourth Reprint, 2007

GE 8152 ENGINEERING GRAPHICS L T P C
2 0 3 4

OBJECTIVES

To develop in students, graphic skills for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION) 1

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREE HAND SKETCHING 14

Basic Geometrical constructions, Curves used in engineering practices

Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves, **Scales:** Construction of Diagonal and Vernier scales.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 14

Orthographic projection- principles-Principal planes-First angle projection-Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces

Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 14

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

UNITIV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 14

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 15

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method and vanishing point method.

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY) 3

Introduction to drafting packages and demonstration of their use.

TOTAL: 75 PERIODS

TEXT BOOKS

1. N.D.Bhatt and V.M.Panchal, “Engineering Drawing”, Charotar Publishing House, 50th Edition, 2010

REFERENCES

1. K.R.Gopalakrishna., “Engineering Drawing” (Vol I&II combined) Subhas Stores, Bangalore, 2007

2. Luzzader, Warren.J., and Duff,John M.,'' Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production", Eastern Economy Edition, Prentice Hall of India Pvt Ltd, New Delhi, 2005
3. M.B.Shah and B.C.Rana, "Engineering Drawing", Pearson, 2nd Edition, 2009
4. K.Venugopal and V.Prabhu Raja, "Engineering Graphics", New Age International (P) Limited ,2008.
5. K. V.Natrajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
6. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi,2008.

PUBLICATION OF BUREAU OF INDIAN STANDARDS:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

PH8161 PHYSICS LABORATORY L T P C

(Common to all branches of B.E./B.Tech. Programmes) 0 0 2 1

1.	Torsional pendulum	Determination of rigidity modulus of wire and moment of inertia of disc
2.	Non – uniform bending	Determination of young's modulus
3.	Lee's disc	Determination of thermal conductivity of a bad conductor
4.	Potentiometer	Determination of thermo e.m.f. of thermocouple
5.	Air wedge	Determination of thickness of a thin sheet of paper
6.	i. Optical fibre	Determination of Numerical Aperture and acceptance angle
	ii. Compact disc	Determination of width of the groove using laser

7.	Acoustic grating	Determination of velocity of ultrasonic waves in liquids
8.	Post office box	Determination of Band gap of a semiconductor
9.	Spectrometer	Determination of wavelength using grating
10.	Viscosity of liquids	Determination of co-efficient of viscosity of a liquid by Poiseuille's flow

TOTAL : 30 PERIODS

CY8161 CHEMISTRY LABORATORY L T P C

(Common to all branches of B.E. / B.Tech. Programmes) 0 0 2 1

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1,10- phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of poly vinyl alcohol using Ostwald viscometer.
12. Pseudo first order kinetics – ester hydrolysis.
13. Corrosion experiment – weight loss method.
14. Determination of CMC.
15. Phase change in a solid.

TOTAL: 30 PERIODS

REFERENCES:

1. A text of quantitative inorganic analysis, A. L. Vogel , ELBS London. 1995.
2. Experiments in physical chemistry, D.P. Shoemarker and C.W. Gardad, McGraw Hill, London, 2001,
3. American Public Health Association.

GE8161 **COMPUTER PRACTICES LABORATORY** **L T P C**

(Common to all branches of B.E. / B.Tech. Programmes) **0 0 3 2**

LIST OF EXPERIMENTS:

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

TOTAL: 45 PERIODS

GE8162 **ENGINEERING PRACTICES LABORATORY** **L T P C**

(common to all branches of B.E./B.Tech. Programmes) **0 0 3 2**

OBJECTIVE

To provide exposure to the students with hands-on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP – A (CIVIL & ELECTRICAL)

1. CIVIL ENGINEERING PRACTICE **12**

PLUMBING

- Basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings. Preparation of plumbing line sketches.
- Laying pipe connection to the suction side of a pump – inlet.
- Laying pipe connection to the delivery side of a pump – out let.
- Practice in mixed pipe connections: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK

- Sawing, planning and making common joints: T-Joint, Mortise and Tennon joint, Dovetail joint.

STUDY

- Study of joints in door panels, wooden furniture
- Study of common industrial trusses using models.

2. ELECTRICAL ENGINEERING PRACTICE **9**

- Basic household wiring using switches, fuse, indicator – lamp etc.,
- Preparation of wiring diagrams
- Stair case light wiring
- Tube – light wiring
- Study of iron-box, fan with regulator, emergency lamp

GROUP – B (MECHANICAL AND ELECTRONICS) **15**

3. MECHANICAL ENGINEERING PRACTICE

WELDING

- Arc welding of butt joints, lap joints, tee joints
- Gas welding Practice.
- Basic Machining
- Simple turning, drilling and tapping operations.
- Machine assembly Practice.
- Study and assembling the following:
- Centrifugal pump, mixies and air conditioners.
- Demonstration on
  - (a) Smithy operations like the production of hexagonal bolt.
  - (b) Foundry operation like mould preparation for grooved pulley.

4. ELECTRONIC ENGINEERING PRACTICE **9**

- Soldering simple electronic circuits and checking continuity.
- Assembling electronic components on a small PCB and testing.
- Study of Telephone, FM radio, low-voltage power supplies.

TOTAL: 45 PERIODS

HS 8251 **TECHNICAL ENGLISH II** **L T P C**

(For all branches of B.E / B.Tech programmes) **3 1 0 4**

OBJECTIVES

- To make the students acquire listening and speaking skills meant for both formal and informal contexts
- To help them develop their reading skills by exposing them to different types of reading strategies
- To equip them with writing skills needed for academic as well as workplace situations
- To make them acquire language skills at their own pace by using e-materials and language lab component

UNIT I

Listening - Listening to informal conversations and participating**; Speaking -** Opening a conversation (greetings, comments on something, weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks); **Reading -** Developing analytical skills, Deductive and inductive reasoning - Extensive reading**; Writing -** Effective use of SMS for sending short notes and messages - Using 'emoticons' as symbols in email messages; **Grammar -** Regular & irregular verbs - Active and passive voice**; Vocabulary -** Homonyms (e.g. 'can') - Homophones (e.g. 'some', 'sum'); **E-materials -** Interactive exercise on Grammar and vocabulary – blogging; **Language Lab -** Listening to different types of conversation and answering questions.

UNIT II

Listening - Listening to situation based dialogues**; Speaking -** Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); **Reading -** Reading a short story or an article from newspaper, Critical reading, Comprehension skills**; Writing -** Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for his success, thanking one's friend / relatives); **Grammar -** modal verbs, Purpose expressions**; Vocabulary -** Phrasal verbs and their meanings, Using phrasal verbs in sentences**; E-materials -** Interactive exercise on Grammar and vocabulary, Extensive reading activity (reading stories / novels from links), Posting reviews in blogs - **Language Lab -** Dialogues (Fill up exercises), Recording students' dialogues.

UNIT III

Listening - Listening to the conversation - Understanding the structure of conversations**; Speaking -** Conversation skills with a sense of stress, intonation, pronunciation and meaning

- Seeking information – expressing feelings (affection, anger, regret etc.); **Reading -** Speed reading – reading passages with the time limit - Skimming**; Writing -** Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading the articles from the journals - Format for the journal articles – elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies; **Grammar -** Conditional clauses - Cause and effect expressions; **Vocabulary -** Words used as nouns and verbs without any change in the spelling (e.g. 'rock', 'train', 'ring'); **E-materials -** Interactive exercise on Grammar & vocabulary - Speed Reading practice exercises; **Language Lab -** Intonation practice using EFLU materials – Attending a meeting and writing minutes.

UNIT IV

Listening - Listening to a telephone conversation, Viewing a model interview (face-to-face, telephonic and video conferencing) and observing the practices**; Speaking -** Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping the interview skills; **Reading -** Reading the job advertisements and the profile of the company concerned – scanning**; Writing -** Applying for a job – cover letter - résumé preparation – vision, mission and goals of the candidate**; Grammar -** Numerical expressions - Connectives (discourse markers); **Vocabulary -** Idioms and their meanings – using idioms in sentences**; E-materials -** Interactive exercises on Grammar & Vocabulary - Different forms of résumés- Filling up a résumé / cover letter; **Language Lab -** Telephonic interview – recording the responses - e-résumé writing.

UNIT V

Listening - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener**; Speaking -** Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/ agreement – assertiveness in expressing opinions – mind mapping technique**; Reading -** Note making skills – making notes from books, or any form of written materials - Intensive reading **Writing -** Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation); **Grammar -** Use of clauses**; Vocabulary –** Collocation**; E-materials -** Interactive grammar and vocabulary exercises - Sample GD - Pictures for discussion, Interactive grammar and vocabulary exercises - Pictures for discussion; **Language Lab -** Different models of group discussion.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Mindscapes: English for Technologists and Engineers, Orient Black Swan, 2012 .

2. S.P.Dhanavel, English and Communication skills for students of science and Engineering, Orient Black Swan, Chennai, 2011.

REFERENCE BOOKS

1. Laws, Anne. **Presentations.** Hyderabad: Orient BlackSwan, 2000.
2. Lewis, Hedwig. **Body Language: A Guide for Professionals.** New Delhi: Sage Publications, 1998.
3. Naterop, Jean B. and Rod Revell. **Telephoning in English.** Cambridge: Cambridge University Press, 1987.
4. Rutherford, Andrea J. **Basic Communication Skills for Technology**. New Delhi: Pearson Education, 2001.
5. Ur, Penny. **Teaching Listening Comprehension**. Cambridge: Cambridge University Press, 1984.

EXTENSIVE READERS

1. Abdul Kalam, A P J. **Ignited Minds: Unleashing the Power within India.** New Delhi: Penguin Books India, 2002.
2. Parameswaran, Uma. **C.V.Raman: A Biography.** New Delhi: Penguin Books India, 2011.

WEB RESOURCES

1. www.esl-lab.com
2. www.englishgrammar.org
3. www.englishclub.com
4. www.mindtools.com
5. www.esl.about.com

MA 8251	MATHEMATICS II	L T P C
	(Common to all branches of B.E. / B.Tech. Programmes)	3 1 0 4

OBJECTIVES:

- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To acquaint the student with the concepts of vector calculus, needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.

- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I DIFFERENTIAL EQUATIONS 9+3

Method of variation of parameters – Method of undetermined coefficients – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients.

UNIT II VECTOR CALCULUS 9+3

Gradient and directional derivative – Divergence and Curl – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral and volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III ANALYTIC FUNCTION 9+3

Analytic functions – Necessary and sufficient conditions for analyticity - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions $w = z + c$, az, $\frac{1}{z}$, z^2 - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 9+3

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis.

UNIT V LAPLACE TRANSFORMS 9+3

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem — Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

Total : 60 Periods

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 40th Edition, 2007.
2. Ramana, B.V. "Higher Engineering Mathematics", Tata McGraw Hill, New Delhi, 2010.

REFERENCES:

1. Glyn James, “Advanced Modern Engineering Mathematics”, Pearson Education, New Delhi, 2007.
2. Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, New Delhi, 3rd Edition, 2007.
3. Bali N., Goyal M. and Watkins C., “Advanced Engineering Mathematics”, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
4. Peter V.O’Neil, “Advanced Engineering Mathematics”, Cengage Learning India Pvt., Ltd, New Delhi, 2007.

PH 8251	MATERIALS SCIENCE	L T P C
	(Common to Manufacturing, Industrial, Mining, Mechanical, Aeronautical, Automobile and Production Engineering)	**3 0 0 3**

OBJECTIVE:

To introduce the essential principles of materials science for mechanical and related engineering applications.

UNIT I MECHANICAL PROPERTIES 9

Introduction to mechanical properties - tensile test - plastic deformation mechanisms - slip and twinning - role of dislocations in slip - strengthening methods - strain hardening - refinement of the grain size - solid solution strengthening - precipitation hardening - creep resistance - creep curves - mechanisms of creep - creep-resistant materials - fracture - the Griffith criterion - critical stress intensity factor and its determination - fatigue failure - fatigue tests - methods of increasing fatigue life - hardness - Rockwell and Brinell hardness - Knoop and Vickers microhardness.

UNIT II PHASE DIAGRAMS 9

Solid solutions - Hume Rothery’s rules - free energy of solid solution - intermediate phases - The phase rule - single component system - one-component system of iron - binary phase diagrams - isomorphous systems - the tie-line rule - the level rule - application to isomorphous system - eutectic phase diagram - peritectic phase diagram - other invariant reactions - microstructural change during cooling.

UNIT III FERROUS ALLOYS AND HEAT TREATMENT 9

The iron-carbon equilibrium diagram - phases, invariant reactions - microstructue of slowly

cooled steels - eutectoid steel, hypo and hypereutectoid steels - effect of alloying elements on the Fe-C system - diffusion in solids - Fick's law - phase transformations - pearlitic transformations - T-T-T-diagram for eutectoid steel - baintic and martensitic transformations - tempering of martensite - heat treatment of steels - annealing - normalizing - quenching and tempering - case hardening - induction, flame and laser hardening - carburizing, cyaniding, carbonitriding and nitriding.

UNIT IV ELECTRONIC MATERIALS 9

Classification of solids - energy bands - concept of Fermi level - conductor, semiconductor, insulator - Semiconductors: intrinsic, extrinsic - carrier concentration expression (qualitative) - compound semiconductors (qualitative) - dielectric materials - polarization mechanisms - dielectric breakdown - magnetic materials - ferromagnetic materials &hysterisis - ferrites - superconducting materials, properties, types and applications.

UNIT V NEW MATERIALS AND APPLICATIONS 9

Introduction to Ceramics and its applications - Ceramic Fibres - Fibre reinforced Plastics – Fibre reinforced Metal – Metallic glasses – Shape memory alloys – Copper base alloys – Nickel – Titanium alloys – Relaxor- Ferroelectric materials – Electro and magneto rheological fluids - Sensors and Actuators – polymer semiconductos – photoconducting polymers – liquid crystals - Bio-sensors - Scintillation detectors (Position sensitive) –Bio materials – hydroxyapatite – PMMA – Silicone.

TOTAL : 45 PERIODS

TEXT BOOK:

1. Raghavan, V., Materials Science and Engineering, Prentice Hall of India, 2007.
2. Palanisamy, P.K., Applied Materials Science, Scitech, 2003.
3. Raghavan, V., Physical Metallurgy, Prentice Hall of India, 2002.

REFERENCE BOOKS:

1. Calister, W.D., Materials Science and Engineering an Introduction, John Wiley, 2003.
2. Rajendarn V and Marikani A, Materials Science, Tata McGraw Hill, 2006

GE 8251 **ENGINEERING MECHANICS** **LT P C**
3 1 0 4

OBJECTIVE

To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering

UNIT I BASICS AND STATICS OF PARTICLES **12**

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces –– Vectorial representation of forces – Vector operations of forces -additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .

UNIT II EQUILIBRIUM OF RIGID BODIES **12**

Free body diagram – Types of supports –Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

UNIT III PROPERTIES OF SURFACES AND SOLIDS **12**

Centroids and centre of mass– Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula –Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem –Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES **12**

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

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 12

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction –wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

TOTAL: 60 PERIODS

TEXT BOOK:

1. Beer, F.P and Johnston Jr. E.R. "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004)
2. Vela Murali, "Engineering Mechanics", Oxford University Press (2010)

REFERENCES:

1. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education (2010).
2. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education (2006)
3. J.L.Meriam and L.G.Kraige, " Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2,Third Edition, John Wiley & Sons,(1993)
4. Rajasekaran, S and Sankarasubramanian, G., "Engineering Mechanics Statics and Dynamics",3rd Edition, Vikas Publishing House Pvt. Ltd., (2005).
5. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, (1998).
6. Kumar, K.L., "Engineering Mechanics", 3rd Revised Edition, Tata McGraw-Hill Publishing company, New Delhi (2008)

ME 8251 DESIGN CONCEPTS IN ENGINEERING L T P C

3 0 0 3

OBJECTIVES:

- To impart the importance of design in today's context of global competition, environmental awareness and customer oriented market.
- To impart the basic concepts and various aspects of design using simple examples and case studies.

UNIT I DESIGN TERMINOLOGY 9

Definition-various methods and forms of design-importance of product design-static and dynamic products-various design projects-morphology of design-requirements of a good

design-concurrent engineering-computer aided engineering-codes and standards-product and process cycles-bench marking.

UNIT II DESIGN PROCESS **9**

Basic module in design process-scientific method and design method-Need identification, importance of definition of problem-structured problem, real life problem- gathering information-customer requirements- Quality Function Deployment (QFD)- product design specifications-generation of alternative solutions- Analysis and selection-Detail design and drawings-Prototype, modeling, simulation, testing and evaluation (Basics only)

UNIT III CREATIVITY IN DESIGN **9**

Creativity and problem solving-vertical and lateral thinking-invention-psychological view, mental blocks-Creativity methods-brainstorming, synectics, force fitting methods, mind map, concept map-Theory of innovative problem solving (TRIZ) - conceptual decomposition-creating design concepts.

UNIT IV HUMAN AND SOCIETAL ASPECTS **9**

Human factors in design, ergonomics, user friendly design-Aesthetics and visual aspects-environmental aspects-marketing aspects-team aspects-legal aspects-presentation aspects.

UNIT V MATERIAL AND PROCESSES IN DESIGN **9**

Material selection for performance characteristics of materials-selection fro new design-substitution for existing design-economics of materials-selection methods-recycling and material selection-types of manufacturing process, process systems- Design for manufacturability (DFM) - Design for assembly (DFA).

TOTAL: 45 PERIODS

TEXT BOOK:

1. George E.Dieter , “Engineering Design: A Materials and Processing Approach” 4th Edition, Tata McGraw Hill, 2008.

REFERENCES:

1. Joseph E.Shigley, Charles R.Mische ,”Mechanical Engineering Design”, McGraw Hill International edition, 6th Edition 2009
2. Edward B.Magrab, “Integrated Product and Process Design and Development” CRC Press, 1997
3. James Garratt,” Design and Technology”, 2nd Revised Edition, Cambridge University Press,1996

PR8251 CONVENTIONAL MACHINING PROCESSES L T P C
3 0 0 3

OBJECTIVE:

- To impart the knowledge on basic concepts of various machining Processes and Machine tools.
- Classes to be supported by demonstration in the workshop and screening of video film of the various operations of the machines.

UNIT I LATHE 10

Introduction to production processes – types of production (job, batch and mass) – production processes – Casting, Forming, Machining and Welding, Machine Tool – Lathe – Engine Lathe – block diagram – sketch – functions of each part – work holding devices in lathe – functions – Chuck, Centre, Dogs, Steady Rest and Follower Rest, mechanism of lathe – Apron, Feed, Tumbler Gear, various operations performed in Lathe – facing, turning, chamfering and knurling – relative positions of tool and job – Taper turning operations (three methods)_ thread cutting – RH and LH thread, single start and multi start with application – Method of thread cutting – selection and arrangement of tool and work. Problems in metric and inch thread conversion – Specifications of Lathe – Burnishing.

UNIT II SHAPER, PLANER & SLOTTER 9

Purpose of shaping – block diagram – functions of each part. Purpose of planer – block diagram – functions of each part. Purpose of slotting machine – block diagram – functions and working principle. Operations carried out – horizontal plane, vertical plane, v type with relative position – Comparison of planer with shaper – work holding devices in shaper and planer – Quick return mechanism in shaper – mechanical and hydraulic – cross feed mechanism – Types of planer with application – Comparison of shaping with slotting – tool holding devices in shaper, planer and slotter – specifications of shaper, planer and slotter simple problems to calculate the velocity – speed, feed and depth of cut.

UNIT III DRILLING 8

Purpose of drilling – block diagram and function – types of drilling machines – portable drilling – bench type – sensitive drilling – radial arm drilling – functions of parts – purpose and operation – gang drilling, multiple drill head, upright drilling, relative operations – reaming, boring, tapping, counter boring, courses sinking, trepanning and spot facing (with simple sketch, purpose and application). Work holding devices – specification torque calculation – speed, feed and depth of cut.

UNIT IV MILLING **9**

Milling machine purpose – up and down milling – classification of milling machines – slot, keyway machining – methods of milling – single piece, string, rotary, index, gang, progressive, copy. Horizontal milling machine – block diagram – functions of each part- applications – Vertical milling machine – block diagram – functions of each part applications – Gear cutting using milling machine – procedure with neat sketch – milling cutters – peripheral, face, end T slot, form etc. – attachments and special accessories for milling – rotary, slotting attachment – indexing mechanism – methods of indexing – direct, plain, compound and differential indexing – problems – specifications – cutting conditions and parameters.

UNIT V GRINDING **9**

Purpose – classification – surface finish – applications – grinding wheel – types – specifications – selection – surface grinding machine – block diagram – functions of each part – cylindrical grinding – Centreless grinding – Comparison – infeed, end feed and through feed. Balancing, dressing, loading and Truing of wheel – special grinding machines – specification of machine – cutting condition.

TOTAL: 45 PERIODS

TEXT BOOK:

1. HMT Bangalore, “Production Technology”, Tata Mc-Graw Hill Publishing Company Limited, New Delhi, 2001.
2. P.C. Sharma, “A Text Book of Production Technology”, S.Chand and Company, 2001.

REFERENCES:

1. R.K. Jain, “Production Technology”, Khanna Publishers, New Delhi, 2001.
2. Hajra Choudhary etal, “Elements of Production Technology –Vol.II”, Asia Publishing House, 2000.
3. B.Kumar, “Manufacturing Technology”, Khanna Publishers, New Delhi 2000.
4. P.Radhakrishnan, “Manufacturing Technology, Vol.I”, Scitech Publications, 2002.
5. Kalpakjain ,”Manufacturing Process for Engineering Material”, Addison - Wesley Publication 2000.

PR 8263 COMPUTER AIDED PART MODELLING LAB L T P C
0 0 3 2

OBJECTIVES

- To impart practical knowledge in modeling.
- To get hands on experience in drafting of automotive / typical industrial components, etc.

LIST OF EXPERIMENTS:

1. Practice on Drafting software using
   Measuring Commands; Basic Draw Commands; Display Commands
   GRID, SNAP CIRCLE, LINE, ARC LIMITS, ZOOM, PAN
2. Practice on using Editing Commands; Creating Layers;
   CHANGE, ERASE, EXTEND, TRIM, GRIPS
   Construction Commands
   ARRAY, COPY, MIRROR, MOVE, OFFSET, FILLET, CHAMFER, OSNAP
3. Placing lettering on a drawing; Crosshatching a drawing
   TEXT BHATCH
4. 2D drafting of automobile components like engine crank shaft, connecting rod etc.
5. 2D drafting of machine components.
6. 2D drafting of machine shop drawing.
7. 2D drafting of pin joints, cotter joints and bearings.

TOTAL: 45 PERIODS

PR 8264 CONVENTIONAL MACHINING PROCESSES LAB L T P C
0 0 3 2

OBJECTIVES:

- To get hands on experience in the conventional machines.
- To prepare the process planning sheets for all the operations and then follow the sequences during the machining processes.

LIST OF EXPERIMENTS:

1. Study of all the conventions machines – identification of parts / Mechanisms and Position of tool and work piece.

2. Facing, plain turning /Step Turning operations in Lathe.
3. Taper Turning/ Threading, Knurling operations in Lathe.
4. Multi start Threading/ Burnishing operations in Lathe.
5. Machining to make a cube using shaper.
6. Machining to make a V-Block in shaper.
7. Counter sinking, Counter Boring, Tapping operation in a drilling machine.
8. Surfacing/Pocket Milling in a vertical milling machine.
9. Polygonal shape milling in a horizontal milling machine.
10. Flat surface grinding and cylindrical grinding operations.
11. Machining an internal spline in a slotting machine. (To prepare the process planning sheets for all the operations and then follow the sequence during the machining process)
12. To machine the given part drawing using Lathe and milling machines.

TOTAL: 45 PERIODS

MA 8353	NUMERICAL METHODS	L T P C
	(Branch specific course)	**3 1 0 4**

OBJECTIVES:

- To provide the mathematical foundations of numerical techniques for solving linear system, eigenvalue problems, interpolation, numerical differentiation and integration and the errors associated with them;
- To demonstrate the utility of numerical techniques of ordinary and partial differential equations in solving engineering problems where analytical solutions are not readily available.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+3

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton-Raphson method- Solution of linear system of equations - Gauss Elimination method – Pivoting - Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel - Matrix Inversion by Gauss-Jordan method - Eigenvalues of a matrix by Power method and by Jacobi's method.

UNIT II INTERPOLATION AND APPROXIMATION 9+3

Interpolation with unequal intervals - Lagrange interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae – Least square method - Linear curve fitting.

UNIT III NUMERICAL DIFFERENTATION AND INTEGRATION 9+3

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9+3

Single step-methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first and second order equations - Multi-step methods - Milne's and Adams-Bashforth predictor-corrector methods for solving first order equations.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9+3

Finite difference methods for solving two-point linear boundary value problems. Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat-flow equation by explicit and implicit (Crank-Nicholson) methods - One dimensional wave equation by explicit method.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Grewal, B.S. and Grewal,J.S., "Numerical methods in Engineering and Science", Khanna Publishers, New Delhi, 9th Edition, 2007.
2. Sankara Rao, K. "Numerical methods for Scientists and Engineers', Prentice Hall of India Private Ltd., New Delhi, 3rd Edition,2007.

REFERENCES:

1. Brian Bradie, "A Friendly Introduction to Numerical Analysis", Pearson Education Asia, New Delhi, 1st Edition, 2007.
2. Gerald, C.F. and Wheatley, P.O., "Applied Numerical Analysis", Pearson Education Asia, New Delhi, 6th Edition, 2006.
3. Laurene V. Fausett, "Applied Numerical Analysis using MATLAB", Pearson Education, New Delhi, 1st print, 2nd Edition, 2009.

AE 8304 **MECHANICS OF SOLIDS** **L T P C**
3 0 0 3

OBJECTIVE:

- To introduce various behavior of structural components under various loading conditions.

UNIT I INTRODUCTION **8**

Definition of stress, strain and their relations – Relations between material constants – Axial loading - Statically determinate and indeterminate problems in tension & compression – Plane truss analysis – method of joints – method of sections – 3-D trusses – Thermal stresses – Impact loading.

UNIT II STRESSES IN BEAMS **10**

Shear force & bending moment diagrams: Bending and shear stress variation in beams of symmetric sections, a typical spar section: Beams of uniform strength - beams of two materials.

UNIT III DEFLECTION OF BEAMS **10**

Double integration method – Macaulay's method – moment area method – conjugate beam method – principle of superposition – Maxwell's reciprocal theorem.

UNIT IV TORSION – SPRINGS – COLUMNS **10**

Torsion of solid and hollow circular shafts – shear stress variation – open and closed-coiled helical springs – stresses in helical springs – classification of columns – Euler buckling – columns with different end conditions.

UNIT V BIAXIAL STRESSES **7**

Stresses in thin-walled pressure vessels – combined loading of circular shaft with bending, torsion and axial loadings – Mohr's circle and its construction – determination of principal stresses.

TOTAL: 45

TEXT BOOKS:

1. William Nash, 'Strength of Materials', Tata McGraw Hill, 2004.
2. Timoshenko and Young "Strength of Materials" Vol. I & II.

REFERENCES:

1. Dym,C.L., and Shames,I.H., 'Solid Mechanics', McGraw Hill, Kogakusha, Tokyo, 1973.
2. Stephen Timoshenko, 'Strength of Materials', Vol I & II, CBS Publishers and Distributors, Third Edition.
3. Timoshenko,S. and Young,D.H., 'Elements of Strength of Materials', T.Van Nostrand Co. Inc., Princeton, N.J., 1977.

AU 8351 THERMODYNAMICS AND THERMAL ENGINEERING LT P C
3 1 0 4

OBJECTIVE:

- To introduce fundamental concepts in thermodynamics, heat transfer, propulsion and refrigeration and air conditioning.

(Use of standard Steam tables with mollier chart and Refrigerant tables are permitted)

UNIT I BASIC THERMODYNAMICS 14

Systems, closed, open and isolated. Property, state, path and process, quasi-static process, Zeroth low, First law. Steady flow energy equation. Heat and work transfer in flow and non-flow processes. Second law, Kelvin-Planck statement – Clausius statement - Concept of Entropy, Clausius inequality, Entropy change in non-flow processes. Availability and Un Availability. Properties of gases and vapours.

UNIT II AIR STANDARD CYCLES AND COMPRESSORS 12

Otto, Diesel, Dual combustion and Brayton cycles. Air standard efficiency. Mean effective pressure. Compressors, Classifications of compressors, Single stage and multi stage, Effect of intercooler in multi stage compressor, Perfect and imperfect intercooler, work done by the compressor, Reciprocating, Rotary, Axial, Vane compressors.

UNIT III STEAM AND JET PROPULSION 12

Properties of steam, Dryness fraction, Quality of steam by steam tables and Molliar chart – Rankine cycle, Work done, Steam rate – Steam Nozzles, Types of nozzles, Friction in nozzles - Simple jet propulsion system – Thrust rocket motor – Specific impulse.

UNIT IV REFRIGERATION AND AIR-CONDITIONING 10

Principles of refrigeration, Vapour compression – Vapour absorption types, comparison - Co-efficient of performance (COP), Properties of refrigerants – Basic Principle, Summer, winter and Year round Air conditioning.

UNIT V HEAT AND MASS TRANSFER **12**

Modes of heat transfer, Heat conduction in parallel, radial and composite wall – Basics of Convective heat transfer. Fundamentals of Radiative heat transfer – Flow through heat exchangers, Logarithmic Mean Temperature Difference (LMTD) for parallel flow and Arithmetic Mean Temperature Difference (AMTD) counter flow heat exchangers.

TOTAL: 60

TEXT BOOKS:

1. Chattopadhyay. P Engineering Thermodynamics", oxford University Press, New Delhi, 2010.
2. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 2007.
3. Rathakrishnan E., "Fundamentals of Engineering Thermodynamics" Prentice-Hall India, 2005.

REFERENCES:

1. Ramalingam K.K. "Thermodynamics", Sci-Tech Publications, 2006.
2. Holman.J.P., "Thermodynamics", 3rd Ed. McGraw-Hill, 2007.
3. Venwylen and Sontag, "Classical Thermodynamics", Wiley Eastern, 1987.
4. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
5. Merala C, Pother, Craig W, Somerton, "Thermodynamics for Engineers", Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.
6. Mathur& Sharma Steam Tables, Jain Publishers, NewDelhi, 2005

EI8307 ELECTRICAL, ELECTRONICS AND CONTROL SYSTEMS **L T P C**
3 0 0 3

OBJECTIVE:

- To study about the electrical components, electronics devices, various types of motors, Control Systems and Measuring Systems.

UNIT I BASIC ELECTRICAL COMPONENTS. **9**

Ohm's law, Kirchhoff's laws ,Faradays law, Lenz 's law, Transformers-principle , operation, properties, and characteristics , Motors- D.C , A.C, Servo, and Stepper-principles, operation, properties and characteristics .

UNIT II BASIC ELECTRONIC DEVICES: 9

R, L, C components- properties and types, Semiconductor devices – Diodes , BJT , FET, UJT, SCR, Displays -- operating principles, characteristics . and applications. Rectifier and power supply circuits.

UNIT III ANALOG AND DIGITAL CIRCUITS 9

Operational Amplifiers – properties and application as -amplifier , differentiator, integrator, summer, Comparator etc , Basics of Boolean Logic – Logic Gates, Flip-Flops, Shift-Registers, Counters, Timers, A/D and D/A Converters.

UNIT IV BASICS OF CONTROL SYSTEM 9

Introduction to control systems – open loop and closed loop, Test signals, Block diagram and signal flow graph representation, concept of pole -zero of system, realization of transfer functions. Time and Frequency response of dynamic systems, Stability analysis of control systems.

UNIT V MEASURING SYSTEMS 9

Measurements of Electrical quantities – voltmeter, ammeter, watt- meter, Digital Multi Meters, Cathode Ray Oscilloscopes, -frequency, phase, amplitude measurements. Recorders- tape recorder , X-Y recorders , UV recorders, Printers, Data loggers. Virtual instruments.

TEXT BOOKS:

1. Millman.J. and Halkias.C., “Integrated Electronics”, Tata McGraw Hill, 2004.
2. J.J.Nagrath and Gopal, “control system engineering”, New age international (p) ltd., 2000.

REFERENCES:

1. Donald P Leach, Albert Paul Malvino and Goutam Saha,” Digital Principles & Applications”,6E, Tata McGraw Hill, 2006.
2. Helfrick.A.D., and Cooper.W.D., ‘“Electronic Instrumentation and Measurement techniques”, Prentice Hall of India, 1998.
3. R.K .Rajput, Text book of Electrical Engineering, Firewell Media Publications, 2004.

PR 8301 FOUNDRY AND WELDING TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To understand the principle, procedure and applications of Foundry and Welding Processes.
- Class supported by video film shows on the various processes.

UNIT I CASTING PROCESS 10

Introduction to casting – pattern – materials allowances – coding – types – moulds – mould making, sand – properties, types and testing of sands – core making – type of cores – single box, two box and 3 box moulding processes, runner, riser, gate, chills and chaplets.

UNIT II WELDING PROCESSES 9

Introduction to soldering, brazing and welding Types of joints – plane of welding – edge preparation – filler material – flux – shielding gases – fusion welding – gas welding – flame types – Manual arc welding – arc theory – power supply – braze welding – Thermit welding – Resistance welding – spot, seam, projection, percussion & flash.

UNIT III SPECIAL CASTING PROCESSES 8

Pressure die casting – Centrifugal – continuous – investment – shell moulding – squeeze – electro slag casting – CO_2 moulding – Plaster Mould castings – Antioch process – Slush casting- Counter gravity low pressure casting electro-magnetic casting.

UNIT IV SPECIAL WELDING PROCESSES 9

Shielded Metal Arc welding, Gas Metal Arc Welding-Gas Tungsten Arc Welding – Submerged arc welding – Flux Cored Arc Welding – Electro slag welding – friction welding – explosive welding – Underwater welding – Diffusion bonding – EBW – LBW – PAW – Stud welding – welding of dissimilar materials – Friction stir welding – High frequency induction welding.

UNIT V TESTING OF CASTINGS & WELDMENTS 9

Causes and remedies for casting defects – welding defects – Destructive testing – NDT methods– Dye penetrant – magnetic particle – X-ray/Radiography -ultrasonic testing- Case studies in testing of welded joints & castings.

TOTAL: 45 PERIODS

TEXT BOOK:

1. P.L.Jain, Principle of Foundry Technology – Tata McGraw Hill – 2003.
2. R.S.Parmer, Welding Engineering & Technology – Khanna Publishers – 2002.
3. Principle of metal casting, Heime, Looper and Rosenthal – Tata McGraw Hill – 2001.
4. Welding Technology, Little,Tata McGraw Hill – 2000.

REFERENCES:

1. Modern Welding Technology – B.Curry – Prentice Hall – 2002.
2. Welding Principle & applications – Larry Jeff in Delmar – 1997.
3. Foundry Engineering – Taylor HF Fleming, M.C. & Wiley Eastern Ltd., 1993.

PR 8302 METALLURGY AND MATERIALS TESTING L T P C

3 0 0 3

OBJECTIVES:

- To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.
- To study the theoretical foundations of metallography, X- ray diffraction, electron diffraction, scanning electron microscopy, chemical and thermal analysis.

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 9

ASTM grain size number. Constitution of alloys – phase diagrams, isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions, Iron – Iron carbide and Iron – Carbide & Iron Graphite equilibrium diagram. Classification of steel and cast iron - microstructures of Steels & Cast irons - properties and application- Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram CCR.

UNIT II HEAT TREATMENT AND STRENGTHENING 9

Defintion – Full annealing, stress relief, recrystallisation and spheroidizing – normalizing, hardening and tempering of steel, – Hardenability, Jominy end quench test –Austempering, martempering – case hardening, carburizing, nitriding cyaniding, carbonitriding – Flame, Induction Laser and Electron beam and plasma phase hardening Special and Duplex surface hardening processes – Strengthening methods.

UNIT III FERROUS AND NON FERROUS METALS 9

Effect of alloying additions on steel (Mn, Si, Cr, Mo, V, Ti & W) – stainless and tool steels – HSLA steels – maraging steels – Gray, white, malleable, spheroidal / graphite, alloy cast irons Copper and Copper alloys, Brass, Bronze and Cupronickel – Aluminium and AI-Cu –precipitation strengthening treatment – Bearing alloys, Alloys of Ti, Zn Mg and Ni –Intermetallics, Ni, Ti Aluminides – Shape memory alloys.

UNIT IV MECHANICAL PROPERTIES AND TESTING 8

Elastic, anelastic and viscoelastic behaviour - Mechanism of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – hardness tests (Brinell, Vickers and Rockwell) micro and nano hardness test, impact test, Izod and charpy, ductile-brittle transition - fatigue and creep mechanisms – types of wear – preventions.

UNIT V CHARACTERISATION OF MATERIALS 10

Metallographic techniques – specimen preparation – resolution – phase contrast – quantitative techniques. X – Ray diffraction techniques – stereograhic projection - determination of crystal structure, lattice parameter, phase diagram and residual stress – quantitative phase estimation - application of Scanning electron microscope, EDX. Electron probe micro analysis, scanning Tunneling Microscope (STM) and Atomic Force Microscope – Thermo gravimetric Analysis.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Donald R.Askeland, “The Science and Engineering of materials”, 4th Edition – Thomson Engineering – 2002
2. Kenneth G.Budinski and Michael K.Budinski “Engineering Materials” Prentice Hall of India Private Limited, 7th Edition Indian Reprint 2004”.

REFERENCES:

1. Sydney H.Avner “Introduction to Physical Metallurgy” McGraw Hill Book Co., 2001
2. Raghavan V. “Materials Science & Engg” Prentice Hall of India Pvt.Ltd., 2004
3. William D Callister “Material Science & Engg”, – John Wiley & Sons, 2002
4. Culity B.D., Stock S.R. & Stock S. ‘Elements of X-ray diffraction’, PHI, 2005
5. Goldsten I.J., Dale E., Echin N.P & Joy D.C., ‘Scanning Electron Microscopy and X-ray micro analysis, ISBN-0306441756, Plenum Publishing Co., 2000.

EI 8313 ELECTRICAL, ELECTRONICS AND CONTROL LAB L T P C
0 0 3 2

OBJECTIVE:

- To study and implement various types of motors and electronic measuring devices.

LIST OF EXPERIMENTS

1. Load test on single phase transformer.
2. Load test on D.C Shunt motor.
3. Load test on generator.
4. Load test on three phase Induction motor.
5. Speed control of DC Shunt motor.
6. Verification of Ohm's law and Kirchhoff's laws.
7. Construction of regulated Power supply circuits.
8. Construction of Amplifier using Operational amplifiers.
9. Construction of Sinusoidal oscillators using Operational amplifiers.
10. Construction of Square wave generators using Operational amplifiers.
11. Testing of logic gates circuits.
12. Measurement of voltage, frequency and phase using C .R.O.
13. Use of Voltmeters and Multimeters.
14. Experiments with virtual instruments.

TOTAL: 45 PERIODS

PR 8311 METALLURGY AND MATERIALS TESTING LAB L T P C
0 0 3 2

OBJECTIVE:

- To study the testing methods and quantifying techniques for the mechanical properties of engineering materials.
- To gain practical knowledge in Microstructure analysis of various steels, Cast iron, Non ferrous Materials and Heat Treated steels.

LIST OF EXPERIMENTS

1. Tension test –using mild steel.
2. Torsion test–using mild steel.
3. Impact test- Izod and Charpy.
4. Hardness test – Vickers /Brinell.
5. Compression test for Helical spring.
6. Fatigue test (Rotary type).
7. Creep test.
8. Specimen preparation for macro – examination.
9. Specimen preparation for micro examination (steel/cast iron/non-ferrous alloys).
10. Quantitative metallography – Estimation of volume fraction, particle size, shape and distribution.
11. Cooling curve- Pure metal and alloy (Pb-Sn).
12. Heat treatments of Steel-Micro structural study: Annealing/ Normalising / Quench Hardening/ Tempering.
13. Jominy End Quench Test.
14. Surface Topography study using AFM/SEM/STM.

TOTAL: 45 PERIODS

GE 8351 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve bio-diversity. The role of government and non-government organization in environment managements.

UNIT – I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 10

Definition, scope and importance of environment – need for public awareness - Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems

– Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

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

UNIT – II ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

Concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds;

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

UNIT – III ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

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

UNIT – IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy –

water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT – V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", 2nd edition, Pearson Education, 2004.
2. Erach Bharucha, "Text book of Environmental Studies", University Press, Hyderabad, 2006.
3. Anubha Kaushik and Kaushik C.P., " Perspectives in Environmental Studies" New age International (P) Ltd., New Delhi, 2005
4. Venugopala Rao.P, " Principles of Environmental Science and Engineering" Prentice Hall of India Pvt. Ltd., New Delhi, 2006.

REFERENCES:

1. Cunningham, W.P. Cooper, T.H. Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
2. Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT LTD, New Delhi, 2007.
3. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 2005.
4. Richard T. Wright, "Environmental Science" Prentice Hall of India Pvt. Ltd., New Delhi 2007.

AE 8451 **ENGINEERING FLUID MECHANICS** **L T P C**
3 0 0 3

OBJECTIVE:

To introduce the concepts of fluid statics viscosity and buoyancy. To make the student understand the basic laws namely, mass momentum and energy.

UNIT – I BASIC CONCEPTS **8**

Introduction – Fluid properties – Newton's viscosity law – Classification of fluids and fluid motion – Fluid statics – Hydrostatic force on submerged surfaces – stability of floating bodies – Manometers.

UNIT – II BASIC EQUATIONS OF FLUID FLOW ANALYSIS **10**

Basic laws for a system in integral form – Conservation of mass – Newton's 2nd law – Laws of thermodynamics – Application of the basic laws for a control volume – Kinematics – Motion of a fluid particle – Fluid deformation – Differential analysis of fluid motion – Continuity equation – Differential momentum equation – The Navier Stokes equations.

UNIT – III INCOMPRESSIBLE INVISCID FLOW **9**

Euler's equations of motion – Bernoulli's equations – Applications – Methods of pressure measurement – Flow measurement – Orifice plate – Venturi meter – Irrotational flow – Stream function and velocity potential – Laplace equation – Elementary plane flows

UNIT – IV INCOMPRESSIBLE VISCOUS FLOW **9**

Fully developed laminar flow between infinite parallel plates – Laminar and turbulent flow through pipes – Velocity profiles – Energy considerations in pipe flow – Calculation of head loss Pipe flow problems – Hydraulic and energy grade lines – Moody's diagram

UNIT – V FLUID MACHINERY **9**

Dimensional analysis – Dimensional homogeneity – Reyleigh's method - The Buckingham-Pi theorem – Model analysis – Similarities – Similitude - Significant dimensionless groups – Flow similarity and model studies – Classification of models.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Shames I H, 'Mechanics of Fluids', Kogakusha, Tokyo, 1998
2. Robert W Fox & Alan T Mc.Donald, 'Introduction to fluid Mechanics', John Wiley and Sons, 1995

REFERENCES:

1. Yuan S W, 'Foundations of fluid Mechanics', Prentice-Hall, 1987
2. Milne Thompson L M, 'Theoretical Hydrodynamics', MacMillan, 1985
3. Rathakrishnan, E, 'Fundamentals of Fluid Mechanics', Prentice-Hall, 2007.

PR 8401 METAL CUTTING AND CNC MACHINES L T P C
3 0 0 3

OBJECTIVES:

- To understand the theory of metal cutting.
- To understand the concepts of gear manufacture.
- To understand CNC machines constructional features, working and programming.

UNIT I TOOL MATERIAL, TOOL WEAR AND TOOL LIFE 9

Requirement of tool materials – types of tool materials – Tool wear – Types, mechanism – Tool life - problems – Machinability – types of chips – cutting fluids.

UNIT II MECHANICS OF METAL CUTTING 9

Cutting tool angles – tool signature – orthogonal & oblique cutting – cutting forces, Merchant circle diagram – force & velocity relationship - problems.

UNIT III GEAR MANUFACTURE 8

Different methods of gear manufacture –– gear generation – different methods - gear hobbing, gear shaping, gear planning and bevel gear generation. gear broaching – gear finishing methods - shaving – grinding , lapping and gear honing

UNIT IV CNC MACHINES 9

NC, CNC & DNC – types of CNC – constructional features of CNC machines - feed back devices – preset & qualified tools – Machining center – Turning center – CNC wire cut EDM.

UNIT V CNC PROGRAMMING 10

Manual part programming – steps involved – sample programs in lathe & milling– canned cycles – Computer aided part programming – APT program.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. B.L.Juneja, G.S. Sekhon, Niting Seth, “Fundamentals of Metal Cutting and Machine Tools, New Age International Publishers, 2005.
2. Jonathan Lin.S.C., Computer Numerical Control from Programming to Networking, Delmar Publishers, 1994.

REFERENCES:

1. Groover, M.P., “Automatic production systems and computer integrated manufacturing”, Prentice Hall, 2003
2. GE Thyer, Computer Numerical Control of Machine Tools, BH, Newners, 1991
3. Hajra Choudhury C.J., “Elements of Workshop Technology”, Vol.I and Vol.II, Asia Publishing House, 1992.
4. Nagpal G.R., Machine Tool Engineering, Khanna Publishers, 2002
5. Geoffrey Boothroyd, Winston A. Knight , “Fundamental sof Machining and Machine Tools”

PR 8402 METAL FORMING PROCESSES L T P C
3 0 0 3

OBJECTIVE:

- To understand the principle, procedure and application of Bulk Metal Forming and Sheet Metal Forming.

UNIT I FUNDAMENTALS OF METAL FORMING 9

State of stress – Components of stress, symmetry of stress tensor, principle stresses – Stress deviator – von-mises, Tresca yield criteria – Octahedral shear stress and shear strain theory – Flow stress determination – Temperature in metal forming – Hot, cold and warm working – strain rate effects – metallurgical structures – residual stresses – Spring back.

UNIT II FORGING AND ROLLING 9

Principle – classification – equipment – tooling – processes parameters and calculation of forces during forging and rolling processes – Ring compression test – Post forming heat treatment – defects (causes and remedies) – applications – Roll forming.

UNIT III EXTRUSION AND DRAWING PROCESSES 9

Classification of extrusion processes – tool, equipment and principle of these processes – influence of friction – extrusion force calculation – defects (causes and remedies) – Rod-Wire

drawing – tool, equipment and principle of processes – defects – Tube drawing and sinking processes – mannessmann process of seamless pipe manufacturing – Tube bending.

UNIT IV SHEET METAL FORMING PROCESSES 9

Classification – conventional and HERF processes – presses – types and selection of presses – formability studies – FLD, Limiting Draw ratio – processes: Deep drawing, spinning, stretch forming, plate bending, Rubber pad forming, bulging and press brake forming – Explosive forming, electro hydraulic forming, Magnetic pulse forming and Super plastic forming.

UNIT V POWDER FORGING AND RECENT ADVANCES 9

Powdered metals and fabrication procedures, Applications, Preparation of powders, Compacting and sintering, Yield criteria and flow rules, Hot and cold pressing (HIP, CIP) –P/M forming – Electro forming – fine blanking – Hydro forming – Peen forming – Laser Forming – Micro forming – Isothermal forging – high speed forging and extrusion near net shape forming – Ultra fine grained materials by severe plastic deformation, CAD and CAM in forming.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Dieter G.E., “Mechanical Metallurgy”, McGraw Hill, Co., S.I. Edition, 2005
2. Nagpal G.R. “Metal forming processes”, Khanna Publishers, New Delhi, 2004

REFERENCES:

1. Serope Kalpakjian, Steven R Schmid, “Manufacturing Process for Engineering Materials” – Pearson Education, 4th Edition, 2003.
2. Rao, P.N. “Manufacturing Technology”, TMH Ltd., 2003
3. Edward M.Mielink, “Metal working science engineering, McGraw Hill, Inc, 2000
4. Metal Hank book Vol 14, “Forming and Forging”, Metal Park, Ohio, USA, 1990

PR 8451 KINEMATICS AND DYNAMICS OF MACHINES L T P C
3 1 0 4

OBJECTIVES:

- To understand the basic concepts of mechanisms and machinery.

UNITI MECHANISMS 14

Definition – Machine and Structure – Kinematic link, pair and chain – classification of Kinematic pairs – Constraint & motion – Degrees of freedom - Slider crank – single and double

– Crank rocker mechanisms – Inversions, applications – Introduction to Kinematic analysis and synthesis of simple mechanisms – Determination of velocity and acceleration of simple mechanisms.

UNITII FRICTION 12

Types of friction – friction in screw and nut – screw jack – pivot, collar and thrust bearings – plate and cone clutch – belt (flat & vee) and rope drives – creep in belts – open and crossed belt drives – Ratio of tensions – Effect of centrifugal and initial tensions – condition for maximum power transmission.

UNITIII GEARING AND CAMS 12

Gear – Types and profile – nomenclature of spur & helical gears – laws of gearing – interference – requirement of minimum number of teeth in gears – gear trains – simple, compound and reverted gear trains – determination of speed and torque in epicyclic gear trains – cams different types of followers – Cam – Types of cams and followers – Cam design for different follower motions.

UNITIV BALANCING 11

Static and dynamic balancing – single and several masses in different planes – primary and secondary balancing of reciprocating masses – Balancing of single and multi cylinder engines – Governors and Gyroscopic effects.

UNITV VIBRATION 11

Free, forced and damped vibrations of single degree of freedom systems – force transmitted to supports – vibration Isolation – vibration absorption – torsional vibration of shafts – single and multirotor systems – geared shafts – critical speed of shafts.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Bansal Dr.R.K. “Theory of Machines” Laxmi Publications (P) Ltd., New Delhi 2001.
2. Rattan S.S.”Theory of machines” Tata McGraw Hill publishing Co., New Delhi, 2002.

REFERENCES:

1. Rao J.S.and Dukkipati R.V. “Mechanism and Machine Theory” Second Edition, Wiley Eastern Limited, 1992.
2. Malhotra D.R. and Gupta H.C “The Theory of machines” Satya Prakasam, Tech. India Publications, 1989.

3. Gosh A and Mallick A.K. “Theory of Machines and Mechanisms” affiliated east west press, 1989.
4. Shigley J.E. and Uicker J.J. Theory of Machines and Mechanisms” McGraw Hill, 1986.

PR 8452 MACHINE COMPONENTS DESIGN L T P C
3 0 0 3

OBJECTIVE:

- To introduce the students the design and theory of common machine elements and to give experience in solving design problems.

UNIT-I INTRODUCTION 12

Fundamentals of Machine Design-Engineering Design, Phases of Design, Design Consideration - Standards and Codes - Selection of Materials –Design against Static and Dynamic Load –Modes of Failure, Factor of Safety, Principal Stresses, Theories of Failure-Stress Concentration, Stress Concentration Factors, Variable Stress, Fatigue Failure, Endurance Limit, Design for Finite and Infinite Life, Soderberg and Goodman Criteria.

UNIT –II DETACHABLE AND PERMANENT JOINTS 12

Design of Bolts Under Static Load, Design of Bolt with Tightening/Initial Stress, Design of Bolts subjected to Fatigue – Keys -Types, Selection of Square and Flat Keys-Design of Riveted Joints and Welded Joints.

UNIT –III SHAFTS, COUPLING AND BRAKES 12

Design of Shaft –For Static and Varying Loads, For Strength and Rigidity-Design of Coupling-Types, Flange, Muff and Flexible Rubber Bushed Coupling-Design of Brakes-Block and Band Brakes.

UNIT-IV GEARS AND BELT DRIVES 12

Design of Spur, Helical, Bevel and Worm Gear drives-Design of Belt drives-Flat and V Belts.

UNIT V SPRINGS AND BEARINGS 12

Design of Helical Spring-Types, Materials, Static and Variable Loads-Design of Leaf Spring-Design of Journal Bearing -Antifriction Bearing-Types, Life of Bearing, Reliability Consideration, Selection of Ball and Roller Bearings.

TOTAL: 60 PERIODS

TEXTBOOK:

1. Joseph Edward Shigley, Charles R. Mischke " Mechanical Engineering Design", McGraw Hill, International Edition, 1992.

REFERENCES:

1. V.B.Bhandari, " Design of Machine Elements", Tata McGraw-Hill Publishing Company Limited, 2003.
2. C.S.Sharma and Kamlesh Purohit, "Design of Machine Elements", Prentice Hall of India Private Limited, 2003.
3. Robert L.Norton, "Machin Design – An Integrated Approach", Prentice Hall International Edition, 2000.

PR 8411 METAL CUTTING AND CNC LAB LT P C
0 0 3 2

OBJECTIVE:

- To expose the students to write, simulate and Machine the various operations in CNC machines with metal cutting concept.

LIST OF EXPERIMENTS

1. Tool life study on a single point turning tool.
2. Measurement of cutting forces in turning using lathe tool dynamometer.
3. Measurement of shear plane angle using chip-thickness ratio criteria.
4. Acceptance test on RAM type milling machine as per ISI test chart & Measurement of single point tool angles.
5. Spur Gear milling in gear shaper.
6. Gear hobbing - (i) Spur Gear / Helical Gear.
7. Programming and machining of step turning and taper turning operation in CNC Lathe.
8. Programming and machining of thread cutting and grooving operation in CNC Lathe.
9. Programming and simulation for canned cycle in CNC lathe.
   (i) Stock removing in facing cycle.
   (ii) Stock removing in turning cycle.
   (iii) Grooving cycle.
   (iv) Thread cutting cycle.
10. Programming for milling operations in a CNC milling simulation.

11. Programming for mirroring / scaling function / Pocket milling and drilling cycle in a CNC milling.
12. Programming for spur gear cutting operation and Programming for hexagonal cutting operation.
13. Programming and Simulation in CNC Router.
14. Virtual CNC Programming & Study And Operation Of Machining / Turning Centre.

TOTAL: 45 PERIODS

PR 8412 METAL FORMING, FOUNDRY AND WELDING LAB L T P C
0 0 3 2

OBJECTIVE:

- To familiarize the students with test procedures followed in forming and in foundry and also to practice various types of welding processes.

LIST OF EXPERIMENTS:

METAL FORMING LAB

1. Construction Flow Stress – Strain curve.
2. Erichsen cupping Test.
3. Determination of interface friction factor using ring compression test.
4. Construction of FLD of a sheet metal.
5. Water hammer forming.
6. Determination of Power consumption in sheet rolling process and wire drawing process.
7. Determination of strain rate sensitivity index of given specimen.
8. Superplastic forming studies on Pb-Sn alloys.
9. Deep drawing.
10. Forward Extrusion process.
11. Micro-forming.
12. Simulation studies on metal forming.

WELDING

1. Oxy-acetylene gas welding of Lap joint, Butt joint and T Joint.
2. Electric arc welding of Lap joint, Butt Joint, and T Joint.
3. Welding of pipes in different positions.

4. Brazing practice – Dissimilar metals.
5. Thermit welding of thick material like rod, plates etc.

FOUNDRY

1. Preparation of green moulding sand
   i. testing for Compression, shear, tensile, transverse strengths.
   ii. Hardness in green condition.
2. In dry condition after drying in oven at 150^{o}C for one and half hour.
3. Permeability testing.
4. Determining the clay content.
5. Sieve analysis of dry silica sand.
6. Determining the moisture content.
7. Melting any non-ferrous metal and making simple castings – Demonstration.

TOTAL: 45 PERIODS

PR 8501 ENGINEERING METROLOGY L T P C
3 0 0 3

OBJECTIVES:

- To understand the concept of Engineering metrology.
- To learn about metrology instruments and application for various measurements.
- To introduce the concepts of computer applications in metrology.

UNIT I FUNDAMENTALS OF MEASUREMENT 8

Definition of Engineering metrology – Line, end and wave length standards of measurement – Errors in measurements – Limits, fits, tolerance and guage design – Interchangeability and selective assembly – Accuracy, precision and calibration of instruments – Light interference and interferometry – Measurement of absolute length using interferometers.

UNIT II LINEAR AND ANGULAR MEASURING SYSTEMS 10

Linear and angular measuring systems. Slip gauges, micrometers, verniers, dial gauges and surface plates – Concept of comparators – mechanical, electrical, optical and pneumatic comparators – Angular measuring systems – angle gauges – sine bar – Precision spirit level, Auto collimators – Angle dekkor – Clinometers – straightness and flatness measurement using precision level and auto collimators.

UNIT III MEASUREMENT OF SURFACE TEXTURE AND MEASURING MACHINES **9**

Surface texture – Definitions – types of surface texture – surface texture measurement methods Comparison – Profilometer – Surface texture measuring instruments – Measurement of run-out and concentricity straightness, flatness and alignment errors – Tool makers microscope – Optical and Laser alignment telescope – Metroscope.

UNIT IV METROLOGY OF SCREW THREADS & GEARS **9**

Metrology of screw threads & gears Internal and external screw threads – terminology - measurement of various elements of screw threads – thread micrometer – two wire and three wire - methods, gear terminology – measurement of various elements of gears pitch circle method, constant chord method, base tangent method – plug method – Rolling gear tester.

UNIT V LASER METROLOGY AND COMPUTER AIDED METROLOGY **9**

Co-ordinate measuring machines – Probe sensors – Errors – Environmental factors – Laser micrometer – Laser interferometer – Testing of geometric features of machine tools using laser interferometer – non contact and in-process inspection using laser – machine tool metrology – vision systems – Automic force microscope – scanning tunneling microscope.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Jain.R.K. “Engineering Metrology” Khanna Publishers, 2002

REFERENCES:

1. Gupta.I.C. “A text book of Engineering Metrology” Dhanpat Rai & Sons, 1996
2. Galyer G.N. and Shotbolt C.R. “Metrology for Engineers” ELBS 1990
3. “ASTE Hand book of Industrial Metrology” Prentice Hall of India Limited 1992
4. Rajput R.K. Engineering Metrology and Instrumentation” Kataria & Sons Publishers, 2001.

PR 8502 FLUID POWER DRIVES AND CONTROLS **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the working principle of hydraulic and pneumatic components and its selection.
- To design hydraulic and pneumatic circuits for different applications.

UNIT I INTRODUCTION TO FLUID POWER & HYDRAULICS PRINCIPLE 8

Introduction to fluid power controls – Hydraulics and pneumatics – Selection criteria, Application of Fluid power, Application of Pascal's Law, equation, Transmission and multiplication of force – Pressure Losses – Fluids, selection & properties – ISO symbols.

UNIT II FLUID POWER DRIVES 10

Fluid Power drives – Pumps – working principle and construction details of Gear, vane and piston pumps, Hydraulic motors, Hydrostatic transmission drives and characteristics, Hydraulic supply components Pneumatic power supply – compressors, air distribution, air motors.

UNIT III FLUID POWER ELEMENTS 10

Control valves – pressure, flow, direction - working principle and construction – Special type - valves – Cartridge, modular, proportional, and servo – Selection and actuation methods. Actuators – Selection and specification, cylinders, mounting, cushioning, pipe fittings – Fluid conditioning elements – Accumulators.

UNIT IV HYDRAULIC AND PNEUMATIC CIRCUITS DESIGN 10

Design of Hydraulic and pneumatic circuits for automation, selection and specification of circuit components, sequencing circuits, cascade, and karnaugh – Veitch map method – Regenerative, speed control, synchronizing circuits.

UNIT V ELECTRO PNEUMATICS AND PLC CIRCUITS 7

Use of electrical timers, switches, solenoid, relays, proximity sensors etc. electro pneumatic sequencing Ladder diagram – PLC – elements, functions and selection – PLC programming – Ladder and different programming methods - Sequencing circuits.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. S.Ilango, V.Soundarajan, "Introduction to Hydraulics and Pneumatics", PHI Learning Pvt. Ltd, 2011.
2. Majumdar, "Oil hydraulics: Principles and Maintenance", Tata McGraw Hill, 2004.
3. Majumdar, "Pneumatic system: Principles and Maintenance", Tata McGraw Hill, 2004.

REFERENCES:

1. William W.Reaves, Technology of Fluid Power, Delmer Publishers, 1997.
2. Petor Rohner, Fluid Power Logic circuit, Design Macmillon Press Ltd., 1990.

3. Andrew Parr “Hydraulics & Pneumatics, Jaico Publishing House, 2004.
4. Anthony Esposito “Fluid power with applications”, 5th editor, Pearson education 2003.

PR8503 JIGS, FIXTURES AND PRESS TOOLS L T P C
3 0 0 3

OBJECTIVES:

- To introduce the concepts of various types of jigs, fixtures and dies.
- To design jig / fixture/ die for a given component.

UNIT I LOCATION AND CLAMPING DEVICES IN JIGS AND FIXUTRES 8

Principles of Jigs and Fixture – Design concepts – Different types of locating devices – different types of clamps – Drill bushes – types – Elements of fixtures.

UNIT II DESIGN OF ELEMENTS OF JIGS AND FIXTURE 10

Design concepts of Template Jig, Plate Jig, Sandwich Jig, Vice Jaw Jig, Latch Jig, Turnover jig, Box jig – Fixtures for Milling, Grinding, Turning, Welding, and Assembly – Modular fixtures.

UNIT III PRESS WORKING OPERATIONS AND FORMING DIES 8

Blanking, Piercing, lancing, notching, bending design features of dies for drawing, extrusion, wire drawing and forging.

UNIT IV ELEMENTS OF DIE 9

Design concepts of the following elements of progressive, compound and Combination dies – Die block – Die shoe – Bolster plate – punch – punch plate – punch holder – guide pins and guide bushes – strippers – knockouts – stops - pilots – selection of standard die sets – strip layout and development.

UNIT V DESIGN OF DIES, JIGS AND FIXTURES 10

Progressive die – compound die – Bending and drawing dies – Drill Jigs – Milling fixtures.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Donaldson, B.H. Lecain, Goold V.V., Tool Design, TMH Edition, 1978.

REFERENCES:

1. Handbook of metal forming, Kurt Lunge, McGraw Hill, Pub.Co. 1985.
2. Paquin, Die Design Fundamentals, Industrial Press Inc, New York, 1979.
3. ASTME, Fundamentals of Tool design, Prentice Hall 1974.
4. Kempster M.H.A., Introduction to Jigs and Fixtures, ELBS Edition, 1976.

PR 8551 QUANTITATIVE TECHNIQUES IN MANAGEMENT L T P C

3 0 0 3

OBJECTIVE:

- To introduce the various quantitative techniques and optimization techniques and to make the students apply these techniques for modeling and solving many engineering situations in general and manufacturing situations in particular.

UNIT I LINEAR PROGRAMMING 10

Problem formulation - Graphical method – simplex method – Special cases – transportation and assignment method – applications.

UNIT II REPLACEMENT MODELS AND GAME THEORY 8

Basic replacement model – individual and group replacement problems – applications – game theory – terminology – decision criteria – solution to a 2 x 2 and 2 x n games – applications of LP in game theory – applications.

UNIT III QUEUING MODELS AND SIMULATION 9

Elements of queue – queue discipline – Poisson arrival and exponential service – queue length – waiting time – steady state conditions – applications – concept of simulation – Monte Carlo method – applications.

UNIT IV FORECASTING AND SEQUENCING 9

Forecasting – purpose – methods – measures of forecast error; scheduling – priority rules - sequencing – methods of sequencing – Johnson's rule – Heuristic approach

UNIT V PROJECT NETWORK ANALYSIS, LINE BALANCING AND DECISION TREE ANALYSIS 9

Network – CPM/PERT – Project time estimation – critical path – crashing of network; line balancing – applications; Decision tree analysis – applications

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R. Panneerselvam, Operation Research, Prentice Hall of India, 2002.

REFERENCES:

1. P.K.Guptha and ManMohan, Problems in Operations Research-Sultan chand & Sons, 1994.
2. MONKS J.G. – Operations Management theory and Practice, McGraw Hill, 1992.
3. Ravindran, Philips and Sojberg, Operations Research Principles and Practice, John Wiley & Sons, Singapore, 1992
4. J.K. Sharma, Operations Research – Theory and Applications – Macmillan India Ltd., 1997.
5. Hamdy A.Taha, Operations Research – An Introduction, Prentice Hall of India, 1997.

AU 8513 DYNAMICS AND CAD LAB L T P C

0 0 3 2

OBJECTIVES:

- To supplement the principles learnt in kinematics and Dynamics of Machinery.
- To understand how certain measuring devices are used for dynamic Testing.
- To design and modeling using the CAD software.

DYNAMICS LAB

CAD LAB

1. Study of 3D Modelling software.
2. 3D modelling of components using solid modelling software.
3. 3D modelling and Assembly of automobile components, Joints, Bearing, Couplings etc.
4. Creation of simple solid models using CSG and B-Rep Approach
5. Surface modelling types.
6. Software mini project using solid & modelling software.

LIST OF EXPERIMENTS:

1. (a) Study of gear parameters.
   (b) Experimental study of velocity ratios of simple, compound, Epicyclic and Differential gear trains.
2. (a) Kinematics of Four Bar, Slider Crank, Crank Rocker,Double crank, Double rocker, Oscillating cylinder Mechanisms.
   (b) Kinematics of single and double universal joints.

3. (a) Determination of Mass moment of inertia of Fly wheel and Axle system.
   (b) Determination of Mass Moment of inertia of Axisymmetric bodies using Turn Table apparatus.
4. Cams – Cam profile drawing, Motion curves and study of jump phenomenon.
5. Spring Mass System – Determination of natural Frequency and verification of Laws of springs – Damping coefficient determination.
6. Whirling of shafts – Determination of critical speeds of shafts with concentrated loads.
7. Balancing of rotating masses.
8. Fatigue testing – Plate, Axial.
9. Mechanism Design – Toys Design & Assembling/building block concept.

PR 8511 **FLUID POWER LAB** **L T P C**
0 0 3 2

OBJECTIVE:

- To study the functional aspects of different pneumatic and hydraulic Components and its use in circuits.
- To train the student in designing different pneumatic and hydraulic circuits for different applications.

LIST OF EXPERIMENTS

1. Study and use of pneumatic and hydraulic elements.
2. Simulation of speed control circuits in a hydraulic trainer.
3. Simulation of hydraulic circuits in a hydraulic trainer.
4. Simulation of single and double acting cylinder circuits using different directional control values.
5. One shot and regenerative pneumatic circuits.
6. Sequencing of pneumatic circuits.
7. Simulation of Electro-pneumatic circuits.
8. Simulation of Logic pneumatic circuits.
9. Simulation of electro pneumatic sequencing circuits.
10. Simulation of PLC based electro pneumatic sequencing circuits.
11. Simulation of pneumatic circuits using PLC.
12. To design and connect the circuits for the given problem (case study).
13. To compare the ladder diagram for electrical and PLC control for the given sequence.
14. Simulation of circuit for the given sequence using software.

TOTAL: 45 PERIODS

PR 8512 **METROLOGY LAB** **L T P C**
0 0 3 2

OBJECTIVE:

- To practice in the various measurement methods.

LIST OF EXPERIMENTS

1. Measurement of Angle using Sine bar/bevel protractor.
2. Inspection of Internal and External taper angle.
3. Measurement of Bore Diameter using different instruments.
4. Calibration of a dial gauge.
5. Measurement of Roundness.
6. Inspection of screw thread parameters using three wire method.
7. Measurement of surface texture.
8. Tool makers microscope- thread parameter measurement.
9. Measurement of tool angle by profile projector.
10. Inspection using vision measuring system.
11. Measurements using CMM.
12. Straightness measurement using Autocollimator .
13. Measurements using profile projector.
14. Measurement of dimensions using LASER.

TOTAL: 45 PERIODS

AU 8651 **PRODUCTION OF AUTOMOTIVE COMPONENTS** **L T P C**
3 0 0 3

OBJECTIVES:

- To impart knowledge in various manufacturing methods in developing automotive components.
- To study the principle of automobile engineering.

UNIT I ENGINE **9**

Working principle of two strokes, four stroke and wankel engines – wet and dry liners – Piston and Piston rings – types – classification.Production of – Cylinder block, Cylinder head, liners, oil pan, piston and piston rings and testing.

UNIT II ENGINE PARTS **8**

Working principle of crank shaft – Cam shaft – valve operating mechanisms – carburetors - spark plug Production of – Connecting rod – Crankshaft - push rod and rocker arm – valves – tappets – carburetors and spark plugs

UNIT III FUEL AND TRANSMISSION SYSTEM **10**

Working principle of – Fuel pumps – fuel injection pumps of diesel engines – multi point fuel injection system – Gear Box – clutch system – differential mechanism – steering system – braking system.Production of – Friction lining materials for clutch and brakes – propeller shaft – gear box housing – steering column – Energy absorbing steering column.

UNIT IV CHASSIS AND SUSPENSION SYSTEM **8**

Working principle of – Suspension system – leaf spring and shock absorbers – wheel housing – design concepts of chassis (aerodynamics and cross worthiness) Production of – Brake shoes – leaf spring – wheel disc, wheel rim –usage of non metallic materials for chassis components.

UNIT V RECENT ADVANCES **10**

Application of sensors and actuators – Emission control system – catalytic converter – Hydro forming of exhaust manifold and lamp housing – stretch forming of Auto body panels – MMC liners – thermal barrier coating of Engine head and valves – Selection of materials for Auto components.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Heldt.P.M, High speed combustion engines, Oxford publishing Co., New York, 1990.

REFERENCES:

1. Kirpal Singh, Automobile Engineering ., Vol.I & II, Standard Publishers, New Delhi, 1997.
2. Newton and steels, the motor vehicle, ELBS, 1990
3. Serope Kalpakjian and Steven R. Schmid, Manufacturing Processes for Engineering Materials, Fourth Edition – Pearson Education publications – 2003.
4. Gupta K.M. Automobile Engineering Vol.I & II, Umesh Publishers, 2000.

PR 8601 **FEA AND SYSTEM SIMULATION** **L T P C**
3 0 0 3

OBJECTIVES:

- To introduce the concept of FEM and to apply in the field of Manufacturing Engineering.

UNIT I INTRODUCTION **9**

General field problems in engineering-Discrete and continuous models-Characteristics-the relevance and place of finite element method-variational calculus-Variational formulation of boundary value problems-The method of weighted residuals-Rayleigh-Ritz and Galerkin methods-Solution of large system of equations-Choleski Decomposition-Gaussian elimination procedures.

UNIT II GENERAL PROCEDURE OF FET **9**

Discretization of Domain selection of interpolation polynomials-Convergence requirements-Formulation of element characteristics matrices and load vectors – Assembly of element characteristics matrices-Solution of finite element equations-Post processing of results.

UNIT III FINITE ELEMENT ANALYSIS OF ONE DIMENSIONAL AND TWO DIMENSIONAL PROBLEMS **10**

One dimensional finite element analysis-Linear bar element-Quadratic bar element-Beam element-Frame elements-One dimensional heat transfer-Two dimensional finite element analysis approximation of geometry and field variables-Three nodded triangular element-Four nodded rectangular element-Six nodded triangular element-Natural coordinates and coordinate transformation – Numerical integration-Incorporation of boundary conditions

UNIT IV ISO-PARAMETRIC ELEMENTS **9**

Iso-parametric elements-Dynamic analysis-Equations of motion using Lagrange's approach-Consistent and Lumped mass matrices-Formulation of FE equations for vibration problems-Solutionof Eigen value problems-Transient vibration analysis-Thermal transients.

UNIT V APPLICATION OF FINITE ELEMENT ANALYSIS **8**

Finite element analysis of Machine elements - Axi-symmetric FEA of a pressure vessel-Application of FEM in various metal forming processes – Solid formulation and flow formulation – FEA simulation of Metal cutting, Solidification of castings and Weldments.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Chandraputla T.R., and Belegundu A.D., “Introduction of Finite Element in Engineering”, Prentice Hall of India, Third Edition, 2002.
2. Reddy. J.N., “An Introduction to Finite Element Method” McGraw Hill, Third Edition, 2005.

REFERENCES:

1. Rao.S.S., “The Finite Element Method in Engineering”, Butterworth-Heinemann, fourth edition, 2004.
2. Segarland. L.J., “Applied Finite Element Analysis”, John Wiley and Sons, Inc.
3. Seshu.P., “Text Book of Finite Element Analysis”, Prentice Hall of India, 2003.

PR 8651 QUALITY CONTROL AND RELIABILITY L T P C
3 0 0 3

OBJECTIVES:

- To impart the knowledge of the quality control, control charts and application and construction of various quality control charts and the selection.
- To study the significance of design of experiments and its application.
- To train the students in the field of reliability and its estimation.

UNIT I STATISTICAL PROCESS CONTROL 9

Quality control – Defenition – Quality Assurance Variation in process – Factors – control charts – variables X_R and X_σ, - Attributes P, C and U-Chart Estblishing and interpreting control charts process capability – Quality rating – Short run SPC.

UNIT II ACCEPTANCE SAMPLING 9

Lot by lot sampling types – probability of acceptance in single, double, multiple sampling plans – OC curves – Producer’s risk and consumer’s risk. AQL, LTPD, AOQL, Concepts Design of single sampling plan – standard sampling plans for AQL and LTPD – Use of standard sampling plans – Sequential sampling plan.

UNIT III EXPERIMENTAL DESIGN AND TAGUCHI METHOD 9

Fundamentals – factorial experiments – Fundamentals – factorial experiments – randomdesign, Latin square design – Taguchi method – Loss function – experiments – S/N ratio and performance measure – Orthogonal array.

UNIT IV RELIABILITY AND ITS PREDICTION 9

Life testing – Failure characteristics – Meantime to failure – maintainability and availability – reliability – system reliability – OC curves – reliability improvement techniques – Reliability testing techniques – Pareto analysis. MTBF MTTF – System reliability – OC curve Availability and Maintainability – Reliability Improvement techniques.

UNIT V FAILURE DATA ANALYSIS 9

Real time distribution, exponential, normal, log normal, gamma and weibull – reliability data requirements – Graphical evaluation.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Amita Mitra "Fundamentals of Quality Control and Improvement" Pearson Education, 2002
2. Modares: Reliability & Risk Analysis Marcel Decker Inc. 1993.

REFERENCES:

1. Bester field D.H., "Quality Control" Prentice Hall, 7th edition 2003.
2. Manohar Mahajan, "Statistical Quality Control" Dhanpal Rai & Sons, 2001.
3. Sharma S.C., "Inspection Quality Control and Reliability", Khanna Publications, 2004.

HS8561 EMPLOYABILITYSKILLS L T P C

(Lab / Practical Course) 0 0 2 1

(Common to all branches of Fifth or Sixth Semester B.E / B.Tech programmes)

OBJECTIVES

- To enhance the employability skills of students with a special focus on Presentation skills, Group discussion skills and Interview skills
- To help them improve their soft skills, including report writing, necessary for the workplace situations

1. Making presentations – introducing oneself – introducing a topic – answering questions – individual presentation practice
2. Creating effective PPTs – presenting the visuals effectively
3. Using appropriate body language in professional contexts – gestures, facial expressions, etc.

4. Preparing job applications - writing covering letter and résumé
5. Applying for jobs online - email etiquette
6. Participating in group discussions – understanding group dynamics - brainstorming the topic
7. Training in soft skills - persuasive skills – People skills - questioning and clarifying skills – mock GD
8. Writing Project proposals – collecting, analyzing and interpreting data / drafting the final report
9. Attending job interviews – answering questions confidently
10. Interview etiquette – dress code – body language – mock interview

TOTAL: 30 PERIODS

REFERENCE BOOKS

1. Dhanavel, S.P. 2010. *English and Soft Skills*. Hyderabad: Orient BlackSwan Ltd.
2. Corneilssen, Joep. *How to Prepare for Group Discussion and Interview*. New Delhi: Tata-McGraw-Hill, 2009.
3. D'Abreo, Desmond A. *Group Discussion and Team Building*. Mumbai: Better Yourself Books, 2004.
4. Ramesh, Gopalswamy, and Mahadevan Ramesh. *The ACE of Soft Skills*. New Delhi: Pearson, 2010.
5. Gulati, Sarvesh. *Corporate Soft Skills*. New Delhi: Rupa and Co. 2006.
6. Van Emden, Joan, and Lucinda Becker. *Presentation Skills for Students*. New York: Palgrave Macmillan, 2004.

EXTENSIVE READERS

1. Covey, Stephen R. *The 7 Habits of Highly Effective People*. New York: Free Press, 1989.
2. Bagchi, Subroto. *The Professional*. New Delhi: Penguin Books India, 2009.

WEB RESOURCES

1. www.humanresources.about.com
2. www.careerride.com

PR 8611 **ANALYSIS AND SIMULATION LAB** **L T P C**
0 0 3 2

OBJECTIVE:

- To train the students to make use of software for simulation and analysis for various applications in the field of manufacturing engineering.

LIST OF EXPERIMENTS

1. One Dimensional FEA Problem.
   a. Truss structure analysis.
   b. Cantilever beam analysis.
   c. Temperature distribution problem.
2. Two Dimensional FEA Problem.
   a. Plane stress analysis.
   b. Axisymmetric analysis.
   c. Vibration Analysis.
3. Three Dimensional FEA Problem.
   a. 3D Shell Analysis.
   b. 3D Contact Analysis.
4. FEA Application in metal forming, Metal cutting, Casting process etc.
5. Preparation of Process Planning Sheet.
6. Simulation of simple mechanism using solid modeling software.
7. Routing & flow process chart.

TOTAL: 45 PERIODS

PR8612 **CREATIVITY AND INNOVATIVE PROJECT** **L T P C**
0 0 3 2

The main objective is to improve the creative and innovative aspects in the design The project should help a rural cause and should be socially useful. The students may be grouped into small groups and work under a project supervisor. A project report to be submitted by the group, which will be evaluated by a committee constituted by the Head of the Department. Student has to take any 2 topics from the given list.

1. Design of Jigs and Fixtures.
2. Automation using Hydraulic and Pneumatic circuits.

3. Software Development.
4. Design for Manufacturability.
5. Design for Automation.

TOTAL: 45 PERIODS

PR 8701 COMPUTER INTEGRATED MANUFACTURING L T P C
3 0 0 3

OBJECTIVE:

- To understand the various automated manufacturing activities.
- To study the application of computer Technology in the manufacturing activities.
- To know the smooth transition from conventional manufacturing to automated production and computer integrated manufacturing.

UNIT I INTRODUCTION TO CIM AND AUTOMATED PRODUCTION SYSTEMS 8

Product design & CAD, CAM, CAD/CAM and CIM – CIM Hardware and software – three step process for implementation of CIM – production concepts– Automation – Reasons for Automation and Automation strategies – The future automated factory. Basic elements of an automated system – Advanced automated functions – Levels of Automation - Fundamentals of Automated Production Lines – Work part Transfer Mechanisms – Storage Buffers – Control of the Production Line – Application to Machining System.

UNIT II MATERIAL HANDLING AND STORAGE SYSTEM 10

Factors influencing material handling system – 10 principles of Material handling – Material transport system – Industrial Trucks, Mono-rails and other rail-guided vehicles, conveyors, cranes & Hoists – Automated guided vehicle system – Types. Guidance technology, vehicle management, despatch rules and safety.Storage systems – Performance, storage location strategies, conventional methods – Automated Storage and Retrieval systems – carousel storage systems.

UNIT III GROUP TECHNOLOGY AND CELLULAR MANUFACTURING 9

Part families – visual – parts classification and coding – case studies in coding – Production flow analysis – benefits of G.T. – Application of G.T.Cellular Manufacturing – Composite

part concept – Machine cell design – Key machine concept - quantitative analysis in cellular manufacturing – Rank order clustering technique – Arranging machines in G.T. Cell – Hollier method 1 and 2.

UNIT IV FLEXIBLE MANUFACTURING SYSTEM 9

FMS - Definition and Types – FMS components – Workstations, Material Handling and storage system – FMS Layout type, computer control system, Human resource – Flow chart showing various operations in FMS – Dead lock in FMS – FMS application and benefits – FMS planning and implementation issues.

UNIT V AUTOMATED ASSEMBLY AND SHOP FLOOR CONTROL 9

Automated assembly – Fundamental – system configuration, part delivery at work station – Design for automated assembly.Shop floor control – Three phases – Factory data collection – manual method – Automated and semi automated data collection (ADC) – Bar code technologies and other ADC Technologies.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Mikell P.Groover, “Automation, Production Systems and Computer-integrated Manufacturing”, Prentice Hall of India Private Limited, 2003.

REFERENCES:

1. Radhakrishnan.P, Subramanyan.S and Raju.V, “CAD/CAM/CIM”, New Age International Publishers, 2000.
2. James A.Retrg and Henry W. Kraebher, “Computer Integrated Manufacturing”, Pearson Education, Asia, 2001.
3. Viswamathan.N and Narahari.Y, “Performance modelling of automated manufacturing system”, Prentice Hall of India Private Limited, 1994.
4. Kant Vajpayee.S, “Principles of Computer-Integrated Manufacturing “, Prentice Hall of India Private Limited, 2006.

PR 8702 **MANUFACTURING MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVE:

- To introduce various concepts of manufacturing management.

UNIT I PRINCIPLES OF MANAGEMENT AND PERSONNEL MANAGEMENT 7

General principles of management – management functions – organization – types – comparison – functions of personnel management – recruitment – training – leadership/ motivation – communication – conflict – Industrial relations – trade union.

UNIT II INVENTORY MANAGEMENT 11

Purpose of inventory – Cost related to inventory – Basic EOQ model – variations in EOQ model – Finite Production, quantity discounts – ABC Analysis – MRP.

UNIT III OPERATIONS MANAGEMENT 10

Plant Location – Layout – Materials Handling – Method study – Time study – Ergonomics – Aggregate Planning – Value Analysis.

UNIT IV FINANCIAL MANAGEMENT 10

Capital – Types – sources – break even analysis – financial statements – income statement – balance sheet – capital budgeting – working capital management – inventory pricing.

UNIT V MARKETING MANAGEMENT 7

Functions of marketing – Sales promotion methods – advertising – product packaging – marketing variables – distribution channels – organization – market research – market research techniques.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R.Kesavan, C.Elanchezhian and T.Sundar Selwyn – Engineering Management – Eswar Press, 2005.
2. R. Panneerselvam – Production and Operations Management – Prentice Hall of India, 2003.

REFERENCES:

1. Koontz and Odonnel-Essentials of Management, McGraw Hill 1992.
2. Philips Kotler – Principles of marketing, Prentice Hall of India, 1995.

3. I.M.Pandey – Financial Management, Vikas Publishing house, 1995
4. K.K.Ahuja – Personnel Management, Kalyane Publication 1992.
5. K.Panneerselvam – Production and Operations Management – Prentice Hall of India, 2003.
6. Martand T. Telesand – Industrial and Business Management – S.Chand & Co., 2001
7. R. Kesavan, C.Elanchezian and B.Vijayaramnath – Production Planning and Control, Anuratha Publishing Co. Ltd., Chennai – 2008.

PR 8703 MECHATRONICS FOR AUTOMATION L T P C
3 0 0 3

OBJECTIVE:

- This syllabus is formed to create knowledge in Mechatronics systems and impart the source of concepts and techniques, which have recently been applied in practical situation. It gives the frame work of knowledge that allows engineers and technicians to develop an interdisciplinary understanding and integrated approach to engineering.

UNIT I MECHATRONICS SYSTEMS ANS SENSORS 9

Introduction to Mechatronics Systems, key elements, ways of integration – hardware and software. sensors – Characteristics –static and dynamic , types - linear , rotational, velocity acceleration , force, torque , flow , temperature , proximity , optical , Micro and Nano sensors, selection of sensors

UNIT II ACTUATORS 9

Electrical actuators - switches – mechanical , solid state , solenoids, relays , Motors –Types and characteristics Micro and Nano actuators, Drive circuits for various actuators. Selection of actuators.

UNIT III SYSTEM MODELS AND SIMULATION 9

Building Models for Mechanical, Electrical, Fluid and Thermal Systems, Rotational -Transnational Systems, Electro mechanical Systems , Hydraulic – Mechanical Systems. Models Simulation using SIMULINK Packages.

UNIT IV MICROCONTROLLER AND APPLICATIONS 9

8051 processors – Architecture , ,Address modes, Instruction sets , simple programming exercises - Memories – different types , 8255 Programmable Peripherals interfacing – Different I/O devices , Stepper motor interface , A/D and D/A interface.

UNIT V MECHATRONICS SYSTEM DESIGN 9

Stages in designing Mechatronics Systems – Traditional and Mechatronic Design –

Optimization techniques in system design, Study of virtual instrumentation and its applications, Case studies in manufacturing.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. W.Bolton, “MECHATRONICS” Pearson Education Limited, 2004.

REFERENCES:

1. R.K.Rajput.A Text Book of Mechatronics, Chand &Co, 2007.
2. Devadas shetty, Richard A. Kolk, “Mechatronics System Design”, PWS Publishing Company, 2001.
3. Dan Necsulescu. Mechatronics, Pearson Education, Inc.2002.
4. M.A Mazidi & M.J. Mazidi, Microcontroller and Embedded systems. PWS Publishing Company, 2001.

PR 8711 **INDUSTRIAL TRAINING** **L T P C**
0 0 3 2

1. The students have to undergo practical industrial training for four weeks in recognized industrial establishments during their vacation periods.
2. At the end of the training they have to submit a report with following information:
    a. Profile of the industry
    b. Product range
    c. Organization structure
    d. Plant layout
    e. Processes/Machines/Equipments/Devices
    f. Personnel welfare schemes
    g. Details of the training undergone
    h. Projects undertaken during the training, if any
    i. Learning points

The assessments will be based equally on the report in the prescribed format and viva-voce examination by a committee nominated by the Head of the Department

PR 8712 MANAGEMENT AND INDUSTRIAL ENGINEERING LAB L T P C
0 0 3 2

OBJECTIVE:

- To give adequate exposure to applications of software packages in the areas of Applied Statistics, Operations Research and Reliability.

MANAGEMENT LAB:

1. Basic Statistics –calculation of Mean, Median, Mode, measures of dispersion.
2. Use of Spreadsheet -Look up tables, Statistics.
3. Use of Reliasoft - Data analysis.
4. Simple OR Programs- Initial Solution of TP, Inventory Price Break Models.
5. Optimization Package (TORA /LINDO)

   LP Models
   Transportation
6. Assignment

   Maximal flow
7. Minimal spanning tree

   Shortest route

   Network scheduling

INDUSTRIAL ENGINEERING LAB:

1. Peg Board Experiment.
2. Stopwatch time study.
3. Performance rating exercise.
4. Work sampling and Graphic tools for method study.
5. Effect of speed of walking on treadmill using least rate and energy expenditure.
6. Effect of work load least rate using Ergo cycle.
7. Evaluation of physical fitness using step test.

TOTAL: 45 PERIODS

PR 8713 **MECHATRONICS AND ROBOTICS LAB** **L T P C**
0 0 3 2

OBJECTIVE:

- To understand the various concepts of sensors and robots.
- To impart practical knowledge in Robotic equipment, Simulation softwares and Microcontroller programming.

LIST OF EXPERIMENTS:

1. Study of characteristics of optical and temperature transducers
2. I/O port programming of an 8051 microcontroller.
3. Applications of ideal operational amplifiers.
4. Characterisation of DC brush servo motor.
5. PC parallel port and microcontroller interfacing of a unipolar stepper motor.
6. Servo Motor Control in a linear slide base.
7. Modelling and Simulation of mechanisms using ADAMS.
8. Kinematic analysis and verification of 2 DOF RR Configuration robot.
9. Analysis and synthesis of two degree of freedom planar robot.
10. Robot control with stepper motor interfacing.
11. Experimental verification of Frankenstein equation for 1 DOF robot.
12. Experiments on LVDT.
13. AC & DC power control.
14. Distance measurement using Acoustic techniques.

TOTAL: 45 PERIODS

PR 8001 **ADVANCES IN OPERATIONS RESEARCH** **L T P C**
3 0 0 3

OBJECTIVE:

- To introduce the advanced OR models and to apply them for Engineering problems.

UNIT I INTRODUCTION **5**

Optimization – Historical Development – Engineering applications of optimization – Statement of an Optimization problem – classification of optimization problems.

UNIT II CLASSIC OPTIMIZATION TECHNIQUES 10

Linear programming - Graphical method – simplex method – dual simplex method – revised simplex method – duality in LP – Sensitivity Analysis - Parametric Linear programming.

UNIT III NON-LINEAR PROGRAMMING 9

Introduction – Lagrangeon Method – Kuhn-Tucker conditions – Quadratic programming – Separable programming – Stochastic programming

UNIT IV INTEGER PROGRAMMING 11

Cutting plane algorithm – Branch and bound technique - Zero-one implicit enumeration; Goal programming – geometric programming; Network Techniques – Shortest Path Model – Minimum Spanning Tree Problem – Maximal flow problem.

UNIT V DYNAMIC PROGRAMMING 10

Formulation – Application to capital budgeting, reliability improvement, shortest path, solution of LP using DP.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R. Panneerselvam, “Operations Research”, Prentice Hall of India Private Limited, New Delhi – 2005.

REFERENCES:

1. P.K. Guptha and Man-Mohan, Problems in Operations Research – Sultan chand & Sons, 1994.
2. Ravindran, Philips and Solberg, Operations Research Principles and Practice, John Wiley & Sons, Singapore, 1992.
3. J.K.Sharma, Operations Research – Theory and Applications – Macmillan India Ltd., 1997.
4. Hamdy A. Taha, Operations Research – An Introduction, Prentice Hall of India, 1997.

PR 8002 APPLIED PROBABILITY AND STATISTICS L T P C

3 0 0 3

OBJECTIVE:

- To train the students so that students will be able to design experimental designs and use these concepts for research design.

UNIT I PROBABILITY THEORY **14**

Random variables – probability density and distribution functions-moment generating and characteristic functions – Binomial, Poisson, Normal distributions and their applications.

UNIT II SAMPLING THEORY **13**

Sampling distributions – Standard error – t, F, Chi square distributions – applications.

UNIT III ESTIMATION THEORY **5**

Interval estimation for population mean, standard deviation, difference in means, ratio of standard deviations – point estimation.

UNIT IV TESTING OF HYPOTHESIS **8**

Hypothesis testing – Small samples – Tests concerning proportion, means, Standard deviations – Tests based on chi square

UNIT V ANOVA **5**

One, two factor models – Design of experiments.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Levin and Rubin, Statistics for Management, Prentice Hall of India, 2001.

REFERENCES:

1. Hooda, Statistics for business and economics, Macmillan India, 2001.
2. John.E.Freunds, “Mathematical statistics with applications”, Pierson Education, 2004.
3. Gupta and Kapoor, Fundamentals of Mathematical Satistics, Sultanchand, 2002.

PR8003 COMPUTER AIDED PRODUCT DESIGN **L T P C**

3 0 0 3

OBJECTIVES:

- To introduce the concepts and applications of CAD.
- To introduce the various concepts and techniques used for product design and to develop product design skills.

UNIT I INTRODUCTION TO COMPUTER AIDED DESIGN 6

Introduction to Engineering Design – Various phases of systematic design – sequential engineering and concurrent engineering – Computer hardware & Peripherals – software packages for design and drafting.

UNIT II COMPUTER GRAPHICS FUNDAMENTALS 9

Computer graphics – applications – principals of interactive computer graphics – 2D 3D transformations – projections – curves – Bezier, B-Spline and NURBS – Concepts.

UNIT III GEOMETRIC MODELING 10

Geometric Modeling – types – Wire frame surface and solid modeling – Boundary Representation, constructive solid geometry – Graphics standards – assembly modeling – use of software packages

UNIT IV PRODUCT DESIGN CONCEPTS 12

Product modeling – types of product models; product development process tools – TRIZ – Altshuller's inventive principles – Modeling of product metrics – Design for reliability – design for manufacturability – machining, casting, and metal forming – design for assembly and disassembly – Design for Ergonomics - Design for environment; Bench marking – FMEA – QFD – DOE – Taguchi method of DOE – Quality loss functions – Design for product life cycle.

UNIT V PRODUCT DATA MANAGEMENT 8

Product Data Management – concepts – Collaborative product design and commerce – Information Acquisition – Sourcing factor – manufacturing planning factor – Customization factor – Product life cycle management.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Kevin Otto, Kristin Wood, "Product Design", Pearson Education, 2000.

REFERENCES:

1. Biren Prasad, "Concurrent Engineering Fundamentals Vol.11", Prentice Hall, 1997.
2. James G.Bralla, "Handbook of Product Design for Manufacturing", McGraw Hill, 1994
3. Ibrahim Zeid, "CAD/CAM theory and Practice", Tata McGraw Hill, 1991.
4. David F.Rogers.J, Alan Adams, "Mathematical Elements for Computer Graphics", McGraw Hill, 1990.

PR8004 **DESIGN OF CASTING AND WELDMENTS** **L T P C**

3 0 0 3

OBJECTIVES:

- At the end of this course the student should be able to understand
  - Melting procedure of various materials
  - Design principles of welding and casting

UNIT I MELTING AND POURING **9**

Principles of melting practice-fluxing- Degasification and inoculation- Types of furnaces-Crucibles, Cupola, Oil fired furnaces – Electric arc and induction furnaces –Melting practice of cast iron, SG iron, steel, aluminum and copper alloys.

UNIT II CASTING DESIGN **9**

Solidification of pure metals and alloys-shrinkage in cast metals-design of sprue, runner, gate and risers-problems in design and manufacture of thin and unequal sections - design for directional solidification, minimum distortion and for overall economy - design problems of L,T,V,X and Y junctions.

UNIT III WELD DESIGN **9**

Design of welded components-symbolic representation of welds on drawings- residual stresses in welds-weld distortions-design consideration-strength consideration of welded joints-analysis of statistically loaded welded joints-welded structures subjected to fatigue loads

UNIT IV PHYSICAL METALLURGY OF WELDING **9**

Welding of ferrous materials: Formation of different micro structural zones in welding of carbon steels. Welding of C-Mn and low-alloy steels, phase transformations in weld and heat - affected zones, cold cracking, role of hydrogen and carbon equivalent, formation of acicular ferrite and effect on weld metal toughness.

UNIT V AUTOMATION **9**

Layout of mechanized foundry – sand reclamation – material handling in foundry pollution control in foundry –– Computer aided design of casting and Automation in welding – robot welding – safety norms.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Parmar,R.S., Welding Processes and Technology, Khanna Publishers, 2006.
2. Jain,P.L., Principles of Foundry Technology, Tata McGraw Hill, 2006.

REFERENCES:

1. A.S.M Hand book, vol 15, casting, ASM international, 1988.
2. Klas Weman, welding processes hand book, CRC press, 2003.
3. Cary and Howard,B., Modern Welding Technology, Prentice-Hall, 1989.
4. Heine, R.W., Loper.L.R., and ROSENTHAL,C, Principles of Metal Casting, Tata McGraw Hill, 1986.
5. Minkoff,J., solidification and cast structure,wiley.1986.
6. Davies, A.C., Welding (10th Edition), Cambridge University Press, 1996.
7. ASM Handbook, Vol 15, Casting, 2004.
8. ASM Handbook vol.6, welding Brazing & Soldering, 2003.
9. Heineloper & Rosenthal, Principles of Metal Casting, Tata McGraw Hill, 2000.
10. Klas Weman, welding processes hand book, CRC press, 2003.

PR 8005 LEAN MANUFACTURING L T P C
3 0 0 3

OBJECTIVES:

- To study the various tools for lean manufacturing (LM).
- To apply the above tools to implement LM system in an organization.

UNIT I INTRODUCTION TO LEAN MANUFACTURING 7

Conventional Manufacturing versus Lean Manufacturing – Identification and Elimination of wastes in all forms - Principles of Lean Manufacturing – Basic elements of lean manufacturing – Introduction to LM Tools.

UNIT II CELLULAR MANUFACTURING, JIT, TPM 9

Cellular Manufacturing – Types of Layout, Principles of Cell layout, Implementation. JIT – Principles of JIT and Implementation of Kanban. TPM – Pillars of TPM, Principles and implementation of TPM.

UNIT III SET UP TIME REDUCTION, TQM, 5S, VSM 10

Set up time reduction – Definition, philosophies and reduction approaches. TQM – Principles

and implementation. 5S Principles and implementation - Value stream mapping - Procedure and principles.

UNIT IV SIX SIGMA **9**

Six Sigma – Definition, statistical considerations, variability reduction, design of experiments – Six Sigma implementation

UNIT V CASE STUDIES **10**

Various case studies of implementation of lean manufacturing at industries.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Design and Analysis of Lean Production Systems, Ronald G. Askin & Jeffrey B. Goldberg, John Wiley & Sons, 2003

REFERENCES:

1. Rother M. and Shook J, 1999 'Learning to See: Value Stream Mapping to Add Value and Eliminate Muda' , Lean Enterprise Institute, Brookline, MA.
2. Mikell P. Groover (2002) 'Automation, Production Systems and CIM.

PR8006 MACHINE VISION L T P C
3 0 0 3

OBJECTIVE:

- To understand the principle, importance and application of machine vision system in Manufacturing and measurement.

UNIT I INTRODUCTION TO MACHINE VISION **6**

Machine Vision use of machine vision – tasks for a vision system – relation to other fields – place of vision in CIM.

UNIT II IMAGE ACQUISITION AND CONVERSION **6**

Colour systems – light sources – lighting techniques – image formation by lensing – image scanning – television cameras – sensors, charge coupled devices – camera and system interface – frame buffers and frame grabbers – digital and smart camers.

UNIT III IMAGE PROCESSING DECISION MAKING 12

Processing of binary images – thresholding, geometrical properties, topological properties – processing of gray scale images statistical operations, spatial operations, segmentation edge detection, morphological operations – image analysis – factors extraction – decision making.

UNIT IV PATTERN RECOGNITION 9

Fundamentals – parametric classifiers – nonparametric, classifiers nearest neighbor CART, neural networks, generic classifiers.

UNIT V MACHINE VISION APPLICATIONS 12

Applications in user industries automotive, semiconductor, electronic manufacturing, printing industries etc. – generic applications founding manufacturing metrology, inspection assembly verification – application analysis and implementation.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Nella zuech, 'Understanding & applying machine vision Marceldekker Inc. 2000.

REFERENCES:

1. Milan sonka, Vaclav hlavac, roger boyie, image processing, analysis and machine vision publisher, 1995
2. Richard O.Duda, Peter E. Hurt, Pattern Classification and Scene Analysis Publisher, 1973
3. Rafael C. Gonzaies, Richard E. Woods, Digital Image processing publisher, 1992

PR8007 MAINTENANCE MANAGEMENT L T P C

3 0 0 3

OBJECTIVE:

- To introduce the concepts of Maintenance Management and it's implementation in industries.

UNIT I MAINTENANCE CONCEPT 8

Need for Maintenance – Maintenance management – Terro technology – Challenges of physical asset management – Scope of Maintenance – Maintenance organization – Maintenance costs – Imperfect maintenance – Toyota maintenance concept – Maintenance policies: PM, CM, DOM, OM – Condition monitoring.

UNIT II MAINTENANCE MODELS **10**

Probability models in maintenance – Choice between PM and brakedown maintenance – Optimal PM schedule and quality loss – Inspection decisions: Maximization of profit – Minimization of downtime – Analysis of downtime – Repair time distribution: exponential – System repair time – Maintainability prediction – Corrective maintenance downtime – Design for maintainability.

UNIT III MAINTENANCE LOGISTICS **12**

Maintenance planning – Maintenance scheduling – Priority systems – Proactive/reactive maintenance – Minimum/extensive maintenance – Work order form – Spare parts control: setting reorder point – Overall part availability – unique/interchangeable spares – Capital spare – Maintenance resource requirements – Queuing theory applications: Optimal number of workshop machines – Optimal repair effort – Maintenance crew size – use of learning curves – simulation – Human factors in maintenance.

UNIT IV REPLACEMENT MODELS **9**

Component replacement decisions – Assumptions –Model for equipment whose operating cost increases with use – Preventive replacement age of item subject to breakdown – Preventive replacement interval/age: minimization of downtime, Capital equipment replacement decisions

UNIT V ADVANCED MAINTENANCE **6**

Total Productive Maintenance – Six big losses – Equipment effectiveness – Autonomous maintenance – Reliability Centered Maintenance – CMMS – Software maintenance.

TOTAL: 45 PERIODS

TEXT BOOK:

1. An introduction to Reliability and Maintainability Engineering –Charles E.Ebeling, Tata McGraw-Hill, New Delhi, 2003.

REFERENCES:

1. Maintenance, Replacement and Reliability –Andrew K.S.Jardine and Albert H.C.Tsang, Taylor & Francis, New York, 2006.
2. Autonomous maintenance in seven steps – Masaji Tajiri and Fumio Gotoh, Productivity Inc., Oregon, 1999.

PR 8008 MICRO ELECTRO MECHANICAL SYSTEMS AND NANO TECHNOLOGY **L T P C 3 0 0 3**

OBJECTIVE:

- To expose the students to the evolution of micro electromechanical systems, to the various fabrication techniques and to make students to be award of micro actuators.

UNIT I MATERIALS FOR MEMS AND MINIATURISATION **6**

Definition – historical development – fundamentals – Scaling laws in miniaturization – Rigid Body dynamics, Electrostatic Forces, Electromagnetic properties, Electricity, diffusion property, optical property and Heat Transfer, Materials for MEMS and Microsystems – Si,Si compounds, Si Piezoressistors, GaAs, Quartz, Piezoelectric Crystals and Polymers – Doping of semiconductors – diffusion process.

UNIT II FABRICATION PROCESSES **10**

Photolithography – photo resist applications, light sources and postbaking – Ion implantation – diffusion process – oxidation – thermal oxidation, silicon dioxide, oxidation rate, oxide thickness by colour – chemical vapour deposition – enhanced CVD – Physical vapour deposition – sputtering – deposition by epitaxy – etching – chemical and plasma etching. Bulk micromanufacturing – wet etching, dry etching and etch stop – surface micromachining – LIGA process – SLIGA process.

UNIT III MICROSYSTEM – WORKING PRINCIPLE AND PACKAGING **10**

Microsensors – Optical, Pressure, Acoustic wave and Thermal sensors – Microactuation – thermal forces, shape memory alloys, piezoelectric crystals and Electrostatic Forces – MEMS with microactuators – Microgripper, Micromotor, microvalves and micropumps – Microaccelerometers – Microfluidics – micromirror array for video projection – Microsystem packaging – die level, device level and system level – Interfaces – Die preparation – surface bonding- wire bonding – sealing – Assembly of Microsystems – selection of packaging materials – signal mapping and transduction – pressure sensors packaging.

UNIT IV MICROSYSTEMS DESIGN **10**

Static bending of thin plates – Mechanical Vibration – thin film mechanics – Design considerations – constraints, selection of materials, selection of Manufacturing processes, selection of signal transduction, electromechanical system and packaging – Process design – Mechanical Design Thermomechanical loading, Thermomechanical stress analysis, Dynamic Analysis and Interfacial fracture Analysis – simulation of Microfabrication process – Design of a Si die for a micropressure sensor – Fluid resistance in Microchannels – capillary electrophoresis network systems – Design of MEMS cell gripper – MOEMS – CMOS.

UNIT V NANO TECHNOLOGY **9**

Classification of nano structures – effect of the nanometer length scale effects of nano scale dimensions on various properties – structural, thermal, chemical, mechanical, magnetic, optical and electronic properties – effect of nanoscale dimensions on biological systems. Fabrication methods – Top down processes – bottom up process – nano positioning systems.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Tai – Ran Hsu, MEMS and Microsystems Design and Manufacture, Tata-McGraw Hill, New Delhi, 2002.
2. Norio Taniguchi, Nano Technology Oxford University Press, New York, 2003

REFERENCES:

1. Mark Madou Fundamentals of Microfabrication, CRC Press, New York, 1997.
2. The MEMS Hand book, Mohammed Gad-el-Hak, CRC Press, New York
3. Charles P Poole, Frank J Owens, Introduction to Nano technology, John Wiley and Sons, 2003
4. Julian W. Hardner Micro Sensors, Principles and Applications, CRC Press 1993.
5. Ananthasuresh G.K. Vinoy K.J. Gopalakrishnan S. Bhat K.N and Aatre V.K., Microand smart systems, Wiley India Pvt. Ltd., New Delhi, 2010
6. Akhlesh Lakhtakia (Editor), "The Hand Book of Nano Technology, Nanometer Structure", Theory, Modeling and Simulations", Prentice-Hall of India (P) Ltd., New Delhi, 2007.
7. Rai-choudhury, P, "MEMS and MOEMS Technology and Application, PHI, New Delhi, 2009.

PR 8009 MICROMACHINING AND FABRICATION **L T P C**
3 0 0 3

OBJECTIVE:

- To introduce the various types of micromachining processes and their Applications.

UNIT I INTRODUCTION **9**

Introduction to micromachining process – Classification of micromachining and nanomachining processes – Molecular dynamics, principle of molecular dynamics simulation potential energy function – Boundary condition – MD simulation procedure.

UNIT II MICROFABRICATION METHODS 9

Methods of microfabrication – Maleno deposition – Electro discharge depositant, Chemical vapour deposition physical vapour deposition – Electro Chemical spark deposition – LIGA.

UNIT III MECHANICAL MICROMACHINING 9

Ultrasonic machining – Abrasive jet machining – Abrasive water jet machining, water jet machining – Beam energy micromachining – Electron beam machining, electro discharge machining, ion beam machining, focused con beam machining.

UNIT IV MICROMACHINING AND NANO FUNCTIONING WITH ABRASIVE FLOW 9

Process principle and description – Process Technology Selection of machine Effect of process parameter on performance – Mechanism of materials removal Magneto Rhological Nanofunctioning Process. Nano functioning – Smart Rhological fluids – Magneto Rhological polishing fluid – Rhological character is of MRP fluid – MRF process – MRAFF Process – MRJF process.

UNIT V HYBRID MICRO MACHINING 9

Chemical Mechanical polishing – Electro chemical spark micro machining – Electro discharge grinding – Electro lytic in process dressing – Application.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. V.K.Jain – Introduction to Micromachining – Narrosa Publishing house 2010.

REFERENCES:

1. Sami Franssito : Introduction to Micro fabrication – Johnwiley and sons.
2. Jain V.K. Advanced machining process, Allied Publisher, Delhi 2002.
3. Mohammed Gad-el-Hat: “The MEMS Hand book” CRC Press 2006.

PR 8011 MODERN MANUFACTURING PROCESSES L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge to the students about various non traditional machining processes and the principles of rapid prototyping.

UNIT I MECHANICAL ENERGY BASED PROCESSES 8

Abrasive Jet Machining – Water Jet machining Abrasive water Jet machining (AWJM) Ultrasonic machining, (AJM, WJM and USM). Working Principle – equipments used – Process parameters – MRR – Variation in techniques used – Applications.

UNIT II CHEMICAL AND ELECTRO CHEMICAL ENERGY BASED PROCESSES 10

Chemical machining and Electro-Chemical machining (CHM and ECM) – Etchants – maskant-techniques of applying maskants – Process Parameters – MRR – Applications, Principles of ECM – Equipments – MRR – Electrical circuit – Process Parameters – ECG and ECH Applications .

UNIT III ELECTRICAL ENERGY BASED PROCESSES 8

Electric Discharge Machining (EDM) – working principle – equipments – medium – Process Parameters – MRR – Electrode-Tool – Power circuits – Tool Wear – Dielectric – Flushing – Wire cut – EDM – Applications – Micro EDM.

UNIT IV THERMAL ENERGY BASED PROCESSES 10

Laser Beam machining (LBM), Plasma Arc machining (PAM) and Electron Beam Machining (EBM), Principle – Equipment – Types – Applications – Ion Beam Machining (IBM)

UNIT V RAPID PROTOTYPING AND RAPID TOOLING 9

Introduction-Stereo Lithography-Fused Deposition Modelling-Selective Laser Sintering Laminated Object Manufacturing-Solid base curing-direct Manufacturing and Rapid Tooling.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Serope Kalpakjian, Stevan R.Schemid, “Manufacturing Processes for Engineering Materials”, Fourth edition, Pearson Education, 2003.
2. Vijay K.Jain “Advanced Machining Processes” Allied Publishers Pvt.Ltd., New Delhi (2002) ISBN 87-7764-294-4.

REFERENCES:

1. Serope Kalpakjian, “Manufacturing Engineering and Technology”, Third Edition – Addison-Wesley Publication, Co, 1995.
2. Brahem, T.Smith, “Advanced Maching”, I.F.S., U.K. 1989.

3. Amstead B.H., Ostwald Physics and Bageman, R.L., “Manufacturing Processes”, John Wileys Songs 1987.
4. Benediet, G.F. “Nontraditional Manufacturing Processes” Marcel Dekker Inc., New York (1987).
5. Pandey P.C. and Shan H.S., “Modern Machining Processes” Tata McGraw Hill, New Delhi (1980).

PR 8012 NON DESTRUCTIVE TESTING METHODS L T P C
3 0 0 3

OBJECTIVES:

- To understand principle behind various NDT techniques.
- To study about NDT equipments and accessories.
- To learn working procedures of various NDT techniques.

UNIT I NON-DESTRUCTIVE TESTING: AN INTRODUCTION 6

Introduction to various non-destructive methods – Comparison of Destructive and Non destructive Tests, Visual Inspection, Optical aids used for visual inspection, Applications.

UNIT II LIQUID PENETRANT TESTING AND MAGNETIC PARTICLE TESTING 10

Physical principles, procedure for penetrant testing, Pentrant testing materials, Penetrant testing methods – Applications Principle of MPT, Magnetising technical and procedure used for testing a component, Equipment used for MPT, Applications

UNIT III EDDY CURRENT TESTING AND ACOUSTIC EMISSION TESTING 10

Principles, Instrumentation for ECT, Various Techniques – High sensitivity Techniques, Single, Multi and high frequency ECT, Applications Principle of AET, AE signal parameters, Applications.

UNIT IV ULTRASONIC TESTING 10

PRINCIPLE, Ultrasonic transducers, Inspection Methods – Normal incident pulse-echo Inspection, through – transmission testing, angle Beam Pulse-echo testing, Techniques A-Scan, B-Scan , C-Scan – Applications.

UNIT V RADIOGRAPHY, COMPARISON AND SELECTION OF NDT METHODS 9

Basic principle, Effect of radiation of Film, Radiographic Imaging – Inspection Techniques

– Single wall single image, Double wall Penetration & Multiwall Penetration technique – Comparison and selection of various NDT techniques.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Baldev raj, T Jeyakumar, M. Thavasimuthu "Practical Non-Destructive Tesitng" Narosa Publishing house, New Delhi, 2002.

REFERENCES:

1. Krautkramer.J, "Ultra Sonic Testing of Materials", 1st Edition, Springer – Verlag Publication, New York, 1996.
2. Peter J. Shull "Non Destructive Evaluation: Theory, Techniques and Application" Marcel Dekker, Inc., New York, 2002
3. www.ndt.net
4. Baldev Raj and B.Venkataraman, "Practical Radiology", Narosa Publishing House, 2004.
5. Birchan.B, "Non-Destructive Testing", Oxford, London, 1975.

PR 8013 OPERATIONS PLANNING AND COST ESTIMATION L T P C
3 0 0 3

OBJECTIVES:

- To develop good process planning capabilities.
- To impart the knowledge on cost estimation of a given product.

UNIT I PROCESS PLANNING 7

Definition – Information required and advantages – process planning activities and chart selection of machining process, machine tools, grouping of jobs. Process selection – Manual process planning – case studies. short comings of Manual process planning.

UNIT II ESTIMATION, COSTING AND ELEMENTS OF COST 9

Importance and aims of cost estimation – Functions of estimation – costing – importance and aims of costing – Difference between costing and estimation – importance of realistic estimates – Estimation procedure – elements of cost – Material cost – Determination of material cost – labour cost – determination of direct labour cost – Expenses – cost of product (Ladder of cost) – Illustrative examples.

UNIT III ANALYSIS OF OVERHEAD EXPENSES & METHODS OF DEPRECIATION 10

Overhead expenses – Factory expenses – Administrative expenses – selling and distributing expenses – Allocation of over head expenses – Depreciation – causes of depreciation – methods of depreciation.

UNIT IV ESTIMATION OF COSTS FOR FORGING, CASTING AND WELDING 10

Estimation of forging cost – Forging process – Forging operations – Losses in forging operations – Calculating forging cost – illustrative examples – estimation in Foundry shop – Estimation of pattern cost – Foundry losses – Steps for calculating casting costs – illustrative examples. Estimating welding costs – Introduction – Arc welding costs – Basic costing procedure (Arc welding) – Gas welding – Basic costing procedure (Gas welding) – illustrative examples.

UNIT V ESTIMATION OF MACHINING TIME 9

Estimation in Machine-shop – Introduction – Machining times and allowances – General term related to machining – calculation of machining time – Estimation of time for lathe operations – estimation of machining time for drilling, slotting, planning, grinding and milling operations – illustrative examples.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. O.P.Khanna, “Mechanical Estimating and Costing”, Dhanpat Rai publishers, 1999
2. R. Kesavan, C. Elenchezian, and B.Vijaya Ramnath, “Process Planning and cost estimation”, New age International Publishers, 2005.

REFERENCES:

1. G.B.S. Narang and V.Kumar, “Production and costing”, Khanna publishers, 2000
2. Mikell P. Groover, “Automation, production systems and computer – Integrated Manufacturing”, Prentice-Hall of India Private Limited, 2003.
3. P. Radhakrishnan, S.Subramanyan and V. Raju, “CAD/CAM/CIM”, New Age International Publishers, 2000
4. Gideon Halevi & Roland D.Weill, “Principles of process planning”, Chapman & Hall, 1995.
5. M.Adithan & B.S. Pabla, “Production Engineering and costing”, Konark publishers Pvt. Ltd. 1990.

PR8014 PLANT LAYOUT AND MATERIAL HANDLING SYSTEMS L T P C
3 0 0 3

OBJECTIVE:

- To introduce the concepts of Plant Layout and Materials Handling Systems and their Applications in industry.

UNIT I INTRODUCTION 9

Faciities in the production system – Manufacturing systems – Production – Quantity – Product variety – Fixed production layout – Process layout Batch – Production Group technology – Cellular layout – Analysis of material transport systems.

UNIT II PLANT LAYOUT 9

Layout for mass production – types of facilities and layouts used for different levels of production quantity and product variety – Single model and mixed model production lines – Flow line production layouts Set up time – Change over times – Manufacturing Support Systems – Automation migration strategy composite part concept – machine cell design – Arranging machines in a G.T. Cell.

UNIT III MATERIAL HANDLING 9

Material handling equipments – Industrial trucks manual and powered – Automated guided vehicle systems – monirails and other Rail Guided vehicles – Powered conveyors – cranes & hoists – Vehicles – Guidance technology – Self Guided vehicles – material handling management and safety.

UNIT IV ANALYSIS OF MATERIAL TRANSPORT SYSTEMS 9

Charting techniques in material handling – Analysis of vehicle based systems – Conveyor analysis – Single direction conveyor – Recirculating conveyor analysis.

UNIT V STORAGE SYSTEMS 9

Storage system performance – Comparison of storage strategies – storage location strategies conventional and automated storage systems. Automated storage and retrieval systems – Engineering Analysis of storage systems.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. MICKELL.P GROOVER “Automation production systems and computer integrated manufacturing” Prentice-Hall of India Private Limited, New Delhi – 110 001, 2005.

REFERENCES:

1. EASTMAN R.M. - “Materials handling” Marcel Dekker.Inc New York 1987.
2. Mulcahy.D.E. “Materials Handling Hand book” McGrah Hill, New York 1999.
3. GROOVER M.P. “Plant Layout and automation” John Wiley & Sons Inc. New York 1994
4. BLACK J.T. The Design of the factory with a future” McGraw Hill Inc, New York 1991.

PR 8015 PRECISION ENGINEERING AND MANUFACTURING L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge in the increasing quality concepts of parts, accuracy requirement of machine tools and also to introduce latest topics in manufacturing like micro machining and smart materials so as to equip them to produce precision parts and to join core electronic manufacturing industries.

UNIT I CONCEPT OF ACCURACY AND OF MACHINE TOOLS 8

Part accuracy – errors, accuracy of machine tools – spindle accuracy – displacement accuracy – errors due to numerical interpolation – definition of accuracy of NC system – errors in the NC machines – feed stiffness – zero stability.

UNIT II STIFFNESS, THERMAL EFFECTS AND FINISH MACHINING 10

Overall stiffness of eathe – compliance of work piece –errors caused by cutting forces – errors due to compliance in machining - deformation in turning – boring – milling – heat sources – thermal effects – heat sources – heat dissipation – geometry of thermal deformations – methods of decreasing thermal effects - finish turning, boring, grinding – surface roughness, influence of machining parameters and roughness.

UNIT III DIMENSIONING, CLAMPING AND SETTING ERRORS AND ERRORS DUETO LOCATION 11

Definition of terms – key dimension – superfluous dimension – dimensional stepped shaft – assigning tolerances in the constituent dimensions – dimensional chains – Clamping errors – setting errors – location of blank, prism, long and short cylinder, tapered hole – datum for measurement – types of locators.

UNIT IV MICRO-MACHINING AND MICRO FABRICATION 8

Micro machining – photo resist process – lithography – LIGA Process – processing of materials – electron beam machining – laser beam machining – Plasma arc machining - micro forming, diamond turning – micro positioning devices – etching – physical vapour deposition – chemical vapour deposition.

UNIT V SMART STRUCTURES, MATERIALS AND MICRO ACTUATORS 8

Smart structures – smart materials types and applications – smart sensors – micro valves – MEMS – micro motors – micro pumps – micro dynamometer – micro machines – micro optics – metro nozzles.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Murthy.R.L. “Precision Engineering in Manufacturing”, New Age International Pvt. Limited, 1996
2. Norio Tanigughi, “Nano Technology, Oxford University Press, 1996.

REFERENCES:

1. Stephen A.Campbell,”The Science and Engineering of Micro electronic Fabrication”, Oxford University Press, 1996.
2. Randy Frank, “Understanding Smart Sensors”, Artech. House, Boston, 1996.
3. Tai-Ran Hsu, MEMS and Microsystems Design and Manufacture, Tata McGraw Hill Publishing Co Ltd., - 2002.

PR 8016 PROCESSING OF POLYMERS AND COMPOSITES L T P C
3 0 0 3

OBJECTIVES:

- To study matrix material, particulates and fibres of polymer matrix composites, MMC and ceramic matrix composites.
- To develop knowledge on processing, interfacial properties and application of computers.

UNIT I INTRODUCTION TO POLYMERS 8

Chemistry and Classification of Polymers – Glass transition temperature, thermal expansion molecular weight, stress strain behaviour - Properties of Thermo plastics – Properties of Thermosetting Plastics – Properties and application of Epoxy, polyester, PMMA, PEEK, Poly propylene, polymide, phenolics, polyetherimide – Merits and Disadvantages.

UNIT II PROCESSIONG OF POLYMERS 9

Extrusion – Injection Moulding – Blow Moulding Compression and Transfer Moulding – Casting – Thermo Forming General Machining properties of Plastics – Machining Parameters and their effect – Joining of Plastics – Mechanical Fasteners – Thermal bonding – Press Fitting.

UNIT III INTRODUCTION TO FIBRES AND COMPOSITE MATERIALS 9

Fibres – Fabrication, Structure, properties and applications – Glass, Boron, carbon, polyethylene, Kevlar, Aramid, Alumina, SiC, Si_3N_4, B_4C, ceramic and metallic fibers whiskers – Matrix materials structure – Polymers – metals and ceramics – Physical and chemical properties – rule of mixture.

UNIT IV PROCESSING OF POLYMER MATRIX COMPOSITES 9

Open mould process, bag moulding, compression moulding with BMC and SMC filament winding – pultrusion – centrifugal casting – injection moulding – structure, properties and application of PMC's semdurich panel – laminate – Carbon Matrix Composites – Interfaces – Properties – recycling of PMC.

UNIT V PROCESSING OF – METAL MATRIX COMPOSITES AND CERAMIC MATRIX COMPOSITES 10

Solid state fabrication techniques – diffusion bonding – powder metallurgy techniques plasma spray, chemical and physical vapour deposition of matrix on fibres chemical vapour infiltration – Sol gel – liquid state fabrication methods – infiltration - squeeze, casting – Rheo casting – compocasting Carbon - Composite – interfaces properties – application of MMC and ceramic matrix composites – Primary and secondary processing of composites.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Krishnan K Chawla, Composite Materials Science and Engineering, International Edition, Springer, 2006.

REFERENCES:

1. Harold Belofsky, Plastics, Product Design and Process Engineering, Hanser Publishers, 2002.
2. Bera.E and Moet.A, High performance polymers, Hanser Publishers, 2001.
3. Rauwendaal, C., Polymer extrusion, Hanser publishers, 2000.

PR 8017 PURCHASING AND MATERIALS MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:

- To introduce the various aspects of Purchasing And Materials Management.

UNIT I FUNCTIONS OF MATERIALS MANAGEMENT 6

Introduction to materials management – objectives – organization – Functions – operating cycle – value analysis – make or buy decisions.

UNIT II PURCHASING MANAGEMENT 8

Purchasing policies and procedures – Selection of sources of supply – Vendor development – Vendor evaluation and rating – Methods of purchasing – Imports – Buyer, – Seller relationship –Negotiations.

UNIT III STORES MANAGEMENT 8

Store function – Location – Layout – Stock taking – Materials handling – Transportation – Insurance – Codification – Inventory pricing – stores management – safety – warehousing.

UNIT IV INVENTORY MANAGEMENT 12

Forecasting – ABC analysis – Materials requirements planning – systems – Quantity – periodic – deterministic and probabilistic models – Aggregate planning – JIT.

UNIT V QUANTITATIVE TECHNIQUES IN MATERIAL MANAGEMENT 11

Finite Production – Lot size under constraints – Application of O.R. Techniques in Materials Management.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Lamer Lee and Donald W.Dobler, Purchasing and Material Management, Texland cases, Tata McGraw Hill, 1996.

REFERENCES:

1. Kesavan.R, Elanchezhian.C and Vijayaramnath.B, Engineering Management, Eswar Press. 2005

2. Gopalakrishnan P. Handbook of Materials Management, Prentice Hall of India, 1996.
3. Guptha P.K. and Manmohan, Problems in Operations Research, Sultan chand & Sons, 1994.

PR8018 SELECTION OF MATERIALS L T P C
3 0 0 3

OBJECTIVE:

- By considering various constraints like material chart, process attributes, Material cost, recyclability, materials are selected for the engineering components.

UNIT I MATERIALS AND PROPERTIES 9

Classes of engineering materials - Evolution of Engineering Materials-Definition of materials properties- Displaying material properties using materials selection charts- Forces for change in materials selection and design, Materials and the environment.

UNIT II FACTORS IN SELECTION PROCESS 10

Design process - types of design, design requirements, function, Material attributes. Shape and Manufacturing processes - Materials processing and design processes and their influence on design, Process attributes, Systematic process selection, Process selection diagrams, Process cost, Energy consumption for production, Material costs, availability and recyclability, Environmental consideration.

UNIT III MATERIALS SELECTION PROCESS 10

Materials selection methods: Screening, Ranking - weighted ranking, Performance indices - Materials selection charts, Deriving property limits and material indices, Structural indices. Shape factors, Efficiency of standard sections, Material limits for shape factors, Material indices which include shape-microscopic or micro structural shape factor, Co-selecting material and shape.

UNIT IV CASE STUDIES ON APPLICATIONS 9

Automobile materials (Body and Crank shaft), Marine structural materials (Hull and Propeller), Aircraft structural materials (Wings and landing gears), Materials for space (Gas turbines and Nose), Materials for power generation machinery (Boilers and Pressure vessels), Materials for medical applications (Surgical knives and Bone replacements), Chemical and petrochemical industries (Acid storage tanks and Fuel carrying pipes).

UNIT V SUBSTITUTION OF MATERIALS & MINI PROJECT WORK 8

Environmental design, Economics and environmental impact of materials, Hybrid materials: composites, sandwich structure, lattices and segmented structure, case studies on hybrid materials, polymer foams, Natural Biomaterials and Implantable Biomaterials. Students will carry out a materials selection exercise for a hypothetical design project, identifying selection parameters and potential materials.

TOTAL: 45 PERIODS

TEXT BOOK:

1. M F Ashby, "Materials Selection in Mechanical Design", third edition, Butterworth-Heineman, New York, 2005.
2. J A Charles and F A A Crane., "Selection and Use of Engineering Materials", second edition, Butterworth-Heinemann Ltd., 1989.

REFERENCES:

1. G E Dieter, "Engineering Design: A Materials and Processing Approach", Third Edition, McGraw-Hill, 2000.
2. ASM Handbook, Volume 20: Materials Selection and Design, ASM International, 1997.
3. H Petroski, "Invention by Design", Harvard University Press, 1997.
4. K. G. Budinski, M. K. Budinski, Engineering Materials: Properties and Selection, 6th edition, Prentice Hall, 1999.
5. Mahmoud M.Farag, Materials and Process Selection for Engineering Design, second edition, CRC Press, New York, 2007.

PR8071 ELECTRONIC MATERIALS AND PROCESSING L T P C
3 0 0 3

OBJECTIVE:

- To introduce the technology behind electronic materials and processing and their applications.

UNIT I INTRODUCTION 9

Overview of semiconductors and other basic materials - Plastics, Elastomers, and Composites -tables with material properties, terms and definitions, trade names, and material structure correlation, MEMS.

UNIT II ORGANIC MATERIALS AND PROCESSES 9

Types and properties of organic materials, manufacturing technique –Vacuum Metallization, Vapour phase deposition, Thermal Imaging, Digital Lithography, Application areas.

UNIT III MEMS MATERIALS AND PROCESS 9

MEMS design process- Methods, Selection of materials for process, Optimization techniques in design, Over view of additive process for –Semiconductors , Dielectric materials, Metals, and Polymer Materials, Piezo electric materials, Shape memory alloys , Micromachining techniques, packaging methods.

UNIT IV MATERIALS SYSTEMS 9

Solder technologies for electronic packaging and assembly, Electroplating and Deposited metallic coatings, Printed circuit board fabrication, Materials and Processes for Hybrid Microelectronics and Multichip modules. Adhesives under fills, and Coatings in electronics assemblies.

UNIT V THERMAL MANAGEMENT OF MATERIALS AND SYSTEMS 9

Temperature effects on circuit operation and physical construction. Laws of heat transfer mechanism and their considerations in the manufacturing process. Thermal management in packaging of electronic materials

TOTAL: 45 PERIODS

TEXT BOOK:

1. Electronic Materials and Processes Hand book By: Harper, Charles McGraw-Hill © 2004.
2. MEMS Materials and Process Handbook by Ghodssi, Reza; Lin, Pinyen Springer © 2011.

REFERENCES:

1. Organic Electronics, Materials, Manufacturing and applications, by Hagen Klauk Wiley - VCH Verlag Gmbh & Co © 2006.

PR 8072 ENERGY MANAGEMENT L T P C
3 0 0 3

AIM:

To instruct the importance of energy conservation in both thermal and electrical energy and its management for the better utilization of resources.

OBJECTIVE:

At the end of the course, the student expected to

- Understand and analyze the plant energy data
- Energy audit and suggest methodologies for energy savings
- Energy accounting and balance and
- Able to utilize the available resources in optimal way

UNIT I IMPORTANCE OF ENERGY CONSERVATION AND MANAGEMENT 8

World, national Energy consumption – environmental aspects – Energy prices, policies – Energy auditing: methodology, analysis, energy accounting – Measurements – Thermal and Electrical.

UNIT II ELECTRICAL SYSTEMS 12

AC / DC current systems, Demand control, power factor correction, load management, Motor drives : motor efficiency testing, energy efficient motors, motor speed control – Lighting : lighting levels, efficient options, day lighting, timers, Energy efficient windows – electrical distribution systems – Transformers – Power quality – harmonic distortion.

UNIT III THERMAL SYSTEMS 10

Boiler – efficiency testing, excess air control, Steam distribution & use – steam traps, condensate recovery, flash steam utilization, Thermal Insulation. Heat exchanger networking – concept of pinch, target settling, problem table approach.

UNIT IV ENERGY CONSERVATION 8

Energy conservation in Pumps, Fans (flow control) and blowers, Compressed Air Systems, Refrigeration and air conditioning systems – Waste heat recovery recuperators, heat sheets, heat pipes, heat pumps.

UNIT V ENERGY MANAGEMENT, ECONOMICS 7

Energy resource management – Energy Management information systems – Computerized energy management – Energy economics – discount rate, payback period, internal rate of Return, life cycle costing – Financing energy conservation Projects.

TOTAL: 45 PERIODS

TEXT BOOK:

1. L.C. Witte, P.S. Schmidt, D.R. Brown, “Industrial Energy Management and Utilization” Hemisphere Publ, Washington, 1988.
2. O. Callaghn, P.W. “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.

REFERENCES:

1. I.G.C. Dryden, “The Efficient Use of Energy” Butterworths, London, 1982
2. W.C. turner, “Energy Management Hand book” Wiley, New York, 1982.
3. W.R. Murphy and G. Mc KAY “Energy Management” Butterworths, London 1987.

PR 8073 ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:

- To introduce the concepts of economics as applied to Engineering and Management of Finance in business.

UNIT I FINANCIAL ACCOUNTING 12

Accounting principles – preparation and interpretation of profit and loss statement – balance sheet – Fixed assets – current assets – depreciation – depreciation methods.

UNIT II PROFIT VOLUME ANALYSIS 10

Cost volume profit relationship – relevant costs in decision making – profit management analysis – break even analysis – margin of safety – angle of incidence and multi product break even analysis Effect of changes in volume, selling price, fixed cost and variable cost.

UNIT III WORKING CAPITAL MANAGEMENT 8

Current assests and liability decisions – Estimation of working capital requirements – Management of accounts receivable – Inventory – Cash – Inventory valuation methods.

UNIT IV CAPITAL BUDGETING 7

Significance of capital budgeting – payback period – present value method – Accounting rate of return method.

UNIT V ENGINEERING ECONOMICS **8**

Economics – Engineering economics – Demand analysis – Laws of demand – Production and cost – Pricing methods – Cost volume profit analysis.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R.Kesavan, C. Elanchezian and T.Sundar Selwyn – Engineering Economics and Financial Accounting, Laxmi Publications 2005.

REFERENCES:

1. C.James, Vanhorn, Fundamentals of Financial Management PHI 1996.
2. Charles T.Homgren, Cost Accounting, PHI 1985.
3. S.N.Maheswaran, Management Accounting and Financial Control, Sultan Chand, 1992.

PR8074 GREEN ELECTRONICS MANUFACTURING **L T P C**
3 0 0 3

OBJECTIVE:

- This course aims to provide students with knowledge on the theories, eco-design concepts, methods, and relevant hands-on experience for designing a range of sustainable green electronic products. It is expected that students will develop their ability to address relevant issues on environmental impact; product design, operating life, and the 3R concept (reduce, reuse, and recycle).

UNIT I INTRODUCTION TO GREEN ELECTRONICS **9**

Environmental concerns of the modern society- Overview of electronics industry and their relevant regulations in China, European Union and other key countries- global and regional strategy and policy on green electronics industry. Restriction of Hazardous substances (RoHS) - Waste Electrical and electronic equipment (WEEE - Energy using Product (EuP) and Registration - Evaluation, Authorization and Restriction of Chemical substances (REACH).

UNIT II GREEN ELECTRONICS MATERIALS &PRODUCTS **9**

Introduction to green electronic materials and products - Lead (Pb) -free solder pastes, conductive adhesives, halogen-free substrates and components. Substitution of non-recyclable thermosetting polymer based composites with recyclable materials X-Ray Fluorescence (XRF) for identifying hazardous substances in electronic products

UNIT III GREEN ELECTRONICS ASSEMBLY AND RECYCLING 9

Various processes in assembling electronics components - the life-cycle environmental impacts of the materials used in the processes - substrate interconnects . Components and process equipments used. Technology and management on e-waste recycle system construction, global collaboration, and product disassembles technology.

UNIT IV PRODUCT DESIGN AND SUSTAINABLE ECO-DESIGN 9

Stages of product development process in green design: Materials- Manufacturing - Packaging and use - End of Life and disposal - Design for recycling - Life Cycle Assessment (LCA), and Eco-design tools - Environmental management systems, and International standards - Eco-design in electronics industry.

UNIT V CASE STUDIES 9

Reliability of green electronics systems , Reuse and recycle of End-of-Life(EOL) electrical and electronic equipment for effective waste management – Introduction of Green Supply Chain, and Modeling green products from Supply Chain point of view - A life-cycle assessment for eco-design of Cathode Ray Tube Recycling.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Lee Goldberg, “Green Electronics/ Green Bottom Line, Newnes Publications, 2002.
2. Sammy G Shina,’ Green Electronics Design and Manufacturing Mc Graw Hill, 2004.
3. John Hu. Mohammed Ismail, “CMOS High Efficiency on – Chip Power Management, Springer Publications, 2006.

REFERENCES:

1. Green Electronic Morning: David Austen and Richard Ingleby, 2004
2. Green Communications and Networks, by Yuhang yang and Maode Ma, Springer Publication, 2005

PR 8075 ROBOTIC ENGINEERING L T P C

3 0 0 3

OBJECTIVE:

- To study the kinematics, drive systems and programming of robots.

UNIT I FUNDAMENTALS OF ROBOT 7

Robot – Definition – Robot Anatomy – Co-ordinate systems, Work Envelope, types and classification – specifications – Pitch, yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and their functions – Need for Robots – Different Applications.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS 10

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of All These Drives. End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic grippers, vacuum grippers, two fingered and three fingered grippers, internal grippers and external grippers, selection and design considerations of a gripper - gripper force calculation and analysis.

UNIT III SENSORS IN ROBOTICS 8

Force sensing, touch and tactile sensors, proximity sensors, non contact sensors, safety considerations in robotic cell, proximity sensors, fail safe hazard sensor systems, and compliance RCC. Machine vision system - camera, frame grabber, sensing and digitizing image data – signal conversion, image storage, lighting techniques, image processing and analysis – data reduction, segmentation, feature extraction, object recognition, other algorithms, applications – Inspection, identification.

UNIT IV ROBOT KINEMATICS AND PROGRAMMING 12

Forward kinematics, inverse kinematics and the difference: forward kinematics and Reverse Kinematics of Manipulators with two, three degrees of freedom (in 2 dimensional), four degrees of freedom (in 3 dimensional) – derivations and problems. Homogeneous transformation matrices, translation and rotation matrices D-H transformation - Teach pendant programming, lead through programming, robot programming languages – VAL programming – Motion Commands, Sensors commands, End-Effector Commands, and simple programs.

UNIT V APPLICATIONS OF ROBOT 8

Role of robots in inspection, assembly, material handling, underwater, space and medical fields, Humanoid robots.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Groover M.P., Industrial Robotics – Technology, Programming and applications, McGraw Hill, 2008.

REFERENCES:

1. Fu K.S. GonzalchR.C. and ice C.S.G.Robotics Control, Sensing, Vision and Intelligence, McGraw Hill book co. 1996.
2. Yoram Koren, Robotics for Engineers, McGraw Hill Book, Co., 1992.
3. Janakiraman P.A., Robotics and Image Processing, Tata McGraw Hill 1995.

PR8076 SENSORS AND CONTROL SYSTEMS IN MANUFACTURING L T P C

3 0 0 3

OBJECTIVE:

- To introduce concepts of sensors and control systems and their applications in Manufacturing.

UNIT I INTRODUCTION 9

Sensor Fundamental , Classification and Types of Sensors, Desirable Sensor Attributes, Sensor Performance and Power dissipation -a trade off, Self Checking and Self Compensating Sensors- Sensor for Work Pieces and Product Monitoring.

UNIT II SENSOR IN PRECISION MANUFACTURING 9

Identification of Manufactured Components, Digital Encoders, Opto Electronic Color Sensors- Principles, Properties, Features and Control Applications in Robotics.

UNIT III SENSORS AND CONTROL IN CIM AND FMS 9

Design of CIM, Decision Support System For CIM , Analysis and Design of CIM , and Development of CIM Strategy with Sensor and Control . FMS- Robot Control with Vision Sensors, Multi Sensor Controlled Robots, Measurement of Robot Density, Robot Programming,

UNIT IV NETWORKING OF SENSORS AND CONTROL SYSTEM IN MANUFACTURING 9

Sensor Network Architecture , Sensor Tracking, Sensors to Detect Machinery Faults, Networks in Manufacturing, Computer Communications- Interface of Sensors With Single Board Computer for PLC, and Numerical Control. Networking with Electro Optic Link using Fiber Sensors.

UNIT V RECENT TRENDS IN SENSOR AND CONTROL SYSTEM 9

Fiber Optics in Sensor and Control System.- Fibre Optics Parameters, Configurations, Photo Electric Sensor for Long Distance, Sensor Alignment Techniques, Sensors for Biomedical Technology.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Sabrie Soloman, Sensors and Control systems in manufacturing, Mc Graw hill publications, second edition 2010.

REFERENCE:

1. H.K Tonshoff, &I.Inasaki, Sensor Applications, vol 1 sensors in manufacturing, wiley-vch publications 2001.

PR8077 SURFACE ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To expose the student on the various treatment and procedures available.

UNIT I METAL CLEANING AND PREVIEW ON SURFACE ENGINEERING 8

.Need and relevance of surface engineering – pre-treatment of coating. General cleaning process for ferrous and non ferrous metals and alloys – selection processes – alkaline cleaning – emulsion cleaning – ultrasonic cleaning – acid and pickling salt bath descaling – abrasive bath cleaning – polishing and bulling shot peening – classification of surface engineering processes.

UNIT II THERMAL SPRAYING PROCESSES AND ELECTRODEPOSITED COATINGS 10

Thermal spraying – Flame, arc, plasma and HVOF processes – PLV process – Design for thermally sprayed coatings – coating production – Spray consumables – principles of electroplating – Technology and control – electroplating systems – properties and Faraday's Law – factors affecting throwing power – Applications of electrodeposites – non aqueous and electroless deposition.

UNIT III HOT DIP COATING AND DIFFUSION COATINGS 10

Principles – surface preparation – batch coating and continuous coating process – coating properties and applications. Principles of cementation – cladding – Diffusion coating of C, N, Al, Si, Cr and B – structure, properties and application of diffusion coatings – chemical vapour deposition – physical vapour deposition.

UNIT IV NON-METALLIC COATING OXIDE AND COVERSION COATINGS 9

Plating coating – Lacquers – rubbers and elastomers – vitreous enamels – anodizing phosphating and chromating – application to aluminium, magnesium, tin, inc, cadmium copper and silver – phosphating primers.

UNIT V QUALITY ASSURANCE, TESTING AND SELECTION OF COATINGS 8

The quality plan – design – testing and Inspection of thickness adhesion, corrosion, resistance and porosity measurement – selection of coatings – industrial applications of engineering coatings. Basic Mechanisms of wear – abrasive, adhesive wear, contact fatigue – Fretting corrosion – Testing wear resistance – practical diagnosis of wear.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Stan Grainger engineering coatings – design and application Jaico publishing House, 1994.

REFERENCES:

1. N.V. Parthasarathy, Electroplating Handbooks, Prentice Hall, 1992.
2. Metals Hand Book vol.2 8th Edition, American society of Metals, 1994
3. D.R.Gabe, Principles of Metal surface treatment and protection, Pergamon, 1990
4. Niku-Lavi, Advances in surface treatments, Pergamon, 1990

GE8751 ENGINEERING ETHICS AND HUMAN VALUES L T P C
3 0 0 3

UNIT I HUMAN VALUES 10

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time– Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law – The Challenger Case Study

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – The Three Mile Island and Chernobyl Case Studies

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

UNIT V GLOBAL ISSUES 8

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

TOTAL: 45 PERIODS

TEXTBOOK

1. Mike W. Martin and Roland Schinzinger, “Ethics in Engineering”, Tata McGraw Hill, New Delhi, 2003.

REFERENCES:

1. Charles B. Fleddermann, “Engineering Ethics”, Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, “Engineering Ethics – Concepts and Cases”, Thompson Wadsworth, A Division of Thomson Learning Inc., United States, 2000
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, “Fundametals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001

WEB SOURCES:

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

MG8654 **QUALITY MANAGEMENT** **L T P C**
3 0 0 3

AIM

To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management.

OBJECTIVES

- To understand the various principles, practices of TQM to achieve quality.
- To learn the various statistical approaches for Quality control in the field of production Engineering
- To understand the TQM tools for continuous process improvement.
- To learn the importance of ISO and Quality systems

UNIT I INTRODUCTION **9**

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality - Basic concepts of TQM – TQM Framework - Contributions of Quality Gurus – Barriers to TQM implementation.

UNIT II TQM PRINCIPLES **9**

Quality statements - Customer focus –Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Continuous process improvement – PDCA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating poka - yoke

UNIT III TQM TOOLS & TECHNIQUES I **9**

The seven traditional tools of quality – New seven management tools applications of old and new tools in production engineering – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking– Reasons to bench mark.

UNIT IV TQM TOOLS & TECHNIQUES II **9**

Quality circles – Quality Function Deployment (QFD) – Taguchi is Robust design - case studies – TPM – Concepts, improvement needs – Performance measures - FMEA - Stages - Types.

UNIT V QUALITY SYSTEMS **9**

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits –Quality Council

– Leadership, Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Dale H.Besterfiled, et al., “Total Quality Management”, Pearson Education Asia, Third Edition, Indian Reprint , 2006.

REFERENCE BOOKS:

1. James R. Evans and William M. Lindsay, “The Management and Control of Quality”, (6th Edition), South-Western (Thomson Learning), 2005.
2. Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, Third Edition , 2003.
3. Suganthi,L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd., 2006 .
4. Janakiraman,B and Gopal, R.K, “Total Quality Management – Text and Cases”,Prentice Hall (India) Pvt. Ltd., 2006.

ME8081 RELIABILITY CONCEPTS IN ENGINEERING L T P C

3 0 0 3

OBJECTIVE:

To impart knowledge in reliability concepts, reliability estimation methods and reliability improvement methods

UNIT I RELIABILITY CONCEPT 9

Reliability definition –Reliability parameters- f(t), F(t) and R(t) functions- Measures of central tendency – Bath tub curve – A priori and posteriori probabilities of failure – Component mortality - Useful life.

UNIT II LIFE DATA ANALYSIS 9

Data classification – Non parametric methods: Ungrouped, Grouped, Complete, Censored data – Time to failure distributions – Probability plotting: Exponential, Weibull - Goodness of fit tests – Survival graphs.

UNIT III RELIABILITY ESTIMATION 9

Series parallel configurations – Parallel redundancy – m/n system – Complex systems: RBD approach – Baye's method – Minimal path and cut sets - Fault Tree analysis – Standby system.

UNIT IV RELIABILITY MANAGEMENT 8

Reliability testing: Failure terminated test – Time terminated test – Upper and lower MTBFs – Sequential Testing – Reliability growth monitoring – Reliability allocation.

UNIT V RELIABILITY IMPROVEMENT 10

Analysis of downtime – Repair time distribution – Maintainability prediction – Measures of maintainability – Availability definitions – System Availability – Replacement decisions – Economic life.

TOTAL: 45 PERIODS

REFERENCES:

1. An Introduction to Reliability and Maintainability Engineering, Charles E.Ebeling, TMH, 2000.
2. Roy Billington and Ronald N. Allan, Reliability Evaluation of Engineering Systems, Springer, 2007.

PR8010 MINI PROJECT L T P C
0 0 6 3

1. The students in batches (not exceeding three in a batch) have to take up a project in the area of Production engineering.
2. Each batch is guided by a faculty member. The students have to select a suitable problem/ design, prepare the drawings, produce the components, assemble and commission the project/develop a software with analysis.
3. The students have to prepare and present a detailed project report at the end of the VIII Semester
4. The evaluation will be made for the continuous internal assessment for the Project by a committee nominated by the Head of the Department.