ANNA UNIVERSITY, CHENNAI

AFFILIATED INSTITUTIONS

R - 2013

B.E. PRODUCTION ENGINEERING

I – VIII SEMESTERS CURRICULUM AND SYLLABUS

SEMESTER I

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	HS6151	Technical English – I	3	1	0	4
2.	MA6151	Mathematics – I	3	1	0	4
3.	PH6151	Engineering Physics – I	3	0	0	3
4.	CY6151	Engineering Chemistry – I	3	0	0	3
5.	GE6151	Computer Programming	3	0	0	3
6.	GE6152	Engineering Graphics	2	0	3	4
PRACTICALS						
7.	GE6161	Computer Practices Laboratory	0	0	3	2
8.	GE6162	Engineering Practices Laboratory	0	0	3	2
9.	GE6163	Physics and Chemistry Laboratory - I	0	0	2	1
		TOTAL	**17**	**2**	**11**	**26**

SEMESTER II

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	HS6251	Technical English – II	3	1	0	4
2.	MA6251	Mathematics – II	3	1	0	4
3.	PH6251	Engineering Physics – II	3	0	0	3
4.	CY6251	Engineering Chemistry – II	3	0	0	3
5.	GE6252	Basic Electrical and Electronics Engineering	4	0	0	4
6.	GE6253	Engineering Mechanics	3	1	0	4
PRACTICALS						
7.	GE6261	Computer Aided Drafting and Modeling Laboratory	0	1	2	2
8.	GE6262	Physics and Chemistry Laboratory - II	0	0	2	1
		TOTAL	**19**	**4**	**4**	**25**

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	MA6351	Transforms and Partial Differential Equations	3	1	0	4
2.	PR6301	Basic Machining Process	3	0	0	3
3.	PR6302	Basics of Thermodynamics and Thermal Engineering	3	1	0	4
4.	PR6303	Engineering Metallurgy	3	0	0	3
5.	CE6451	Fluid Mechanics and Machinery	3	0	0	3
6.	EE6351	Electrical Drives and Controls	3	0	0	3
PRACTICAL						
7.	PR6311	Basic Machining Process Laboratory	0	0	3	2
8.	CE6461	Fluid Mechanics and Machinery Laboratory	0	0	3	2
9.	EE6365	Electrical Engineering Laboratory	0	0	3	2
		TOTAL	**18**	**2**	**9**	**26**

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	MA6459	Numerical Methods	3	1	0	4
2.	CE6306	Strength of Materials	3	1	0	4
3.	PR6401	Advanced Machining Process	3	0	0	3
4.	PR6402	Theory of Machines	3	1	0	4
5.	PR6403	Fluid Power Drives and Control	3	1	0	4
6.	ME6008	Welding Technology	3	0	0	3
PRACTICAL						
7.	PR6411	Metallurgy Laboratory	0	0	3	2
8.	CE6315	Strength of Materials Laboratory	0	0	3	2
9.	PR6412	Computer Aided Machine Drawing Laboratory	0	0	3	2
		TOTAL	**18**	**4**	**9**	**28**

SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	GE6351	Environmental Science and Engineering	3	0	0	3
2.	PR6501	Engineering Metrology and Measurements	3	0	0	3
3.	MF6502	Metal Forming Technology	3	1	0	4
4.	PR6502	Engineering Statistics and Quality Control	3	1	0	4
5.	PR6503	Machine Elements Design	3	1	0	4
6.	PR6504	Foundry Technology	3	0	0	3
PRACTICAL						
7.	PR6511	CNC Machine Laboratory	0	0	3	2
8.	PR6512	Fluid Power Laboratory	0	0	3	2
9.	GE6563	Communication Skills - Laboratory Based	0	0	4	2
		TOTAL	**18**	**3**	**10**	**27**

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	IE6605	Production Planning and Control	3	0	0	3
2.	PR6601	Computer Aided Product Design	3	1	0	4
3.	PR6602	Automated Production and Computer Integrated Manufacturing	3	1	0	4
4.	PR6603	Design of Jigs, Fixture and Press Tools and Drawing	3	0	0	3
5.		Elective I	3	0	0	3
6.		Elective II	3	0	0	3
PRACTICAL						
7.	PR6611	Metal Forming Lab and Special Machines Laboratory	0	0	4	2
8.	PR6612	Metrology and Inspection Laboratory	0	0	3	2
9.	PR6613	Welding and Foundry Laboratory	0	0	4	2
		TOTAL	**18**	**2**	**11**	**26**

SEMESTER VII

SL.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	GE6757	Total Quality Management	3	0	0	3
2.	ME6702	Mechatronics	3	0	0	3
3.	PR6701	Finite Element Analysis in Manufacturing Engineering	3	0	0	3
4.	ME6010	Robotics	3	0	0	3
5.		Elective III	3	0	0	3
6.		Elective IV	3	0	0	3
PRACTICAL						
7.	MF6711	Computer Aided Simulation and Analysis Laboratory	0	0	3	2
8.	PR6711	Microprocesser and Mechatronics Laboratory	0	0	3	2
9.	PR6712	Design and Fabrication Project	0	0	4	2
		TOTAL	**18**	**0**	**10**	**24**

SEMESTER VIII

SL.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	ME6005	Process Planning and Cost Estimation	3	0	0	3
2.		Elective – V	3	0	0	3
PRACTICAL						
3.	PR6811	Comprehension	0	0	2	1
4.	PR6812	Project Work	0	0	12	6
		TOTAL	**6**	**0**	**14**	**13**

TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 195

ELECTIVES FOR B.E. PRODUCTION ENGINEERING

SEMESTER VI (Elective I)

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	ME6004	Unconventional Machining Processes	3	0	0	3
2.	MF6503	Precision Engineering	3	0	0	3
3.	PR6001	Surface Engineering	3	0	0	3
4.	ME6015	Operations Research	3	0	0	3
5.	GE6083	Disaster Management	3	0	0	3

SEMESTER VI (Elective II)

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	MG6072	Marketing Management	3	0	0	3
2.	PR6002	Fuzzy Logic and ANN	3	0	0	3
3.	PR6003	Instrumentation and Control	3	0	0	3
4.	GE6081	Fundamentals of Nanoscience	3	0	0	3
5.	GE6084	Human Rights	3	0	0	3

SEMESTER VII (Elective III)

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	PR6004	Design of Machine Tool Structure	3	0	0	3
2.	ME6007	Composite Materials and Mechanics	3	0	0	3
3.	PR6005	Processing of Polymer and Composites	3	0	0	3
4.	PR6006	Non Destructive Testing Methods	3	0	0	3
5.	PR6007	Simulation of Manufacturing Systems	3	0	0	3
6.	PR6008	Machine Vision	3	0	0	3

SEMESTER VII (Elective IV)

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	PR6009	Production Management	3	0	0	3
2.	PR6010	Ergonomics	3	0	0	3
3.	MG6097	Engineering Economics and Financial Management	3	0	0	3
4.	PR6011	Purchasing and Material Management	3	0	0	3
5.	PR6012	Advances in Operation Research	3	0	0	3

SEMESTER VIII (Elective V)

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	IE6603	Reliability Engineering	3	0	0	3
2.	PR6013	Machine Tool Control and Condition Monitoring	3	0	0	3
3.	PR6014	Mini Project	0	0	6	3
4.	GE6075	Professional Ethics in Engineering	3	0	0	3
5.	MG6071	Entrepreneurship Development	3	0	0	3
6.	ME6012	Maintenance Engineering	3	0	0	3

HS6151 **TECHNICAL ENGLISH – I** **L T P C**
3 1 0 4

OBJECTIVES:

- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading and writing leading to effective and efficient communication.

UNIT I **9+3**

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 **9+3**

Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process (filling a form, etc.) - Asking and 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) - Process descriptions (general/specific) - Definitions - Recommendations – Instructions; Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association (connotation); E-materials - Interactive exercises for Grammar and Vocabulary - Listening exercises with sample telephone conversations / lectures – Picture-based activities.

UNIT III **9+3**

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 and effect / compare and 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 **9+3**

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 and acronyms; E-materials - Interactive exercises for Grammar and Vocabulary - Sample interviews - film scenes - dialogue writing.

UNIT V **9+3**

Listening - Listening to different accents, Listening to Speeches/Presentations, Listening to broadcast and telecast from Radio and 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 and Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents - Interpreting posters.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

Learners should be able to

- speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
- write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- read different genres of texts adopting various reading strategies.
- listen/view and comprehend different spoken discourses/excerpts in different accents

TEXTBOOKS:

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

REFERENCES:

1. Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice. Oxford University Press, New Delhi. 2011.
2. Regional Institute of English. English for Engineers. Cambridge University Press, New Delhi. 2006.
3. Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi. 2005
4. Rutherford, Andrea. J Basic Communication Skills for Technology. Pearson, New Delhi. 2001.
5. Viswamohan, Aysha. English for Technical Communication. Tata McGraw-Hill, New Delhi. 2008.

EXTENSIVE Reading (Not for Examination)

1. Kalam, Abdul. Wings of Fire. Universities Press, Hyderabad. 1999.

WEBSITES:

1. http://www.usingenglish.com
2. http://www.uefap.com

TEACHING METHODS:

- Lectures
- Activities conducted individually, in pairs and in groups like self introduction, peer introduction, group poster making, grammar and vocabulary games, etc.
- Discussions
- Role play activities
- Short presentations
- Listening and viewing activities with follow up activities like discussion, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc.

EVALUATION PATTERN:

Internal assessment: 20%

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Reviews
- Creative writing
- Poster making, etc.

All the four skills are to be tested with equal weightage given to each.

- ✓ Speaking assessment: Individual speaking activities, Pair work activities like role play, Interview, Group discussions
- ✓ Reading assessment: Reading passages with comprehension questions graded from simple to complex, from direct to inferential
- ✓ Writing assessment: Writing paragraphs, essays etc. Writing should include grammar and vocabulary.
- ✓ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content.

End Semester Examination: 80%

MA6151	**MATHEMATICS – I**	**L T P C**
		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 – Statement and applications of Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II SEQUENCES AND SERIES 9+3

Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparison test, Integral test and D'Alembert's ratio test – Alternating series – Leibnitz's test – Series of positive and negative terms – Absolute and conditional convergence.

UNIT III APPLICATIONS OF DIFFERENTIAL CALCULUS 9+3

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes - Evolute as envelope of normals.

UNIT IV DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES 9+3

Limits and Continuity – Partial derivatives – Total derivative – Differentiation of implicit functions – Jacobian and properties – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT V MULTIPLE INTEGRALS 9+3

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

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

- This course equips students to have basic knowledge and understanding in one fields of materials, integral and differential calculus.

TEXT BOOKS:

1. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt Ltd., 2011.
2. Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi, 2011.

REFERENCES:

1. Dass, H.K., and Er. Rajnish Verma," Higher Engineering Mathematics", S. Chand Private Ltd., 2011.
2. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2012.
3. Peter V. O'Neil," Advanced Engineering Mathematics", 7th Edition, Cengage learning, 2012.
4. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.
5. Sivarama Krishna Das P. and Rukmangadachari E., "Engineering Mathematics", Volume I, Second Edition, PEARSON Publishing, 2011.

PH6151 ENGINEERING PHYSICS – I L T P C
3 0 0 3

OBJECTIVES:

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I CRYSTAL PHYSICS 9

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment) - Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)

UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS 9

Elasticity- Hooke's law - Relationship between three modulii of elasticity (qualitative) – stress -strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young's modulus by uniform bending- I-shaped girders

Modes of heat transfer- thermal conductivity- Newton's law of cooling - Linear heat flow – Lee's disc method – Radial heat flow – Rubber tube method – conduction through compound media (series and parallel)

UNIT III QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect. Theory and experimental verification – Properties of Matter waves – G.P Thomson experiment -Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

UNIT IV ACOUSTICS AND ULTRASONICS 9

Classification of Sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies.

Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications - Sonogram

UNIT V PHOTONICS AND FIBRE OPTICS 9

Spontaneous and stimulated emission- Population inversion -Einstein's A and B coefficients - derivation. Types of lasers – Nd:YAG, CO_2, Semiconductor lasers (homojunction & heterojunction)- Industrial and Medical Applications.

Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- Endoscope.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will have knowledge on the basics of physics related to properties of matter, optics, acoustics etc., and they will apply these fundamental principles to solve practical problems related to materials used for engineering applications.

TEXT BOOKS:

1. Arumugam M. Engineering Physics. Anuradha publishers, 2010
2. Gaur R.K. and Gupta S.L. Engineering Physics. Dhanpat Rai publishers, 2009
3. Mani Naidu S. Engineering Physics, Second Edition, PEARSON Publishing, 2011.

REFERENCES:

1. Searls and Zemansky. University Physics, 2009
2. Mani P. Engineering Physics I. Dhanam Publications, 2011
3. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009
4. Palanisamy P.K. Engineering Physics. SCITECH Publications, 2011
5. Rajagopal K. Engineering Physics. PHI, New Delhi, 2011
6. Senthilkumar G. Engineering Physics I. VRB Publishers, 2011.

CY6151 ENGINEERING CHEMISTRY - I L T P C
3 0 0 3

OBJECTIVES:

- To make the students conversant with basics of polymer chemistry.
- To make the student acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
- To acquaint the student with concepts of important photophysical and photochemical processes and spectroscopy.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- To acquaint the students with the basics of nano materials, their properties and applications.

UNIT I POLYMER CHEMISTRY 9

Introduction: Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerization. Types and mechanism of polymerization: Addition (Free Radical, cationic and anionic); condensation and copolymerization. Properties of polymers: Tg, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension. Preparation, properties and uses of Nylon 6,6, and Epoxy resin.

UNIT II CHEMICAL THERMODYNAMICS 9

Terminology of thermodynamics - 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 (problems); Criteria of spontaneity; Gibbs-Helmholtz equation (problems); Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore(problems).

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY 9

Photochemistry: Laws of photochemistry - Grotthuss–Draper law, Stark–Einstein law and Lambert-Beer Law. Quantum efficiency – determination- Photo processes - Internal Conversion, Inter-system crossing, Fluorescence, Phosphorescence, Chemiluminescence and Photo-sensitization. Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and rotational transitions. UV-visible and IR spectroscopy – principles, instrumentation (Block diagram only).

UNIT IV PHASE RULE AND ALLOYS 9

Phase rule: Introduction, definition of terms with examples, One Component System- water system - Reduced phase rule - Two Component Systems- classification – lead-silver system, zinc-magnesium system. Alloys: Introduction- Definition- Properties of alloys- Significance of alloying, Functions and effect of alloying elements- Ferrous alloys- Nichrome and Stainless steel – heat treatment of steel; Non-ferrous alloys – brass and bronze.

UNIT V NANOCHEMISTRY 9

Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: nano cluster, nano rod, nanotube(CNT) and nanowire. Synthesis: precipitation, thermolysis, hydrothermal, solvothermal, electrode position, chemical vapour deposition, laser ablation; Properties and applications

TOTAL :45 PERIODS

OUTCOMES:

- The knowledge gained on polymer chemistry, thermodynamics. spectroscopy, phase rule and nano materials will provide a strong platform to understand the concepts on these subjects for further learning.

TEXT BOOKS:

1. Jain P.C. and Monica Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2010
2. Kannan P., Ravikrishnan A., “Engineering Chemistry”, Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009

REFERENCES:

1. Dara S.S, Umare S.S, “Engineering Chemistry”, S. Chand & Company Ltd., New Delhi 2010
2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2008.
3. Gowariker V.R. , Viswanathan N.V. and JayadevSreedhar, “Polymer Science”, New Age International P (Ltd.,), Chennai, 2006.
4. Ozin G. A. and Arsenault A. C., “Nanochemistry: A Chemical Approach to Nanomaterials”, RSC Publishing, 2005.

GE6151 COMPUTER PROGRAMMING L T P C
3 0 0 3

OBJECTIVES:

The students should be made to:

- Learn the organization of a digital computer.
- Be exposed to the number systems.
- Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

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

OUTCOMES:

At the end of the course, the student should be able to:

- Design C Programs for problems.
- Write and execute C programs for simple applications.

TEXTBOOKS:

1. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009
3. Yashavant P. Kanetkar. " Let Us C", BPB Publications, 2011.

REFERENCES:

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

GE6152 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.
- To 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 5+9

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 5+9

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

UNIT III PROJECTION OF SOLIDS 5+9

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.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+9

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 6+9

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 .

COMPUTER AIDED DRAFTING (Demonstration Only) 3

Introduction to drafting packages and demonstration of their use.

TOTAL: 75 PERIODS

OUTCOMES:

On Completion of the course the student will be able to

- perform free hand sketching of basic geometrical constructions and multiple views of objects.
- do orthographic projection of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- prepare isometric and perspective sections of simple solids.
- demonstrate computer aided drafting.

TEXT BOOK:

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

REFERENCES:

1. Gopalakrishna K.R., “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. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2nd Edition, 2009.
4. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.
5. Natrajan K.V., “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

GE6161 COMPUTER PRACTICES LABORATORY L T P C
0 0 3 2

OBJECTIVES:

The student should be made to:

- Be familiar with the use of Office software.
- Be exposed to presentation and visualization tools.
- Be exposed to problem solving techniques and flow charts.
- Be familiar with programming in C.
- Learn to use Arrays, strings, functions, structures and unions.

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 – Includes Parameter Passing
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Apply good programming design methods for program development.
- Design and implement C programs for simple applications.
- Develop recursive programs.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C compiler 30 Nos.

(or)

Server with C compiler supporting 30 terminals or more.

GE6162 ENGINEERING PRACTICES LABORATORY L T P C
0 0 3 2

OBJECTIVES:

- 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 & MECHANICAL)

I CIVIL ENGINEERING PRACTICE 9

Buildings:

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise:

Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE 13

Welding:

(a) Preparation of arc welding of butt joints, lap joints and tee joints.
(b) Gas welding practice

Basic Machining:

(a) Simple Turning and Taper turning
(b) Drilling Practice

Sheet Metal Work:

(a) Forming & Bending:
(b) Model making – Trays, funnels, etc.
(c) Different type of joints.

Machine assembly practice:

(a) Study of centrifugal pump
(b) Study of air conditioner

Demonstration on:

(a) Smithy operations, upsetting, swaging, setting down and bending. Example –

Exercise – Production of hexagonal headed bolt.

(b) Foundry operations like mould preparation for gear and step cone pulley.

(c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE 10

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

IV ELECTRONICS ENGINEERING PRACTICE 13

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EOR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 45 PERIODS

OUTCOMES:

- ability to fabricate carpentry components and pipe connections including plumbing works.
- ability to use welding equipments to join the structures.
- ability to fabricate electrical and electronics circuits.

REFERENCES:

1. Jeyachandran K., Natarajan S. & Balasubramanian S., "A Primer on Engineering Practices Laboratory", Anuradha Publications, 2007.
2. Jeyapoovan T., Saravanapandian M. & Pranitha S., "Engineering Practices Lab Manual", Vikas Puplishing House Pvt.Ltd, 2006.
3. Bawa H.S., "Workshop Practice", Tata McGraw – Hill Publishing Company Limited, 2007.
4. Rajendra Prasad A. & Sarma P.M.M.S., "Workshop Practice", Sree Sai Publication, 2002.
5. Kannaiah P. & Narayana K.L., "Manual on Workshop Practice", Scitech Publications, 1999.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	15 Sets.
2. Carpentry vice (fitted to work bench)	15 Nos.
3. Standard woodworking tools	15 Sets.
4. Models of industrial trusses, door joints, furniture joints	5 each
5. Power Tools: (a) Rotary Hammer	2 Nos
(b) Demolition Hammer	2 Nos
(c) Circular Saw	2 Nos
(d) Planer	2 Nos
(e) Hand Drilling Machine	2 Nos

(f) Jigsaw 2 Nos

MECHANICAL

1. Arc welding transformer with cables and holders 5 Nos.
2. Welding booth with exhaust facility 5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc. 5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. 2 Nos.
5. Centre lathe 2 Nos.
6. Hearth furnace, anvil and smithy tools 2 Sets.
7. Moulding table, foundry tools 2 Sets.
8. Power Tool: Angle Grinder 2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner One each.

ELECTRICAL

1. Assorted electrical components for house wiring 15 Sets
2. Electrical measuring instruments 10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp 1 each
4. Megger (250V/500V) 1 No.
5. Power Tools: (a) Range Finder 2 Nos
   (b) Digital Live-wire detector 2 Nos

ELECTRONICS

1. Soldering guns 10 Nos.
2. Assorted electronic components for making circuits 50 Nos.
3. Small PCBs 10 Nos.
4. Multimeters 10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply

GE6163 PHYSICS AND CHEMISTRY LABORATORY – I L T P C
0 0 2 1

PHYSICS LABORATORY – I

OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

LIST OF EXPERIMENTS

(Any FIVE Experiments)

1. (a) Determination of Wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
2. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
3. Determination of wavelength of mercury spectrum – spectrometer grating
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of Young's modulus by Non uniform bending method
6. Determination of specific resistance of a given coil of wire – Carey Foster's Bridge

OUTCOMES:

- The hands on exercises undergone by the students will help them to apply physics principles of optics and thermal physics to evaluate engineering properties of materials.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Diode laser, lycopodium powder, glass plate, optical fiber.
2. Ultrasonic interferometer
3. Spectrometer, mercury lamp, grating
4. Lee's Disc experimental set up
5. Traveling microscope, meter scale, knife edge, weights
6. Carey foster's bridge set up

(vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

CHEMISTRY LABORATORY- I

OBJECTIVES:

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by vacometry.

LIST OF EXPERIMENTS

(Any FIVE Experiments)

1 Determination of DO content of water sample by Winkler's method.
2 Determination of chloride content of water sample by argentometric method.
3 Determination of strength of given hydrochloric acid using pH meter.
4 Determination of strength of acids in a mixture using conductivity meter.
5 Estimation of iron content of the water sample using spectrophotometer. (1,10- phenanthroline / thiocyanate method).
6 Determination of molecular weight of polyvinylalcohol using Ostwald viscometer.
7 Conductometric titration of strong acid vs strong base.

TOTAL: 30 PERIODS

OUTCOMES:

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

REFERENCES:

1. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York 2001.
2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry", LBS Singapore 1994.
3. Jeffery G.H., Bassett J., Mendham J.and Denny vogel's R.C, "Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
4. Kolthoff I.M., Sandell E.B. et al. "Quantitative chemical analysis", Mcmillan, Madras 1980.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Iodine flask - 30 Nos
2. pH meter - 5 Nos
3. Conductivity meter - 5 Nos
4. Spectrophotometer - 5 Nos
5. Ostwald Viscometer - 10 Nos

Common Apparatus : Pipette, Burette, conical flask, percelain tile, dropper (each 30 Nos.)

HS6251 TECHNICAL ENGLISH II L T P C
3 1 0 4

OBJECTIVES:

- To make learners acquire listening and speaking skills in both formal and informal contexts.
- To help them develop their reading skills by familiarizing them with different types of reading strategies.
- To equip them with writing skills needed for academic as well as workplace contexts.
- To make them acquire language skills at their own pace by using e-materials and language lab components.

UNIT I 9+3

Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on topics like 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 and 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 9+3

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 / her success, thanking one's friends / relatives); Grammar - modal verbs, Purpose expressions; Vocabulary - Phrasal verbs and their meanings, Using phrasal verbs in sentences; E-materials - Interactive exercises on Grammar and vocabulary, Extensive reading activity (reading stories / novels), Posting reviews in blogs - Language Lab - Dialogues (Fill up exercises), Recording students' dialogues.

UNIT III 9+3

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 time limit - Skimming; Writing - Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading articles from journals - Format for 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 and vocabulary - Speed Reading practice exercises; Language Lab - Intonation practice using EFLU and RIE materials – Attending a meeting and writing minutes.

UNIT IV 9+3

Listening - Listening to a telephone conversation, Viewing model interviews (face-to-face, telephonic and video conferencing); Speaking - Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping 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 and Vocabulary - Different forms of résumés- Filling up a résumé / cover letter; Language Lab - Telephonic interview – recording the responses - e-résumé writing.

UNIT V **9+3**

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 – Checklist - 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; Language Lab - Different models of group discussion.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

Learners should be able to

- speak convincingly, express their opinions clearly, initiate a discussion, negotiate, argue using appropriate communicative strategies.
- write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
- read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation.
- listen/view and comprehend different spoken excerpts critically and infer unspoken and implied meanings.

TEXTBOOKS:

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

REFERENCES:

1. Anderson, Paul V. Technical Communication: A Reader-Centered Approach. Cengage. New Delhi. 2008
2. Muralikrishna, & Sunita Mishra. Communication Skills for Engineers. Pearson, New Delhi. 2011
3. Riordan, Daniel. G. Technical Communication. Cengage Learning, New Delhi. 2005
4. Sharma, Sangeetha & Binod Mishra. Communication Skills for Engineers and Scientists. PHI Learning, New Delhi. 2009
5. Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason USA. 2007

EXTENSIVE Reading (Not for Examination)

1. Khera, Shiv. You can Win. Macmillan, Delhi. 1998.

Websites

1. http://www.englishclub.com
2. http://owl.english.purdue.edu

TEACHING METHODS:

- Lectures
- Activities conducted individually, in pairs and in groups like individual writing and presentations, group discussions, interviews, reporting, etc
- Long presentations using visual aids
- Listening and viewing activities with follow up activities like discussions, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc
- Projects like group reports, mock interviews etc using a combination of two or more of the language skills

EVALUATION PATTERN:

Internal assessment: 20%

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Report
- Creative writing, etc.

All the four skills are to be tested with equal weightage given to each.

- ✓ Speaking assessment: Individual presentations, Group discussions
- ✓ Reading assessment: Reading passages with comprehension questions graded following Bloom's taxonomy
- ✓ Writing assessment: Writing essays, CVs, reports etc. Writing should include grammar and vocabulary.
- ✓ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content graded following Bloom's taxonomy.

End Semester Examination: 80%

MA6251 MATHEMATICS – II L T P C
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 VECTOR CALCULUS 9+3

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

UNIT II ORDINARY DIFFERENTIAL EQUATIONS 9+3

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT III LAPLACE TRANSFORM 9+3

Laplace transform – Sufficient condition for existence – Transform of elementary functions – Basic properties – Transforms of derivatives and integrals of functions - Derivatives and integrals of transforms - Transforms of unit step function and impulse functions – Transform of periodic functions. Inverse Laplace transform -Statement of Convolution theorem – Initial and final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

UNIT IV ANALYTIC FUNCTIONS 9+3

Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping: $w = z+k$, kz, $1/z$, z^2, e^z and bilinear transformation.

UNIT V COMPLEX INTEGRATION 9+3

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor's and Laurent's series expansions – Singular points – Residues – Cauchy's residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

- The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions. Students will be able to solve problems related to engineering applications by using these techniques.

TEXT BOOKS:

1. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt Ltd.,2011.
2. Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi, 2011.

REFERENCES:

1. Dass, H.K., and Er. Rajnish Verma," Higher Engineering Mathematics", S. Chand Private Ltd., 2011
2. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2012.
3. Peter V. O'Neil," Advanced Engineering Mathematics", 7th Edition, Cengage learning, 2012.
4. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.
5. Sivarama Krishna Das P. and Rukmangadachari E., "Engineering Mathematics" Volume II, Second Edition, PEARSON Publishing, 2011.

PH6251 ENGINEERING PHYSICS – II L T P C
3 0 0 3

OBJECTIVES:

- To enrich the understanding of various types of materials and their applications in engineering and technology.

UNIT I CONDUCTING MATERIALS 9

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS 9

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors -direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration –– Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications

Superconductivity: properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High T_c superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS 9

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V ADVANCED ENGINEERING MATERIALS 9

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials –Birefringence- optical Kerr effect – Classification of Biomaterials and its applications

TOTAL: 45 PERIODS

OUTCOMES:

- The students will have the knowledge on physics of materials and that knowledge will be used by them in different engineering and technology applications.

TEXT BOOKS:

1. Arumugam M., Materials Science. Anuradha publishers, 2010
2. Pillai S.O., Solid State Physics. New Age International(P) Ltd., publishers, 2009

REFERENCES:

1. Palanisamy P.K. Materials Science. SCITECH Publishers, 2011
2. Senthilkumar G. Engineering Physics II. VRB Publishers, 2011
3. Mani P. Engineering Physics II. Dhanam Publications, 2011
4. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009

CY6251 ENGINEERING CHEMISTRY - II L T P C
3 0 0 3

OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- Principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.

UNIT I WATER TECHNOLOGY 9

Introduction to boiler feed water-requirements-formation of deposits in steam boilers and heat exchangers- disadvantages (wastage of fuels, decrease in efficiency, boiler explosion) prevention of scale formation -softening of hard water -external treatment zeolite and demineralization - internal treatment- boiler compounds (phosphate, calgon, carbonate, colloidal) - caustic embrittlement -boiler corrosion-priming and foaming- desalination of brackish water –reverse osmosis.

UNIT II ELECTROCHEMISTRY AND CORROSION 9

Electrochemical cell - redox reaction, electrode potential- origin of electrode potential- oxidation potential- reduction potential, measurement and applications - electrochemical series and its significance - Nernst equation (derivation and problems). Corrosion- causes- factors- types- chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control - material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method. Paints- constituents and function. Electroplating of Copper and electroless plating of nickel.

UNIT III ENERGY SOURCES 9

Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion- differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor- solar energy conversion- solar cells- wind energy. Batteries and fuel cells:Types of batteries- alkaline battery- lead storage battery- nickel-cadmium battery- lithium battery- fuel cell H_2 -O_2 fuel cell- applications.

UNIT IV ENGINEERING MATERIALS 9

Abrasives: definition, classification or types, grinding wheel, abrasive paper and cloth. Refractories: definition, characteristics, classification, properties – refractoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity; Manufacture of alumina, magnesite and silicon carbide, Portland cement- manufacture and properties - setting and hardening of cement, special cement- waterproof and white cement–properties and uses. Glass - manufacture, types, properties and uses.

UNIT V FUELS AND COMBUSTION 9

Fuel: Introduction- classification of fuels- calorific value- higher and lower calorific values- coal- analysis of coal (proximate and ultimate)- carbonization- manufacture of metallurgical coke (Otto Hoffmann method) - petroleum- manufacture of synthetic petrol (Bergius process)- knocking- octane number - diesel oil- cetane number - natural gas- compressed natural gas(CNG)- liquefied petroleum gases(LPG)- producer gas- water gas. Power alcohol and bio diesel. Combustion of fuels: introduction- theoretical calculation of calorific value- calculation of stoichiometry of fuel and air ratio- ignition temperature- explosive range - flue gas analysis (ORSAT Method).

TOTAL: 45 PERIODS

OUTCOMES:

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

TEXT BOOKS:

1. Vairam S, Kalyani P and SubaRamesh.,"Engineering Chemistry"., Wiley India PvtLtd.,New Delhi., 2011
2. DaraS.S,UmareS.S."Engineering Chemistry", S. Chand & Company Ltd., New Delhi , 2010

REFERENCES:

1 Kannan P. and Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009

2. AshimaSrivastava and Janhavi N N., "Concepts of Engineering Chemistry", ACME Learning Private Limited., New Delhi., 2010.
3. RenuBapna and Renu Gupta., "Engineering Chemistry", Macmillan India Publisher Ltd., 2010.

4 Pahari A and Chauhan B., "Engineering Chemistry"., Firewall Media., New Delhi., 2010

GE6252 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING L T P C
4 0 0 4

OBJECTIVES:

- To explain the basic theorems used in Electrical circuits and the different components and function of electrical machines.
- To explain the fundamentals of semiconductor and applications.
- To explain the principles of digital electronics
- To impart knowledge of communication.

UNIT I ELECTRICAL CIRCUITS & MEASURMENTS 12

Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase Balanced Circuits.

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT II ELECTRICAL MECHANICS 12

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS 12

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation.

Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier.

UNIT IV DIGITAL ELECTRONICS 12

Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts)

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING 12

Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations.

Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TOTAL: 60 PERIODS

OUTCOMES:

- ability to identify the electrical components explain the characteristics of electrical machines.
- ability to identify electronics components and use of them to design circuits.

TEXT BOOKS:

1. Mittle N., "Basic Electrical Engineering", Tata McGraw Hill Edition, New Delhi, 1990.
2. Sedha R.S., "Applied Electronics", S. Chand & Co., 2006.

REFERENCES:

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics and Computer Engineering", Tata McGraw Hill, Second Edition, 2006.
2. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering", Oxford press 2005.
3. Mehta V K, "Principles of Electronics", S.Chand & Company Ltd, 1994.
4. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002.
5. Premkumar N, "Basic Electrical Engineering", Anuradha Publishers, 2003.

GE6253 ENGINEERING MECHANICS L T P C
3 1 0 4

OBJECTIVES:

- 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

OUTCOMES:

- ability to explain the differential principles applies to solve engineering problems dealing with force, displacement, velocity and acceleration.
- ability to analyse the forces in any structures.
- ability to solve rigid body subjected to dynamic forces.

TEXT BOOKS:

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. Meriam J.L. and Kraige L.G., " 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.

GE6261 COMPUTER AIDED DRAFTING AND MODELING LABORATORY L T P C

0 1 2 2

OBJECTIVES:

- To develop skill to use software to create 2D and 3D models.

LIST OF EXERCISES USING SOFTWARE CAPABLE OF DRAFTING AND MODELING

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and

dimensioning.

5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

TOTAL: 45 PERIODS

OUTCOMES:

- ability to use the software packers for drafting and modeling
- ability to create 2D and 3D models of Engineering Components

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Sl.No	Description of Equipment	Quantity
1.	Pentium IV computer or better hardware, with suitable graphics facility	30 No.
2.	Licensed software for Drafting and Modeling.	30 Licenses
3.	Laser Printer or Plotter to print / plot drawings	2 No.

GE6262 PHYSICS AND CHEMISTRY LABORATORY – II L T P C
0 0 2 1

PHYSICS LABORATORY – II

OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

LIST OF EXPERIMENTS
(Any FIVE Experiments)

1. Determination of Young's modulus by uniform bending method
2. Determination of band gap of a semiconductor
3. Determination of Coefficient of viscosity of a liquid –Poiseuille's method
4. Determination of Dispersive power of a prism - Spectrometer
5. Determination of thickness of a thin wire – Air wedge method
6. Determination of Rigidity modulus – Torsion pendulum

OUTCOMES:

- The students will have the ability to test materials by using their knowledge of applied physics principles in optics and properties of matter.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Traveling microscope, meter scale, Knife edge, weights
2. Band gap experimental set up
3. Burette, Capillary tube, rubber tube, stop clock, beaker and weighing balance

4. spectrometer, prism, sodium vapour lamp.
5. Air-wedge experimental set up.
6. Torsion pendulum set up.
   (vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

CHEMISTRY LABORATORY - II

OBJECTIVES:

- To make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation of hardness, alkalinity, metal ion content, corrosion in metals and cement analysis.

LIST OF EXPERIMENTS
(Any FIVE Experiments)

1 Determination of alkalinity in water sample
2 Determination of total, temporary & permanent hardness of water by EDTA method
3 Estimation of copper content of the given solution by EDTA method
4 Estimation of iron content of the given solution using potentiometer
5 Estimation of sodium present in water using flame photometer
6 Corrosion experiment – weight loss method
7 Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4
8 Determination of CaO in Cement.

TOTAL: 30 PERIODS

OUTCOMES:

- The students will be conversant with hands-on knowledge in the quantitative chemical analysis of water quality related parameters, corrosion measurement and cement analysis.

REFERENCES:

1. Daniel R. Palleros, “Experimental organic chemistry” John Wiley & Sons, Inc., New York, 2001.
2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., “Vogel’s Textbook of practical organic chemistry, LBS Singapore ,1994.
3. Jeffery G.H, Bassett J., Mendham J. and Denny R.C., “Vogel’s Text book of quantitative analysis chemical analysis”, ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
4. Kolthoff I.M. and Sandell E.B. et al. Quantitative chemical analysis, McMillan, Madras 1980

- **Laboratory classes on alternate weeks for Physics and Chemistry.**

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1.	Potentiometer	-	5 Nos
2.	Flame photo meter	-	5 Nos
3.	Weighing Balance	-	5 Nos
4.	Conductivity meter	-	5 Nos

Common Apparatus : Pipette, Burette, conical flask, percelain tile, dropper (30 Nos each)

MA6351 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS L T P C
3 1 0 4

OBJECTIVES

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9 + 3

Formation of partial differential equations – Singular integrals -- Solutions of standard types of first order partial differential equations - Lagrange's linear equation -- Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II FOURIER SERIES 9 + 3

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9 + 3

Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).

UNIT IV FOURIER TRANSFORMS 9 + 3

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 9 + 3

Z- transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES

- The understanding of the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

TEXT BOOKS

1. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Grewal. B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi, 2012.
3. Narayanan.S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.

REFERENCES

1. Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd , 2007.
2. Ramana.B.V., "Higher Engineering Mathematics", Tata Mc-GrawHill Publishing Company Limited, NewDelhi, 2008.

3. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, Wiley India, 2007.
5. Ray Wylie. C and Barrett.L.C, "Advanced Engineering Mathematics" Tata Mc Graw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.
6. Datta.K.B., "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt Ltd, Delhi, 2013.

PR6301 BASIC MACHINING PROCESSES L T P C
3 0 0 3

OBJECTIVES:

- To impart the knowledge on basic concepts of various machining processes and machine tools.

UNIT I LATHE 9

Introduction to production processes – types of production (job, batch and mass) – production processes – Casting, Forming, Machining and Welding, Machine and 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 – thread – RH and LH, 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 AND 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 – mechanism in planer – 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 9

Purpose of drilling – block diagrm and function – types of drilling machines – portable drilling – bench type – sensitive drilling – radial arm drilling – functions of parts – purpose and operation – gang milling, 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 partapplications – 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. For all machines, demonstration to be done in a Workshop or using CD to explain the actual operation.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this subject, the students can able to identify different manufacturing techniques for the Industrial component production.

TEXT BOOKS

1. HMT Bangalore, "Production Technology", Tata McGraw Hill Publishing Company Limited, New Delhi, 2001.
2. Sharma. P.C., "A Text Book of Production Technology", S. Chand and Company, 2001.

REFERENCES

1. Jain. R.K., "Production Technology", Khanna Publishers, New Delhi, 2001.
2. Hajra Choudhary etal, "Elements of Production Technology –Vol.II", Asia Publishing House, 2000.
3. Kumar. B., "Manufacturing Technology", Khanna Publishers, New Delhi 2000.
4. Radhakrishnan. P., "Manufacturing Technology, Vol.I", Scitech Publications, 2002.

PR6302 BASICS OF THERMODYNAMICS AND THERMAL ENGINEERING L T P C

3 1 0 4

OBJECTIVES

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

UNIT I BASIC THERMODYNAMICS 16

Systems, 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. Properties of gases and vapours.

UNIT II AIR CYCLE AND COMPRESSORS 12

Otto, Diesel, Dual combustion and Brayton cycles. Air standard efficiency . Mean effective pressure, Reciprocating compressors.

UNIT III STEAM AND JET PROPULSION 12

Properties of steam – Rankine cycle – Steam Nozzles – Simple jet propulsion system – Thrust rocket motor – Specific impulse.

UNIT IV REFRIGERATION AND AIR-CONDITIONING 10

Principles of Psychrometry and refrigeration - Vapour compression - Vapour absorption types - Co-efficient of performance, Properties of refrigerants – Basic Principle and types Air conditioning.

UNIT V HEAT TRANSFER 10

Conduction in parallel, radial and composite wall – Basics of Convective heat transfer - Fundamentals of Radiative heat transfer – Flow through heat exchangers.

TOTAL (L:45+T:15): 60 PERIODS

(Use of standard thermodynamic tables, Mollier diagram and Refrigerant property tables are permitted)

OUTCOMES:

- Upon completion of this subject, the students can able to apply basic thermodynamics principles to different thermal engines jet propulsion system and refrigeration and air conditioning systems.

TEXT BOOKS

1. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 2007.
2. 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.

PR6303 ENGINEERING METALLURGY L T P C
3 0 0 3

OBJECTIVES:

- To introduce the various concepts of metallurgy, metallurgical structures and mechanical properties, testing of metals
- To impart the knowledge on metallurgy with respect to foundry and welding Processes

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 10

Crystal structure – BCC, FCC and HCP structure – unit cell – crystallographic planes and directions, miller indices – crystal imperfection, point, line, planner and volume defects – Grain size, ASTM grain size number. Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions, Iron – Iron carbide and Iron – Charbide & Iron Graphite equilibrium diagram. Classification of steel and cast iron - microstructures of Steels & Cast irons - properties and application.

UNIT II HEAT TREATMENT 10

Defintion – Full annealing, stress relief, recrystallisation and spheroidizing – normalizing, hardening and tempering of steel, Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram CCR – 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.

UNIT III FERROUS, NON FERROUS METALS 9

Effect of alloying additions on steel (Mn, Si, Cr, Mo, V Ti & W) – stainless and tool steels – HSLA – 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

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, fatigue and creep mechanisms – types of wear – preventions.

UNIT V WELDING AND FOUNDRY METALLURGY 8

Weld thermal cycle – Microstructure of HAZ in Steel and Aluminium alloys – weldability of steel, cast iron and non-ferrous alloys – Pre and Post weld heat treatment – Residual stress and distortion – casting solidification – Formation of dendrite, columnar and equiaxed grains – castability of steel, cast iron, Stainless Steel Al and Cu alloys.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this subject, the students can able to identify suitable heat treatment different materials in mechanical industries and also perform testing to know the mechanical properties of the materials.

TEXT BOOKS

1. Donald R.Askeland – "The Science and Engineering of materials", 4th Edition, Thomson Engineering, 2002
2. Keneth G.Budinski and Michael K.Budinski “Engineering Materials”, 7th Edition, Prentice Hall of India Private Limited, 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. Van Vlack. L.H., “Materials Engg. Concepts and Applications, 2001.

CE6451 FLUID MECHANICS AND MACHINERY L T P C
3 0 0 3

OBJECTIVES:

- The applications of the conservation laws to flow through pipes and hydraulic machines are studied
- To understand the importance of dimensional analysis.
- To understand the importance of various types of flow in pumps and turbines.

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 8

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS 8

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli-Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor- Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel.

UNIT III DIMENSIONAL ANALYSIS 9

Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

UNIT IV PUMPS 10

Impact of jets - Euler's equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle - work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps –classification.

UNIT V TURBINES 10

Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to apply mathematical knowledge to predict the properties and characteristics of a fluid.
- Can critically analyse the performance of pumps and turbines.

TEXT BOOK:

1. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2004.

REFERENCES:

1. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010
2. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi 2004
3. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, "Fluid Mechanics and Machinery", 2011.
4. Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011

EE6351 ELECTRICAL DRIVES AND CONTROLS L T P C

3 0 0 3

OBJECTIVES

- To understand the basic concepts of different types of electrical machines and their performance.
- To study the different methods of starting D.C motors and induction motors.
- To study the conventional and solid-state drives

UNIT I INTRODUCTION 8

Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors

UNIT II DRIVE MOTOR CHARACTERISTICS 9

Mechanical characteristics – Speed-Torque characteristics of various types of load and drive motors – Braking of Electrical motors – DC motors: Shunt, series and compound - single phase and three phase induction motors.

UNIT III STARTING METHODS 8

Types of D.C Motor starters – Typical control circuits for shunt and series motors – Three phase squirrel cage and slip ring induction motors.

UNIT IV CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C. DRIVES 10

Speed control of DC series and shunt motors – Armature and field control, Ward-Leonard control system - Using controlled rectifiers and DC choppers –applications.

UNIT V CONVENTIONAL AND SOLID STATE SPEED CONTROL OF A.C. DRIVES 10

Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Using inverters and AC voltage regulators – applications**.**

TOTAL : 45 PERIODS

OUTCOMES:

- Upon Completion of this subject, the students can able to explain different types of electrical machines and their performance

TEXT BOOKS

1. Vedam Subrahmaniam, “Electric Drives (concepts and applications)”, Tata McGraw-Hill, 2001
2. Nagrath .I.J. & Kothari .D.P, “Electrical Machines”, Tata McGraw-Hill, 1998

REFERENCES

1. Pillai.S.K “A first course on Electric drives”, Wiley Eastern Limited, 1998
2. Singh. M.D., K.B.Khanchandani, “Power Electronics”, Tata McGraw-Hill, 1998
3. Partab. H., “Art and Science and Utilisation of Electrical Energy”, Dhanpat Rai and Sons, 1994

PR6311 BASIC MACHINING PROCESS LABORATORY L T P C
0 0 3 2

OBJECTIVES:

- To introduce different machining process and machine tool to develop components.

LIST OF EXPERIMENTS:

1. Lathe: Facing, Plain turning, Step Turning
2. Lathe: Taper Turning, Threading, Knurling
3. Lathe: Multi start Threading, Burnishing
4. Shaper: Cube
5. Shaper: Cube, V-Block
6. Drilling: Counter sinking, Counter Boring, Tapping
7. Milling Vertical: Surfacing, Pocket Milling
8. Milling Horizontal: Polygonal shape milling
9. Grinding: Surface & Cylindrical grinding
10. Slotting: Machining an internal spline

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to use the machine tool and processes to shape and fabricate the components.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Lathe	20
2	Drilling Machine	4
3	Shaper	4
4	Vertical Milling Machine	2
5	Horizontal Milling Machine	2
6	Surface Grinding Machine	4
7	Cylindrical Grinding Machine	1
8	Slotting Machine	2

CE6461 FLUID MECHANICS AND MACHINERY LABORATORY L T P C
0 0 3 2

OBJECTIVES:

- Upon Completion of this subject, the students can able to have hands on experience in flow measurements using different devices and also perform calculation related to losses in pipes and also perform characteristic study of pumps, turbines etc.,

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to use the measurement equipments for flow measurement
- Ability to do performance trust on different fluid machinery

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S. No.	NAME OF THE EQUIPMENT	Qty.
1	Orifice meter setup	1
2	Venturi meter setup	1
3	Rotameter setup	1
4	Pipe Flow analysis setup	1
5	Centrifugal pump/submergible pump setup	1
6	Reciprocating pump setup	1
7	Gear pump setup	1

8	Pelton wheel setup	1
9	Francis turbine setup	1
10	Kaplan turbine setup	1

EE6365 ELECTRICAL ENGINEERING LABORATORY L T P C
0 0 3 2

OBJECTIVES:

• To validate the principles studied in theory by performing experiments in the laboratory

LIST OF EXPERIMENTS

1. Load test on DC Shunt & DC Series motor
2. O.C.C & Load characteristics of DC Shunt and DC Series generator
3. Speed control of DC shunt motor (Armature, Field control)
4. Load test on single phase transformer
5. O.C & S.C Test on a single phase transformer
6. Regulation of an alternator by EMF & MMF methods.
7. V curves and inverted V curves of synchronous Motor
8. Load test on three phase squirrel cage Induction motor
9. Speed control of three phase slip ring Induction Motor
10. Load test on single phase Induction Motor.
11. Study of DC & AC Starters

TOTAL: 45 PERIODS

OUTCOMES

- Ability to perform speed characteristic of different electrical machine

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	DC Shunt motor	2
2	DC Series motor	1
3	DC shunt motor-DC Shunt Generator set	1
4	DC Shunt motor-DC Series Generator set	1
5	Single phase transformer	2
6	Three phase alternator	2
7	Three phase synchronous motor	1
8	Three phase Squirrel cage Induction motor	1
9	Three phase Slip ring Induction motor	1
10	Single phase Induction motor	1

MA6459 **NUMERICAL METHODS** **L T P C**
3 1 0 4

OBJECTIVES

- This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 10+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 method – Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method - Eigenvalues of a matrix by Power method.

UNIT II INTERPOLATION AND APPROXIMATION 8+3

Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9+3

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 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 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 (L:45+T:15): 60 PERIODS

OUTCOMES

- The students will have a clear perception of the power of numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.

TEXT BOOKS

1. Grewal. B.S., and Grewal. J.S., " Numerical methods in Engineering and Science", 9th Edition, Khanna Publishers, New Delhi, 2007.
2. Gerald. C. F., and Wheatley. P. O., " Applied Numerical Analysis", 6th Edition, Pearson Education, Asia, New Delhi, 2006.

REFERENCES

1. Chapra. S.C., and Canale.R.P., "Numerical Methods for Engineers, 5th Edition, Tata McGraw-Hill, New Delhi, 2007.
2. Brian Bradie. "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi, 2007.

3. Sankara Rao. K., "Numerical methods for Scientists and Engineers", 3rd Edition, Prentice Hall of India Private Ltd., New Delhi, 2007.

CE6306 STRENGTH OF MATERIALS L T P C
3 1 0 4

OBJECTIVES:
To understand the stresses developed in bars, compounds bars, beams, shafts, cylinders and spheres.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9
Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains –Stresses on inclined planes – principal stresses and principal planes – Mohr's circle of stress.

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9
Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending– bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

UNIT III TORSION 9
Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts– Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

UNIT IV DEFLECTION OF BEAMS 9
Double Integration method – Macaulay's method – Area moment method for computation of slopes and deflections in beams - Conjugate beam and strain energy – Maxwell's reciprocal theorems.

UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS 9
Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure –Deformation in spherical shells – Lame's theorem.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
- Upon completion of this course, the students can able to apply mathematical knowledge to calculate the deformation behavior of simple structures.
- Critically analyse problem and solve the problems related to mechanical elements and analyse the deformation behavior for different types of loads.

TEXT BOOKS:
1. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2007
2. Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2007

REFERENCES:
1. Egor. P.Popov "Engineering Mechanics of Solids" Prentice Hall of India, New Delhi, 2001
2. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, 2007.
3. Hibbeler, R.C., "Mechanics of Materials", Pearson Education, Low Price Edition, 2007
4. Ferdinand P. Been, Russell Johnson, J.r. and John J. Dewole "Mechanics of Materials", Tata McGraw Hill Publishing 'co. Ltd., New Delhi, 2005.

PR6401 ADVANCED MACHINING PROCESS 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 MECHANICS OF METAL CUTTING 10

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

UNIT II TOOL MATERIAL, TOOL WEAR AND TOOL LIFE 9

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

UNIT III GEAR MANUFACTURE 8

Different methods of gear manufacture – Gear hobbling and gear shaping machines specifications – gear generation – different methods – gear finishing and shaving – grinding and lapping of hobs and shaping cutters – gear honing – gear broaching.

UNIT IV CNC MACHINES 9

NC, CNC & DNC – types of CNC – constructional features – drives and control systems – feed back devices – Interchangeable tooling system – preset & qualified tools – ISO specification – Machining center – Turning center – CNC wire cut EDM.

UNIT V CNC PROGRAMMING 9

Manual part programming – steps involved – sample program in lathe & milling. - Computer aided part programming – APT program - CAM package – canned cycles - Programming.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to perform machining operations and study the forces tool life and wear can select proper tool materials for machining difficult materials and generate CNC processing to perform metal cutting operation.

TEXT BOOKS

1. Hazlehurst M, “Manufacturing Technology”, - El.BS, 1978
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 , 1990.
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

PR6402 **THEORY OF MACHINES** **L T P C**
3 1 0 4

OBJECTIVES:

- To understand the basic concepts of mechanisms and machinery

UNIT I 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.

UNIT II 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.

UNIT III 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.

UNIT IV 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.

UNIT V 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

OUTCOMES:

- Upon completion of this course, the students can able to predict the force analysis in mechanical system and related vibration issues and can able to solve the problem

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.

PR6403 FLUID POWER DRIVES AND CONTROL L T P C
3 1 0 4

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 12

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 12

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 12

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 12

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 12

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: 60 PERIODS

OUTCOME:

- Identify hydraulic and pneumatics components.
- Ability to design hydraulic and pneumatics circuits.

TEXT BOOKS:

1. Anthony Esposito "Fluid power with applications", 5th Edition, Pearson education 2003.
2. Majumdar, "Oil hydraulics: Principles and Maintenance", Tata McGraw Hill, 2004
3. Majumdar, "Pneumatic system: Principles and Maintenance", Tata McGraw Hill, 2004
4. Srinivasan. R., "Hydraulic and Pneumatic Controls", Vijay Nicole Imprints Private Limited, 2011.

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

ME6008 **WELDING TECHNOLOGY** **L T P C**
3 0 0 3

OBJECTIVES

- To understand the basics of welding and to know about the various types of welding processes

UNIT I GAS AND ARC WELDING PROCESSES: 9

Fundamental principles – Air Acetylene welding, Oxyacetylene welding, Carbon arc welding, Shielded metal arc welding, Submerged arc welding, TIG & MIG welding, Plasma arc welding and Electroslag welding processes - advantages, limitations and applications.

UNIT II RESISTANCE WELDING PROCESSES: 9

Spot welding, Seam welding, Projection welding, Resistance Butt welding, Flash Butt welding, Percussion welding and High frequency resistance welding processes - advantages, limitations and applications.

UNIT III SOLID STATE WELDING PROCESSES: 9

Cold welding, Diffusion bonding, Explosive welding, Ultrasonic welding, Friction welding, Forge welding, Roll welding and Hot pressure welding processes - advantages, limitations and applications.

UNIT IV OTHER WELDING PROCESSES: 9

Thermit welding, Atomic hydrogen welding, Electron beam welding, Laser Beam welding, Friction stir welding, Under Water welding, Welding automation in aerospace, nuclear and surface transport vehicles.

UNIT V DESIGN OF WELD JOINTS, WELDABILITY AND TESTING OF WELDMENTS 9

Various weld joint designs – Weldability of Aluminium, Copper, and Stainless steels. Destructive and non destructive testing of weldments.

TOTAL : 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to compare different types of Welding process for effective Welding of Structural components.

TEXT BOOKS

1. Parmer R.S., “Welding Engineering and Technology”, 1st Edition, Khanna Publishers, New Delhi, 2008.
2. Parmer R.S., “Welding Processes and Technology”, Khanna Publishers, New Delhi, 1992.
3. Little R.L., “Welding and welding Technology”, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 34th reprint, 2008.

REFERENCES

1. Schwartz M.M. “Metals Joining Manual”. McGraw Hill Books, 1979.
2. Tylecote R.F. “The Solid Phase Welding of Metals”. Edward Arnold Publishers Ltd. London.
3. AWS- Welding Hand Book. 8th Edition. Vol- 2. “Welding Process”
4. Nadkarni S.V. “Modern Arc Welding Technology”, Oxford IBH Publishers, 1st Edition, 2005.
5. Christopher Davis. “Laser Welding- Practical Guide”. Jaico Publishing House.
6. Davis A.C., “The Science and Practice of Welding”, Cambridge University Press, Cambridge, 1993

PR6411 **METALLURGY LABORATORY** **L T P C**
0 0 3 2

OBJECTIVES:

- To train the students in observation and interpretation of Microstructure of Engineering materials.
- To train students in Heat treatment, hardenability and surface treatment of Engineering Materials
- To train the students in testing of Foundry sand

LIST OF EXPERIMENTS:

1. Specimen preparation for macro – examination.
2. Specimen preparation for micro examination and study of Micro structure of –

a) Carbon steel s(High, Medium, and Low)
b) Cast Iron (Gray, White, Nodular, Malleable)
c) Brass (70/30), Bronze (tin bronze), Al-Si alloy, cupro-nickel, Ti alloy.

3. Quantitative metallography – Estimation of volume fraction, particle size, size distribution, and shape.
4. Cooling curves

a) Pure Metal (Pb or Sn)
b) Alloy (Pb-Sn or Pb-Sb)

5. Heat treatments (carry out the following heat treatment and study the micro structure before and after heat treatments)

a) Annealing
b) Normalising
c) Quench Hardening
d) Tempering

6. Jominy End Quench Test
7. Foundry Sand testing

a) Sieve analysis
b) Strength of moulding sand
c) Permeability of moulding sand
d) Clay content of moulding sand
e) Moisture content of moulding sand

8. Electro-chemical Test

a) Electro deposition
b) Electro-chemical etching test

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to incorporate to microstructure of different ferrous and non ferrous alloy
- Ability to perform heat treatment, surface treatment on metals.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Jominy End Quench Test	1
2	Specimen Mounting Test with Digital Measurements	2
3	Trinocular Microscopes with Objective Lens	4
4	Disc Polishing Machine	2
5	Muffle Furnace	1

CE6315 STRENGTH OF MATERIALS LABORATORY L T P C
0 0 3 2

OBJECTIVES

To supplement the theoretical knowledge gained in Mechanics of Solids with practical testing for determining the strength of materials under externally applied loads. This would enable the student to have a clear understanding of the design for strength and stiffness

LIST OF EXPERIMENTS

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison
(i) Unhardened specimen
(ii) Quenched Specimen and
(iii) Quenched and tempered specimen.
11. Microscopic Examination of
(i) Hardened samples and
(ii) Hardened and tempered samples.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to perform different destructive testing
- Ability to characteristic materials

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Universal Tensile Testing machine with double 1 shear attachment – 40 Ton Capacity	1
2	Torsion Testing Machine (60 NM Capacity)	1
3	Impact Testing Machine (300 J Capacity)	1
4	Brinell Hardness Testing Machine	1
5	Rockwell Hardness Testing Machine	1
6	Spring Testing Machine for tensile and compressive loads (2500 N)	1
7	Metallurgical Microscopes	3
8	Muffle Furnace (800 C)	1

PR6412 COMPUTER AIDED MACHINE DRAWING LABORATORY L T P C
0 0 3 2

OBJECTIVES

- To introduce the students the Indian standard code of practice for engineering drawing and general symbols and abbreviation used on the drawing.

LIST OF EXPERIMENTS

To provide hands on experience to develop 2D and 3D models of engineering components

1. Drawing of automobile components such as piston, connecting rod, valves, manifold and crank shaft.
2. Assembly drawing of screw jack, piston – connecting rod assembly, valve assembly, clutch assembly and gear box assembly.

TOTAL: 45 PERIODS

OUTCOMES

- Ability to develop engineering drawing for the industrial component using Indian Standard code of practice.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Computer nodes	30
2	Auto CAD	15
3	Pro-E	5

GE6351 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
3 0 0 3

OBJECTIVES

To the study of nature and the facts about environment.

- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 12

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – 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 II ENVIRONMENTAL POLLUTION 10

Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry- Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry;- Mitigation procedures- Control of particulate and gaseous emission, Control of SO_2, NO_X, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies – Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

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 overutilization of surface and ground 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. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; 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. Introduction to Environmental Biochemistry: Proteins –Biochemical degradation of pollutants, Bioconversion of pollutants. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

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 – 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark). enforcement machinery involved in environmental legislation- central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides. 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 –Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health – Case studies.

TOTAL : 45 PERIODS

OUTCOMES:

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXT BOOKS :

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd Edition, Pearson Education, 2004.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.

REFERENCES :

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005)

PR6501 ENGINEERING METROLOGY AND MEASUREMENTS L T P C
3 0 0 3

OBJECTIVES

- To understand the basic principles of measurements
- To learn about various methods of measuring Mechanical parameters

UNIT I CONCEPT OF MEASUREMENT 10

General concept – Generalised measurement system-Units and standards-measuring instruments: sensitivity, stability, range, accuracy and precision-static and dynamic response-repeatability-systematic and random errors-correction, calibration - Introduction to Dimensional and Geometric Toleranceing – interchangeability.

UNIT II LINEAR AND ANGULAR MEASUREMENT 12

Definition of metrology-Linear measuring instruments: Vernier, micrometer, Slip gauges and classification, - Tool Makers Microscope - interferometery, optical flats, - Comparators: limit gauges Mechanical, pneumatic and electrical comparators, applications. Angular measurements: -Sine bar, Sine center, bevel protractor and angle Decker..

UNIT III FORM MEASUREMENT 12

Measurement of screw threads: Thread gauges, floating carriage micrometer measurement of gear tooth thickness: constant chord and base tangent method-Gleason gear testing machine – radius measurements-surface finish: equipment and parameters, straightness, flatness and roundness measurements.

UNIT IV LASER AND ADVANCES IN METROLOGY 12

Precision instruments based on laser-Principles- laser interferometer-application in measurements and machine tool metrology- Coordinate measuring machine (CMM): need, construction, types, applications.- computer aided inspection.

UNIT V MEASUREMENT OF MECHANICAL PARAMETERS 14

Force, torque, power:-mechanical, pneumatic, hydraulic and electrical type-Pressure measurement - Flow: Venturi, orifice, rotameter, pitot tube –Temperature: bimetallic strip, thermocouples, pyrometer, electrical resistance thermistor

TOTAL: 60 PERIODS

OUTCOMES:

- Upon completion of this course the student can able to learn the various linear and angular measuring equipments, their principle of operation and applications

TEXT BOOKS

1. Jain R.K., "Engineering Metrology", Khanna Publishers, 2005
2. Alan S. Morris, "The Essence of Measurement", Prentice Hall of India, 1997

REFERENCES

1. Gupta S.C, "Engineering Metrology", Dhanpat rai Publications, 2005
2. Jayal A.K, "Instrumentation and Mechanical Measurements", Galgotia Publications 2000
3. Beckwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson Education, 2006.
4. Donald Deckman, "Industrial Instrumentation", Wiley Eastern, 1985.

MF6502 METAL FORMING TECHNOLOGY L T P C
3 1 0 4

OBJECTIVES:

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

UNIT I FUNDAMENTALS OF METAL FORMING 15

State of stress – Components of stress, symmetry of stress tensor, principal 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 10

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 15

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 10

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 – Explosion forming, electro hydraulic forming, Magnetic pulse forming.

UNIT V RECENT ADVANCES 10

Super plastic forming – Electro forming – fine blanking – Hydro forming – Peen forming – Laser Forming – Micro forming - P/M forging – Isothermal forging – high speed hot forging – near net shape forming high velocity extrusion – CAD and CAM in forming

TOTAL: 60 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to perform difficult forming process to make different shape components.

TEXT BOOKS:

1. Dieter G.E., "Mechanical Metallurgy", McGraw Hill, Co., S.I. Edition, 2001
2. Nagpal G.R. "Metal forming processes", Khanna publishers, New Delhi, 2004

REFERENCES:

1. Serope Kalpakjian, Steven R Schmid, "Manufacturing Process for Engineering Materials", 4th Edition, Pearson Education, 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

PR6502 ENGINEERING STATISTICS AND QUALITY CONTROL L T P C
3 1 0 4

OBJECTIVES:

- To provide an introduction to fundamental concepts of statistical Process control
- Enhance the student understanding of the complexities of Statistical Analysis and control chart interpretation
- To understand the concept of reliability and it's improving techniques and design of experiments

UNIT I SAMPLING THEORY AND TESTING OF HYPOTHESIS 11

Population, sample – influence of sample size – Estimation of population parameter from sample – mean and variance, difference of means, variances and ratios of variances – Tests of hypothesis – large and small samples – Chi-square distribution – F distribution.

UNIT II STATISTICAL PROCESS CONTROL 15

Variation in process – Factors – control charts – variables X R and X, , - Attributes P, C and U-Chart Establishing and interpreting control charts process capability – Quality rating – Short run SPC.

UNIT III ACCEPTANCE SAMPLING 15

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 end LTPD – use of standard sampling plans – Sequential sampling plan.

UNIT IV RELIABILITY AND QUALITY 10

Life testing – failure characteristics – meantime to failure – maintainability and availability – reliability – system reliability – OC curves – reliability improvement techniques – Reliability testing techniques - Pareto analysis.

UNIT V EXPERIMENTAL DESIGN AND TAGUCHI METHOD 9

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

TOTAL: 60 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to perform statistical analysis using different control chart and able to apply concept of reliability, and design of experiment for quality improvement.

TEXT BOOKS:

1. Amcta Mitra "Fundamentals of Quality Control and improvement" Pearson Education, 2002.

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.

PR6503 MACHINE ELEMENTS DESIGN L T P C

3 1 0 4

OBJECTIVES:

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

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

OUTCOMES:

- Upon completion of this course, the students can able to successfully design engine components. The students can able to successfully design transmission components used in Engine and machines

TEXT BOOKS:

1. Joseph Edward Shigley, Charles R. Mischke " Mechanical Engineering Design", McGraw Hill, International Edition, 1992
2. Sharma. C.S. and Kamlesh Purohit, " Design of Machine Elements", Prentice Hall of India Private Limited, 2003

REFERENCES:

1. Bhandari. V.B., "Design of Machine Elements", Tata McGraw-Hill Publishing Company Limited, 2003.
2. Robert L.Norton, "Machin Design – An Integrated Approach", Prentice Hall International Edition, 2000.

PR6504 FOUNDRY TECHNOLOGY L T P C
3 0 0 3

OBJECTIVE:

- To understand the principle, procedure and applications of various foundry 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.

UNIT II CASTING METALLURGY 8

Solidification of pure metal and alloys – shrinkage in cast metals – progressive and directional solidification –– Degasification of the melt-casting defects – Castability of steel , Cast Iron, Al alloys , Babbit alloy and Cu alloy.

UNIT III DESIGN OF GATING SYSTEMS 10

Gating systems and their characteristics; the effects of gates on aspiration; turbulence and dross trap; recent trends. Chvorinov's Rule Riser design; risering curves; NRL method of riser design; feeding distance; risering of complex casting;

UNIT IV RECENT TRENDS IN CASTING AND FOUNDRY LAYOUT 8

Shell moulding, precision investment casting, CO2 moulding, centrifugal casting, Die casting, Continuous casting, Counter gravity low pressure casting, Squeeze casting and semisolid processes. Layout of mechanized foundry – sand reclamation – material handling in foundry pollution control in foundry –– Computer aided design of casting.

UNIT V TESTING OF CASTINGS 9

Causes and remedies for casting defects –Destructive testing – NDT – Dye penetrant – magnetic particle – X-ray, ultrasonic cell – studies in testing of joints & castings. Methods of elimination and control of dissolved gases in castings. use of statistical quality control in foundry.

TOTAL: 45 PERIODS

OUTOME:

- Upon completion of this course, the students can able to design different casting system and use different Foundry practices to make practical component,
- To perform different testing to study the defect in the casting and apply engineering skills to minimise the defects.

TEXT BOOKS:

1. Jain P.L., Principles of Foundry Technology, Tata McGraw Hill Publishers, 2003
2. Principle of metal casting – Heime, Looper and Rosenthal – Tata McGraw Hill – 2001

REFERENCES

1. Taylor H.F., Fleming.M.C.,, "Foundry Engineering" M.C. & Wiley Eastern Ltd., 1993
2. ASM Handbook, Vol 15, Casting, 2004

PR6511 CNC MACHINE LABORATORY L T P C
0 0 3 2

OBJECTIVES:

To train the students to write CNC Programing to simulate tool path simulation for different components.

LIST OF EXPERIMENTS

1. Study of different control systems and NC codes.
2. Program for Turning, Facing operation.
3. Program for circular interpolation, Taper turning operation
4. Program for thread cutting operation
5. Program using Do-Loop and Sub-routine.
6. Program for profile milling operation, circular interpolation
7. Program for Circular, rectangular pocket milling
8. Program for drilling cycle
9. Program for tool compensation and Program offset
10. NC code generation using CAD software packages
11. Study of cam packages
12. Study of CNC Wire cut EDM

TOTAL: 45 PERIODS

OUTCOME:

- Upon completion of this course, the students can able to perform programming on CNC machine and simulate tool path movement and also able to apply the programming to machine industrial components.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	CNC Lathe / Turning Centre	1
2	CNC Milling Machine / Machining Centre	1

PR6512 **FLUID POWER LABORATORY** **L T P C**
0 0 3 2

OBJECTIVES:

- To study the functional aspects of different pneumatic and hydraulic components and its usage in circuits.
- To train the students in designing different pneumatic and hydraulic circuits for different application.

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 latch 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

TOTAL: 45 PERIODS

OUTCOME:

- Upon completion of this course, the students can able to select and apply different pneumatics and hydraulic components to design fluid power circuit

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Hydraulic Trainer	1
2	Electro Hydraulic Trainer	1
3	PLC Based Hydraulic Trainer	1
4	Hydraulic Accumulator Intensifier, Press.	1
5	Transparent Hydraulic & Pneumatic Trainer	1
6	Vane Pump Test Rig	1
7	Pneumatic Trainer	1
8	Electro Pneumatic Trainer	1
9	PLC Based Pneumatic Trainer	1
10	Gear Pump Test Rig	1

GE6563 COMMUNICATION SKILLS – LABORATORY BASED L T P C
0 0 4 2

OBJECTIVES:

- To provide opportunities to learners to practice their communicative skills to make them become proficient users of English.
- To enable learners to fine-tune their linguistic skills (LSRW) with the help of technology to communicate globally.
- To enhance the performance of learners at placement interviews and group discussions and other recruitment procedures.

UNIT I LISTENING / VIEWING 10

Listening and note-taking – Listening to telephonic conversations – Ted talks – Inspiring Speeches – Watching documentaries on personalities, places, socio-cultural events, TV news programmes and discussions to answer different kinds questions, viz., identifying key idea and comprehension questions… so on.

UNIT II SPEAKING 12

Conversation practice – Interview – Group Discussion – Introducing oneself and others – Role play – Debate – Presentation – Panel discussion – Neutral accent.

UNIT III READING 10

Different genres of text (literature, media, technical) for comprehension – Reading strategies like note-making – reading graphs, charts and graphic organizer – Sequencing sentences – reading online sources like e-books, e-journals and e-newspapers.

UNIT IV WRITING 12

Blogs – Tweets – Online resume/ – e-mails – SMS and Online texting – Report writing – Describing charts and tables – Writing for media on current events.

UNIT V VOCABULARY 8

Idioms and Phrases – Proverbs – Collocations – Chunks of language.

UNIT VI GRAMMAR 8

Sentence structures – Subject-Verb agreement – Pronoun-Antecedent agreement – Tense forms – Active and passive voices – Direct and Indirect speeches – Cohesive devices.

TOTAL: 60 PERIODS

Teaching Methods:

1. To be totally learner-centric with minimum teacher intervention as the course revolves around practice.
2. Suitable audio/video samples from Podcast/YouTube to be used for illustrative purposes.
3. Portfolio approach for writing to be followed. Learners are to be encouraged to blog, tweet, text and email employing appropriate language.
4. GD/Interview/Role Play/Debate could be conducted off the laboratory (in a regular classroom) but learners are to be exposed to telephonic interview and video conferencing.
5. Learners are to be assigned to read/write/listen/view materials outside the classroom as well for graining proficiency and better participation in the class.

Lab Infrastructure:

S. No.	Description of Equipment (minimum configuration)	Qty Required
1	**Server** • PIV System	1 No.

	• 1 GB RAM / 40 GB HDD	
	• OS: Win 2000 server	
	• Audio card with headphones	
	• JRE 1.3	
2	**Client Systems**	60 Nos.
	• PIII System	
	• 256 or 512 MB RAM / 40 GB HDD	
	• OS: Win 2000	
	• Audio card with headphones	
	• JRE 1.3	
3	Handicam	1 No.
4	Television 46"	1 No.
5	Collar mike	1 No.
6	Cordless mike	1 No.
7	Audio Mixer	1 No.
8	DVD recorder/player	1 No.
9	LCD Projector with MP3/CD/DVD provision for Audio/video facility	1 No.

Evaluation:

Internal: 20 marks

Record maintenance: Students should write a report on a regular basis on the activities conducted, focusing on the details such as the description of the activity, ideas emerged, learning outcomes and so on. At the end of the semester records can be evaluated out of 20 marks.

External: 80 marks

Online Test	- 35 marks
Interview	- 15 marks
Presentation	- 15 marks
Group Discussion	- 15 marks

Note on Internal and External Evaluation:

1. Interview – mock interview can be conducted on one-on-one basis.
2. Speaking **–** example for role play:
   a. Marketing engineer convincing a customer to buy his product.
   b. Telephonic conversation- fixing an official appointment / placing an order / enquiring and so on.
3. Presentation – should be extempore on simple topics
4. Discussion – topics of different kinds; general topics, case studies and abstract concept

OUTCOMES:

At the end of the course, learners should be able to

- Take international examination such as IELTS and TOEFL
- Make presentations and Participate in Group Discussions.
- Successfully answer questions in interviews**.**

REFERENCES:

1. Barker, A. **Improve Your Communication Skills.** New Delhi: Kogan Page India Pvt. Ltd., 2006.

2. Craven, Miles. **Listening Extra – A resource book of multi-level skills activities**.Cambridge University Press, 2004.
3. Gammidge, Mick. **Speaking Extra - A resource book of multi-level skills activities.** Cambridge University Press, 2004.
4. Hartley, Peter. **Group Communication**. London: Routledge, 2004.
5. John Seely. **The Oxford Guide to Writing and Speaking**. New Delhi: Oxford University Press, 2004.
6. Naterop, Jean & Rod Revell. **Telephoning in English**. Cambridge University Press, 1987.
7. Ramesh, Gopalswamy and Mahadevan Ramesh. **The ACE of Soft Skills**. New Delhi: Pearson,
2010.

Web Sources:
www.humanresources.about.com
www.careerride.com

IE6605 PRODUCTION PLANNING AND CONTROL L T P C
3 0 0 3

OBJECTIVES:

- To understand the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory Control.
- To know the recent trends like manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

UNIT I INTRODUCTION 9

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

UNIT II WORK STUDY 9

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

UNIT III PRODUCT PLANNING AND PROCESS PLANNING 9

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

UNIT IV PRODUCTION SCHEDULING 9

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

UNIT V INVENTORY CONTROL AND RECENT TRENDS IN PPC 9

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

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to prepare production planning and control activities such as work study, product planning, production scheduling, Inventory Control.
- They can plan manufacturing requirements manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

TEXT BOOK:

1. Martand Telsang, "Industrial Engineering and Production Management", First Edition,S. Chand and Company, 2000.
2. James.B.Dilworth,"Operations management – Design, Planning and Control for manufacturing and services" Mcgraw Hill International Edition1992.

REFERENCES:

1. Samson Eilon, "Elements of Production Planning and Control", Universal Book Corpn.1984
2. Elwood S.Buffa, and Rakesh K.Sarin, "Modern Production / b Operations Management", 8th Ed. John Wiley and Sons, 2000.
3. Kanishka Bedi, " Production and Operations management", 2nd Edition, Oxford university press, 2007.
4. Melynk, Denzler, " Operations Management – A value driven approach" Irwin Mcgrawhill.
5. Norman Gaither, G. Frazier, " Operations Management" Thomson learning 9th edition IE, 2007
6. K.C.Jain & L.N. Aggarwal, "Production Planning Control and Industrial Management", Khanna Publishers, 1990.
7. S.N.Chary, "Theory and Problems in Production & Operations Management", Tata McGraw Hill, 1995.
8. Upendra Kachru, " Production and Operations Management – Text and cases" Excel books 1st edition 2007.

PR6601 COMPUTER AIDED PRODUCT DESIGN L T P C

3 1 0 4

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 12

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 12

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

UNIT III GEOMETRIC MODELING 12

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 environment; Bench marking – FMEA – QFD – DOE – Taguchi method of DOE – Quality loss functions – Design for product life cycle.

UNIT V PRODUCT DATA MANAGEMENT 12

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

TOTAL: 60 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to apply geometric modeling principles to design a component and also able to manage the product data and apply product life cycle management to industrial components.

TEXT BOOKS

1. Kevin Otto, Kristin Wood, "Product Design", Pearson Education, 2000
2. Ibrahim Zeid, "CAD/CAM theory and Practice", Tata McGraw Hill, 1991.

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. David F.Rogers.J, Alan Adams, "Mathematical Elements for Computer Graphics", McGraw Hill, 1990

PR6602 AUTOMATED PRODUCTION AND COMPUTER INTEGRATED MANUFACTURING

L	T	P	C
3	1	0	4

OBJECTIVES:

- 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 12

Product design & CAD, CAM, CAD/CAM and CIM – CIM Hardware and software – three step process for implementation CIM – production concepts and mathematical models covering production rate, manufacturing lead time, capacity utilisation, availability & WIP – Automation – Reason for Automation and Automation strategies – The future automated factory.

UNIT II AUTOMATED PRODUCTION SYSTEMS AND MATERIAL HANDLING AND STORAGE SYSTEM 12

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. 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 12

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 12

What is an FMS? – Types of FMS – 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. Quantitative analysis of FMS – various bottle neck model – Sizing the FMS – Illustrative examples.

UNIT V AUTOMATED ASSEMBLY, COMPUTER PROCESS CONTROL AND SHOP FLOOR CONTROL 12

Automated assembly – Fundamental – system configuration, part delivery at work station – Design for automated assembly Computer process control – continuous, discrete process, control requirement, capabilities, Level of process control – Computer process control – Computer process interface, computer process monitoring, Direct Digital control, Supervisory control – Distributed control system and personal computer. Short floor control – Three phases – Factory data collection – manual method – Automated and semiautomated data collection (ADC) – Bar code technologies and other ADC Technologies.

TOTAL: 60 PERIODS

OUTCOMES:

Upon completion of this course, the students can able to

- Ability to group similar parts
- Ability to design FMS process
- Ability to constiuent control that to calculate the amount of script to develop manufacturing plans.
- Ability to combine different concepts to describe computer integrated manufacturing

TEXT BOOKS:

1. Mikell P.Groover, “Automation, Production Systems and Computer-integrated Manufacturing”, Prentice Hall of India Private Limited, 2003
2. Radhakrishnan.P, Subramanyan.S and Raju.V, “CAD/CAM/CIM”, New Age International Publishers, 2000
3. Phillip.F Ostwalal and Jairo Munez, “Manufacturing Processes and systems”, 9th Edition, John Wiley, 1998

REFERENCES:

1. James A.Retrg and Henry W. Kraebher, “Computer Integrated Manufacturing”, Pearson Education, Asia, 2001
2. Viswamathan.N and Narahari.Y, “Performance Modelling of Automated Manufacturing System”, Prentice Hall of India Private Limited, 1994.

PR6603 DESIGN OF JIGS, FIXTURES AND PRESS TOOLS AND DRAWING **L T P C**
3 0 0 3

OBJECTIVES:

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

UNIT I LOCATION AND CLAMPING DEVICES IN JIGS AND FIXUTRES 9

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 9

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 OPERATION AND FORMING DIES 9

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 AND DRAWING DIES, JIGS AND FIXTURES 9

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

TOTAL: 45 PERIODS

Note: (Use of P S G Design Data Book is permitted in the University examination)

OUTCOMES:

- Upon completion of this course, the students can able to design jigs, fixtures and press tools and drawing.

TEXT BOOKS:

1. Donaldson, B.H. Lecain, Goold V.V., Tool Design, TMH Edition, 1978.
2. Kempster M.H.A., Introduction to Jigs and Fixtures, ELBS Edition, 1976

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

PR6611 METAL FORMING LAB AND SPECIAL MACHINES LABORATORY **L T P C**
0 0 4 2

OBJECTIVES:

- To establish hands-on experience in sheet metal forming, bulge forming and Super plastic forming.
- To get hands on experience in machining gear, V-block, dovetail, etc.

- To study tool wear, acceptance test for machine tool

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 sheet metal
5. Water hammer forming
6. Determination of Power consumption in sheet rolling 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

SPECIAL MACHINES LAB:

1. Gear Hobbing

a. Spur Gear

b. Helical Gear

2. Planning Machine

a. V-Block

b. Dove Tail

3. Centreless Cylindrical Grinding
4. Milling Machine

a. Spur Gear

5. Tool And Cutter Grinding
6. Tool Wear Studies
7. Acceptance Test Of Machine Tool As Per ISI Test Chart
8. EDM
9. Capstan And Turret Lathe
10. Measurement Of Cutting Force

TOTAL: 60 PERIODS

OUTCOMES:

- Ability to perform sheet metal forming, bulge forming and super plastic forming
- Ability to machine raw materisls to perepate gear, V-block, etc.,
- Ability to conduct acceptance test for machine tool.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Universal Testing Machine 10T	1
2	Erichsen cupping Tester	1
3	Hydraulic Press 50T	1
4	Water hammer forming apparatus	1
5	Two high Rolling mill	1
6	Top open muffle furnace (Max 1200 oC)	1
7	Dies for deep drawing	1 SET
8	Dies for Micro forming	1 SET
9	Dies for super plastic forming	1 SET
10	FEM package (ABAQUS, ANSYS…)	1
11	Dies for Constructing FLD of sheet metals	1 SET

PR6612 METROLOGY AND INSPECTION LABORATORY L T P C
0 0 3 2

OBJECTIVES

- To familiar with different measurement equipments and use of this industry for quality inspection

LIST OF EXPERIMENTS

1. Measurements of angle using Sine bar / bevel protractor
2. Measurement of External and internal Taper angle
3. Measurement of Bore Diameter
4. Calibration of Dial gauge
5. Measurement of Roundness
6. Measurements of Screw Thread Parameters using three-wire method
7. Measurements of Surface Roughness
8. Measurements using toolmaker Microscope
9. Measurements using Profile Projector
10. Measurements using Vision Measuring System
11. Measurements using CMM

TOTAL: 45 PERIODS

OUTCOMES

- Ability to handle different measurement tools and perform measurements in quality impulsion

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Vernier Calipers 0-150 mm	5
2	Vernier Calipers 0-300 mm	2
3	Micrometer 0-25 mm	5
4	Micrometer 25-50 mm	2
5	Micrometer 50-75 mm	2
6	Dial gauges LC 10micrometer	3
7	Dial gauge L.C. 2micrometer	12
8	Height gauge Analog	1
9	Height gauge Digital	1
10	Slip gauge set	2 SET
11	Sine Bar 100 mm	1
12	Sine Bar 200 mm	2
13	Toolmakers microscope	1
14	Profile Projector	1
15	Gear tooth verniers	2
16	Flangernic 0-25	1
17	Flangemic 25-50	1
18	Floating carriage micrometer	1
19	Thread plug gauges m24 x 3	1
20	Thread plug gauges m20 x 2.5	1
21	3 wire set box	1
22	Surface roughness measuring Instrument	1
23	Precision spheres different dia	1 SET
24	Dial Guage Caliberator	1
25	Precision level	1
26	Digital Micrometer	1
27	Digital Vernier 0-150 mm	1

28	Digital Ht. Guage	1
29	Bevel Protractor	1
30	CMM	1
31	Vision measuring system	1
32	Boredial gauge 16-35, 35-60	1 BOX
33	Depth Vernier 0-150mm	1
34	Depth micrometer with 6 rods	1
35	Internal micrometer with Extn sleeves	1
36	Precision Rollers 8	2
37	Surface plate	1
38	Bench centre	1

PR6613 WELDING AND FOUNDRY LABORATORY L T P C
0 0 4 2

OBJECTIVES

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

LIST OF EXPERIMENTS

Welding

Study of different welding equipments and accessories: Gas, Electric Welding
Oxy-acetylene gas welding of Lap joint, Butt Joint and T Joint.
Electric are welding of Lap Joint, Butt Joint, and T Joint.
Welding of pipes in different positions.
Brazing practice – furnace brazing.
Brazing welding of cast iron.
Thermit welding of thick material like rod plates etc.

Foundry

Preparation of green moulding sand using a 5 kg muller and testing for
Compression, shear, tensile, transverse strengths, hardness
in green condition:
ii. in dry condition after drying in oven at 150 □ C for one and half hour.
Permeability testing.
Determining the clay content.
Sieve analysis of dry silica sand.
Determining the moisture content by various methods.
Melting any non-ferrous metal and making simple castings - Demonstration.

TOTAL: 60 PERIODS

OUTCOMES:

- Ability to perform different welding operations to form the metals
- Ability to carryout the foundry practices and perform different test required to characteristic transfer materials.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	5 Kg Muller	1
2	Sand rammer	1
3	Weighing balance	1

4	Universal sand strength testing with all accessories	1 SET
5	Permeability tester	1
6	Quick moisture tester	1
7	Infra-red drier	1
8	Sieve shaker with Sieves	1 SET
9	Crucible furnace	1
10	Oxy acetylene gas welding equipment	1 SET

GE6757 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

OBJECTIVES :

- To facilitate the understanding of Quality Management principles and process.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality.

UNIT II TQM PRINCIPLES 9

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I 9

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS AND TECHNIQUES II 9

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors..

TOTAL: 45 PERIODS

OUTCOMES:

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXTBOOK:

1. Dale H. Besterfiled, et at., "Total quality Management", Pearson Education Asia, Third Edition, Indian Reprint (2006).

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
3. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

ME6702 MECHATRONICS L T P C
3 0 0 3

OBJECTIVES:

- To impart knowledge about the elements and techniques involved in Mechatronics systems which are very much essential to understand the emerging field of automation.

UNIT I INTRODUCTION 12

Introduction to Mechatronics – Systems – Concepts of Mechatronics approach – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. Sensors and Transducers**:** Static and dynamic Characteristics of Sensor, Potentiometers – LVDT – Capacitance sensors – Strain gauges – Eddy current sensor – Hall effect sensor – Temperature sensors – Light sensors

UNIT II 8085 MICROPROCESSOR AND 8051 MICROCONTROLLER 10

Introduction – Architecture of 8085 – Pin Configuration – Addressing Modes –Instruction set, Timing diagram of 8085 – Concepts of 8051 microcontroller – Block diagram,.

UNIT III PROGRAMMABLE PERIPHERAL INTERFACE 8

Introduction – Architecture of 8255, Keyboard interfacing, LED display –interfacing, ADC and DAC interface, Temperature Control – Stepper Motor Control – Traffic Control interface.

UNIT IV PROGRAMMABLE LOGIC CONTROLLER 7

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

UNIT V ACTUATORS AND MECHATRONIC SYSTEM DESIGN 8

Types of Stepper and Servo motors – Construction – Working Principle – Advantages and Disadvantages. Design process-stages of design process – Traditional and Mechatronics design concepts – Case studies of Mechatronics systems – Pick and place Robot – Engine Management system – Automatic car park barrier.

TOTAL : 45 PERIODS

OUTCOMES:

- Upon completion of this course, the Students can able to design mechatronics system with the help of Microprocessor, PLC and other electrical and Electronics Circuits.

TEXT BOOKS:

1. Bolton, “Mechatronics”, Printice Hall, 2008
2. Ramesh S Gaonkar, “Microprocessor Architecture, Programming, and Applications with the 8085”, 5th Edition, Prentice Hall, 2008.

REFERENCES:

1. Michael B.Histand and Davis G.Alciatore, “Introduction to Mechatronics and Measurement systems”, McGraw Hill International edition, 2007.
2. Bradley D.A, Dawson D, Buru N.C and Loader A.J, “Mechatronics”, Chapman and Hall, 1993.
3. Smaili.A and Mrad.F,“Mechatronics Integrated Technologies for Intelligent Machines”,Oxford University Press, 2007.
4. Devadas Shetty and Richard A. Kolk, “Mechatronics Systems Design”, PWS publishing company, 2007.
5. Krishna Kant, “Microprocessors & Microcontrollers”, Prentice Hall of India, 2007.

PR6701	FINITE ELEMENT ANALYSIS IN MANUFACTURING ENGINEERING	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

OUTCOMES:

Upon completion of this course, the Students can able to

- Develop element stiffness matrix equation from spring elemenets
- Assemble element matrix equation in to a global matrix
- Enforce boundary condition and forces on the system.
- Solve the resulting system and interpert result.
- Develop the concept of local, global coordinate system and their transformation.

TEXT BOOKS:

1. Chandraputla T.R., and Belegundu A.D., “Introduction of Finite Element in Engineering”, Prentice Hall of India, 1997.
2. Reddy.J.N., “An Introduction to Finite Element Method” McGraw Hill, International Student Edition, 1993.

REFERENCES:

1. Rao.S.S., “The Finite Element Method in Engineering”, Pergamon Press, 1993.
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
4. Rajasekaran.S., “Numerical Methods for Initial and Boundary Value Problems”, Wheeler and Co., Pvt. Ltd., 1987
5. Lewis R.W., Morgan K., Thomas H.R. and Seetharamu K.N., The Finite Element Method in Heat Transfer Analysis, John Wiley & Sons Ltd., 1996.

ME6010 ROBOTICS L T P C
3 0 0 3

OBJECTIVES:

- To understand the functions of the basic components of a Robot.
- To study the use of various types of End of Effectors and Sensors
- To impart knowledge in Robot Kinematics and Programming
- To learn Robot safety issues and economics.

UNIT I FUNDAMENTALS OF ROBOT 6

Robot - Definition - Robot Anatomy - Co ordinate Systems, Work Envelope Types and Classification-Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load- Robot Parts and their Functions-Need for Robots-Different Applications.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS 9

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT III SENSORS AND MACHINE VISION 12

Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors ,binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data-Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications-Inspection, Identification, Visual Serving and Navigation.

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING 13

Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in

3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS 5

RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to apply the basic engineering knowledge for the design of robotics

TEXT BOOKS:

1. Klafter R.D., Chmielewski T.A and Negin M., "Robotic Engineering - An Integrated Approach", Prentice Hall, 2003.
2. Groover M.P., "Industrial Robotics-Technology Programming and Applications", McGraw Hill, 2001.

REFERENCES:

1. Craig J.J., "Introduction to Robotics Mechanics and Control", Pearson Education, 2008.
2. Deb S.R., "Robotics Technology and Flexible Automation" Tata Mc Graw Hill Book Co., 1994.
3. Koren Y., "Robotics for Engineers', Mc Graw Hill Book Co., 1992.
4. Fu.K.S.,Gonzalz R.C. and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw Hill Book Co., 1987.
5. Janakiraman P.A., "Robotics and Image Processing", Tata Mc Graw Hill, 1995.
6. Rajput R.K., "Robotics and Industrial Automation", S.Chand and Company, 2008.
7. Surender Kumar, "Industrial Robots and Computer Integrated Manufacturing", Oxford and IBH Publishing Co. Pvt. Ltd., 1991.

MF6711 COMPUTER AIDED SIMULATION AND ANALYSIS LABORATORY L T P C
0 0 3 2

OBJECTIVES:

- To give exposure to software tools needed to analyze engineering problems.
- To expose the students to different applications of simulation and analysis tools.

LIST OF EXPERIMENTS:

A. SIMULATION

1. MATLAB basics, Dealing with matrices, Graphing-Functions of one variable and two variables
2. Use of Matlab to solve simple problems in vibration
3. Mechanism Simulation using software

B. ANALYSIS

1. Force and Stress analysis using link elements in Trusses, cables etc.
2. Stress and deflection analysis in beams with different support conditions.
3. Stress analysis of flat plates and simple shells.
4. Stress analysis of axi – symmetric components.
5. Thermal stress and heat transfer analysis of plates.

6. Thermal stress analysis of cylindrical shells.
7. Vibration analysis of spring-mass systems.
8. Model analysis of Beams.
9. Harmonic, transient and spectrum analysis of simple systems.

TOTAL: 45 PERIODS

OUTCOME

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

TEXT BOOKS:

1. The Mathworks, Inc, "The student Edition of Matlab", student Edition, The MATLAB curriculum series, 1997
2. Rudra Pratap, "Getting started with MATLAB", 1st Edition, Oxford University Press, 2010

EQUIPMENTS FOR A BATCH OF 30 STUDENTS

Finite Element Analysis Software, MATLAB Software, Computers with necessary accessories.

PR6711 MICROPROCESSOR AND MECHATRONICS LABORATORY L T P C
0 0 3 2

OBJECTIVES:

- To expose the students to use the microprocessor to perform simple operations / Programming
- To design and develop hydraulic pneumatic and electrical circuits using simulating systems
- To study the characteristic of different hydraulic, pneumatic and electrical components.

MICROPROCESSOR LABORATORY

LIST OF EXPERIMENTS

1. Addition and subtraction of two 16- bit numbers
2. Sorting a series of numbers in Ascending and Descending order
3. Conversion of Binary number to BCD
4. Conversion of BCD to Binary
5. Implementation of Block-Data transfer
6. Controlling stepper motor using Microprocessor
7. Verification of Logic gates
8. Design of adders and subtractors
9. Multiplexer and Demultiplexer
10. Applications of an OPAMP
11. Characteristics of common emitter transistor
12. Transfer and Drain Characteristics of FET amplifier

MECHATRONICS LABORATORY

LIST OF EXPERIMENTS

1. Design and testing of fluid power circuits to control
(i) Velocity **(ii)** direction and **(iii)** force of single and double acting actuators
2. Design of circuits with logic sequence using Electro pneumatic trainer kits.
3. Simulation of basic Hydraulic, Pneumatic and Electric circuits using software
4. Circuits with multiple cylinder sequences in Electro pneumatic using PLC
5. Speed Control of AC & DC drives

6. Servo controller interfacing for DC motor
7. PID controller interfacing
8. Stepper motor interfacing with 8051 Micro controller
(i) full step resolution (ii) half step resolution
9. Modeling and analysis of basic electrical, hydraulic and pneumatic systems
Using appropriate softwares
11. Computerized data logging system with control for process variables like pressure
flow and temperature.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to use the microprocessor to perform simple programme
- Ability to use microprocessor, PID controller for interface
- Ability to perform testing on fluid power inverter
- Ability to simulate circuits using hydraulic, Pneumatic and electrical components.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Basic Pneumatic Trainer Kit with manual and electrical controls/ PLC Control	30
2	Basic Hydraulic Trainer Kit	1
3	Hydraulics and Pneumatics Systems Simulation Softwares	10 SET
4	8051 - Microcontroller kit with stepper motor and drive circuit	2 SET
5	Simulation Softwares and Sensors to measure Pressure, Flow rate, direction, speed, velocity and force	2 SET

PR6712 DESIGN AND FABRICATION PROJECT L T P C
0 0 4 2

OBJECTIVES:

- The main objective is to give an opportunity to the student to get hands on training in the fabrication of one or more components of a complete working model, which is designed by them.

GUIDELINE FOR REVIEW AND EVALUATION

The students may be grouped into 2 to 4 and work under a project supervisor. The device/ system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL : 60 PERIODS

OUTCOMES:

- Use of design principles and develop conceptual and engineering design of any components.
- Ability to fabricate any components using different manufacturing tools.

ME6005 PROCESS PLANNING AND COST ESTIMATION L T P C
3 0 0 3

OBJECTIVES:

- To introduce the process planning concepts to make cost estimation for various products after process planning

UNIT I INTRODUCTION TO PROCESS PLANNING 10

Introduction- methods of process planning-Drawing interpretation-Material evaluation – steps in process selection-.Production equipment and tooling selection

UNIT II PROCESS PLANNING ACTIVITIES 10

Process parameters calculation for various production processes-Selection jigs and fixtures election of quality assurance methods - Set of documents for process planning-Economics of process planning- case studies

UNIT III INTRODUCTION TO COST ESTIMATION 8

Importance of costing and estimation –methods of costing-elements of cost estimation –Types of estimates – Estimating procedure- Estimation labor cost, material cost- allocation of over head charges- Calculation of depreciation cost

UNIT IV PRODUCTION COST ESTIMATION 8

Estimation of Different Types of Jobs - Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop

UNIT V MACHINING TIME CALCULATION 9

Estimation of Machining Time - Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations ,Drilling and Boring - Machining Time Calculation for Milling, Shaping and Planning -Machining Time Calculation for Grinding

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to use the concepts of process planning and cost estimation for various products.

TEXT BOOKS:

1. Peter scalon, “Process planning, Design / Manufacture interface”, Elsevier science technology Books, Dec 2002.

REFERENCES:

1. Ostwalal P.F. and Munez J., “Manufacturing Processes and systems”, John Wiley, 9th Edition, 1998.
2. Russell R.S and Tailor B.W, “Operations Management”, PHI, 4th Edition, 2003.
3. Chitale A.V. and Gupta R.C., “Product Design and Manufacturing”, PHI, 2nd Edition, 2002.

PR6811 **COMPREHENSION** **L T P C**
0 0 2 1

OBJECTIVES:

- To encourage the students to comprehend the knowledge acquired from the first Semester to Sixth Semester of B.E Degree Course through periodic exercise.

METHOD OF EVALUATION:

The students will be assessed 100% internally through weekly test with objective type questions on all the subject related topics

TOTAL : 30 PERIODS

OUTCOMES:

- ability to understand and comprehend any given problem related to mechanical engineering field.

PR6812 **PROJECT WORK** **L T P C**
0 0 12 6

OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 180 PERIODS

OUTCOMES:

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

ME6004 **UNCONVENTIONAL MACHINING PROCESSES** **L T P C**
3 0 0 3

OBJECTIVES:

- To learn about various unconventional machining processes, the various process parameters and their influence on performance and their applications

UNIT I INTRODUCTION **6**

Unconventional machining Process – Need – classification – Brief overview .

UNIT II MECHANICAL ENERGY BASED PROCESSES 9

Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining - Ultrasonic Machining.(AJM, WJM, AWJM and USM). Working Principles – equipment used – Process parameters – MRR- Applications.

UNIT III ELECTRICAL ENERGY BASED PROCESSES 9

Electric Discharge Machining (EDM)- working Principle-equipments-Process Parameters-Surface Finish and MRR- electrode / Tool – Power and control Circuits-Tool Wear – Dielectric – Flushing – Wire cut EDM – Applications.

UNIT IV CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES 11

Chemical machining and Electro-Chemical machining (CHM and ECM)-Etchants – Maskant - techniques of applying maskants - Process Parameters – Surface finish and MRR-Applications. Principles of ECM- equipments-Surface Roughness and MRR Electrical circuit-Process Parameters-ECG and ECH - Applications.

UNIT V THERMAL ENERGY BASED PROCESSES 10

Laser Beam machining and drilling (LBM), plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – Applications.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to demonstrate different unconventional machining processes and know the influence of difference process parameters on the performance and their applications

TEXT BOOKS:

1. Vijay.K. Jain “Advanced Machining Processes” Allied Publishers Pvt. Ltd., New Delhi, 2007
2. Pandey P.C. and Shan H.S. “Modern Machining Processes” Tata McGraw-Hill, New Delhi, 2007.

REFERENCES:

1. Benedict. G.F. “Nontraditional Manufacturing Processes” Marcel Dekker Inc., New York, 1987.
2. Mc Geough, “Advanced Methods of Machining” Chapman and Hall, London (1998).
3. Paul De Garmo, J.T.Black, and Ronald.A.Kohser, “Material and Processes in Manufacturing” 8th Edition, Prentice Hall of India Pvt. Ltd., New Delhi , 2001.

MF6503 PRECISION ENGINEERING L T P C

3 0 0 3

OBJECTIVES :

- 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 join core electronic manufacturing industries.

UNIT I CONCEPTS OF ACCURACY AND MACHINE TOOLS 9

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

UNIT II STIFFNESS, THERMAL EFFECTS AND FINISH MACHINING 12

Overall stiffness of Lathe – compliance of work piece – errors caused by cutting forces – deformation in turning – boring – milling – heat sources – thermal effects – Finish Turning, boring, grinding – Surface roughness.

UNIT III DIMENSIONING 6

Definition of terms – Key dimension – Superfluous dimension – dimensional stepped shaft – assigning tolerances in the constituent dimensions – dimensional chains.

UNIT IV MICRO-MACHINING MICRO FABRICATION 9

Micro Machining – Photo resist process – Lithography – LIGA Process – Optical, processing of materials – electron beam machining – beam machining – micro forming, diamond turning – micro positioning devices – etching – physical vapour deposition – Chemical vapour deposition

UNIT V SMART STRUCTURES, MATERIALS AND MICRO ACTUATORS 9

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

TOTAL: 45 PERIODS

OUTCOMES

- Upon completion of this course the student can able to use of quality concepts parts, accuracy requirements of machine tools and use of latest machining process such as micro machining and micro fabrication.

TEXT BOOKS:

1. Murthy R.L. “Precision Engineering in Manufacturing”, New Age Internaional Pvt. Limited.
2. Juliar W.Gardner. Vijay K. Varadan, "Micro sensors, MEMS and Smart Devices", John wiley and sons, 2001.

REFERENCES:

1. Stephen A.Campbell, “The Science and Engineering of Micro electronic Fabrication”, Oxford University Press, 1996.
2. Raady Frank, “Understanding smart sensors”, Artech. House, Boston, 1996.
3. MEMS Hand Book, CRC Press, 2001

PR6001 SURFACE ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To study the surface preparation techniques
- To import knowledge on thermal spraying process and electrodeposited coating
- To study the process of Hot dip and diffusion coating
- To induce the testing procedure for surface coating

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 of cleaning process – alkaline cleaning – emulsion cleaning- ultrasonic cleaning – acid and pickling salt bath descaling – abrasive bath cleaning – polishing and short 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 COVENSION COATINGS 9

Plating coating – laequers – rubbers and elastomers – vitreous enamels – anodizing phosphating and chromating – application to aluminium, magnesium, tin, zinc, 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

OUTCOMES:

- Explain the important of surface engineering to industries
- Use of thermal spray for coating
- Explain the process and mechanism of different diffusion coating process
- Explain the methods of non metallic coating
- Explain the testing procedure for quality assurance.

TEXT BOOKS:

1. Stand Grainger engineering coatings – design and application jaico publishing House, 1994.

REFERENCES:

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

ME6015 OPERATIONS RESEARCH L T P C
3 0 0 3

OBJECTIVES:

- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

UNIT I LINEAR MODELS 15

The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

UNIT II TRANSPORTATION MODELS AND NETWORK MODELS 8

Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

UNIT III INVENTORY MODELS 6

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

UNIT IV QUEUEING MODELS 6

Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

UNIT V DECISION MODELS 10

Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variable search technique – Dynamic Programming – Simple Problem.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to use the optimization techniques for use engineering and Business problems

TEXT BOOK:

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

REFERENCES:

1. Shennoy G.V. and Srivastava U.K., “Operation Research for Management”, Wiley Eastern, 1994.
2. Bazara M.J., Jarvis and Sherali H., “Linear Programming and Network Flows”, John Wiley, 1990.
3. Philip D.T. and Ravindran A., “Operations Research”, John Wiley, 1992.
4. Hillier and Libeberman, “Operations Research”, Holden Day, 1986
5. Budnick F.S., “Principles of Operations Research for Management”, Richard D Irwin, 1990.
6. Tulsian and Pasdey V., “Quantitative Techniques”, Pearson – Asia 2002.

GE6083 DISASTER MANAGEMENT L T P C

3 0 0 3

OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

TEXTBOOK:

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

MG6072 MARKETING MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To enable students to deal with newer concepts of marketing concepts like strategic marketing segmentation, pricing, advertisement and strategic formulation. The course will enable a student to take up marketing as a professional career.

UNIT I MARKETING PROCESS 9

Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy.

UNIT II BUYING BEHAVIOUR AND MARKET SEGMENTATION 9

Cultural, demographic factors, motives, types, buying decisions, segmentation factors - demographic - Psycho graphic and geographic segmentation, process, patterns.

UNIT III PRODUCT PRICING AND MARKETING RESEARCH 9

Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION 9

Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION 9

Characteristics, impact, goals, types, and sales promotions - point of purchase - unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing, Modern Trends, e-Marketing.

TOTAL: 45 PERIODS

OUTCOME :

- The learning skills of Marketing will enhance the knowledge about Marketer's Practices and create insights on Advertising, Branding, Retailing and Marketing Research.

TEXTBOOKS:

1. Philip Kolter & Keller, "Marketing Management", Prentice Hall of India, 14th Edition, 2012.
2. Chandrasekar K.S., "Marketing Management Text and Cases", 1st Edition, Tata McGraw Hill – Vijaynicole, 2010.

REFERENCES:

1. Ramasamy and Nama kumari, "Marketing Environment: Planning, implementation and control the Indian context", 1990.
2. Czinkota&Kotabe, "Marketing management", Thomson learning, Indian Edition 2007
3. Adrain palmer, " Introduction to marketing theory and practice", Oxford university press IE 2004.
4. Donald S. Tull and Hawkins, "Marketing Reasearch", Prentice Hall of Inida-1997.
5. Philip Kotler and Gary Armstrong "Principles of Marketing" Prentice Hall of India, 2000.

6. Steven J.Skinner, “Marketing”, All India Publishers and Distributes Ltd. 1998.
7. Graeme Drummond and John Ensor, Introduction to Marketing Concepts, Elsevier, Indian Reprint, 2007.

PR6002 FUZZY LOGIC AND ANN L T P C
3 0 0 3

OBJECTIVES:

- To impact knowledge on fuzzy logic principles
- To understand models of ANN
- To use the fuzzy logic and neural network for application related to design and manufacture

UNIT I INTRODUCTION TO FUZZY LOGIC PRINCIPLES 9

Basic concepts of fuzzy set theory – operations of fuzzy sets – properties of fuzzy sets – Crisp relations – Fuzzy relational equations – operations on fuzzy relations – fuzzy systems – propositional logic – Inference – Predicate Logic – Inference in predicate logic – fuzzy logic principles – fuzzy quantifiers – fuzzy inference – fuzzy rule based systems – fuzzification and defuzzification – types.

UNIT II ADVANCED FUZZY LOGIC APPLICATIONS 9

Fuzzy logic controllers – principles – review of control systems theory – various industrial applications of FLC adaptive fuzzy systems – fuzzy decision making – Multiobjective decision making – fuzzy classification – means clustering – fuzzy pattern recognition – image processing applications – systactic recognition – fuzzy optimization.

UNIT III INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS 9

Fundamentals of neural networks – model of an artificial neuron – neural network architectures – Learning methods – Taxonomy of Neural network architectures – Standard back propagation algorithms – selection of various parameters – variations Applications of back propagation algorithms.

UNIT IV OTHER ANN ARCHITECTURES 9

Associative memory – exponential BAM – Associative memory for real coded pattern pairs – Applications adaptive reasonance theory – introduction – ART 1 – ART2 – Applications – neural networks based on competition – kohenen self organizing maps – learning vector quantization – counter propagation networks – industrial applications.

UNIT V RECENT ADVANCES 9

Fundamentals of genetic algorithms – genetic modeling – hybrid systems – integration of fuzzy logic, neural networks and genetic algorithms – non traditional optimization techniques like ant colony optimization – Particle swarm optimization and artificial immune systems – applications in design and manufacturing.

TOTAL: 45 PERIODS

OUTCOMES:

- Develop the skill in basic understanding on fuzzy and neural network
- Explore the functional components of neural classification conducer and the functional components of fuzzy logic classification on controller.
- Develop and implement a basic trainable neural network (or) a fuzzy logic system to design and manufacturing.

TEXT BOOKS:

1. Rajasekaran. S.. Vijayalakshmi Pai. G.A. “Neural Networks, Fuzzy Logic and Genetic Algorithms”, Prentice Hall of India Private Limited, 2003

2. Timothy J.Ross, “Fuzzy logic with Engineering Applications”, McGraw Hill, 1995
3. Zurada J.M. “Introduction to Artificial Neural Systems”, Jaico publishing house, 1994.

REFERENCES:

1. Klir.G, Yuan B.B. “Fuzzy sets and Fuzzy Logic Prentice Hall of India private limited, 1997.
2. Laurance Fausett, “Fundamentals of Neural Networks”, Prentice hall, 1992
3. Gen, M. and Cheng R. “Genetic Algorithm and Engineering Design”, john wiley 1997

PR6003 INSTRUMENTATION AND CONTROL L T P C
3 0 0 3

OBJECTIVES:

- To understand the principle of measuring displacement, velocity, acceleration, vibration, force, stress and strain
- To build mathematical model for control system.
- To familiar with bode plots.

UNIT I INTRODUCTION 9

Static and dynamic characteristics of measurement systems, standards and calibration, error and uncertainty analysis, statistical analysis of data, and curve fitting.

UNIT II MECHANICAL MEASUREMENTS AND INDUSTRIAL INSTRUMENTATION 10

Measurement of displacement, velocity (linear and rotational), acceleration, shock, vibration, force torque power, strain, stress, pressure temperature.

UNIT III DATA DISPLAY AND RECORDING DEVICES 8

Data display-CRO,LED, LCD, magnetic tape recorders, x-y recorders, UV recorders, Oscilloscope recorders, digital printers and data loggers.

UNIT IV CONTROL 9

Introduction to control systems, mathematical model of physical systems in transfer function and state space forms, response of dynamic systems, concept of pole and zero of a system, realization of transfer functions.

UNIT V STABILITY ANALYSIS 9

Stability criteria bode plots, routh and Nyquist criteria.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion ot this course student can able to perform measurement of displacement, velocity, force, torque, strain, stress, pressure and temperature.

TEXT BOOKS:

1. B.C.Nakra, K.K.Choudry, “Instrumentation, Measurement and analysis”, Tata McGraw Hill 2002
2. Nagrath. J.J. and Gopal, “control system engineering”, New age international (p) ltd., 2000.

REFERENCES:

1. Rangan. C.S., Sarma. G.R., Mani. VSV, Instrumentation Devices and Systems”, Tata McGraw Hill, 2000

2. Sowhney. A.K., “Electrical and Electronic Measurement and Instrumentation, “Dhanpat rai & Cu, 2003.
3. Benjamin C.Kuo, “Automatic Control System”, prentice hall of India pvt ltd., 2002
4. Ernest O.Doeblin, “measurement systems applications and design”, McGraw Hill International editions, 1990
5. Renganathan. S., “transducer engineering”, Allied publishers, 1990.

GE6081 FUNDAMENTALS OF NANOSCIENCE L T P C
3 0 0 3

OBJECTIVES

- To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION 8

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION 9

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS 12

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO2,MgO, ZrO2, NiO, nanoalumina, CaO, AgTiO2, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications

UNIT IV CHARACTERIZATION TECHNIQUES 9

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

UNIT V APPLICATIONS 7

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery

TOTAL : 45 PERIODS

OUTCOMES

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS

1. Edelstein. A.S., and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. John Dinardo. N, “Nanoscale charecterisation of surfaces & Interfaces”, 2nd edition,
3. Weinheim Cambridge, Wiley-VCH, 2000

REFERENCES

1. Timp. G, “Nanotechnology”, AIP press/Springer, 1999.
2. Akhlesh Lakhtakia, “The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.

GE6084 HUMAN RIGHTS L T P C
3 0 0 3

OBJECTIVES :

- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I **9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II **9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III **9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV **9**

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V **9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO’s, Media, Educational Institutions, Social Movements.

TOTAL : 45 PERIODS

OUTCOME :

- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

1. Kapoor S.K., “Human Rights under International law and Indian Laws”, Central Law Agency, Allahabad, 2014.
2. Chandra U., “Human Rights”, Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

PR6004 DESIGN OF MACHINE TOOL STRUCTURE L T P C
3 0 0 3

OBJECTIVES:

- To understand different machine tools used for maching.
- To understand the design criteria for machine tool structures.

- To know the designing of slideways
- To understand the vibration in the machine tool during operation.

UNIT I INTRODUCTION 10

Classification of machining processes, machine tools – machine tool construction – factors – performance criteria – trends in modern machine tool – kinematic arrangement of different types of machine tools – work holding and tool holding devices – calculation of cutting forces and power requirements for turning, milling, boring and grinding – force distribution on different parts of drilling, milling and grinding machine tools.

UNIT II STRENGTH AND RIGIDITY OF MACHINE TOOL STRUCTURES 10

Basic principles of design – comparison of materials used in machine tool construction – dependence of process capability on rigidity – static compliance – design of lathe beds – materials – typical construction – torsional modulus of regangular and box sections – methods of increasing rigidities.

UNIT III SLIDEWAYS 9

Slide ways – types – materials – constructions – clearance adjustments – Hydrostatically lubricated slide ways – slide way design – pressure distribution – antifriction ways – design – construction.

UNIT IV SPINDLES AND SPINDLE SUPPORTS 8

Spindle units – materials – spindle design – spindle bearings – types of materials – constructions.

UNIT V MACHINE TOOL DYNAMICS 9

Dynamic system – elastic system – working processes – vibration in machine tools – self excited vibration and dynamic stability – basic principles of chatter – effects of vibration – vibration elimination – damping – isolation of vibration – dynamic absorber with damping.

TOTAL: 45 PERIODS

OUTCOMES

- Ability to design strength and components of machine tools.

TEXT BOOKS:

1. Sen. G.C., and A.Battacharya, “Principles of machine tools”, New central book agency, 1999
2. Metha. N.K., “Machine Tool Design and Numerical control”, Tata McGraw Hill publishing company, 1996

REFERENCES:

1. Manfred week, “Hand Book of Machine Tools – Vol1, Vol 2, Vol.3" John Wiley & Sons, 1984.
2. Acherkan.N, “Machine Tool Design”, Vol 3, MIR publishers, 1978

ME6007 COMPOSITE MATERIALS AND MECHANICS L T P C
3 0 0 3

OBJECTIVES:

- To understand the fundamentals of composite material strength and its mechanical behavior Understanding the analysis of fiber reinforced Laminate design for different
- combinations of plies with different orientations of the fiber.

- Thermo-mechanical behavior and study of residual stresses in Laminates during processing. Implementation of Classical Laminate Theory (CLT) to study and analysis for residual stresses in an isotropic layered structure such as electronic chips.

UNIT I INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS & MANUFACTURING 12

Definition – Need – General Characteristics, Applications. Fibers – Glass, Carbon, Ceramic and Aramid fibers. Matrices – Polymer, Graphite, Ceramic and Metal Matrices – Characteristics of fibers and matrices. Lamina Constitutive Equations: Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke's Law. Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix, Typical Commercial material properties, Rule of Mixtures. Generally Orthotropic Lamina –Transformation Matrix, Transformed Stiffness. Manufacturing: Bag Moulding – Compression Moulding – Pultrusion – Filament Winding – Other Manufacturing Processes

UNIT II FLAT PLATE LAMINATE CONSTITUTE EQUATIONS 10

Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli. Evaluation of Lamina Properties from Laminate Tests. Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.

UNIT III LAMINA STRENGTH ANALYSIS 5

Introduction - Maximum Stress and Strain Criteria. Von-Misses Yield criterion for Isotropic Materials. Generalized Hill's Criterion for Anisotropic materials. Tsai-Hill's Failure Criterion for Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure

UNIT IV THERMAL ANALYSIS 8

Assumption of Constant C.T.E's. Modification of Hooke's Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E's. C.T.E's for special Laminate Configurations – Unidirectional, Off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi-Isotropic Laminates

UNIT V ANALYSIS OF LAMINATED FLAT PLATES 10

Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations – Natural Frequencies

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to analyse the fiber reinforced Laminate for optimum design
- Apply classical laminate theory to study and analyse the residual stresses in Laminate.

TEXT BOOKS:

1. Gibson, R.F., "Principles of Composite Material Mechanics", Second Edition, McGraw-Hill, 1994, CRC press in progress.
2. Hyer, M.W., "Stress Analysis of Fiber – Reinforced Composite Materials", McGraw- Hill, 1998

REFERENCES:

1. Issac M. Daniel and Ori Ishai, "Engineering Mechanics of Composite Materials", Oxford University Press-2006, First Indian Edition - 2007
2. Mallick, P.K., Fiber, "Reinforced Composites: Materials, Manufacturing and Design", Maneel Dekker Inc, 1993.
3. Halpin, J.C., "Primer on Composite Materials, Analysis", Techomic Publishing Co., 1984.

4. Agarwal, B.D., and Broutman L.J., “Analysis and Performance of Fiber Composites”, John Wiley and Sons, New York, 1990.
5. Mallick, P.K. and Newman, S., (edition), “Composite Materials Technology: Processes and Properties”, Hansen Publisher, Munish, 1990.

PR6005 PROCESSING OF POLYMER AND COMPOSITES L T P C
3 0 0 3

OBJECTIVES

To understand the characteristics of different reinforcement matrix materials

- To develop composite materials for different application.
- To know the different process used for polymer matrix composites, metal matrix composites and ceramics matrix composites

UNIT I INTRODUCTION 8

Classification of polymers – properties and applications of selective engineering polymers – fundamentals of composites – need for composites – enhancement of properties – classification of composites – matrix polymer matrix composites (PMC), metal matrix composites (MMC), Ceramic matrix composites (CMC) reinforcement – particle reinforced composites, fibre reinforced composites, applications of various types of composites.

UNIT II POLYMER MATRIX COMPOSITES 12

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

UNIT III METAL MATRIX COMPOSITES 9

Characteristics of MMC, various types of metal matrix composites alloy vs. MMC, advantages of MMC limitations of MMC – Metal matrix – reinforcements – particles – fibres. Effect of reinforcement – volume fraction – Rule of mixtures, processing of MMC – Powder metallurgy process diffusion bonding – stir casting squeeze casting.

UNIT IV CERAMICS MATRIX COMPOSITES 9

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

UNIT V ADVANCES IN POLYMERS & COMPOSITES 7

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

TOTAL: 45 PERIODS

OUTCOMES

- Ability to select suitable matrix, reinforce materials for polymer matrix composites, metal matrix composites and ceramics matrix composites

TEXT BOOKS:

1. Mathews F.L. and Rawings R.D., “Composite materials, Engineering and Science”, Chapman.
2. Chawla K.K. “Composite Materails”, Springer Verlag, 1987

3. Kenneth G.Budinski & Michael K. Budinski, “Engineering Materials”, Prentice Hall of India pvt ltd., 4th Indian reprint, 2002.

REFERENCES:

1. Clync. T.W., and Withers. P.J., “Introduction to Metal Matrix Composites”. Cambridge University Press, 1993.
2. Strong. B., “Fundamentals of Composite Manufacturing, SME, 1989
3. Sharma. S.C., “Composite Materials”, Narosa publications, 2000
4. “Short term course on advances in composite materials”, “composite technology centre, department of metallurgy, iit – madras, December 2001.
5. Brydson, Hand book of plastic processing
6. Weatherhead R.G. “FRP technology” (Fibre Reinforced Resin System), Applied Science Publishers Limited, London, 1990.

PR6006 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, Penetrant 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 for Normal Beam Inspection, Ultrasonic Flaw detection Equipment, Modes of display – Ascan, B-Scan & C- Scan-Applications

UNIT V RADIOGRAPHY, COMPARISON AND SELECTION OF NDT METHODS 9

Basic principle, Effect of radiation on 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

OUTCOMES

- Ability to defect the flow and other defects using non destructive testing procedure for industrial component.

TEXT BOOKS:

1. Baldev raj, T Jeyakumar, M. Thavasimuthu “Practical Non Destructive Testing” 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

PR6007 SIMULATION OF MANUFACTURING SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

- To introduce the concepts of simulation and to apply them for manufacturing system

UNIT I INTRODUCTION 8

Basic concept of system – elements of manufacturing system - concept of simulation – simulation as a decision making tool – types of simulation – system modeling – types of modeling.

UNIT II RANDOM NUMBERS 10

Probability and statistical concepts of simulation – Pseudo random numbers – methods of generating random numbers – discrete and continuous distribution – testing of random numbers – sampling - simple, random and simulated.

UNIT III DESIGN OF SIMULATION EXPERIMENTS 10

Problem formulation – data collection and reduction – time flow mechanical – key variables - logic flow chart starting condition – run size – experimental design consideration – output analysis, interpretation and validation – application of simulation in engineering industry.

UNIT IV SIMULATION LANGUAGE 9

Study of GPSS (Basic blocks only) Generate, Queue, Depart, Size, Release, Advance, Terminate, Transfer, Enter and Leave.

UNIT V CASE STUDIES 10

Development of simulation models using GPSS for queuing, production, inventory, maintenance and replacement systems, (Students may be asked to prepare and present the case studies)

TOTAL: 45 PERIODS

OUTCOMES

- Use of concepts of simulation to the manufacturing systems.

TEXT BOOK:

1. Jerry Banks and John S.Carson, “Discrete Event System Simulation”, Prentice Hall 1991.

REFERENCES:

1. John H.Mize and J.Grady Cox, “Essential of simulation” – Prentice hall 1989.
2. Geoffrey Gordon “System simulation” – Prentice Hall of India, 1992
3. Jeffrey L.Written, Lonnie D, Bentley and V.M. Barice, “System analysis and Design Methods”, Galgotia publication, 1995
4. Averill M.Law and W.David Kelton, “Simulation Modelling and analysis”, McGraw Hill International Editions, 1991
5. Shannon R.E., “System simulation”, Prentice Hall 1993.

PR6008 MACHINE VISION L T P C
3 0 0 3

OBJECTIVES:

- 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

OUTCOMES

- Use of machine vision techniques to pattern recognizing.
- Use of machine vision in manufacturing industries in process implementation, assembly.

TEXTBOOK

1. Milan sonka, Vaclav hlavac, roger boyie, "Image Processing", "Analysis and machine vision" Cengage Learning India Pvt Ltd (2008)

REFERENCES:

1. Richard O.Duda, Peter E. Hurt, Pattern Classification and Scene Analysis Publisher, 1973
2. Rafael C. Gonzaies, Richard E. Woods, Digital Image processing publisher, 1992

3. Nella zuech, ‘Understanding & applying machine vision Marceldekker Inc. 2000.

PR6009 PRODUCTION MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

- To study the evolution of Management
- To study the functions and Production management
- To learn the application of the principles in an organization

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 inventors – Basic EOQ model – variations in EOQ model – Finite Production quality discounts – ABC Analysis – MRP Analysis.

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 – 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

OUTCOMES

- Ability to use inventory Management, Operation Management, Financial Management, Manufacturing Management and Industrial Development.

TEXT BOOKS:

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

REFERENCES:

1. Koont and G’donnel, "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, "Personal Management", Kalyane Publication 1992
5. Martand T. Telesand, "Industrial and Business Management", S.Chand & Co., 2001

PR6010 ERGONOMICS L T P C
3 0 0 3

OBJECTIVES:

- To introduce the concepts of man machine systems and techniques of providing human comfort in man-making work systems.

UNIT I INTRODUCTION 9

Inter disciplinary nature of ergonomics modern ergonomics human performance – information processing – factors affecting human performance – physical workload and energy expenditure.

UNIT II WORK SPACE DESIGN 9

Anthropometry – workspace design for standing and seatedworkers – Arrangements of components within a physical space – Interpersonal aspect of workplace design.

UNIT III DESIGN OF EQUIPMENT 9

Programme factors to be considered, design of displays and controls – design for maintainability – heat stresses – manual lifting.

UNIT IV DESIGN FOR ENVIRONMENT 9

Illumination – Climate – Noise – Vibration – Heat, cold – Lighting design considerations – Effect of noise on task performance.

UNIT V RECENT ADVANCES AND TRENDS 9

Legislative trends – Trends in work system design – occupational diseases – Application of Ergonomcis in automobiles.

TOTAL: 45 PERIODS

OUTCOMES

- Use the concept of ergonomics design in equipment
- Perform work space design considering physical space and inter personal space.

TEXT BOOK:

1. Martin Helander, A Guide to Ergonomics of Manufacturing, TMH, 1996.

REFERENCES:

1. Bridger, R.S. "Introduction to Ergonomics", McGraw Hill, 1995.
2. Micormic, J. "Human factors in Engineering and Design", McGraw Hill, 1992.
3. Wilson,J.R.Corlect EN, "Evaluation of Human work", A. practical Ergonomcis methodology, Taylor and Frances, 1990.
4. Shackel, B.Richardson S, "Human Factors for Information usability", Cambridge University, Cambridge University Press, 1991.

MG6097 ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT L T P C
3 0 0 3

OBJECTIVES :

- To enable students to understand and interpret the basic financial statements, to comprehend the basics in managing finance and to know pricing mechanism.

UNIT I INTRODUCTION 7

Introduction to Engineering Economics – Engineering efficiency – Economic efficiency. Scope of Engineering Economics – Elements of Cost, Marginal Cost, Marginal Revenue, Sunk and Opportunity cost, Break Even Analysis, Elementary economic analysis, Demand and Supply.

UNIT II FINANCIAL ACCOUNTING 13

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

UNIT III PROFIT VALUE ANALYSIS 10

Cost volume profit analysis – relevant costs in decision making profit management analysis – break even analysis – margin of safety, Angle of incidence & multi product break even analysis.

UNIT IV WORKING CAPITAL MANAGEMENT 8

Current assets and liability decisions – estimation of working capital requirements – Management of accounts receivable – Inventory – cash – inventory valuation methods.

UNIT V CAPITAL BUDGETING 7

Significance of capital budgeting – payback period – present value method – Accounting rate of return method, Internal Rate of Return.

TOTAL: 45 PERIODS

OUTCOME :

- Upon successful completion of this course, students will get the ability to prepare and interpret financial statements, manage funds efficiently and fix and revise prices as warranted.

TEXTBOOKS:

1. R. Kesavan, C.Elanchezhian and T.Sundar Selwyn, "Engineering Economics and Financial Accounting", Laxmi Publications 2011
2. Maheswaran. S.N., "Management Accounting and Financial Control", Sultan Chand, 2011

REFERENCES:

1. James. C., Vanhorn, "Fundamentals of Financial Management" PHI, 2012
2. Charles T.Homgren, "Cost Accounting", PHI, 2012

PR6011 PURCHASING AND MATERIALS MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

- To impact knowledge on general structure of material management
- To understand the general procedure and structures of purchase management
- To understand and train the students in materials planning and solve forecasting related problems
- To understand inventory management and to study different models

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 - Insurance and claims managements

UNIT III STORES MANAGEMENT 8

Store function – Location – Layout – Stock taking – Materials handling – codification – Inventory pricing – MIS for stores management

UNIT IV MATERIALS PLANNING 12

Forecasting - ABC analysis – Materials requirements planning - Inventory systems – Quantity – periodic – Deterministic models – Aggregate planning – JIT.

UNIT V INVENTORY MANAGEMENT 11

Basic EOQ Model – Discount Model - Finite Production – Lot size under constraints – Application of O.R. Techniques in Materials Management.

TOTAL: 45 PERIODS

OUTCOMES

- To explain the functions and structure of materials, purchase and store management
- To perform analysis on materials planning
- To perform calculation using different inventory models.

TEXT BOOK:

1. Lamer Lee and Donald W.Dobler, "Purchasing and Material Management", Text and Cases, Tata McGraw Hill, 1996.

REFERENCES:

1. Gopalakrishnan P. Handbook of Materials Management, Prentice Hall of India, 1996.
2. Guptha P.K. and Manmohan, "Problems in Operations Research", Sultan Chand & Sons, 1994
3. R. Kesavan, C.Elanchezhian and T.Sundar Selwyn, "Engineering Management", Eswar Press 2005

PR6012 ADVANCES IN OPERATION RESEARCH L T P C

3 0 0 3

OBJECTIVES:

- 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 – 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

OUTCOMES

- Upon completion of this course, the students can able to use the optimization techniques for use engineering and Business problems

TEXT BOOKS:

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

REFERENCES:

1. Guptha. P.K., 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. Sharma. J.K., Operations Research – Theory and Applications – Macmillan India Ltd., 1997
4. Hamdy A. Taha, Operations Research – An Introduction, Prentice Hall of India, 1997

IE6603 RELIABILITY ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To stress the importance of reliability in Engineering and products also the concept of maintability, failure modes and testing methods.

UNIT I CONCEPTS OF RELIABILITY, SYSTEM AND MODELS 12

Definition of reliability – reliability Vs quality-reliability function-MTTF – hazard rate function- bathtub curve – derivation of the reliability function-constant failure rate model – time dependent failure models. Weibull distribution – normal distribution – the lognormal distribution. Serial configuration – parallel configuration – combined series parallel systems – system structure function, minimal cuts and minimal paths – Markov analysis – load sharing systems, standby system, degraded systems, three state devices – covariate models, static models, dynamic models, physics of failure models.

UNIT II DESIGN FOR RELIABILITY AND MAINTAINABILITY 12

Reliability design process – system effectiveness – economic analysis and life cycle cost – reliability allocation – optimal, Arinc, Agree, - Design methods – parts and material selection, derating, stress-strength analysis – failure analysis – identification of failure mode – determination of causes – assessment of effects – classification of seventy – computation of critically index – corrective action – system safety and FTA. Analysis of downtime – the repair time distribution – stochastic point processes – system repair time – reliability under preventive maintenance – state dependent systems with repair – MTTR-mean system downtime – MTR – MH/OH – cost model – fault isolation and self

diagnostics – repair Vs replacement – replacement model – proactive, preventive, predictive maintenance – maintenance and spares provisioning – maintainability prediction and demonstration – concepts and definition of availability.

UNIT III OPTIMIZATION OF SYSTEM RELIABILITY 7

Optimization techniques for system reliability with redundancy – heuristic methods applied to optimal system reliability- redundancy allocation by dynamic programming – reliability optimization by non linear programming.

UNIT IV THE ANALYSIS OF FAILURE DATA AND RELIABILITY TESTING 7

Data collection – empirical methods – ungrouped and grouped complete, censored data – static life estimation – test time calculation – burn in testing, acceptance, sequential, binomial testing – accelerated life testing – ther acceleration models – experimental design – reliability growth process – idealized growth curve – various growth models – identifying failure and repair distributions.

UNIT V PACKAGING AND TRANSPORTATION FOR RELIABILITY 7

Objectives – preservation-packaging – transportation and subsequent storage – reliability and the customer - Purchase of equipment – installation – commissioning a new system – reliability prediction and control – reliability management – the people concerned with reliability, coordination, training

TOTAL: 45 PERIODS

OUTCOMES

- The Student must apply and optimize reliability for time independent and time dependent failure models through various testing methods for various manufacturing amnesty process

TEXT BOOKS:

1. Charles E. Ebling, “An introduction to Reliability and Maintainability Engg”, Tata McGraw-Hill, 2000.

REFERENCES:

1. Patrick D T o’connor, “Practical Reliability Engineringt”, John-Wiley and Sons inc, 2002.
2. David J Smith, “Reliability, Maintainability and Risk: Practical Methods for Engineers”, Butterworth, 2002
3. Way kuo, Rajendra Prasad V, Frank A and Tillman, ching- lai Hwang “Optimal Reliability Design and Applciations”, Cambridge University Press P ltd., 2001.
4. Srinath I.S, Engineering Design and Reliability, ISTE, 1999.
5. Oleg Vinogradov, “Introduction to Mechanical Reliability: A Designers Approach, Hemisphere Publications, 1991.

PR6013 MACHINE TOOL CONTROL AND CONDITION MONITORING L T P C

3 0 0 3

OBJECTIVES:

- To understand the control system of machine tools and its applications
- To understand the objectives, aims and methodology of machine tool condition onitoring and diagnostics.

UNIT I OVERVIEW OF AUTOMATIC CONTROLS IN MACHINE TOOLS 6

Open loop – closed loop system – block diagram representation of machine tool control systems.

UNIT II COMPUTER CONTROL SYSTEM 15

Process computer-peripherals – Data logger-Direct digital control-Supervisory computer control-Adaptive control-types-adaptive control for turning, milling, grinding and EDMProgrammable logic controller-Functions-applications in machine tools.

UNIT III DRIVE SYSTEMS IN MACHINE TOOLS 8

Electrical, hydraulic and pneumatic types – servo motor-stepper motor-ball screw mechanism. Feed back devices-Syncro, resolver, diffraction gratings, potentiometer, and inductosyn-encoders-application in machine tools.

UNIT IV CONDITION MONITORING 8

Condition monitoring techniques – Visual, temperature, vibration, lubricant, thickness, noise and sound. Condition monitoring of machine tools.

UNIT V MACHINE TOOL DIAGNOSTICS 8

Objectives-aims-examples of monitoring and diagnosis-control structures for machine diagnosis-utilization of diagnostic results.

TOTAL: 45 PERIODS

OUTCOMES

- Ability to use different techniques to monitor the machine tool to prevent from failures.

TEXTBOOK

1. Manfred weck, “Hand book of machine tools – Vol.3, John Wiley & Sons, 1984.

REFERENCES:

1. Sushil Kumar Srivstava “ Industrial maintenance management” S.Chand & company ltd., New Delhi, 1998.
2. Mikell P.Groover, “Automation Production system and Computer Integrated Manufacturing”, Prentice Hall of India, Pvt. Ltd., 1995.

PR6014 MINI PROJECT L T P C
0 0 6 3

OBJECTIVES:

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

GE6075 PROFESSIONAL ETHICS IN ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

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 – Introduction to Yoga and meditation for professional excellence and stress management.

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.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - 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 –Code of Conduct – Corporate Social Responsibility

TOTAL: 45 PERIODS

OUTCOME :

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society

TEXTBOOKS:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

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", Cengage Learning, 2009
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
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi 2013.\
6. World Community Service Centre, ' Value Education', Vethathiri publications, Erode, 2011

Web sources:

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

MG6071 ENTERPRENEURSHIP DEVELOPMENT L T P C
3 0 0 3

OBJECTIVES :

- To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.

UNIT I ENTREPRENEURSHIP 9

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

UNIT II MOTIVATION 9

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

UNIT III BUSINESS 9

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

UNIT IV FINANCING AND ACCOUNTING 9

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.

UNIT V SUPPORT TO ENTREPRENEURS 9

Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures - Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

TOTAL : 45 PERIODS

OUTCOMES:

- Upon completion of the course, students will be able to gain knowledge and skills needed to run a business successfully.

TEXTBOOKS :

1. Khanka. S.S., “Entrepreneurial Development” S.Chand & Co. Ltd.,Ram Nagar, New Delhi, 2013.
2. Donald F Kuratko, “ Entreprenuership – Theory, Process and Practice”, 9th Edition, Cengage Learning 2014.

REFERENCES :

1. Hisrich R D, Peters M P, “Entrepreneurship” 8th Edition, Tata McGraw-Hill, 2013.
2. Mathew J Manimala, "Enterprenuership theory at cross roads: paradigms and praxis” 2nd Edition Dream tech, 2005.

3. Rajeev Roy, 'Entrepreneurship' 2nd Edition, Oxford University Press, 2011.
4. EDII "Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development", Institute of India, Ahmadabad, 1986.

ME6012 MAINTENANCE ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.
- To explain the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.
- To illustrate some of the simple instruments used for condition monitoring in industry.

UNIT I PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING 10

Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity – Importance and benefits of sound Maintenance systems – Reliability and machine availability – MTBF, MTTR and MWT – Factors of availability – Maintenance organization – Maintenance economics.

UNIT II MAINTENANCE POLICIES – PREVENTIVE MAINTENANCE 9

Maintenance categories – Comparative merits of each category – Preventive maintenance, maintenance schedules, repair cycle - Principles and methods of lubrication – TPM.

UNIT III CONDITION MONITORING 9

Condition Monitoring – Cost comparison with and without CM – On-load testing and offload testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear-debris analysis.

UNIT IV REPAIR METHODS FOR BASIC MACHINE ELEMENTS 10

Repair methods for beds, slideways, spindles, gears, lead screws and bearings – Failure analysis – Failures and their development – Logical fault location methods – Sequential fault location.

UNIT V REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT 7

Repair methods for Material handling equipment - Equipment records –Job order systems -Use of computers in maintenance.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of the programme, the students can able to implement the maintenance function and different practices in industries for the successful management of maintenance activities
- To identify the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.

TEXT BOOKS:

1. Srivastava S.K., "Industrial Maintenance Management", - S. Chand and Co., 1981
2. Venkataraman .K "Maintancence Engineering and Management", PHI Learning, Pvt. Ltd., 2007

REFERENCES:

1. Bhattacharya S.N., “Installation, Servicing and Maintenance”, S. Chand and Co., 1995
2. White E.N., “Maintenance Planning”, I Documentation, Gower Press, 1979.
2. Garg M.R., “Industrial Maintenance”, S. Chand & Co., 1986.
3. Higgins L.R., “Maintenance Engineering Hand book”, McGraw Hill, 5th Edition, 1988.
4. Armstrong, “Condition Monitoring”, BSIRSA, 1988.
5. Davies, “Handbook of Condition Monitoring”, Chapman &Hall, 1996.
6. “Advances in Plant Engineering and Management”, Seminar Proceedings - IIPE, 1996.