St. PETER'S UNIVERSITY

St. Peter's Institute of Higher Education and Research
(Declared under section 3 of UGC Act 1956)
Avadi, Chennai – 600 054.

PROGRAMME

B.E. (PRODUCTION ENGINEERING)

(I TO VIII SEMESTERS)

REGULATIONS AND SYLLABI

(REGULATIONS – 2012)

B.E. (PRODUCTION ENGINEERING) PROGRAMME
Regulations and Syllabi
(Effective from 2012)

1. Eligibility:

(1)   Candidates who passed the following Examination or any other equivalent Examination thereto and who appeared for the entrance test conducted by the University or approved institutions wherever prescribed are eligible for admission to Four Year B.E. (Production Engineering) Programme.

> Higher Secondary Examination with Mathematics, Physics and Chemistry conducted by the Government of Tamil Nadu or its equivalent in the relevant subjects.

(2)   Candidates who passed Three Year Diploma in Technical Education in the concerned subject conducted by the Government of Tamil Nadu are eligible for admission to Second Year of Four Year B.E. (Production Engineering) Programme.

2. Duration: Four Years comprising 8 Semesters. Each semester has a minimum 90 working days with a minimum of 5 hours a day.

3. Medium: English is the medium of instruction and examination.

4. Weightage for Continuous and End Assessment: The weightage for Continuous Assessment (CA) and End Assessment (EA) be 25:75 unless the ratio is specifically mentioned in the scheme of Examinations.

5. Credit System: Credit system be followed with 18 credits for each semester and each credit is equivalent to 25 hours of effective study provided in the Time Table.

6. Scheme of Examinations

I Semester

Code No.	Course Title	Credit	Marks		
Theory			**CA**	**EA**	**Total**
112EHT01	Technical English – I	1	25	75	100
112MAT02	Mathematics – I	3	25	75	100
112PHT03	Engineering Physics – I	3	25	75	100
112CYT04	Engineering Chemistry – I	3	25	75	100
112EGT05	Engineering Graphics – I	3	25	75	100
112FCT06	Fundamentals of Computing – I	3	25	75	100
Practical					
112CLP01	Computer Practices Laboratory – I	1	25	75	100
112ELP02	Engineering Practices Laboratory – I	1	25	75	100
	Total	**18**	**200**	**600**	**800**

II Semester

Code No.	Course Title	Credit	CA	EA	Total
Theory					
212EHT01	Technical English – II	2	25	75	100
212MAT02	Mathematics – II	3	25	75	100
212PHT03	Engineering Physics – I	2	25	75	100
212CYT04	Engineering Chemistry – II	2	25	75	100
212EMT05	Engineering Mechanics	3	25	75	100
212EET06	Basic Electrical & Electronics Engineering	3	25	75	100
Practical					
212CLP01	Computer Practices Laboratory – II	1	25	75	100
212ELP02	Physics & Chemistry Laboratory – II	1	25	75	100
212DMP03	Computer Aided Drafting and Modelling Laboratory	1	25	75	100
	Total	**18**	**225**	**675**	**900**

III Semester

Code No.	Course Title	Credit	CA	EA	Total
Theory					
312PET01	Transforms And Partial Differential Equation	3	25	75	100
312PET02	Basic Machining Process	2	25	75	100
312PET03	Basic of Thermodynamics and Thermal Engineering	3	25	75	100
312PET04	Engineering Metallurgy	2	25	75	100
312PET05	Fluid Mechanics and Machinery	3	25	75	100
312PET06	Electrical Drives and Control	2	25	75	100
Practical					
312PEP01	Basic Machining Process Lab	1	25	75	100
312PEP02	Fluid Mechanics and Machinery Lab	1	25	75	100
312PEP03	Electrical Engineering Lab	1	25	75	100
	Total	**18**	**225**	**675**	**900**

IV Semester

Code No.	Course Title	Credit	CA	EA	Total
Theory					
412PET01	Statistics and Numerical Methods	3	25	75	100
412PET02	Strength of Materials	3	25	75	100
412PET03	Advanced Machining Process	2	25	75	100
412PET04	Theory of Machines	2	25	75	100
412PET05	Fluid Power Drives and Control	3	25	75	100
412PET06	Electronics and Micro-Processors	2	25	75	100
Practical					
412PEP01	Metallurgy Lab	1	25	75	100
412PEP02	Strength of Materials Lab	1	25	75	100
412PEP03	Computer Aided Machine Drawings Lab	1	25	75	100
	Total	**18**	**225**	**675**	**900**

V Semester

Code No.	Course Title	Credit	Marks		
Theory			CA	EA	Total
512PET01	Environmental Science & Engineering	2	25	75	100
512PET02	Engineering Metrology and Measurements	3	25	75	100
512PET03	Metal Forming Technology	2	25	75	100
512PET04	Engineering Statistics and Quality Control	3	25	75	100
512PET05	Machine Elements Design	2	25	75	100
512PET06	Foundry and Welding Technology	3	25	75	100
Practical					
512PEP01	CNC Machine Lab	1	25	75	100
512PEP02	Fluid Power Lab	1	25	75	100
512PEP03	Electronics & Microprocessors Lab	1	25	75	100
	Total	**18**	**225**	**700**	**900**

VI Semester

Code No.	Course Title	Credit	Marks		
Theory			CA	EA	Total
612PET01	Finite Element Analysis In Manufacturing	2	25	75	100
612PET02	Computer Aided Product Design	3	25	75	100
612PET03	Automated Production and Computer Integrated Manufacturing	3	25	75	100
612PET04	Design of Jigs, Fixtures and Press Tools	3	25	75	100
	Elective – I	2	25	75	100
	Elective – II	2	25	75	100
Practical					
612PEP01	Metal Forming Lab and Special Machines Lab	1	25	75	100
612PEP02	Metrology and Inspection Lab	1	25	75	100
612PEP03	Welding and Foundry Lab	1	25	75	100
	Total	**18**	**225**	**700**	**900**

VII Semester

Code No.	Course Title	Credit	Marks		
Theory			CA	EA	Total
712PET01	Total Quality Management	2	25	75	100
712PET02	Mechatronics	3	25	75	100
712PET03	Process Planning and Cost Estimation	3	25	75	100
712PET04	Robotics	3	25	75	100
	Elective – III	2	25	75	100
	Elective – IV	2	25	75	100
Practical					
712PEP01	Computer Aided Design & Simulation Lab	1	25	75	100
712PEP02	Mechatronics Lab	1	25	75	100
712PEP03	Design and Fabrication Lab	1	25	75	100
	Total	**18**	**225**	**675**	**900**

VIII Semester

Code No.	Course Title	Credit	Marks		
			CA	EA	Total
Theory					
812PET01	Engineering Economics & Cost Analysis	3	25	75	100
	Elective – V	3	25	75	100
	Elective – VI	3	25	75	100
Practical					
812PEP01	Project Work	9	25	75	100
	Total	**18**	**125**	**75**	**500**

LIST OF ELECTIVE COURSES

Code No.	Course Title
Elective – I & II	
612PET05	Marketing Management
612PET06	Quality Control & Reliability Engineering
612PET07	Unconventional Manufacturing Processes
612PET08	Precision Engineering
612PET09	Fuzzy Logic and ANN
612PET10	Instrumentation and Control
612PET11	Surface Engineering
Elective – III & IV	
712PET05	Design of Machine Tool Structure
712PET06	Production Management
712PET07	Ergonomics
712PET08	Composite Materials
712PET09	Processing of Polymer and Composites
712PET10	Engg Economics and Financial Management
712PET11	Purchasing and Materials Management
712PET12	Operations Research
712PET13	Non Destructive Testing Methods
712PET14	Simulation of manufacturing system
Elective – V & VI	
812PET02	Reliability Engineering
812PET03	Machine Tool Control and Condition Monitoring
812PET04	Mini Project
812PET05	Machine Vision
812PET06	Advances in Operation Research
812PET07	Professional Ethics in Engineering
812PET08	Fundamentals of Nanoscience
812PET09	Entrepreneurship Development
812PET10	Production Planning & Control
812PET11	Maintenance Engineering

7. Passing Requirements: The minimum pass mark (raw score) be 50% in End Assessment (EA) and 50% in Continuous Assessment (CA) and End Assessment (EA) put together. No minimum mark (raw score) in Continuous Assessment (CA) be prescribed unless it its specifically mentioned in the scheme of Examination.

8. Grading System: Grading System on a 10 Point Scale be followed with 1 mark = 0.1 Grade point to successful candidates as given below.

CONVERSION TABLE

(1 mark = 0.1 Grade Point on a 10 Point Scale)

Range of Marks	Grade Point	Letter Grade	Classification
90 to 100	9.0 to 10.0	O	First Class
80 to 89	8.0 to 8.9	A	First Class
70 to 79	7.0 to 7.9	B	First Class
60 to 69	6.0 to 6.9	C	First Class
50 to 59	5.0 to 5.9	D	Second Class
0 to 49	0 to 4.9	**F**	**Reappearance**

Procedure for Calculation

$$\text{Cumulative Grade Point Average (CGPA)} = \frac{\text{Sum of Weighted Grade Points}}{\text{Total Credits}}$$

$$= \frac{\sum (CA+EA) \, C}{\sum C}$$

Where Weighted Grade Points in each Course = Grade Points (CA+EA) multiplied by Credits

$$= (CA+EA)C$$

Weighted Cumulative Percentage of Marks(WCPM) = CGPAx10

C- Credit,   CA-Continuous Assessment,   EA- End Assessment

9. Pattern of the Question Paper: The question paper for End Assessment will be set for three hours and for the maximum of 100 marks with following divisions and details.

Part A: 10 questions (with equal distribution to all units in the syllabus). Each question carries 2 marks.

Part B: 5 question with either or type (with equal distribution to all units in the syllabus). Each question carries 16 marks.

The total marks scored by the candidates will be reduced to the maximum prescribed in the Regulations.

Registrar

10. Syllabus

112EHT01 - TECHNICAL ENGLISH – I

AIM:
To encourage students to actively involve in participative learning of English and to help them acquire Communication Skills.

OBJECTIVES:
- To help students develop listening skills for academic and professional purposes.
- To help students acquire the ability to speak effectively in English in real-life situations.
- To inculcate reading habit and to develop effective reading skills.
- To help students improve their active and passive vocabulary.
- To familiarize students with different rhetorical functions of scientific English.
- To enable students write letters and reports effectively in formal and business situations.

UNIT I
General Vocabulary - changing words from one form to another - Adjectives, comparative adjectives – Adverbs - Active and passive voice – Tenses - simple present, present continuous - Adverb forms – Nouns – compound nouns - Skimming and scanning - Listening and transfer of information – bar chart, flowchart - Paragraph writing, description – Discussing as a group and making an oral report on the points discussed, conversation techniques - convincing others.

Suggested activities:
1. Matching words & meanings - Using words in context – Making sentences.
2. Changing sentences from active to passive voice & vice versa.
3. Skimming, cloze exercises, exercises transferring information from text to graphic form – bar charts, flow charts.
4. Writing descriptions using descriptive words & phrases, and technical vocabulary.
5. Role play, conversation exercises, discussions, oral reporting exercises
   Any other related relevant classroom activity

UNIT II
Vocabulary – prefixes & suffixes – simple past tense - Spelling and punctuation – 'wh' Question forms - Scanning, inference - Listening & note-taking - Paragraph writing - comparison and contrast - Creative thinking and speaking.

Suggested Activities:
1. a. Vocabulary actiivities using prefixes and suffixes.
   b. Exercises using questions – asking & answering questions.
2. Scanning the text for specific information
3. Listening guided note-taking - Writing paragraphs using notes, giving suitable headings
   and subheadings for paragraphs. Using expressions of comparison and contrast.
4. Discussion activities and exploring creative ideas.
   Any other related relevant classroom activity

UNIT III
Tenses - simple past, simple future and past perfect - Reading in Context -Listening & note-taking – single line – Definitions – sequencing of sentences – instruction - Persuasive speaking.

Suggested activities:
1. a. Providing appropriate context for the use of tenses
2. Listening and note-taking
3. (a) Writing sentence definitions, instructions
   (b) Identifying the discourse links and sequencing jumbled sentences /
       writing instructions.
4. Speaking exercises, discussions, role play exercises using explaining,   convincing and persuasive strategies
   Any other related relevant classroom activity

UNIT IV
Modal verbs and Probability – Concord subject verb agreement – Correction of errors - Cause and effect expressions – Extended Definition - Speaking about the future plans.

Suggested activities:
1. a. Making sentences using modal verbs to express probability
   b. Gap filling using relevant grammatical form of words.
2. 2. Writing extended definitions
3. Speaking - role play activities, discussions, extempore speaking exercises speculating about the future.
    Any other related relevant classroom activity

UNIT V
'If' conditionals – Gerunds - Intensive reading - Speaking – Presentation of problems & solutions - Itinerary – planning for an industrial visit - Formal Letter writing – Letter to the editor, invititation letter, accepting, declining letter and permission letter.

Suggested activities:
1. a) Sentence completion exercises using 'If' conditionals.
   b) Gap filling exercises using gerunds and present participle forms
2. Reading comprehension exercises.
3. Role play, discussion, debating and speaking activities for stating, discussing
   a. problems and suggesting solutions.
4. Planning a tour, Writing a travel itinerary. Writing letters to officials and to the
   a. editor in formal/official contexts.
   Any other related relevant classroom activity

TEXT BOOK:
1. Department of Humanities & Social Sciences, Anna University, 'English for Engineers and Technologists' Combined Edition (Volumes 1 & 2), Chennai: Orient Longman Pvt. Ltd., 2006. Themes 1 – 4 (Resources, Energy, Computer, Transport)

REFERENCES:
1. Meenakshi Raman and Sangeeta Sharma, 'Technical Communication English skills for Engineers', Oxford University Press, 2008.
2. Andrea, J. Rutherford, 'Basic Communication Skills for Technology', Second Edition, Pearson Education, 2007.

Extensive Reading:
1. A.P.J.Abdul Kalam with Arun Tiwari, 'Wings of Fire' An Autobiography, University Press (India) Pvt. Ltd.,1999, 30th Impression 2007.

NOTE:
The book given under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

112MAT02 - MATHEMATICS – I

UNIT I MATRICES
Characteristic equation – Eigen values and eigen vectors of a real matrix – Properties – Cayley-Hamilton theorem (excluding proof) – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY
Equation of a sphere – Plane section of a sphere – Tangent Plane – Equation of a cone – Right circular cone – Equation of a cylinder – Right circular cylinder.

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

UNIT IV FUNCTIONS OF SEVERAL VARIABLES
Partial derivatives – Euler's theorem for homogenous functions – Total derivatives – Differentiation of implicit functions – Jacobians – Taylor's expansion – Maxima and Minima – Method of Lagrangian multipliers.

UNIT V   MULTIPLE INTEGRALS   Double
integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between Cartesian and polar coordinates – Triple integration in Cartesian co-ordinates – Area as double integral – Volume as triple integral

TEXT BOOK:
1. Bali N. P and Manish Goyal, "Text book of Engineering Mathematics", Third edition, Laxmi Publications(p) Ltd.,(2008).
2. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi, (2007).

REFERENCES:
1. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, (2007).
2. Glyn James, "Advanced Engineering Mathematics", 7th Edition, Pearson Education, (2007).
3. Jain R.K and Iyengar S.R.K," Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House Pvt. Ltd., (2007).

112PHT03 – ENGINEERING PHYSICS I

UNIT-I: ACOUSTICS & ULTRASONICS

Classifications of sound – Characteristics of musical sound – Intensity – Loudness – Weber Fechner law – Decibel – reverberation – reverberation time, derivation of Sabine's formula for reverberation – (Jager's Method) - absorption coefficient and its determination – factors affecting acoustics of building (optimum reverberation time, loudness, focusing, echo, echelon, effect, resonance, and noise) and their remedies – Ultrasonic production –Magnetostriction and piezoelectric methods – Properties – applications of ultrasonic with particular reference to detection of flaws in metal (Non – Destructive testing NDT) – SONAR.

UNIT II LASER & ITS APPLICATIONS

Introduction – Principle of Spontaneous emission and stimulated emission. Population inversion, pumping. Einsteins A and B Coefficient – derivations. Types of lasers – He-Ne, CO_2, Nd-YAG, Semiconductor lasers (homojunction & heterojunction) Qualitative Industrial Applications – Lasers in welding, heat treatment, cutting – Medical applications – Holography (construction & reconstruction).

UNIT III CRYSTAL PHYSICS

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, BBC, FCC and HCP structure –Polymorphism and allotrophy – Crysal defects – point, line and surface defects.

UNIT IV PROPERTIES OF MATTER

Elasticity – types of moduli of elasticity – stress strain diagram –Young's modules of elasticity – rigidity modules – bulk modules – Factors affecting elasticity – twisting couple on a wire – Torsional pendulum – determination of rigidity modules of a wire – depression of a cantilever – Young's modulus by cantilever – uniform and non uniform bending – viscosity – Coefficient of viscosity – Determination of viscosity - Poiseuille's Method –Ostwalds viscometer – comparision of viscosities.

Unit V OPTICS & FIBER OPTICS

Air Wedge theory and experiment – testing of flat surfaces –anti reflection coating – Michelson interferometer – types of fringes, determination of wave length of monochromatic source and thickness of a thin transparent sheet – Double refraction – Photoelasticity – Photoelastic effect – Photoelastic analysis –Photoelastic material – Block diagram of a photoelastic bench.

Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle – Types – Types of optical fibres (material, refraction index, mode)- Double crucible technique of fibre drawing – Fibre drawing – Fibre optical communication system (Block diagram)

TEXT BOOK:

1. S.Stella Mary , m. Parasuraman and a. Mohammed Hidayathullah , 'Engineering Physics I R.K. Publishers, Coimbatore (2012)

REFERENCES:

1. R.K. Gaur and S.C.Gupta, "Engineering Physics" Dhanpat Rai Publications , New Delhi(2003)
2. M.N. Avadhanulu and PG Kshirsagar, 'A Text book of Engineering Physics' S.Chand and company, Ltd. New Delhi, 2005.
3. Serway and Jewett, 'Physics for Scientists and Engineering with Modern Physics', 6th Edition, Thomson Brooks/Cole, Indian reprint (2007).
4. Rajendran, Vand Marikani A, 'Engineering Physics' Tata McGraw Hill Publications Ltd,lll edition New Delhi,(2004).
5. Palaniswamy, P.K. 'Engineering Physics' Scitech publications,Chennai,(2007)
6. Jayakumar.s 'Engineering Physics' , R.K.publishers, Coimbatore. (2007)
7. Jayakumar. S 'Engineering Physics', Pearson Education,New Delhi, (2007).
8. Dr. P. Santhana Raghavan, Dr.P. Ramasamy, Crystal Growth- Process and Methods –KRU Publications-Kumbakonam.

112CYT04   ENGINEERING CHEMISTRY –I

AIM

   To impart a sound knowledge on principles of Chemistry involving industrial application oriented topics required for all engineering branches.

OBJECTIVES
   *   The student should be conversant with the principles, treatment of water for potable and industrial purposes
   *   Principles of polymer chemistry and its application in industries
   *   Industrial application of surface chemistry
   *   Conventional and Non- conventional energy sources and Principle and working of energy storage devices
   *   Chemistry of engineering materials and their industrial applications.

UNIT I   WATER TECHNOLOGY

Characteristics –alkalinity-types of alkalinity and determination - Water - Hardness and problems -Estimation of Hardness by EDTA method - Problems in EDTA Titrations - Domestic water treatment-Disinfection methods (boiling, bleaching powder, chlorination UV treatment, ozonisation) Boiler feed water- Requirements -Disadvantages of using hard water in boilers-Scale and sludge formation, Carry over trouble, Caustic embrittlement and Boiler corrosion –Internal conditioning- colloidal,carbonate,phosphate and calgon conditioning methods. External conditioning -Zeolite Process and Demineralization process- Desalination - Reverse osmosis and Electro dialysis

UNIT II   POLYMERS AND COMPOSITES

Polymers   -   Definition   –Nomenclature -Functionality- Polymerization –Types -addition condensation, copolymerization and co-ordination polymerization –Mechanism of free radicaland Co-ordination polymerization -Plastics-Classification -Preparation .properties and uses of PVC, Teflon – Polycarbonates, Polyurethanes,Nylon 6,6, PET- Rubber-Vulcanisation of rubber ,synthetic rubber,Butyl rubber ,SBR.
Composites- Definition – Types of Composites - Polymer matrix composites –Metal matrix composites – Ceramic matrix composites ,properties and their application

UNIT III   SURFACE CHEMISTRY

Adsorption – Terminology –Types- physical adsorption and chemical adsorption -Differences - Adsorption of gases on solids -Adsorption isotherms -Freundlich adsorption isotherm -Langmuir adsorption isotherm – Limitation. Adsorption of solutes from solutions - Ion exchange adsorption- Pollution abatement -Chromatography
Catalysis –Types-– Role of adsorbent in catalysis.

UNIT IV   NON –CONVENTIONAL ENERGY SOURCES   AND   ENERGY STORAGE DEVICES

Nuclear energy – Difference between chemical and nuclear reactions -fusion and fission reactions – Binding energy – Mass defect-problems- Nuclear reactor- components -Light water nuclear power plant -Breeder reactor –Atom bomb.
Solar energy conversion-Solar cells, wind energy –-Fuel cells– Hydrogen-oxygen fuel cell – Batteries – Dry cell- alkaline battery -Lead - acid battery –Nickel –Cadmium battery - Lithium battery-   Lithium – Sulphur battery.

UNIT V   ENGINEERING MATERIALS

Refractories –classification –acidic, basic and neutral refractories-properties of refractories – refractoriness- refractoriness under load –dimensional stability-porosity-thermal spalling-chemical inertness-Manufacture of alumina, magnesite and zirconia bricks - Abrasives- natural and synthetic abrasives- Quartz, corundum, emery, garnet, diamond, silicon carbide ,alundum and boron carbide- Lubricants- Mechanism of lubrication – Classification - Solid lubricants-graphite and molybdenum disulphide.- Semi -Solid lubricants – Grease- Liquid lubricants -Synthetic lubricants - Blended oils -Properties- Viscosity ,Viscosity index, Flash and fire points, Cloud and pour points,Oiliness. and their significance –Adhesives -Classification and applications

 Nano chemistry- Introduction –Properties –Carbon nanotubes –Classification – Synthesis – Applications

TEXT BOOKS

> 1. P.C.Jain and Monica Jain , ''Engineering Chemistry'', Dhanpat Rai Pub Co
>   Ltd New Delhi (2002)
> 2. S.S.Dara , '' A Text Book of Engineering Chemistry'', S.Chand & Co Ltd
>   New Delhi   (2006)
> 3. Dr.Sayeeda Sultana " Engineering chemistry '' Vol-I Professional and
>   Technical   Publishers, Coimbatore (2011)

REFERENCE BOOKS

> 1**.** B.K.Sharma ''Engineering Chemistry'',Krishna Prakasan Media (P) Ltd
>   Meerut   (2001)
> 2. B.Shiva Sankar ''Engineering Chemistry'',Tata McGraw-Hill Pub Co Ltd
>   New Delhi (2008)

112EGT05 - ENGINEERING GRAPHICS

AIM
To develop graphic skills in students.

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

Concepts and conventions (Not for Examination)
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

Curves used in engineering practices:
Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of squad and circle – Drawing of tangents and normal to the above curves.

Free hand sketching:
Representation of Three Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT II   PROJECTION OF POINTS, LINES AND PLANE SURFACES
Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT III   PROJECTION OF SOLIDS
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT IV   SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES
Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section.

Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones – Development of lateral surfaces of solids with cylindrical cutouts, perpendicular to the axis.

UNIT V   ISOMETRIC AND PERSPECTIVE PROJECTIONS
Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones.
 Perspective projection of prisms, pyramids and cylinders by visual ray method.

TEXT BOOKS:
 N.D. Bhatt, "Engineering Drawing" Charotar Publishing House, 46th Edition, (2003).

REFERENCES:

1. K. V. Natrajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai (2006).
2. M.S. Kumar, "Engineering Graphics", D.D. Publications, (2007).
3. K. Venugopal & V. Prabhu Raja, "Engineering Graphics", New Age International (P) Limited (2008).
4. M.B. Shah and B.C. Rana, "Engineering Drawing", Pearson Education (2005).
5. K. R. Gopalakrishnana, "Engineering Drawing" (Vol.I&II), Subhas Publications (1998).
6. Dhananjay A.Jolhe, "Engineering Drawing with an introduction to AutoCAD" Tata McGraw Hill Publishing Company Limited (2008).
7. 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. Whenever the total number of candidates in a college exceeds 150, the University Examination in that college will be conducted in two sessions (FN and AN on the same day) for 50 percent of student (approx) at a time.

112FCT06 - FUNDAMENTALS OF COMPUTING AND PROGRAMMING

AIM :
To provide an awareness to Computing and Programming

OBJECTIVES :
- To enable the student to learn the major components of a computer system
- To know the correct and efficient ways of solving problems
- To learn to use office automation tools
- To learn to program in C

UNIT I   INTRODUCTION TO COMPUTERS
Introduction – Characteristics of Computers – Evolution of Computers - Computer Generations – Classification of Computers – Basic Computer organization – Number Systems

UNIT II   COMPUTER SOFTWARE
Computer Software –Types of Software – Software Development Steps – Internet Evolution - Basic Internet Terminology – Getting connected to Internet Applications.

UNIT III   PROBLEM SOLVING AND OFFICE APPLICATION SOFTWARE
Planning the Computer Program – Purpose – Algorithm – Flow Charts – Pseudocode -Application Software Packages- Introduction to Office Packages (not detailed commands for examination).

UNIT IV   INTRODUCTION TO C
Overview of C – Constants, Variables and Data Types – Operators and Expressions – Managing Input and Output operators – Decision Making - Branching and Looping.

UNIT V   FUNCTIONS AND POINTERS
Handling of Character Strings – User-defined Functions – Definitions – Declarations - Call by reference – Call by value – Structures and Unions – Pointers – Arrays – The Preprocessor – Developing a C Program : Some Guidelines

TEXT BOOKS:
1. Ashok.N.Kamthane," Computer Programming", Pearson Education (India) (2008).
2. Behrouz A.Forouzan and Richard.F.Gilberg, "A Structured Programming Approach Using C", II Edition, Brooks-Cole Thomson Learning Publications, (2007).

REFERENCES:
1. Pradip Dey, Manas Ghoush, "Programming in C", Oxford University Press. (2007).
2. Byron Gottfried, "Programming with C", 2nd Edition, (Indian Adapted Edition), TMH publications, (2006).
3. Stephen G.Kochan, "Programming in C", Third Edition, Pearson Education India, (2005).
4. Brian W.Kernighan and Dennis M.Ritchie, "The C Programming Language", Pearson Education Inc., (2005).
5. E.Balagurusamy, "Computing fundamentals and C Programming", Tata McGraw-Hill Publishing Company Limited, (2008).
6. S.Thamarai Selvi and R.Murugan, "C for All", Anuradha Publishers, (2008).

112CLP01 - COMPUTER PRACTICE LABORATORY – I

LIST OF EXERCISES

a) Word Processing

1. Document creation, Text manipulation with Scientific notations.
2. Table creation, Table formatting and Conversion.
3. Mail merge and Letter preparation.
4. Drawing - flow Chart

b) Spread Sheet

5. Chart - Line, XY, Bar and Pie.
6. Formula - formula editor.
7. Spread sheet - inclusion of object, Picture and graphics, protecting the document   and sheet.
8. Sorting and Import / Export features.

Simple C Programming

9. Data types, Expression Evaluation, Condition Statements.
10. Arrays
11. Structures and Unions
12. Functions

* For programming exercises Flow chart and pseudocode are essential

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS

Hardware

☐LAN System with 33 nodes (OR) Standalone PCs – 33 Nos.
☐Printers – 3 Nos.

Software

☐OS – Windows / UNIX Clone
☐Application Package – Office suite
☐Compiler – C

112ELP02 - ENGINEERING PRACTICES LABORATORY

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

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

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

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

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.

REFERENCES:

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

SEMESTER EXAMINATION PATTERN

The Laboratory examination is to be conducted for Group A & Group B, allotting 90 minutes for each group, with a break of 15 minutes. Both the examinations are to be taken together in sequence, either in the FN session or in the AN session. The maximum marks for Group A and Group B lab examinations will be 50 each, totaling 100 for the Lab course. The candidates shall answer either I or II under Group A and either III or IV under Group B, based on lots.

Engineering Practices Laboratory

List of equipment and components
(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

<p>Test</p>

212EHT01 - TECHNICAL ENGLISH II

AIM:
To encourage students to actively involve in participative learning of English and to help them acquire Communication Skills.

OBJECTIVES:
1. To help students develop listening skills for academic and professional purposes.
2. To help students acquire the ability to speak effectively in English in real-life situations.
3. To inculcate reading habit and to develop effective reading skills.
4. To help students improve their active and passive vocabulary.
5. To familiarize students with different rhetorical functions of scientific English.
6. To enable students write letters and reports effectively in formal and business situations.

UNIT I
Technical Vocabulary - meanings in context, sequencing words, Articles- Prepositions, intensive reading& predicting content, Reading and interpretation, extended definitions, Process description

Suggested activities:
1. Exercises on word formation using the prefix 'self' - Gap filling with preposition.
2. Exercises - Using sequence words.
3. Reading comprehension exercise with questions based on inference – Reading headings
4. and predicting the content – Reading advertisements and interpretation.
5. Writing extended definitions – Writing descriptions of processes – Writing paragraphs based on discussions – Writing paragraphs describing the future.

UNIT II
Phrases / Structures indicating use / purpose – Adverbs-Skimming – Non-verbal communication - Listening – correlating verbal and non-verbal communication -Speaking in group discussions – Formal Letter writing – Writing analytical paragraphs.

Suggested activities:
1. Reading comprehension exercises with questions on overall content – Discussions analyzing stylistic features (creative and factual description) - Reading comprehension exercises with texts including graphic communication - Exercises in interpreting non-verbal communication.
2. Listening comprehension exercises to categorise data in tables.
3. Writing formal letters, quotations, clarification, complaint – Letter seeking permission for Industrial visits– Writing analytical paragraphs on different debatable issues.

UNIT III
Cause and effect expressions – Different grammatical forms of the same word - Speaking – stress and intonation, Group Discussions - Reading – Critical reading - Listening, - Writing – using connectives, report writing – types, structure, data collection, content, form, recommendations .

Suggested activities:
1. Exercises combining sentences using cause and effect expressions – Gap filling exercises using the appropriate tense forms – Making sentences using different grammatical forms of the same word. (Eg: object –verb / object – noun)
2. Speaking exercises involving the use of stress and intonation – Group discussions– analysis of problems and offering solutions.
3. Reading comprehension exercises with critical questions, Multiple choice question.
4. Sequencing of jumbled sentences using connectives – Writing different types of reports like industrial accident report and survey report – Writing recommendations.

UNIT IV

Numerical adjectives – Oral instructions – Descriptive writing – Argumentative paragraphs – Letter of application - content, format (CV / Bio-data) - Instructions, imperative forms - Checklists, Yes/No question form – E-mail communication.

Suggested Activities:
1. Rewriting exercises using numerical adjectives.
2. Reading comprehension exercises with analytical questions on content – Evaluation of content.
3. Listening comprehension – entering information in tabular form, intensive listening exercise and completing the steps of a process.
4. Speaking - Role play – group discussions – Activities giving oral instructions.
5. Writing descriptions, expanding hints – Writing argumentative paragraphs – Writing formal letters – Writing letter of application with CV/Bio-data – Writing general and safety instructions – Preparing checklists – Writing e-mail messages.

UNIT V

Speaking - Discussion of Problems and solutions - Creative and critical thinking – Writing an essay, Writing a proposal.

Suggested Activities:
1. Case Studies on problems and solutions
2. Brain storming and discussion
3. Writing Critical essays
4. Writing short proposals of 2 pages for starting a project, solving problems, etc.
5. Writing advertisements.

TEXT BOOK:

1. Chapters 5 – 8. Department of Humanities & Social Sciences, Anna University, 'English for Engineers and Technologists' Combined Edition (Volumes 1 & 2), Chennai: Orient Longman Pvt. Ltd., 2006. Themes 5 – 8 (Technology, Communication, Environment, Industry)

REFERENCES:

1. P. K. Dutt, G. Rajeevan and C.L.N Prakash, 'A Course in Communication Skills', Cambridge University Press, India 2007.
2. Krishna Mohan and Meera Banerjee, 'Developing Communication Skills', Macmillan India Ltd., (Reprinted 1994 – 2007).
3. Edgar Thorpe, Showick Thorpe, 'Objective English', Second Edition, Pearson Education, 2007.

Extensive Reading:

1. Robin Sharma, 'The Monk Who Sold His Ferrari', Jaico Publishing House, 2007

Note:
The book listed under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

212MAT02 - MATHEMATICS – II

UNIT I   ORDINARY DIFFERENTIAL EQUATIONS
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 II   VECTOR CALCULUS
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 parallelpipeds.

UNIT III   ANALYTIC FUNCTIONS   Functions   of   a
complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping : w= z+c, cz, 1/z, and bilinear transformation.

UNIT IV   COMPLEX INTEGRATION
Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor and Laurent expansions – Singular points – Residues – Residue theorem – Application of residue theorem to evaluate real integrals – Unit circle and semi-circular contour(excluding poles on boundaries).

UNIT V   LAPLACE TRANSFORM   Laplace   transform
– Conditions for existence – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function and impulse functions – Transform of periodic functions.

Definition of Inverse Laplace transform as contour integral – Convolution theorem (excluding proof) – Initial and Final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

TEXT BOOK:
1. Bali N. P and Manish Goyal, "Text book of Engineering Mathematics", 3rd Edition, Laxmi Publications (p) Ltd., (2008).
2. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi, (2007).

REFERENCES:
1. Ramana B.V, "Higher Engineering Mathematics",Tata McGraw Hill Publishing Company, New Delhi, (2007).
2. Glyn James, "Advanced Engineering Mathematics", 3rd Edition, Pearson Education, (2007).
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 7th Edition, Wiley India, (2007).
4. Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House Pvt. Ltd., (2007).

212PHT03 – ENGINEERING PHYSICS II

UNIT I: CONDUCTING MATERIALS

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

UNIT II: SEMICONDUCTING MATERIALS

INSTRINSIC SEMICONDUCTOR: Intrinsic semiconductor – Density of electrons in conduction band – Density of holes in valence band – Intrinsic carrier concentration – derivation – Fermi level – Variation – of Fermi with temperature – electrical conductivity – mobility – band gap determination.

EXTRINSIC SEMICONDUCTOR: Extrinsic semiconductors – carrier concentration derivation in n-type and p- type semiconductor variation of Fermi level with temperature and impurity concentration – compound semiconductors.

UNIT III: DIELECTRIC MATERIALS

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

UNIT IV: QUANTUM AND SUPER CONDUCTING MATERIALS

Black body radiation – Planck's theory (derivation) – Deduction of Wien' displacement law and Rayleigh – jeans' Law from Planck's theory - Compton Effect – Theory and experimental verification – Matter waves – Schrodinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box – Superconductivity: Properties – Types of super conductors – BCS theory of superconductivity(Qualitative) – High Tc superconductors – Applications of super conductors - SQUID, cryotron, magnetic levitation.

UNIT V: NEW ENGINEERING & NANO MATERIALS

Metallic glasses: Preparation, properties and applications – Shape memory alloys (SMA): Characteristic, Properties of NiTi alloy, application, advantages and disadvantages of SMA-synthesis –Plasma arcing – Chemical vapour deposition – sol-gels – eletrodeposition – ball milling – properties of nanoparticles and applications Carbon nanotubes: fabrication – arc method – pulsed laser deposition – chemical vapour deposition –Structure – properties and applications.

TEXT BOOKS:

1. S. Stella Mary, M. Parasuraman and A. Mohammed Hidayathullah, 'Engineering Physics ll' R.K Publishers, Coimbatore(2012).

REFERENCES:

1. Charles Kittel 'Introduction to solid state physics', John Wiley & Sons, 7th edition, Singapore (2007).
2. Charles P.Poole and Frank J. Ownen, 'Introduction to nanotechnology' Wiley India (2007)(for unit V)
3. Rajendran. v and Marikani.A. 'Materials Science' Tata McGraw hill publications, (2004) New Delhi.
4. Jayakumar. S, 'Materials Science' R.K. Publishers, Coimbatore, (2008).
5. Palanisamy P.K, 'Materials Science' , Scitech publications (India) Pvt. Ltd., Chennai, Second Edition(2007).
6. M. Arumugam, 'Materials Science' Anuradha Publications, Kumbakonam, (2006).

212CYT04   ENGINEERING CHEMISTRY –II

To impart a sound knowledge on principles of Chemistry involving industrial application oriented topics required for all engineering branches.

OBJECTIVES
* The student should be conversant with the principles of Electrochemistry Electrochemical cells and their applications.
* Principles of corrosion and its inhibition.
* Chemistry of fuels and combustion.
* Importance of phase rule , alloys and their industrial application.
* Analytical techniques and their instrumentation.

UNIT I   ELECTROCHEMISTRY
Electrochemical cells-Reversible and irreversible cells-Concentration cells -EMF Measurement of emf- Single electrode potential -Nernst equation(problem)-Reference electrodes-Standard hydrogen electrode-Calomel electrode-Ion selective electrode-Glass electrode-Measurement of pH-Electrochemical series-significance- Potentiometric titration (redox Fe^{2+}Vs Dichromate,) - Conductometric titrations (acid-base and precipitation titrations)

UNIT II   CORROSION AND CORROSION CONTROL
Chemical corrosion –Pilling- Bedworth rule-electrochemical corrosion –mechanism Different types of corrosion-Galvanic corrosion-Differential aeration corrosion –pitting corrosion-waterline corrosion – stress corrosion –crevice corrosion-Factors influencing corrosion -corrosion control-sacrificial anode and impressed cathodic current methods-corrosion inhibitors –protective coatings-paints-constituents-functions- metallic coatings- anodic coating –cathodic coating- metal cladding - diffusion coating - electroplating of gold and electroless plating of nickel.

UNIT III   FUELS AND COMBUSTION
Calorific value –Classification-coal -Proximate analysis and Ultimate analysis-Metallurgical Coke-Manufacture by Bee-hive oven and Otto-Hoffmann method-Petroleum processing and fractions-Cracking -Catalytic cracking and methods-Knocking –octane number –cetane number-Synthetic petrol-Fischer –Tropsch and Bergius process-Gaseous fuels-,Water gas-Producer gas., CNG and LPG-Flue gas analysis-Orsat apparatus-Theoretical air for combustion-Problems

UNIT IV   PHASE RULE AND ALLOYS
Statement and Explanation of terms involved with examples- Phase diagram-One Component system-Water system- Condensed phase rule-Construction of phase diagram by Thermal analysis-Simple eutectic system(Lead-silver system only)- Limitations of phase rule-Alloys-importance of Ferrous alloys-Nichrome-Alnico -Stainless steel-Heat treatment of steel -Non-Ferrous alloys -Brass and Bronze

UNIT V   ANALYTICAL TECHNIQUES
Spectroscopy –Atomic and molecular spectroscopy-Absorption spectrum –Emission spectrum **–** Absorbance**-**Beer-Lamberts law-Problems-UV Visible spectroscopy -IR spectroscopy-(principle,instrumentation (block diagram only)and applications colorimetry(principle ,instrumentation and applications)-Estimation of iron by colorimetry.Flame photometry-(principle , instrumentation and applications)-Estimation of Sodium by Flame photometry-Atomic absorption spectroscopy(principle , instrumentation and applications)-Estimation of Nickel by Atomic absorption spectroscopy.

TEXT BOOKS

1. P.C.Jain and Monica Jain , ''Engineering Chemistry'', Dhanpat Rai Pub Co Ltd ,New Delhi (2002)
2. S.S.Dara , '' A Text Book of Engineering Chemistry'', S.Chand & Co Ltd New Delhi (2006)
3. Dr.Sayeeda Sultana " Engineering chemistry '' Vol –II, Professional and Technical publishers ,Coimbatore (2011)

REFERENCE BOOKS

1. B.K.Sharma ''Engineering Chemistry'',Krishna Prakasan Media (P) Ltd Meerut   (2001)
2. B.Shiva Sankar ''Engineering Chemistry'',Tata McGraw-Hill Pub Co Ltd New Delhi **(** 2008)

212EMT05 - ENGINEERING MECHANICS

OBJECTIVE

At the end of this course the student should be able to understand the vectorial and scalar representation of forces and moments, static equilibrium of particles and rigid bodies both in two dimensions and also in three dimensions. Further, he should understand the principle of work and energy. He should be able to comprehend the effect of friction on equilibrium. He should be able to understand the laws of motion, the kinematics of motion and the interrelationship. He should also be able to write the dynamic equilibrium equation. All these should be achieved both conceptually and through solved examples.

UNIT I   BASICS & STATICS OF PARTICLES

Introduction – Units and Dimensions – Laws of Mechanics – Lame's theorem, Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments – Vector operations: additions, subtraction, dot product, cross product – Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

UNIT II   EQUILIBRIUM OF RIGID BODIES

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions – Examples

UNIT III   PROPERTIES OF SURFACES AND SOLIDS

Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, - Angle section, Hollow section by using standard formula – second and product moments of plane area – Rectangle, triangle, circle from integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Mass moment of inertia – Derivation of mass moment of inertia for rectangular section, prism, sphere from first principle – Relation to area moments of inertia.

UNIT IV   DYNAMICS OF PARTICLES   Displacements,
Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies.

UNIT V   FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS

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

TEXT BOOK:

1. Beer, F.P and Johnson Jr. E.R. "Vector Mechanics for Engineers", Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, (1997).

REFERENCES:

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

212CCT05 - CIRCUIT THEORY
(Common to EEE, EIE and ICE Branches)

UNIT I   BASIC CIRCUITS ANALYSIS
Ohm's Law – Kirchoffs laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits.

UNIT II   NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS:
Network reduction: voltage and current division, source transformation – star delta conversion. Thevenins and Novton & Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem.

UNIT III   RESONANCE AND COUPLED CIRCUITS
Series and paralled resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

UNIT IV   TRANSIENT RESPONSE FOR DC CIRCUITS
Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input.

UNIT V   ANALYSING THREE PHASE CIRCUITS
Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits.

TEXT BOOKS:
1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis",Tata McGraw Hill publishers, 6th edition, New Delhi, (2002).
2. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis",Tata McGraw Hill, (2007).

REFERENCES:
1. Paranjothi SR, "Electric Circuits Analysis," New Age International Ltd., New Delhi, (1996).
2. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, Tata McGraw-Hill, New Delhi (2001).
3. Chakrabati A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, (1999).
4. Charles K. Alexander, Mathew N.O. Sadik, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, (2003)

212EDT05 - ELECTRIC CIRCUITS AND ELECTRON DEVICES
(For ECE, CSE, IT and Biomedical Engg. Branches)

UNIT I   CIRCUIT ANALYSIS TECHNIQUES
Kirchoff's current and voltage laws – series and parallel connection of independent sources – R, L and C – Network Theorems – Thevenin, Superposition, Norton, Maximum power transfer and duality – Star-delta conversion.

UNIT II   TRANSIENT RESONANCE IN RLC CIRCUITS
Basic RL, RC and RLC circuits and their responses to pulse and sinusoidal inputs – frequency response – Parallel and series resonances – Q factor – single tuned and double tuned circuits.

UNIT III   SEMICONDUCTOR DIODES
Review of intrinsic & extrinsic semiconductors – Theory of PN junction diode – Energy band structure – current equation – space charge and diffusion capacitances – effect of temperature and breakdown mechanism – Zener diode and its characteristics.

UNIT IV   TRANSISTORS
Principle of operation of PNP and NPN transistors – study of CE, CB and CC configurations and comparison of their characteristics – Breakdown in transistors – operation and comparison of N-Channel and P-Channel JFET – drain current equation – MOSFET – Enhancement and depletion types – structure and operation – comparison of BJT with MOSFET – thermal effect on MOSFET.

UNIT V   SPECIAL SEMICONDUCTOR DEVICES
**   (Qualitative Treatment only)**
Tunnel diodes – PIN diode, varactor diode – SCR characteristics and two transistor equivalent model – UJT – Diac and Triac – Laser, CCD, Photodiode, Phototransistor, Photoconductive and Photovoltaic cells – LED, LCD.

TEXT BOOKS:
1. Joseph A. Edminister, Mahmood, Nahri, "Electric Circuits" – Shaum series,Tata McGraw Hill, (2001)
2. S. Salivahanan, N. Suresh kumar and A. Vallavanraj, "Electronic Devices and Circuits",Tata McGraw Hill, 2nd Edition, (2008).
3. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5th Edition, (2008).

REFERENCES:
1. Robert T. Paynter, "Introducing Electronics Devices and Circuits", Pearson Education, 7th Education, (2006).
2. William H. Hayt, J.V. Jack, E. Kemmebly and steven M. Durbin, "Engineering Circuit Analysis",Tata McGraw Hill, 6th Edition, 2002.
3. J. Millman & Halkins, Satyebranta Jit, "Electronic Devices & Circuits",Tata McGraw Hill, 2nd Edition, 2008.

212EET06 - BASIC ELECTRICAL AND ELECTRONICS ENGINEERING
(Common to branches under Civil, Mechanical and Technology faculty)

UNIT I   ELECTRICAL CIRCUITS & MEASURMENTS

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

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

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

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

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).

TEXT BOOKS:

1. V.N. Mittle "Basic Electrical Engineering",Tata McGraw Hill Edition, New Delhi, 1990.
2. R.S. Sedha, "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)

212CMT06 - BASIC CIVIL & MECHANICAL ENGINEERING
(Common to branches under Electrical and I & C Faculty)

A – CIVIL ENGINEERING

UNIT I SURVEYING AND CIVIL ENGINEERING MATERIALS

Surveying: Objects – types – classification – principles – measurements of distances – angles – leveling – determination of areas – illustrative examples.

Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel sections.

UNIT II   BUILDING COMPONENTS AND STRUCTURES

Foundations: Types, Bearing capacity – Requirement of good foundations.

Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – Mechanics – Internal and external forces – stress – strain – elasticity – Types of Bridges and Dams – Basics of Interior Design and Landscaping.

B – MECHANICAL ENGINEERING

UNIT III   POWER PLANT ENGINEERING
Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps and turbines – working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

UNIT IV   I C ENGINES
Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Boiler as a power plant.

UNIT V   REFRIGERATION AND AIR CONDITIONING SYSTEM
Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.

REFERENCES:

1. Shanmugam G and Palanichamy M S, "Basic Civil and Mechanical Engineering",Tata McGraw Hill Publishing Co., New Delhi, (1996).
2. Ramamrutham. S, "Basic Civil Engineering", Dhanpat Rai Publishing Co. (P) Ltd. (1999).
3. Seetharaman S. "Basic Civil Engineering", Anuradha Agencies, (2005).
4. Venugopal K and Prahu Raja V, "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam, (2000).
5. Shantha Kumar S R J., "Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai, (2000).

212CLP01 - COMPUTER PRACTICE LABORATORY – II

LIST OF EXPERIMENTS

1. UNIX COMMANDS

Study of Unix OS - Basic Shell Commands - Unix Editor

2. SHELL PROGRAMMING

Simple Shell program - Conditional Statements - Testing and Loops

3. C PROGRAMMING ON UNIX

Dynamic Storage Allocation-Pointers-Functions-File Handling

HARDWARE / SOFTWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS

Hardware

☐1 UNIX Clone Server
☐33 Nodes (thin client or PCs)
☐Printer – 3 Nos.

Software

☐OS – UNIX Clone (33 user license or License free Linux)
☐Compiler - C

COMMON TO ALL BRANCHES

PHYSICS LABORATORY (Any Ten Experiments)

1. Determination of Young's modulus of the material – non uniform bending.
2. Determination of Young's modulus of the material – uniform bending .
3. Determination of viscosity of liquid – Poiseuille's method.
4. Torsional pendulum – Determination of rigidity modulus.
5. Determination of the thermal conductivity of a bad conductor – Lee's Disc method.
6. Determination of the thickness of a thin wire – Air Wedge method.
7. (a) Particle size determination using Diode Laser.
   (b) Determination of Laser Parameters – Wave length, and angle of divergence.
   (c) Determination of acceptance angle in an optical fiber.
8. Spectrometer dispersive power of a prism.
9. Determination of Wave length of mercury spectrum –Spectrometer grating.
10. Determination of Band Gap of a Semiconductor diode.
11. Determination of velocity of sound and compressibility of liquid- Ultrasonic Interferometer.
12. Determination of Hysteresis loss in a ferromagnetic material

- **A minimum of FIVE experiments shall be offered in Each Semester.**
- **Laboratory classes on alternate weeks for physics and chemistry.**
- **The lab examinations will be held only in the second Semester.**

CHEMISTRY LABORATORY – II

LIST OF EXPERIMENTS

1. Conductometric titration (Simple acid base)

2. Conductometric titration (Mixture of weak and strong acidsVs base)

3. Conductometric titration using $BaCl_2$ Vs $Na_2 SO_4$

4. Potentiometric Titration (Fe^{2+}/KMnO4 or $K_2Cr_2O_7$)

5. PH titration (acid & base)

6. Determination of water of crystallization of a crystalline salt (Copper sulphate)

7. Estimation of Ferric iron by spectrophotometry.

8. Estimation of sodium and potassium by flame photometry.

- Any five experiments.

212DMP03 COMPUTER AIDED DRAFTING AND MODELING LABORATORY

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.

List of Equipments for a batch of 30 students:

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.

212ELP03 - ELECTRICAL CIRCUIT LABORATORY
(Common to EEE, EIE and ICE)

LIST OF EXPERIMENTS

1. Verification of ohm's laws and kirchoff's laws.
2. Verification of Thevemin's and Norton's Theorem
3. Verification of superposition Theorem
4. Verification of maximum power transfer theorem.
5. Verification of reciprocity theorem
6. Measurement of self inductance of a coil
7. Verification of mesh and nodal analysis.
8. Transient response of RL and RC circuits for DC input.
9. Frequency response of series and parallel resonance circuits.
10. Frequency response of single tuned coupled circuits.

212CDP03   CIRCUITS AND DEVICES LABORATORY

1. Verification of KVL and KCL
2. Verification of Thevenin and Norton Theorems.
3. Verification of superposition Theorem.
4. Verification of Maximum power transfer and reciprocity theorems.
5. Frequency response of series and parallel resonance circuits.
6. Characteristics of PN and Zener diode
7. Characteristics of CE configuration
8. Characteristics of CB configuration
9. Characteristics of UJT and SCR
10. Characteristics of JFET and MOSFET
11. Characteristics of Diac and Triac.
12. Characteristics of Photodiode and Phototransistor.

312ITT01 - TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS
(Common to all branches)

OBJECTIVES

The course objective is to develop the skills of the students in the areas of Transforms and Partial Differtial Equations. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.

1.   FOURIER SERIES

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 identify – Harmonic Analysis.

2.   FOURIER TRANSFORMS

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

3.   PARTIAL DIFFERENTIAL EQUATIONS

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

4.   APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded) – Fourier series solutions in cartesian coordinates.

5.   Z -TRANSFORMS AND DIFFERENCE EQUATIONS

Z-transforms - Elementary properties – Inverse Z-transform – Convolution theorem -Formation of difference equations – Solution of difference equations using Z-transform.

TEXT BOOKS
1. Grewal, B.S, *'Higher Engineering Mathematics'* 40th Edition, Khanna publishers, Delhi, (2007)

REFERENCES
1. Bali.N.P and Manish Goyal *'A Textbook of Engineering Mathematics'*, Seventh Edition, Laxmi Publications(P) Ltd. (2007)
2. Ramana.B.V. *'Higher Engineering Mathematics'* Tata Mc-GrawHill Publishing Company limited, New Delhi (2007).
3. Glyn James, *'Advanced Modern Engineering Mathematics'*, Third edition-Pearson Education (2007).
4. Erwin Kreyszig *'Advanced Engineering Mathematics',* Eighth edition-Wiley India (2007).

312PET02 - BASIC MACHINING PROCESSES

OBJECTIVE:
(i) To impart the knowledge on basic concepts of various machining processes and machine tools

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

UNIT V   GRINDING
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.

TEXT BOOK

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

REFERENCES

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

312PET03 - BASICS OF THERMODYNAMICS AND THERMAL ENGINEERING

OBJECTIVE
To introduce fundamental concepts in thermodynamics, heat tramsfer, propulsion and
 refrigeration and air conditioning.

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

UNIT III   STEAM AND JET PROPULSION
Properties of steam – Rankine cycle – Steam Nozzles – Simple jet propulsion system – Thrust
rocket motor – Specific impulse.

UNIT IV   REFRIGERATION AND AIR-CONDITIONING
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
Conduction in parallel, radial and composite wall – Basics of Convective heat transfer -
Fundamentals of Radiative heat transfer – Flow through heat exchangers.

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

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.

312PET04 - ENGINEERING METALLURGY

OBJECTIVE:
(i) To introduce the various concepts of metallurgy, metallurgical structures and mechanical properties, testing of metals
(ii) To impart the knowledge on metallurgy with respect to foundry and welding processes

UNIT I   CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS
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
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 AND NON FERROUS METALS
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
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
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.

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" Prentice Hall of India Private Limited, 7th Edition Indian Reprint 2004".

REFERENCES
1. Sydney H.Avner "Introduction to Physical Metallurgy" McGraw Hill Book Co., 2001
2. Raghavan V. Materials Science & Engg" Prentice Hall of India Pvt.Ltd., 2004
3. William D Callister "Material Science & Engg – John Wiley & Sons, 2002
4. L.H.Van Vlack, "Materials Engg. Concepts and Applications, 2001.

312PET05   FLUID MECHANICS AND MACHINERY
(Common to Aeronautical, Mechanical, Automobile & Production)

OBJECTIVES
- The student is introduced to the mechanics of fluids through a thorough understanding of the properties of the fluids. The dynamics of fluids is introduced through the control volume approach which gives an integrated under standing of the transport of mass, momentum and energy.
- The applications of the conservation laws to flow though pipes and hydraulics machines are studied

UNIT I   INTRODUCTION
Units & Dimensions. Properties of fluids – Specific gravity, specific weight, viscosity, compressibility, vapour pressure and gas laws – capillarity and surface tension. Flow characteristics: concepts of system and control volume. Application of control volume to continuity equiation, energy equation, momentum equation and moment of momentum equation.

UNIT II   FLOW THROUG CIRCULAR CONDUITS
Laminar flow though circular conduits and circular annuli. Boundary layer concepts. Boundary layer thickness. Hydraulic and energy gradient. Darcy – Weisbach equiation. Friction factor and Moody diagram. Commercial pipes. Minor losses. Flow though pipes in series and in parallel.

UNIT III   DIMENSIONAL ANALYSIS
Dimension and units: Buckingham's Π theorem. Discussion on dimensionless parameters. Models and similitude. Applications of dimensionless parameters.

UNIT IV   ROTO DYNAMIC MACHINES
Homologus units. Specific speed. Elementary cascade theory. Theory of turbo machines. Euler's equation. Hydraulic efficiency. Velocity components at the entry and exit of the rotor. Velocity triangle for single stage radial flow and axial flow machines. Centrifugal pumps, turbines, performance curves for pumps and turbines.

UNIT V   POSITIVE DISPLACEMENT MACHINES
Recriprocating pumps, Indicator diagrams, Work saved by air vessels. Rotory pumps. Classification. Working and performance curves.

TEXT BOOKS:
1.   Streeter. V. L., and Wylie, E.B., Fluid Mechanics, McGraw Hill, 1983.
2.   Rathakrishnan. E, Fluid Mechanics, Prentice Hall of India (II Ed.), 2007.

REFERENCES:
1.   Ramamritham. S, Fluid Mechanics, Hydraulics and Fluid Machines, Dhanpat Rai & Sons, Delhi, 1988.
2.   Kumar. K.L., Engineering Fluid Mechanics (VII Ed.) Eurasia Publishing House (P) Ltd., New Delhi, 1995.
3.   Bansal, R.K., Fluid Mechanics and Hydraulics Machines, Laxmi Publications (P) Ltd., New Delhi.

312PET06 - ELECTRICAL DRIVES AND CONTROLS
(Common to Mechanical, Production &Technology Faculty)

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

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

REFERENCE BOOKS
1. PILLAI.S.K "A first course on Electric drives", Wiley Eastern Limited, 1998
2. M.D.SINGH, K.B.KHANCHANDANI, "Power Electronics", Tata McGraw-Hill, 1998
3. H.Partab, "Art and Science and Utilisation of electrical energy", Dhanpat Rai and Sons, 1994

312PEP01 - BASIC MACHINING PROCESS LAB

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

312PEP02 - FLUID MECHANICS AND MACHINERY LAB
(Common to Mechanical & Production)

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.

LIST OF EQUIPMENT
(for a batch of 30 students)

1. Orifice meter setup
2. Venturi meter setup
3. Rotameter setup
4. Pipe Flow analysis setup
5. Centrifugal pump/submergible pump setup
6. Reciprocating pump setup
7. Gear pump setup
8. Pelton wheel setup
9. Francis turbine setup
10. Kaplan turbine setup
Quantity: one each.

312PEP03 - **ELECTRICAL ENGINEERING LABORATORY**
(Common to Mechanical & Production)

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

LIST OF EQUIPMENT
(for batch of 30 students)

Equipment	-	No.
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

412PET01 - STATISTICS AND NUMERICAL METHODS
(Common to Mechanical, Automobile & Production)

UNIT I   TESTING OF HYPOTHESIS

Sampling distributions - Tests for single mean, Proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – chi-square test for goodness of fit – Independence of attributes.

UNIT II   DESIGN OF EXPERIMENTS

Completely randomized design – Randomized block design – Latin square design - 2^2 - factorial design.

UNIT III   SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS

Newton-Raphson method- Gauss Elimination method – Pivoting - Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel - Matrix Inversion by Gauss-Jordan method - Eigenvalues of a matrix by Power method .

UNIT IV   INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION

Lagrange's and Newton's divided difference interpolation –Newton's forward and backward difference interpolation - Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal and Simpson's 1/3 rules.

UNIT V   NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first and second order equations - Milne's predictor-corrector methods for solving first order equations - Finite difference methods for solving second order equation.

TEXT BOOKS

1. R.A. Johnson and C.B. Gupta, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th edition, 2007 (For units 3, 4 and 5).
2. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, New Delhi, 2004.

BOOKS FOR REFERENCES:

1. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia , 8th edition, 2007.
2. M.R. Spiegel, J. Schiller and R.A. Srinivasan, "Schaum's Outlines Probability and Statistics", Tata McGraw Hill edition, 2004.
3. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 5th Edition, Tata McGraw-Hill, New Delhi, 2007.
4. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 6th Edition, Pearson Education Asia, New Delhi, 2006.

412PET02 - STRENGTH OF MATERIALS
(Common to Mechanical, Automobile & Production)

OBJECTIVES
- To gain knowledge of simple stresses, strains and deformation in components due to external loads.
- To assess stresses and deformations through mathematical models of beams, twisting bars or combinations of both.
- Effect of component dimensions and shape on stresses and deformations are to be understood.
- The study would provide knowledge for use in the design courses
Rigid and Deformable bodies – Strength, Stiffness and Stability – Stresses; Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxial loads.

UNITII   BEAMS - LOADS AND STRESSES
Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever, Simply supported and Overhanging beams – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Effect of shape of beam section on stress induced – Shear stresses in beams – Shear flow

UNITIII   TORSION
Analysis of torsion of circular bars – Shear stress distribution – Bars of Solid and hollow circular section – Stepped shaft – Twist and torsion stiffness – Compound shafts – Fixed and simply supported shafts – Application to close-coiled helical springs – Maximum shear stress in spring section including Wahl Factor – Deflection of helical coil springs under axial loads – Design of helical coil springs – stresses in helical coil springs under torsion loads

UNIT IV   BEAMDEFLECTION
Elastic curve of Neutral axis of the beam under normal loads – Evaluation of beam deflection and slope: Double integration method, Macaulay Method, and Moment-area Method –Columns – End conditions – Equivalent length of a column – Euler equation – Slenderness ratio – Rankine formula for columns

UNIT V ANALYSIS OF STRESSES IN TWO DIMENSIONS
Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and stresses – Mohr's circle for biaxial stresses – Maximum shear stress - Strain energy in bending and torsion.

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

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

412PET03 - ADVANCED MACHINING PROCESS

OBJECTIVES:
- (i) To understand the theory of metal cutting
- (ii) To understand the concepts of gear manufacture
- (iii) To understand CNC machines constructional features, working and programming

UNIT I MECHANICS OF METAL CUTTING
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
Requirement of tool materials – types of tool materials – Tool wear – Types, mechanism – Tool life - Machinability - types of chips – cutting fluids.

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

TEXT BOOK
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

412PET04 - THEORY OF MACHINES

OBJECTIVES:
To understand the basic concepts of mechanisms and machinery

UNIT I   MECHANISMS
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
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
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
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
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.

TEXT BOOK
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.

412PET05 - FLUID POWER DRIVES AND CONTROL

OBJECTIVES:
 (i) To understand the working principle of hydraulic and pneumatic components and its selection
(ii) To design hydraulic and pneumatic circuits for different applications

UNIT I   INTRODUCTION TO FLUID POWER & HYDRAULICS PRINCIPLE
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
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
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
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
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.

TEXT BOOK:
1. Anthony Esposito "Fluid power with applications", 5th editor, 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

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

412PET06 - **ELECTRONICS AND MICROPROCESSORS**
(Common to Mechanical, Automobile & Production)

OBJECTIVE

To enable the students to understand the fundamental concepts of Semi Conductors, Transistors, Rectifiers, Digital Electronics and 8085 Microprocessors

UNIT I   SEMICONDUCTORS AND RECTIFIERS
Classification of solids based on energy band theory-Intrinsic semiconductors-Extrinsic semiconductors-P type and N type-PN junction-Zenor effect-Zenor diode characteristics-Half wave and full wave rectifiers -Voltage regulation

UNIT II   TRANSISTORS AND AMPLIFIERS
Bipolar junction transistor- CB, CE, CC configuration and characteristics-Biasing circuits-Class A, B and C amplifiers- Field effect transistor-Configuration and characteristic of FET amplifier-SCR, Diac, Triac, UJT-Characteristics and simple applications-Switching transistors-Concept of feedback-Negative feedback-Application in temperature and motor speed control.

UNIT III   DIGITAL ELECTRONICS
Binary number system - AND, OR, NOT, NAND, NOR circuits-Boolean algebra-Exclusive OR gate - Flip flops-Half and full adders-Registers-Counters-A/D and D/A conversion.

UNIT IV   8085 MICROPROCESSOR
Block diagram of microcomputer-Architecture of 8085-Pin configuration-Instruction set-Addressing modes-Simple programs using arithmetic and logical operations.

UNIT V   INTERFACING AND APPLICATIONS OF
Basic interfacing concepts - Interfacing of Input and Output devices-Applications of microprocessor Temperature control, Stepper motor control, traffic light control.

TEXT BOOKS
1. Milman and Halkias, "Integrated Electronics", Tata McGraw-Hill   publishers, 1995.
2. Ramesh Goankar, "Microprocessor Architecture", Programming and Applications with 8085, Wiley Eastern, 1998.

REFERENCE BOOKS
1. Malvino and Leach, "Digital Principles and Applications", Tata McGraw-Hill, 1996
2. Mehta V.K, "Principles of Electronics", S. Chand and Company Ltd., 1994
3. Dougles V.Hall, "Microprocessor and Interfacing", Programming and Hardware, Tata McGraw-Hill, 1999.
4. Salivahanan S, Suresh Kumar N, Vallavaraj A, "Electronic Devices and Circuits" First Edition, Tata McGraw-Hill, 1999.

412PEP01 - METALLURGY LABORATORY

OBJECTIVE:
    (i) To train the students in observation and interpretation of Microstructure of Engineering materials.
    (ii) To train students in Heat treatment, hardenability and surface treatment of Engineering Materials
    (iii) To train the students in testing of Foundry sand

LIST OF EXPERIMENTS:

1. Specimen preparation for macro – examination.
   Specimen preparation for micro examination and study of Micro structure of –
   - Carbon steel s(High, Medium, and Low)
   - Cast Iron (Gray, White, Nodular, Malleable)
   - Brass (70/30), Bronze (tin bronze), Al-Si alloy, cupro-nickel, Ti alloy.

   Quantitative metallography – Estimation of volume fraction, particle size, size distribution, and shape.

2. Cooling curves
   - Pure Metal (Pb or Sn)
   - Alloy (Pb-Sn or Pb-Sb)

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

   - Annealing
   - Normalising
   - Quench Hardening
   - Tempering

4. Jominy End Quench Test
5. Foundry Sand testing

   - Sieve analysis
   - Strength of moulding sand
   - Permeability of moulding sand
   - Clay content of moulding sand
   - Moisture content of moulding sand

6. Electro-chemical Test

   - Electro deposition
   - Electro-chemical etching test

412PEP02 - STRENGTH OF MATERIALS LAB
(Common to Auto, Mechanical & Production)

OBJECTIVE

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 Hardened samples and
      (i) Hardened and tempered samples.

LIST OF EQUIPMENT
(for a batch of 30 students)

1. Universal Tensile Testing machine with double 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

412PEP03 - COMPUTER AIDED MACHINE DRAWING LAB
(Common to Automobile & Production)

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.

LIST OF EQUIPMENTS
(for a batch of 30 students)

1.   Computer nodes   - 30 Nos.
2.   Software
      • Auto CAD   - 15 licenses
      • Pro-E   - 5 Nos.

FIFTH SEMESTER
512PET01 - ENVIRONMENTAL SCIENCE AND ENGINEERING

AIM
The aim of this course is to create awareness in every engineering graduate about the importance of environment, the effect of technology on the environment and ecological balance and make them sensitive to the environment problems in every professional endeavour that they participates.

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

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY
Definition, scope and importance of environment – need for public awareness – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and exsitu conservation of biodiversity. Field study of common plants, insects, birds Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION
Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution(c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES
Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

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 nongovernmental organization-environmental ethics: Issues and possible solutions –
climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

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

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).

REFERENCE BOOKS

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).

512PET02 - ENGINEERING METROLOGY AND MEASUREMENTS
(Common to Mechanical, Production and Automobile)

OBJECTIVE
- To understand the basic principles of measurements
- To learn the various linear and angular measuring equipments, their principle of operation and applications
- To learn about various methods of measuring Mechanical parameters

UNIT I CONCEPT OF MEASUREMENT
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
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
Measurement of screw threads: Thread gauges, floating carriage micrometermeasurement 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
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
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.

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.

512PET03 - METAL FORMING TECHNOLOGY

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

UNIT I FUNDAMENTALS OF METAL FORMING
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
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
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
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
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.

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" – Pearson Education, 4th Edition, 2003.
2. Rao, P.N. "Manufacturing Technology", TMH Ltd., 2003.
3. Edward M.Mielink, "Metal working science Engineering, McGraw Hill, Inc, 2000.
4. Metal Hank book Vol.14, "Forming and Forging", Metal Park, Ohio,USA, 1990.

512PET04 - ENGINEERING STATISTICS AND QUALITY CONTROL

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

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

TEXT BOOK
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.

512PET05 - MACHINE ELEMENTS DESIGN

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

UNIT V SPRINGS AND BEARINGS
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.

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

REFERENCES
1. V.B.Bhandari, "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.

512PET06 - FOUNDRY AND WELDING TECHNOLOGY

OBJECTIVE:
To understand the principle, procedure and applications of Foundry and Welding Processes.

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

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

UNIT III SPECIAL CASTING PROCESSES
Pressure die casting – Centrifugal – continuous – investment – shell moulding – squeeze – electro slag casting – CO_2 moulding – Plaster mould castings – Antioch process – Slush casting.

UNIT IV SPECIAL WELDING PROCESSES
Atomic H2 arc welding – Shielded gas arc welding GMAW & GTAW – Submerged arc welding – Electro slag welding – friction welding – explosive welding – Underwater welding – Diffusion bonding – EBW – LBW – PAW – Stud welding – welding of dissimilar materials – Friction stir welding.

UNIT V TESTING OF CASTINGS & WELDMENTS
Causes and remedies for casting defects – welding defects – Destructive testing – NDT – Dye penetrant – magnetic particle – X-ray, ultrasonic cell – studies in testing of joints & castings.

TEXT BOOKS
1. Welding Engineering & Technology R.S.Parmer – Khanna Publishers – 2002.
2. Principle of metal casting – Heime, Looper and Rosenthal – Tata McGraw Hill – 2001.

REFERENCES
1. Principle of Foundry Technology – P.L.John Tata McGraw Hill – 2003.
2. Modern Welding Technology – B.Curry – Prentice Hall – 2002.
3. Welding Principle & applications – Larry Jeff in Delmar – 1997.
4. Foundry Engineering – Taylor HF Fleming, M.C. & Wiley Eastern Ltd., 93.

512PEP01 - CNC MACHINE LAB

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

(Requirement for a batch of 30 Students)

S. No.	Description of Equipment	Quantity required	Quantity available	Deficiency %
1.	CNC Trainer Lathe	2 No.		
2.	CNC Trainer milling machine	2 No.		
3.	Any standard CAM software (Examples : PRO-E, Master CAM, SMART CAM, etc.,)	10 users		
4.	CNC wire cut EDM	1		
5.	Computers (Pentium 4, 128 RAM, 20 GB HDD, 17" Color Monitor)	5		

512PEP02 - FLUID POWER LAB

OBJECTIVES:
(i) To study the functional aspects of different pneumatic and hydraulic components and its usage in circuits.
(ii) 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

(Requirement for a batch of 30 Students)

S. No.	Description of Equipment	Quantity required	Quantity available	Deficiency %
1.	Hydraulic cut section models	1 kit		
2.	Pneumatic cut section models	1 kit		
3.	Hydraulic trainer kit	1 kit		
4.	Pneumatic trainer kit	1 No.		
5.	Electro Pneumatic trainer kit	1 No.		
6.	PLC Trainer Kit	1 No.		
7.	Hydraulic Simulation Software	5 licenses		
8.	Pneumatic Simulation software	5 licenses		

512PEP03 - ELECTRONICS AND MICROPROCESSORS LAB
(Common to Mechanical, Production and Automobile)

OBJECTIVE:

To supplement the theoretical knowledge with practical use of electronic components and programming and control using micro-processors

LIST OF EXPERIMENTS

Electronics 30(P)
1. VI Characteristics of PN Junction Diode
2. VI Characteristics of Zener Diode
3. Characteristics of CE Transistor
4. Characteristics of JFET
5. Characteristics of Uni Junction Transistor
6. RC or Wein Bridge Oscillator
7. Study of Logic Gates (Basic Gates)
8. Half Adder and Full Adder
9. Shift Registers and Counters
10. Operational Amplifier (Adder, Subtractor, Differentiator, Integrator, Inverting and Non - Inverting

MICROPROCESSORS 15(P)
1. Block Transfer
2. 8 bit Addition, Subtraction
3. Multiplication and Division
4. Maximum and minimum of block of data
5. Sorting
6. Stepper Motor Interfacing

LIST OF EQUIPMENT

(for a batch of 30 students)

1.	Voltmeters	5 No.
2.	Ammeters	5 No.
3.	PN Diode, BJT, JFET, Logic Gates, Shift Registers and Counters	1 set.
4.	Digital Logic Trainer Kits	1 No.
5.	Breadboards	1 No.
6.	Microprocessor Kits – 8085	5 No.
7.	D/A Converter Interface	1 No.
8.	Stepper Motor Interface	1 No.
9.	CRO	1 No.
10.	Wavefarm Generator	1 No.
11.	Multimeter	1 No.

(Requirement for a batch of 30 Students)

S. No.	Description of Equipment	Quantity required	Quantity available	Deficiency %
1.	Voltmeters	5 No.		
2.	Ammeters	5 No.		
3.	PN Diode, BJT, JFET, Logic Gates, Shift Registers and Counters	1 Set.		
4.	Digital Logic Trainer Kits	1 No.		
5.	Breadboards	1 No.		
6.	Microprocessor Kits – 8085	5 No.		
7.	D/A Converter Interface	1 No.		
8.	Stepper Motor Interface	1 No.		
9.	CRO	1 No.		
10.	Wavefarm Generator	1 No.		
11.	Multimeter	1 No.		

612PET01 - FINITE ELEMENT ANALYSIS IN MANUFACTURING ENGINEERING

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

UNIT I INTRODUCTION
General field problems in engineering-Discrete and continuous models Characteristicsthe 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
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
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
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
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.

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.

612PET02 - COMPUTER AIDED PRODUCT DESIGN

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

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

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

612PET03 - AUTOMATED PRODUCTION & COMPUTER INTEGRATED MANUFACTURING

AIM:
To impart the knowledge of computer technology in all of the operational and information processing activities related to manufacturing.

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

PRE-REQUISITES:
Students must have sound knowledge on various Manufacturing types, – system and operations.

UNIT I INTRODUCTION
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.

UNITII AUTOMATED PRODUCTION SYSTEMS AND MATERIAL HANDLING AND STORAGE SYSTEM
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
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
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
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 semi automated data collection (ADC) – Bar code technologies and other ADC Technologies.

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

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.

612PET04 - DESIGN OF JIGS, FIXTURE, PRESS TOOLS & DRAWING

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

UNIT IV ELEMENTS OF DIE
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
Progressive die – compound die – Bending and drawing dies – Drill Jigs – Milling fixtures, turning fixtures.

TEXT BOOK:
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

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ELECTIVE I & II
612PET05 - MARKETING MANAGEMENT
(COMMON TO MECHANICAL, PRODUCTION AND MECHATRONICS)

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OBJECTIVE:
- To understand the various processes involved in Marketing and its Philosophy.
- To learn the Psychology of consumers.
- To formulate strategies for advertising, pricing and selling

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

UNIT III PRODUCT PRICING AND MARKETING RESEARCH
Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION
Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION
Characteristics, impact, goals, types, and sales promotions- point of purchase- unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing.

TEXT BOOKS:
1. Govindarajan. M, "Marketing management – concepts, cases, challenges and trends", Prentice hall of India, second edition 2007.
2. Philip Kolter,Koshy Jha "Marketing Management", Pearson Education ,Indian adapted edition.2007.

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.

612PET06 - QUALITY CONTROL AND RELIABILITY ENGINEERING
(Common to Mechanical, Automobile And Production- VI Semester Core)

OBJECTIVE:
- To introduce the concept of SQC
- To understand process control and acceptance sampling procedure and their application.
- To learn the concept of reliability.

UNIT I INTRODUCTION AND PROCESS CONTROL FOR VARIABLES
Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance,Quality control: Quality cost-Variation in processcausesof variation –Theory of control chart- uses of control chart – Control chart for variables – X chart, R chart and □ chart -process capability – process capability studies and simple problems.Six sigma concepts.

UNIT II PROCESS CONTROL FOR ATTRIBUTES
Control chart for attributes –control chart for non conformings– p chart and np chart – control chart for nonconformities– C and U charts, State of control and process out of control identification in charts, pattern study.

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

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

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

Note: Use of approved statistical table permitted in the examination.

TEXT BOOKS:
1. Douglas.C.Montgomery, " Introduction to Statistical quality control" John wiley 4th edition2001.
2. L.S.Srinath, "Reliability Engineering", Affiliated East west press, 1991.

REFERENCES:
1. John.S. Oakland. Statistical process control", Elsevier, 5th edition, 2005
2. Connor, P.D.T.O., " Practical Reliability Engineering", John Wiley, 1993
3. Grant, Eugene .L "Statistical Quality Control", McGraw-Hill, 1996
4. Monohar Mahajan, "Statistical Quality Control", Dhanpat Rai & Sons, 2001.
5. R.C.Gupta, "Statistical Quality control", Khanna Publishers, 1997.
6. Besterfield D.H., "Quality Control", Prentice Hall, 1993.
7. Sharma S.C., "Inspection Quality Control and Reliability", Khanna Publishers, 1998.
8. Danny Samson, "Manufacturing & Operations Strategy", Prentice Hall, 1991.

612PET07 - UNCONVENTIONAL MACHINING PROCESSES
(Common to Mechanical And Production)

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

UNIT I INTRODUCTION
Unconventional machining Process – Need – classification – Brief overview.

UNIT II MECHANICAL ENERGY BASED PROCESSES
Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining Ultrasonic Machining. (AJM, WJM, AWJM and USM). Working Principles – equipment used – Process parameters – MRR-Variation in techniques used – Applications.

UNIT III ELECTRICAL ENERGY BASED PROCESSES
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
Chemical machining and Electro-Chemical machining (CHM and ECM)-Etchantsmaskant-techniques of applying maskants-Process Parameters – Surface finish and MRR-Applications. Principles of ECM-equipments-Surface Roughness and MRRElectrical circuit-Process Parameters-ECG and ECH - Applications.

UNIT V THERMAL ENERGY BASED PROCESSES
Laser Beam machining and drilling (LBM), plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – 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" Prentice Hall of India Pvt. Ltd., New Delhi ,8th Edition,2001.

612PET08 - PRECISION ENGINEERING

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

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

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 Microelectronic Fabrication", Oxford University Press, 1996.
2. Raady Frank, "Understanding smart sensors", Artech. House, Boston, 1996.
3. MEMS Hand Book, CRC Press, 2001.

612PET09 - FUZZY LOGIC AND ANN

UNIT I INTRODUCTION TO FUZZY LOGIC PRINCIPLES
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
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 – various.

UNIT III INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS
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
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
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.

TEXT BOOKS:
1. S.Rajasekaran.G.A.Vijayalakshmi Pai "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 R. Cheng "Genetic algorithm and engineering design", john wiley 1997.

612PET10 - INSTRUMENTAITON AND CONTROL

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

UNITII MECHANICAL MEASUREMENTS AND INDUSTRIAL INSTRUMENTATION
Measurement of displacement, velocity (linear and rotational), acceleration, shock, vibration, force torque power, strain, stress, pressure temperature.

UNIT III DATA DISPLAY AND RECORDING DEVICES
Data display-CRO,LED, LCD, magnetic tape recorders, x-y recorders, UV recorders, Oscilloscope recorders, digital printers and data loggers.

UNIT IV CONTROL
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
Stability criteria bode plots, routh and Nyquist criteria.

TEXT BOOKS:
1. B.C.Nakra, K.K.choudry, "Instrumentation, Measurement and analysis", Tata McGraw Hill 2002.
2. J.J.Nagrath and Gopal, "control system engineering", New age international (p) ltd., 2000.

REFERENCES:
1. C.S.Rangan, G.R.Sarma, VSV Mani, Instrumentation devices and systems", Tata McGraw Hill, 2000.
2. A.K. Sowhney, "electricaland 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. S.Renganathan, "transducer engineering", Allied publishers, 1990.

612PET11 - SURFACE ENGINEERING

UNIT I METAL CLEANING AND PREVIEW ON SURFACE ENGINEERING
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
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
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
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
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.

TEXT BOOK:
1. STAND GRAINGER engineering coatings – design and application jaico publishing House, 1994.

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

612PEP01 - METAL FORMING LAB AND SPECIAL MACHINES LAB

AIM:

To understand the basic principles of Metal forming process and to impart practical knowledge in special machines.

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 MACHINE LAB:

1. Gear Hobbing
   - Spur Gear
   - Helical Gear
2. Planning Machine
   - V-Block
   - Dove Tail
3. Centreless Cylindrical Grinding
4. Milling Machine
   - 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

(Requirement for a batch of 30 Students)

S.No.	Description of Equipment	Quantity required
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…)	Any one
11.	Dies for Constructing FLD of sheet metals	1 Set

612PEP02 - METROLOGY AND INSPECTION LAB

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

(Requirement for a batch of 30 Students)

S. No.	Description of Equipment	Quantity required
1.	Vernier Calipers 0-150	5 Nos.
	Vernier Calipers 0-300	2 Nos.
2.	Micrometer 0-25	5 Nos.
	Micrometer 25-50	2 Nos.
	Micrometer 50-75	2 Nos.
3.	Dial gauges L.C 10micrometer	3 Nos.
	Dial gauge L.C. 2micrometer, 1 m.m.range	2 Nos.
4.	Height gauge Analog	1 No.
	Height gauge Digital	1 No.
5.	Slip gauge set	2 sets
6.	Sine Bar 100 mm	1 No.
	Sine Bar 200 mm	1 No.
7.	Toolmakers microscope	1 No.
	Profile Projector	1 No.
8.	Gear tooth verniers	2 Nos.
9.	Flangemic 0-25	1 No.
	Flangemic 25-50	1 No.
10.	Floating carriage micrometer	1 No.
	Thread plug gauges m24 x 3	1 No.
	Thread plug gauges m20 x 2.5	1 No.
11.	3 wire set box	1 No.
12.	Surface roughness measuring Instrument with accessories	1 No.
13.	Precision spheres different dias	1 set
14.	Dial Guage Caliberator	1 No.
15.	Precision level	1 No.
16.	Digital Micrometer	1 No.
17.	Digital Vernier 0-150	1 No.
18.	Digital Ht. Guage	1 No.
19.	Bevel Protractor	1 No.
20.	CMN	1 System
21.	Vision measuring system	1 System
22.	Boredial gauge 16-35, 35-60	1 Box each
23.	Depth Vernier 0-150	1 No.
24.	Depth micrometer with 6 rods	1 No.
25.	Internal micrometer with Extn sleeves	1 No.
26.	Precision Rollers 8	2 Nos.
27.	Surface plate	1 No.
28.	Bench centre	1 No.

612PEP03 - WELDING AND FOUNDRY LABORATORY

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

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

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

LIST OF EQUIPMENTS
(for a batch of 30 students)

1.	5 Kg Muller	- 1No.
2.	Sand rammer	- 1 No
3.	Weighing balance	- 1 No.
4.	Universal sand strength testing with all accessories	- 1 Set.
5.	Permeability tester	- 1 No.
6.	Quick moisture tester	- 1 No.
7.	Infra-red drier	- 1 No.
8.	Sieve shaker with Sieves	- 1 Set.
9.	Crucible furnace	- 1 No.
10.	Oxy acetylene gas welding equipment	- 1 Set.
11.	Electric Welding Transformer, welding booth	- 5 Nos.

712PET01 - TOTAL QUALITY MANAGEMENT

UNIT I INTRODUCTION
Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT II TQM PRINCIPLES
Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & TECHNIQUES I
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 & TECHNIQUES II
Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

UNIT V QUALITY SYSTEMS
Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

TEXT BOOKS:
1. Dale H.Besterfiled, et at., "Total Quality Management", Pearson Education Asia, Third Edition, Indian Reprint (2006).
2. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd.,2006.

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

712PET02 - MECHATRONICS
(Common to Mechanical and Production)

OBJECTIVE:
To understand the interdisciplinary applications of Electronics, Electrical, Mechanical and Computer Systems for the Control of Mechanical and Electronic Systems.

UNIT I MECHATRONICS, SENSORS AND TRANSDUCERS
Introduction to Mechatronics Systems – Measurement Systems – Control Systems – Microprocessor based Controllers. Sensors and Transducers – Performance Terminology – Sensors for Displacement, Position and Proximity; Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature,Light Sensors – Selection of Sensors.

UNIT II ACTUATION SYSTEMS
Pneumatic and Hydraulic Systems – Directional Control Valves – Rotary Actuators. Mechanical Actuation Systems – Cams – Gear Trains – Ratchet and pawl – Belt and Chain Drives – Bearings. Electrical Actuation Systems – Mechanical Switches – Solid State Switches – Solenoids – Construction and working principle of DC and AC Motors – speed control of AC and DC drives, Stepper Motors-switching circuitries for stepper motor – AC & DC Servo motors.

UNITIII SYSTEM MODELS AND CONTROLLERS
Building blocks of Mechanical, Electrical, Fluid and Thermal Systems, Rotational – Transnational Systems, Electromechanical Systems – Hydraulic – Mechanical Systems. Continuous and discrete process Controllers – Control Mode – Two – Step mode – Proportional Mode – Derivative Mode – Integral Mode – PID Controllers – Digital Controllers – Velocity Control – Adaptive Control – Digital Logic Control – Micro Processors Control.

UNIT IV PROGRAMMING LOGIC CONTROLLERS
Programmable Logic Controllers – Basic Structure – Input / Output Processing – Programming – Mnemonics – Timers, Internal relays and counters – Shift Registers –
Master and Jump Controls – Data Handling – Analogs Input / Output – Selection of a PLC.

UNIT V DESIGN OF MECHATRONICS SYSTEM
Stages in designing Mechatronics Systems – Traditional and Mechatronic Design - Possible Design Solutions. Case studies of Mechatronics systems- Pick and place Robot- Autonomous mobile robot-Wireless suriviellance balloon- Engine Management system- Automatic car park barrier.

TEXT BOOKS:
1. Bolton,W, "Mechatronics" , Pearson education, second edition, fifth Indian Reprint, 2003.
2. Smaili.A and Mrad.F , "Mechatronics integrated technologies for intelligent machines", Oxford university press, 2008.

REFERENCES:
1. Rajput. R.K, A textbook of mechatronics, S. Chand & Co, 2007
2. Michael B. Histand and David G. Alciatore, " Introduction to Mechatronics and Measurement Systems", McGraw-Hill International Editions, 2000.
3. Bradley D. A., Dawson D., Buru N.C. and. Loader A.J, "Mechatronics", Chapman and Hall, 1993.
4. Dan Necsulesu, "Mechatronics", Pearson Education Asia, 2002 (Indian Reprint).
5. Lawrence J. Kamm, "Understanding Electro – Mechanical Engineering", An Introduction to Mechatronics, Prentice – Hall of India Pvt., Ltd., 2000.
6. Nitaigour Premchand Mahadik, "Mechatronics", Tata McGraw-Hill publishing Company Ltd, 2003.

712PET03 - PROCESS PLANNING AND COST ESTIMATION
(Common to Production and Mechanical)

OBJECTIVE:
To introduce the process planning concepts
To make cost estimation for various products after process planning

UNIT I WORK STUDY AND ERGONOMICS
Method study – Definition – Objectives-Motion economy- Principles – Tools and Techniques-Applications – Work measurements- purpose – use – procedure – tools and techniques- Standard time –Ergonomics – principles – applications.

UNIT II PROCESS PLANNING
Definition – Objective – Scope – approaches to process planning- Process planning activities – Finished part requirements - operating sequences - machine selection – material selection parameters- Set of documents for process planning – Developing manufacturing logic and knowledge- production time calculation – selection of cost optimal processes.

UNIT III INTRODUCTION TO COST ESTIMATION
Objective of cost estimation- costing – cost accounting- classification of cost- Elements of cost.

UNIT IV COST ESTIMATION
Types of estimates – methods of estimates – data requirements and sources- collection of cost-allowances in estimation.

UNIT V PRODUCTION COST ESTIMATION
Estimation of material cost, labour cost and over heads, allocation of overheads – Estimation for different types of jobs.

TEXT BOOK:
1. Banga and Sharma , Cost estimation , Sinha.B.P., "Mechanical Estimating and Costing", Tata McGraw-Hill, Publishing Co., 1995.

REFERENCES:
1. Phillip.F Ostwalal and Jairo Munez, "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.

712PET04 - ROBOTICS
(Common to Production and VII Semester Elective for Mechanical)

OBJECTIVES
- To introduce the basic concepts, parts of robots and types of robots
- To make the student familiar with the various drive systems for robot, sensors
  and their applications in robots, programming of robots
- To discuss about the various applications of robots, justification, implementation
  and safety of robot.

UNIT I FUNDAMENTALS OF ROBOT
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
Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and
Comparison of All these Drives End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT III SENSORS AND MACHINE VISION
Requirements of a sensor, Principles and Applications of the following types of sensors – Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Time of Flight Range Finders, Laser Range Meters), Proximity Sensors (Inductive, Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors), 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
Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional) – Deviations and Problems Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effecter commands, and Simple programs.

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS
RGV, AGV; Implementation of Robots in Industries – Various Steps; Safety Considerations for Robot Operations; Economic Analysis of Robots – Pay back Method, EUAC Method, Rate of Return Method.

TEXT BOOKS:
1. M.P.Groover, "Industrial Robotics – Technology, Programming and Applications", McGraw-Hill, 2001
2. Yoram Koren, "Robotics for Engineers", McGraw-Hill Book Co., 1992.

REFERENCES:
1. Fu.K.S. Gonzalz.R.C., and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw-Hill Book Co., 1987.
2. Janakiraman.P.A., "Robotics and Image Processing", Tata McGraw-Hill, 1995

ELECTIVE III & IV

712PET05 - DESIGN OF MACHINE TOOL STRUCTURE

UNIT I INTRODUCTION
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
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
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
Spindle units – materials – spindle design – spindle bearings – types of materials – constructions.

UNIT V MACHINE TOOL DYNAMICS
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.

TEXT BOOKS:
1. G.C. Sen and A.Battacharya, "Principles of machine tools", New central book agency, 1999.
2. N.K.Metha, "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.

712PET06 - PRODUCTION MANAGEMENT

UNIT I PRINCIPLES OF MANAGEMENT AND PERSONNEL MANAGEMENT
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
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
Plant Location – Layout – Materials Handling – Method Study – Time Study – Ergonomics – Aggregate Planning – Value Analysis

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

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

TEXT BOOKS:
1. R. Kesavan, C.Elanchezhian and T.Sundar Selwyn – Engineering management – Eswar Press, 2005.
2. K. Panneerselvam – 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.

712PET07 - ERGONOMICS

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

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

UNIT III DESIGN OF EQUIPMENT
Programme factors to be considered, design of displays and controls – design for maintainability – heat stresses – manual lifting.

UNIT IV DESIGN FOR ENVIRONMENT
Illumination – Climate – Noise – Vibration – Heat, cold – Lighting design considerations – Effect of noise on task performance.

UNIT V RECENT ADVANCES AND TRENDS
Legislative trends – Trends in work system design – occupational diseases – Application of Ergonomcis in automobiles.

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
4. methodology, Taylor and Frances, 1990.
5. Shackel, B.Richardson S, Human Factors for Inforamtion usability, Cambridge University, Cambridge University Press, 1991.

712PET08 - COMPOSITE MATERIALS

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
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 (Q_{ij}), 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
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
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
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
Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations – Natural Frequencies

TEXT BOOKS:
1. Gibson, R.F., Principles of Composite Material Mechanics, McGraw-Hill, 1994, Second Edition - 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.

712PET09 - PROCESSING OF POLYMER AND COMPOSITES

UNIT I INTRODUCTION
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
Polymer matrix resins – thermosetting resins, thermoplastic resins – reinforcement fibres – rovings – woven fabrics – non woven random mats – various types of fibres, PMC processes – hand layup processes – spray layup 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
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
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
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.

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. T.W.Clync and P.J. Withers, "Introduction to Metal Matrix Composites". Cambridge University Press, 1993.
2. B.Strong, "Fundamentals of composite manufacturing, SME, 1989
3. S.C.Sharma, "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.

712PET10 - ENGINEERING ECONOMICS & FINANCIAL MANAGEMENT

UNIT I FINANCIAL ACCOUNTING

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

UNIT II PROFIT VALUE ANALYSIS

Cost valume profit relationship – relevant costs in decision making profit management analysis – break even analysis – margin of safety Angle of incident & multi product break even analysis – Effect of changes in volume selling price fixed cost and variable cost on profit.

UNIT III WORKING CAPITAL MANAGEMENT

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

UNIT IV CAPITAL BUDGETING

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

UNIT V ENGINEERING ECONOMICS

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

TEXT BOOKS:
1. R. Kesavan, C.Elanchezhian and T.Sundar Selwyn – Engineering Economics and Financial Accounting, Laxmi Publications 2005.
2. S.N.Maheswaran, Management Accounting and Financial Control, Sultan Chand, 1992.

REFERENCES:
1. C.James, Vanhorn, Fundamentals of Financial management PHI 1996.
2. Charles T.Homgren, Cost Accounting, PHI 1985.

712PET11 - PURCHASING AND MATERIALS MANAGEMENT

UNIT I FUNCTIONS OF MATERIALS MANAGEMENT
Introduction to materials management – objectives – Organization – Functions – Operating Cycle – Value analysis – Make or buy decisions.

UNIT II PURCHASING MANAGEMENT
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
Store function – Location – Layout – Stock taking – Materials handling – codification – Inventory pricing – MIS for stores management.

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

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

TEXT BOOKS:
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.

712PET12 - OPERATIONS RESEARCH
(Common To Mechanical, Metallurgy, Automobile And Mechatronics – VI Semester Elective)

OBJECTIVE:
- To create awareness about optimization in utilization of resources.
- To understand and apply operations research techniques to industrial operations.

UNIT I LINEAR MODEL
The phases of OR study – formation of an L.P model- graphical solution – simplex algorithm – artificial variables technique– Big M method, two phase method, Duality in LPP. Transportation problems- VAM – MODI technique, Assignment problems.

UNIT II NETWORK MODELS
Shortest route – minimal spanning tree - maximum flow models – project network- CPM and PERT network-critical path scheduling.

UNIT II INVENTORY MODEL
Types of Inventory- EOQ –ERL- Deterministic inventory problems – Price breaks - Stochastic inventory problems- selective inventory control techniques.

UNIT II REPLACEMENT MODELS
Replacement of items that deteriorate with time – value of money changing with time – not charging with time – optimum replacement policy – individual and group replacement. Sequencing problem: models with n jobs with 2 machines – problem with n jobs with m machines.

UNIT III QUEUING THEORY
Queuing models – queuing systems and structures – notation –parameter – single server and multiserver models – Poisson input – exponential service – constant rate service – infinite population.

TEXT BOOKS:
1. Wayne.L.Winston, Operations research applications and algorithms, Thomson learning,4th edition 2007.
2. Taha H.A, "Operation Research", Pearson Education sixth edition, 2003.

REFERENCES:
1. Frederick.S.Hiller and Gerald.J.Lieberman, "Operations research concepts and cases", TMH (SIE) 8th edition.
2. J.K.Sharma, "Operations research theory and applications", Macmillan India .3rd edition 2007.
3. Hira and Gupta " Problems in Operations Research", S.Chand and Co,2002.
4. Panneerselvam, "Operations Research" Prentice Hall of India, 2003.
5. G Srinivasan, "Operations research principles and applications", PHI (EEE) 2007.
6. Wagner, "Operations Research", Prentice Hall of India, 2000.

712PET13 - NON-DESTRUCTIVE TESTING METHODS

AIM:
To impart knowledge on Non Destructive Testing procedures.

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

PRE-REQUISITES:
Basic knowledge on various process defects

UNIT I NON-DESTRUCTIVE TESTING: AN INTRODUCTION
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

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
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
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 – A- scan, B-Scan & C- Scan- Applications.

UNIT V RADIOGRAPHY, COMPARISON AND SELECTION OF NDT METHODS
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.

TEXT BOOK:
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.

712PET14 - SIMULATION OF MANUFACTURING SYSTEMS

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

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

UNIT V CASE STUDIES
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).

TEXT BOOKS:
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.

712PEP01 - COMPUTER AIDED DESIGN & SIMULATION LAB

LIST OF EXPERIMENTS
A. Simulation
1. Simulation of Air conditioning system with condenser temperature and evaporator
2. temperatures as input to get COP using C /MAT Lab.
3. Simulation of Hydraulic / Pneumatic cylinder using C / MAT Lab.
4. Simulation of cam and follower mechanism using C / MAT Lab.

B. Analysis (Simple Treatment only)
1. Stress analysis of a plate with a circular hole.
2. Stress analysis of rectangular L bracket
3. Stress analysis of an axi-symmetric component
4. Stress analysis of beams (Cantilever, Simply supported, Fixed ends)
5. Mode frequency analysis of a 2 D component
6. Mode frequency analysis of beams (Cantilever, Simply supported, Fixed ends)
7. Harmonic analysis of a 2D component
8. Thermal stress analysis of a 2D component
9. Conductive heat transfer analysis of a 2D component
10. Convective heat transfer analysis of a 2D component

LIST OF Equipments
(for a batch of 30 students)

Computer System 30
1. 17" VGA Color Monitor
2. Pentium IV Processor
3. 40 GB HDD
4. 512 MB RAM

Color Desk Jet Printer 01
Software
1. Suitable analysis software   - 30 licenses
2. C / MATLAB   - 5 licenses

712PEP02 - MECHATRONICS LAB
*(*Common to Mechanical and Production*)*

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
10. Computerized data logging system with control for process variables like pressure flow and temperature.

LIST OF EQUIPMENT
(For a batch of 30 students)

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

712PEP03 - DESIGN AND FABRICATION LAB

The objective of this project is to provide opportunity for the students to implement their skills acquired in the previous semesters to practical problems. The students in convenient groups of not more than 4 members have to take one small item for design and fabrication. Every project work shall have a guide who is the member of the faculty of the institution and if possible with an industry guide also. The item chosen may be small machine elements (Example-screw jack, coupling, machine vice, cam and follower, governor etc), attachment to machine tools, tooling (jigs, fixtures etc), small gear box, automotive appliances, agricultural implements, simple heat exchangers, small pumps, hydraulic /pneumatic devices etc. The students are required to design and fabricate the chosen item in the college and demonstrate its working apart from submitting the project report. The report should contain assembly drawing, parts drawings, process charts relating to fabrication.

812PET01 - ENGINEERING ECONOMICS AND COST ANALYSIS
(Common to Mechanical, Production, Automobile)

OBJECTIVES

To learn about the basics of economics and cost analysis related to engineering so as to take economically sound decisions.

UNIT I INTRODUCTION TO ECONOMICS

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

UNIT II VALUE ENGINEERING

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

UNIT III CASH FLOW

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

UNIT IV REPLACEMENT AND MAINTENANCE ANALYSIS

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

UNIT V DEPRECIATION

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

TEXT BOOKS:
1. Panneer Selvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2001.
2. Suma Damodaran, " Managerial economics", Oxford university press 2006.

REFERENCES:
1. References Chan S.Park, "Contemporary Engineering Economics", Prentice Hall of India, 2002.
2. Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis" Engg. Press, Texas, 2002
3. Degarmo, E.P., Sullivan, W.G and Canada, J.R, "Engineering Economy", Macmillan, New York, 1984
4. Grant.E.L., Ireson.W.G., and Leavenworth, R.S, "Principles of Engineering Economy", Ronald Press, New York,1976.
5. Smith, G.W., "Engineering Economy", Lowa State Press, Iowa, 1973.
6. Truett & Truett, " Managerial economics- Analysis, problems & cases " Wiley India 8th edition 2004.
7. Luke M Froeb / Brian T Mccann, " Managerail Economics – A problem solving approach" Thomson learning 2007.

ELECTIVE V & VI
812PET02 - RELIABILITY ENGINEERING

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
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
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
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
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
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

TEXT BOOK:
1. Charles E. Ebling, "An introduction to Reliability and Maintainability Engg", Tata McGraw-Hill, 2000.

REFERENCES:
1. Patrick D T o'connor, "Practical Reliability Enginering t", 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.

812PET03 - MACHINE TOOL CONTROL & CONDITION MONITORING

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

UNIT I OVERVIEW OF AUTOMATIC CONTROLS IN MACHINE TOOLS
Open loop – closed loop system – block diagram representation of machine tool control systems.

UNIT II COMPUTER CONTROL SYSTEM
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
Electrical, hydraulic and pneumatic types – servo motor-stepper motor-ball screw mechanism. Feedback devices-Syncro, resolver, diffraction gratings, potentiometer, and inductosyn-encoders-application in machine tools.

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

UNIT V MACHINE TOOL DIAGNOSTICS
Objectives-aims-examples of monitoring and diagnosis-control structures for machine diagnosis-utilization of diagnostic results.

REFERENCES:
1. Manfred weck, "Hand book of machine tools – Vol.3, John Wiley & Sons, 1984.
2. Sushil Kumar Srivstava " industrial maintenance management" S.Chand & company ltd., New Delhi, 1998.
3. Mikell P.Groover, "Automation Production system and Computer Integrated Manufacturing", Prentice Hall of India, Pvt.Ltd., 1995.

812PET04 - MINI PROJECT

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 be made for the continuous internal assessment for the Project by a committee nominated by the Head of the Department.

812PET05 - MACHINE VISION

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

UNIT – I INTRODUCTION TO MACHINE VISION
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
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
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
Fundamentals – parametric classifiers – nonparametric, classifiers nearest neighbor CART, neural networks, generic classifiers.

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

REFERENCES:
1. Milan sonka, Vaclav hlavac, roger boyie, image processing, analysis and machine vision publisher, 1995.
2. Richard O.Duda, Peter E. Hurt, Pattern Classification and Scene Analysis Publisher, 1973.
3. Rafael C. Gonzaies, Richard E. Woods, Digital Image processing publisher, 1992.
4. Nella zuech, 'Understanding & applying machine vision Marceldekker Inc. 2000.

812PET06 - ADVANCES IN OPERATIONS RESEARCH

OBJECTIVE:
- To introduce the advanced OR models and to apply them for Engineering Problems.

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

UNIT II CLASSIC OPTIMIZATION TECHNIQUES
Linear programming - Graphical method – simplex method – dual simplex method – revised simplex method – duality in LP – Parametric Linear programming.

UNIT III NON-LINEAR PROGRAMMING
Introduction – Lagrangeon Method – Kuhn-Tucker conditions – Quadratic programming – Separable programming – Stochastic programming.

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

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

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

812PET07 - PROFESSIONAL ETHICS IN ENGINEERING

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

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION
Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study.

UNIT III ENGINEER'S RESPONSIBILITY FOR SAFETY
Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl Case Studies and Bhopal.

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

UNIT V GLOBAL ISSUES
Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct.

TEXT BOOKS:
1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York (2005).
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Thompson Learning, (2000).

REFERENCES:
1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, (1999).
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, (2003)
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, (2001)
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics – An Indian Perspective", Biztantra, New Delhi, (2004)
5. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, (2003).

812PET08 - FUNDAMENTALS OF NANOSCIENCE

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

UNITIII PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES
Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wet etching, dry (Plasma /reactive ion) etching, Etch resists-dip pen lithography.

UNIT IV PREPARATION ENVIRONMENTS
Clean rooms: specifications and design, air and water purity, requirements for particular processes, Vibration free environments: Services and facilities required. Working practices, sample cleaning, Chemical purification, chemical and biological contamination, Safety issues, flammable and toxic hazards, biohazards.

UNIT V CHARECTERISATION TECHNIQUES
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.

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

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

812PET09 - ENTREPRENEURSHIP DEVELOPMENT
(Common to all branches)

OBJECTIVE:
- Study of this subject provides an understanding of the scope of an entrepreneur, key areas of development, financial assistance by the institutions, methods of taxation and tax benefits, etc.

UNIT I ENTREPRENEURSHIP
Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur – Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurical Growth.

UNIT II MOTIVATION
Major Motives Influencing an Entrepreneur – Achievement Motivation Training, self Rating, Business Game, Thematic Apperception Test – Stress management, Entrepreneurship Development Programs – Need, Objectives.

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

UNIT V SUPPORT TO ENTREPRENEURS
Sickness in small Business – Concept, Magnitude, causes and consequences, Corrective Measures – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

TEXT BOOKS:
1. S.S.Khanka "Entrepreneurial Development" S.Chand & Co. Ltd. Ram Nagar New Delhi, 1999.
2. Kuratko & Hodgetts, "Enterprenuership – Theory, process and practices", Thomson learning 6th edition.

REFERENCES:
1. Hisrich R D and Peters M P, "Entrepreneurship" 5th Edition Tata McGraw-Hill, 2002.
2. Mathew J Manimala," Enterprenuership theory at cross roads: paradigms and praxis" Dream tech 2nd edition 2006.
3. Rabindra N. Kanungo "Entrepreneurship and innovation", Sage Publications, New Delhi, 1998.
4. EDII " Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development" Institute of India, Ahmadabad, 1986.

812PET10 - PRODUCTION PLANNING AND CONTROL

OBJECTIVE:
- 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
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 aspectaesthetic aspect. Profit consideration-Standardization, Simplification & specialization - Break even analysis-Economics of a new design.

UNIT II WORK STUDY
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
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
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
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.

TEXT BOOKS:
1. Martand Telsang, "Industrial Engineering and Production Management", S. Chand and Company, First edition, 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 / Operations Management", 8th Ed. John Wiley and Sons, 2000.
3. Kanishka Bedi, " Production and Operations management", Oxford university press, 2nd Edition 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.

812PET11 - MAINTENANCE ENGINEERING
(COMMON TO MECHANICAL AND PRODUCTION)

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

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

TEXT BOOKS:
1. Srivastava S.K., "Industrial Maintenance Management", - S. Chand and Co., 1981
2. Bhattacharya S.N., "Installation, Servicing and Maintenance", S. Chand and Co., 1995.

REFERENCES:
1. 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.

812PEP02 - PROJECT WORK

OBJECTIVE:

The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project. The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem. 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. Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines. The continuous assessment shall be made as prescribed in the regulations (vide clause 10.3 of Regulations 2004 for B.E., B.Tech. programmes)

Registrar