ANNA UNIVERSITY, CHENNAI

AFFILIATED INSTITUTIONS

R - 2008

B.TECH. POLYMER TECHNOLOGY

II – VIII SEMESTERS CURRICULA AND SYLLABI

SEMESTER II

(Common to all B. E. / B. Tech. Degree Programmes except B. E. – Marine Engineering)

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A. CIRCUIT BRANCHES

I  Faculty of Electrical Engineering

1. B.E. Electrical and Electronics Engineering
2. B.E. Electronics and Instrumentation Engineering
3. B.E. Instrumentation and Control Engineering

II Faculty of Information and Communication Engineering

1. B.E. Computer Science and Engineering
2. B.E. Electronics and Communication Engineering
3. B.E. Bio Medical Engineering
4. B.Tech. Information Technology

B. NON – CIRCUIT BRANCHES

I  Faculty of Civil Engineering

1. B.E. Civil Engineering

II  Faculty of Mechanical Engineering

1. B.E. Aeronautical Engineering
2. B.E. Automobile Engineering
3. B.E. Marine Engineering
4. B.E. Mechanical Engineering
5. B.E. Production Engineering

III  Faculty of Technology

1. B.Tech. Chemical Engineering
2. B.Tech. Biotechnology
3. B.Tech. Polymer Technology
4. B.Tech. Textile Technology
5. B.Tech. Textile Technology (Fashion Technology)
7. B.Tech. Plastics Technology
# SEMESTER – III

(Applicable to the students admitted from the Academic year 2008 – 2009 onwards)

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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
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

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.

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.

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.

TOTAL: 60 PERIODS

TEXT BOOK

REFERENCES

Extensive Reading:

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.
UNIT I  ORDINARY DIFFERENTIAL EQUATIONS  12
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  12

UNIT III  ANALYTIC FUNCTIONS  12
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  12

UNIT V  LAPLACE TRANSFORM  12

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.

TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES
UNIT I  CONDUCTING MATERIALS  9

UNIT II  SEMICONDUCTING MATERIALS  9

UNIT III  MAGNETIC AND SUPERCONDUCTING MATERIALS  9
Superconductivity : properties - Types of super conductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV  DIELECTRIC MATERIALS  9

UNIT V  MODERN ENGINEERING MATERIALS  9
Metallic glasses: preparation, properties and applications.
Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, advantages and disadvantages of SMA

TOTAL : 45 PERIODS

TEXT BOOKS
2. Charles P. Poole and Frank J.Ownen, ‘Introduction to Nanotechnology’, Wiley India(2007) (for Unit V)

REFERENCES
AIM
To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

OBJECTIVES
- The student should be conversant with the principles electrochemistry, electrochemical cells, emf and applications of emf measurements.
- Principles of corrosion control
- Chemistry of Fuels and combustion
- Industrial importance of Phase rule and alloys
- Analytical techniques and their importance.

UNIT I  ELECTROCHEMISTRY  9
Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – Single electrode potential – Nernst equation (problem) – reference electrodes – Standard Hydrogen electrode -Calomel electrode – Ion selective electrode – glass electrode and measurement of pH – electrochemical series – significance – potentiometer titrations (redox - Fe²⁺ vs dichromate and precipitation – Ag⁺ vs Cl⁻ titrations) and conduct metric titrations (acid-base – HCl vs, NaOH) titrations,

UNIT II  CORROSION AND CORROSION CONTROL  9

UNIT III  FUELS AND COMBUSTION  9

UNIT IV  PHASE RULE AND ALLOYS  9

UNIT V  ANALYTICAL TECHNIQUES  9

TOTAL: 45 PERIODS
TEXT BOOKS

REFERENCES

ME2151 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

UNIT II EQUILIBRIUM OF RIGID BODIES

UNIT III PROPERTIES OF SURFACES AND SOLIDS
UNIT IV  DYNAMICS OF PARTICLES  12

UNIT V  FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS  12
Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion.

TEXT BOOK

REFERENCES

EE2151  CIRCUIT THEORY  L T P C
(Common to EEE, EIE and ICE Branches)  3 1 0 4

UNIT I  BASIC CIRCUITS ANALYSIS  12

UNIT II  NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS  12
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  12

UNIT IV  TRANSIENT RESPONSE FOR DC CIRCUITS  12
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  12
Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & unbalanced – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits.

TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES

EC2151  ELECTRIC CIRCUITS AND ELECTRON DEVICES  L T P C
(For ECE, CSE, IT and Biomedical Engg. Branches)  3 1 0 4

UNIT I  CIRCUIT ANALYSIS TECHNIQUES  12

UNIT II  TRANSIENT RESONANCE IN RLC CIRCUITS  12

UNIT III  SEMICONDUCTOR DIODES  12

UNIT IV  TRANSISTORS  12
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)    12

TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES
UNIT V  FUNDAMENTALS OF COMMUNICATION ENGINEERING  12
Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES

GE2152  BASIC CIVIL & MECHANICAL ENGINEERING  L  T  P  C
(Common to branches under Electrical and I & C Faculty)  4  0  0  4

A – CIVIL ENGINEERING

UNIT I  SURVEYING AND CIVIL ENGINEERING MATERIALS  15


UNIT II  BUILDING COMPONENTS AND STRUCTURES  15
Foundations: Types, Bearing capacity – Requirement of good foundations.


TOTAL: 30 PERIODS

B – MECHANICAL ENGINEERING

UNIT III  POWER PLANT ENGINEERING  10
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

TOTAL: 30 PERIODS

REFERENCES

GE2155 COMPUTER PRACTICE LABORATORY – II

L T P C
0 1 2 2

LIST OF EXPERIMENTS

1. UNIX COMMANDS 15
Study of Unix OS - Basic Shell Commands - Unix Editor

2. SHELL PROGRAMMING 15
Simple Shell program - Conditional Statements - Testing and Loops

3. C PROGRAMMING ON UNIX 15
Dynamic Storage Allocation-Pointers-Functions-File Handling

TOTAL : 45 PERIODS

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
LIST OF EXPERIMENTS

1. Determination of Young's modulus of the material – non uniform bending.
2. Determination of Band Gap of a semiconductor material.
3. Determination of specific resistance of a given coil of wire – Carey Foster Bridge.
5. Spectrometer dispersive power of a prism.
6. Determination of Young’s modulus of the material – uniform bending.

• A minimum of FIVE experiments shall be offered.
• Laboratory classes on alternate weeks for Physics and Chemistry.
• The lab examinations will be held only in the second semester.

LIST OF EXPERIMENTS

1. Conduct metric titration (Simple acid base)
2. Conduct metric titration (Mixture of weak and strong acids)
3. Conduct metric titration using BaCl₂ vs Na₂SO₄
4. Potentiometric Titration (Fe²⁺ / KMnO₄ or K₂Cr₂O₇)
5. PH titration (acid & base)
6. Determination of water of crystallization of a crystalline salt (Copper sulphate)
7. Estimation of Ferric iron by spectrophotometry.

• A minimum of FIVE experiments shall be offered.
• Laboratory classes on alternate weeks for Physics and Chemistry.
• The lab examinations will be held only in the second semester.
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,


10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

TOTAL: 45 PERIODS

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.

EE2155 ELECTRICAL CIRCUITS LABORATORY (Common to EEE, EIE and ICE)

LIST OF EXPERIMENTS
1. Verification of ohm’s laws and kirchoff’s laws.
2. Verification of Thovemin’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.
10. Frequency response of single tuned coupled circuits.

TOTAL: 45 PERIODS
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

TOTAL: 45 PERIODS

ENGLISH LANGUAGE LABORATORY (Optional)

1. Listening: 5
   Listening & answering questions – gap filling – Listening and Note taking- Listening to telephone conversations

2. Speaking: 5
   Pronouncing words & sentences correctly – word stress – Conversation practice.

Classroom Session 20

1. Speaking: Introducing oneself, Introducing others, Role play, Debate-
   Presentations: Body language, gestures, postures.
   Group Discussions etc
2. Goal setting – interviews – stress time management – situational reasons

Evaluation

(1) Lab Session – 40 marks
   Listening – 10 marks
   Speaking – 10 marks
   Reading – 10 marks
   Writing – 10 marks

(2) Classroom Session – 60 marks
   Role play activities giving real life context – 30 marks
   Presentation – 30 marks
Note on Evaluation

1. Examples for role play situations:
   a. Marketing engineer convincing a customer to buy his product.
   b. Telephone conversation – Fixing an official appointment / Enquiry on availability of flight or train tickets / placing an order. etc.

2. Presentations could be just a Minute (JAM activity) or an Extempore on simple topics or visuals could be provided and students could be asked to talk about it.

REFERENCES

LAB REQUIREMENTS
1. Teacher – Console and systems for students
2. English Language Lab Software
3. Tape Recorders.

GE 2211 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
3 0 0 3
(Common to EEE, EIE, ICE, Biotech, Chemical, Textile Tech.(Fashion Tech.) / Fashion Tech., Plastic Tech., Polymer Tech. & Textile Tech.)

OBJECTIVES
• To create an awareness on the various environmental pollution aspects and issues.
• To give a comprehensive insight into natural resources, ecosystem and biodiversity.
• To educate the ways and means to protect the environment from various types of pollution.
• To impart some fundamental knowledge on human welfare measures.

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES
Definition, scope and importance – need for public awareness – forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their ground water, floods, drought, conflicts over water, dams-benefits and problems – mineral resources: use effects on forests and tribal people – water resources: use and over-utilization of surface and exploitation, environmental effects of extracting and using mineral resources, case studies – food resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – energy resources: growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies – land resources: land as a resource, land degradation, man induced
landslides, soil erosion and desertification – role of an individual in conservation of natural resources – equitable use of resources for sustainable lifestyles.
Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

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

UNIT III ENVIRONMENTAL POLLUTION
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 – solid waste management: causes, effects and control measures of urban and industrial wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.
Field study of local polluted site – urban / rural / industrial / agricultural

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

TOTAL: 45 PERIODS

TEXT BOOKS:
REFERENCES:

PT2201 MATERIALS ENGINEERING L T P C
3 0 0 3
(Common Polymer & Plastic Technology)

AIM
To learn about the properties and testing of materials.

OBJECTIVES
- To study the mechanical behaviour of materials, types of fractures and testing
- To know the importance of phase diagram
- To understand the various diffusion processes and heat treatment of steel

UNIT I
Mechanical Behavior of materials – Stress – Strain curve, Elastic deformation-
Characteristics of elastic deformations, atomic mechanism of elastic deformation,
Inelastic deformation, Strain-Time curves, Damping capacity, Viscous deformation,
Plastic deformation, Mechanism of plastic deformation- slip & twinning, Schmidt’s law,
critical resolved shear stress.

UNIT II
Mechanical testing and fracture of materials – tensile test, stress-strain curves for ductile
and brittle materials – mild steel, copper, proof stress, yield point phenomena, Luder’s
bands, compression test, hardness test – various hardness tests. Impact test – ductile-
brittle transitions. Fatigue- Stress cycles for fatigue testing, endurance limit, fatigue limit,
S-N curve, Creep-curve, primary creep, secondary creep, tertiary creep. Fracture – ideal
fracture stress, brittle fracture- Griffith’s theory- fracture toughness, ductile failure, cup &
cone type fracture, fatigue failure.

UNIT III
Phase diagram – solid solutions, inter metallic compound, cooling curves, non-
equilibrium cooling, phase rule, equilibrium diagrams – Isomorphous diagrams, Eutectic,
Peritectic and eutectoid reactions with examples. Ferrous and non-ferrous alloys – Fe-C
diagram, Effect of alloying elements on properties of steel, tool steel, heat resisting and
die steel. Alloys of copper, aluminium, magnesium, nickel and zinc – compositions and
their uses, bearing materials, brazing and soldering alloys. Polymeric and composite
materials, metal matrix composites, ceramics, refractories, abrasives , shape memory
materials.
UNIT IV

UNIT V

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
3. J. C. Anderson, K. D. Leaver, R. D.Rawlings, J. M. Alexander, Material Science,
5. C. W. Richards, Engineering material Science, Prentice Hall Of India.

MA2211 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATION

(LT) P C
3 1 0 4

(Common to all branches of BE / B.Tech Programmes)

OBJECTIVES
The course objective is to develop the skills of the students in the areas of Transforms and Partial Differential 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.

UNIT I FOURIER SERIES
UNIT II  FOURIER TRANSFORMS  

UNIT III  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.

UNIT IV  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.

UNIT V  Z -TRANSFORMS AND DIFFERENCE EQUATIONS  

L : 45  T : 15  TOTAL : 60 PERIODS

TEXT BOOK

REFERENCES

PT2202  ORGANIC CHEMISTRY AND TECHNOLOGY  
(Common Polymer & Plastic Technology)  
L T P C 3 1 0 4

AIM
To learn about the various basic organic reactions, their mechanisms, preparation, properties and uses of monomers.

OBJECTIVES
• To get know about the basics of organic chemistry, mechanism of organic reactions; preparation, properties and uses of majority of the monomers involved in polymer formation.

UNIT I
UNIT II 12
Types of reagents- Electrophiles and Nucleophiles, types of reactions – addition (>C=C<, >C=O) substitution – Electrophilic and Nucleophilic substitution - elimination and rearrangement reactions – Inter and Intra molecular rearrangement – Hoffman, Beckman, Benzidine rearrangements - General conditions and mechanism of each of the above.

UNIT III 12
Natural gas – Synthesis gas – Petroleum and petroleum products – Coal and coal products – Cellulose and cellulose products.

UNIT IV 12

UNIT V 12

TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES

PT2203 PHYSICAL CHEMISTRY OF POLYMERS L T P C
3 0 0 3
(Common Polymer & Plastic Technology)

AIM
To learn about the structures, conformations and orientation of polymeric materials.

OBJECTIVES
To understand
- Physical and conformational properties of polymeric materials
- Molecular arrangement in polymers and their orientation under the influence of stress.
- Solubility behaviour of polymers
UNIT I
Potential energy and conformational energy of molecules - Staggered and eclipsed states - conformations and configurations, isomeric states and isomerism in polymers - Tactility, stereoisomerism, geometric isomerism - Unperturbed and Gaussian chains - Random coils and average end to end distance - Freely jointed and freely rotating chain models - Random flight analysis.

UNIT II
Thermodynamics - First and second law of Thermodynamics, Carnot cycle - Entropy and enthalpy - Energy driven and entropy driven elasticity - Thermoelectricity - Thermodynamic treatment of rubbers - entropic and energetic contributions to the elastic force in rubbers - Stastical mechanical theory.

UNIT III

UNIT IV
Chain orientation - Concept of chain orientation - orientation in amorphous and crystalline polymers - Uniaxial and biaxial orientation practical significance - Orientation processes - fibre spinning, blown film extrusion, solid state extrusion, profile extrusion - Properties of oriented polymers - Birefringence.

UNIT V
Polymer solutions - Terms and definitions, types of solutions - Hilderbrand approach, Flory Huggins theory - Thermodynamic view of miscibility, upper critical solution temperature (UCST), lower critical solution temperature (LCST) - Concentration regimes in polymer solutions - theta conditions.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCE
AIM
To learn the basic concepts of polymers, reactions and kinetics involved in polymerization and characterization.

OBJECTIVES
To understand the mechanism of polymerization, various techniques of polymerization, characterization of polymers by molecular weight, reactions and degradation of polymers

UNIT I

UNIT II

UNIT III

UNIT IV
Molecular weight – Molecular weight averages – Molecular weight distribution – Unidispersity, polydispersity, degree of polymerisation - Molecular weight determination - Basic concepts of end group analysis, colligative properties, osmametry, light scattering, and gel permeation chromatography - Viscosity of polymers solutions, size of the polymer molecules.

UNIT V

TOTAL : 60 PERIODS

TEXT BOOKS
2. George Odian, “ Principles of polymerisation”, Seymor Robert

REFERENCES
Lab Requirements

Bunsen Burner 15Nos
Electronic Balance 1 No
Thermostatic Water bath 2 Nos
Melting Point Apparatus 1 No
Retort Stand 15Nos
Polymer Samples and Glass wares

Experiments:

Identification of polymers by simple methods like density, melting point, burning characteristics, solubility and confirmatory test by chemical analysis.

A. PLASTICS
1. Polyethylene
2. Polypropylene
3. Polystyrene
4. Polyvinyl Chloride
5. Polyamide
6. Polyethylene terephthalate
7. Polybutylene terephthalate
8. Polycarbonate
9. Polyacetal
10. Polyphenylene oxide
11. Polyphenylene sulphide
12. Phenol Formaldehyde
13. Urea formaldehyde
14. Melamine formaldehyde

B. IDENTIFICATION OF RUBBERS BY SIMPLE METHODS
1. Natural Rubber (NR)
2. Polybutylene Rubber (BR)
3. Styrene Butadiene Rubber (SBR)
4. Isoprene Rubber (IR)
5. Isobutyene Isoprene Rubber (IIR)
6. Chloroprene Rubber (CR)
7. Acrylonitrile – Butadiene Rubber (NBR)
8. Silicone Rubber

TOTAL : 45 PERIODS

REFERENCE
1. Identification of plastics and rubbers by simple methods, CIPET publications 2002
Lab Requirements
Conical flask 15 No.
Liebig condenser 15 No.
Round bottom flask 15 No.
Burette 15 No.
Pipette 15 No.
Iodine flask 15 No.
Test tubes 01 Gross
Test tube holder 15 No.
Tongs 15 No.
Bunsen burner 15 No.
Chemicals

Experiments:

PART A: Identification of Organic compounds of the following types:
1. Alcohols
2. Aldehydes
3. ketones
4. Carboxylic acids
5. Esters
6. Nitro compounds
7. Amines
8. Amides
9. Carbohydrates
10. Halogen compounds
11. Phenols

PART – B: Single step preparation of organic compounds by the following methods
1. Nitration
2. Acetylation
3. Bromination
4. Oxidation
5. Hydrolysis

II. Quantitative Estimation of
1. Phenol
2. Acetone
3. Urea
4. Formaldehyde
5. Methyl Methacrylate
6. Acrylonitrile

TOTAL: 45 PERIODS

REFERENCES
1. A.I. Vogel, Organic Qualitative and Quantitative Analysis.
OBJECTIVES
At the end of the course, the students would

- Acquire skills in handling situations involving more than one random variable and functions of random variables.
- Be introduced to the notion of sampling distributions and have acquired knowledge of statistical techniques useful in making rational decision in management problems.
- Be exposed to statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.

UNIT I   RANDOM VARIABLES  9 + 3
Discrete and continuous random variables - Properties- Moments - Moment generating functions and their properties. Binomial, Poisson ,Geometric, Negative binomial, Uniform, Exponential, Gamma, and Weibull distributions.

UNIT II   TWO DIMENSIONAL RANDOM VARIABLES  9 + 3
Joint distributions - Marginal and conditional distributions – Covariance - Correlation and Regression – function of a random variable-Transformation of random variables - Central limit theorem.

UNIT III   TESTING OF HYPOTHESIS  9 + 3
Sampling distributions – Testing of hypothesis for mean, variance, proportions and differences using Normal, t, Chi-square and F distributions - Tests for independence of attributes and Goodness of fit.

UNIT IV   DESIGN OF EXPERIMENTS  9 + 3

UNIT V   RELIABILITY AND QUALITY CONTROL  9 + 3
Concepts of reliability-hazard functions-Reliability of series and parallel systems- control charts for measurements (x and R charts) – control charts for attributes (p, c and np charts)

L : 45  T : 15  TOTAL: 60 PERIODS

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

TEXT BOOKS

REFERENCES
AIM
To learn the techniques employed in mould making.

OBJECTIVES
• To study the mould making techniques such as metal cutting, metal erosion, metal deposition, metal displacement and mould polishing

UNIT I

UNIT II
Die sinking (copy milling), Pentograph, Profile grinding, Electrical discharge machining – Characteristics, physical processes, special technological features, types of EDM, design consideration & functions and technological planning. Applications of wire cut EDM in mold making.

UNIT III
Electroforming for mold manufacturing – discussion of the process, materials for electroforming, design & materials for models, machining for electroformed blanks, mold cavities, economy & service life.
Hobbing for mold making – Discussion of the hobbing process & its advantages, elements of hobbing like hobbing punch, shape of the hob, materials used for cavity, lubrication, and depth of hobbing, Hobbing presses, Hobbing operations & its economy with examples.

UNIT IV
Polishing technology in mold making: Definition of surface roughness, basis of polishing technology, Effect of mold materials on polishability, Types of polishing tools, Methods of polishing - Basic information on Electro sonic polishing – Principles of Electro deposition in damaged molding surfaces.
Surface Texturing of molds – Process description, types of molds, types of patterns and mold shapes, metals that can be etched, mold preparation, limitations of chemical texturing.

UNIT V
Metrology and inspection: Scope of inspection, Procedures, Choices of basic measuring instruments, Vernier, Micrometer, Surface Plates, Angle plates, Squares, Vernier height gauges, Depth gauges, Slip gauges, Dial gauges, Surface roughness measurement, Hardness testing, Comparators, Optical profiles projectors, Tool makers microscope, Optical flats – types and uses.

TOTAL : 60 PERIODS

TEXT BOOKS
2. HMT Production Technology, TMH (India), 1992
REFERENCES

PT 2252 POLYMER STRUCTURE AND PROPERTY RELATIONSHIP

(Common Polymer & Plastic Technology)

AIM
To emphasize the relationship between the structure and properties of polymers.

OBJECTIVES
To understand
- The structure of polymers and prediction of polymer properties
- The relationship between polymer structure and properties such as mechanical, thermal, electrical, optical and chemical properties

UNIT I
Structure of polymers - Linear, branched, crosslinked, and network polymers - Homochain and hetero atomic chain polymers - Copolymers - Linear and cyclic arrangement - Prediction of polymer properties, group contribution techniques, topological techniques - Volumetric properties - molar volume, density, Van der Waals volume - Coefficient of linear thermal expansion and volumetric thermal expansion - Pressure volume temperature (PVT) relationship.

UNIT II
Mechanical properties - Stress-strain properties of polymers - Effect of polymer structure on modulus of elasticity, tensile strength, flexural strength, impact strength, yield strength, fracture toughness - Crazing in glassy polymers - Ductile brittle transition. Effect of additives on mechanical properties of polymers - Creep, stress relaxation, and fatigue.

UNIT III
Thermodynamic and transition properties - Transition temperature in polymers, glass transition ($T_g$), melt transition ($T_m$), relationship between $T_g$ and $T_m$ - other transitions like $\beta$-transitions, upper and lower glass transition temperatures - Prediction of $T_g$ and $T_m$ of polymers by group contributions. Calorimetric properties - Heat capacity, specific heat, latent heat of crystallization and fusion, enthalpy and entropy - Calculation of heat capacities of polymers.

UNIT IV
Electrical and optical properties - Effect of polymer structure on dielectric constant, power factor, dissipation factor, and loss factor - effect of frequency of voltage and temperature on dielectric properties - Prediction of molar polarization and effective dipole moment. Effect of additives on electrical properties of polymers. Optical properties - Effect of polymer structure on optical properties - clarity, transparency, haze, transmittance, reflectance, and gloss - Prediction of refractive indices of polymers by group contributions, Static charges, volume & surface resistivity, arc resistance.
UNIT V
Chemical Properties - Cohesive energy, cohesive energy density, solubility parameter, determination of solubility parameter of polymers - Prediction of solubility parameter - Effect of polymer structure on solubility in solvents and oils - Influence of structure in prediction of flame retardancy, water repellency - Chemical resistance of polymers - Polymer toxicity.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

PT 2253 PRINCIPLES OF CHEMICAL ENGINEERING

(3003)

UNIT I
Classification of Unit Operations
Fluid flow -Types of fluids – Newtons’s law of viscosity; Reynolds number regimes, internal flow - flow through pipes – pressure drop under laminar and turbulent flow conditions Mixing and agitation – types of impellers, power requirement for mixing.

UNIT II
Mechanical operations
Properties of solids - Sieve analysis; Laws of crushing, Crushers and grinders. Principle of separation and selection and details of equipment for screening, sedimentation, cyclones and hydro cyclones and filtration

UNIT III
Heat transfer
UNIT IV
Mass transfer
Principles of diffusion, theory of diffusion, Two film theory and mass transfer coefficients

UNIT V
Absorption – Principle and equipment (packed towers and plate columns).
Distillation – Vapour liquid equilibria, flash distillation, Binary distillation. Industrial equipments for distillation
Adsorption – Principle and equipment for adsorption.
Extraction - Principle and equipment for adsorption.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
2. Chemical Engineer’s handbook - Perry and Chilton.

PT2254 STRENGTH OF MATERIALS
L T P C
3 0 0 3
(Common Polymer & Plastic Technology)

AIM
To acquire knowledge on behaviour of materials on application of load.

OBJECTIVES
To study the behavior and failure pattern of different materials under different loading conditions
Design of structural member under given loading conditions

UNIT I
Elasticity: Stress and strain, compressive, tensile, shear and bearing stress – Stress – strain diagram, Hooks law, modulus of elasticity, modulus of rigidity, bulk modulus of rigidity, bulk modulus, Poisson’s ratio. Relationship between elastic constants and temperature stresses, composite bars.

UNIT II
Properties of section, calculation of areas, centroid, neutral axis, moment of inertia, modulus of section, radius of gyration with reference to structural shapes.
UNIT III
9

UNIT IV
9
Principal stresses and strains - Thin cylinders and shells subjected to internal pressures.

UNIT V
9
Deflection – deflection of beams in simple cases column and struts – long and short columns – axial loading – effect of end conditions – equivalent length and slenderness ratio – Euler and Rankine formulae.

TOTAL : 45 PERIODS

TEXT BOOKS

PT 2255 POLYMERIC MATERIALS I L T P C
4 0 0 4

AIM
To learnt about the various methods of preparation, properties and applications of thermoplastic materials.

OBJECTIVES
To understand the methods of preparation, properties and applications of thermoplastic materials covering commodity, engineering and high performance plastics.

UNIT I
12

UNIT II
12
Methods of manufacturing – Properties and applications of poly(vinyl chloride)- Poly(vinylidene chloride)- Poly(vinyl alcohol) – Poly(vinyl acetate)- Chlorinated poly(vinyl chloride)- Plastisols, Polystyrene, HIPS, EPS, SAN, EVA, EPDM, ABS.

UNIT III
12
Methods of manufacturing – properties and applications of Acrylates – Poly (methyl methacrylate)- Polyacrylonitrile. Aliphatic polyamides –Aromatic polyamides – Polyethylene terephthalate - Polybutylene terephthalate - Polyacetals and copolymers – Polycarbonates-Thermoplastic polyurethane (TPU)

UNIT IV
12
Methods of manufacturing – Properties and applications of Fluoro polymers – Polytetrafluoroethylene, Polychlorofluoroethylene, Thermoplastic polyurethanes, Cellulose nitrate – Cellulose acetate- ethyl cellulose- Cellulose esters.
UNIT V
Preparation, properties and applications of High performance Thermoplastic materials-PPS, PPO, Polysulphone, Polyether Sulphone, PEEK, Polyimide- Biodegradable plastics, photodegradable plastics

TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES

PT 2257 CHEMICAL ENGINEERING - I LAB

(Common Common Polymer & Plastic Technology)

AIM:

LAB REQUIREMENTS
Fluidized bed 1 No.
Packed bed 1 No.
Stop watch 2 No.
Measuring cylinder (1 Lit) 2 No.
Sieve shaker and sieve set 1 No.
Ball mill 1 No.
Jaw crusher 1 No.
Electronic balance 1 No.
Plastics tray 2 No.
Friction pipe apparatus 1 No.
Single speed centrifugal pump 1 No.
Venturi meter apparatus 1 No.
Orifice/mouth piece apparatus 1 No.
Stop watch 4 No.
Meter scale 4 No.
Vernier caliper 2 No.
Flow measuring meters 3 No.
Stop watch 2 No.
Thermometer 5 No.
Tacho meter 1 No.
Measuring jar (2 lit and 1 Lit each one) 2 No.
Air compressor 1 No.
Parallel and counter flow heat exchanger 1 No.
Stephen Boltzman apparatus 1 No.
Thermal conductivity Apparatus 1 No.

Experiments:
1. Flow through rough and smooth pipes.
2. Centrifugal pump.
3. Calibration of orifice meter.
4. Air compressor
5. Calibration of rotameter
6. Pressure drop in packed bed  
7. Fluidization  
8. Flow through weirs  
10. Open orifice and drainage time  
11. Thermal conductivity of solids.  
12. Heat exchanger  
13. Stefan-Boltzman constant  
14. Jaw crusher  
15. Ball Mill  
16. Screening efficiency.  
17. Simple distillation  
18. Steam distillation  
(Any Nine Experiments)  

TOTAL : 45 PERIODS  

REFERENCES  

PT 2258  
MOULD ENGINEERING LAB  
L T P C  
0 0 3 2  
(Common to Plastic & Polymer Technology)  

AIM  
To learn the techniques employed in mould making.  

OBJECTIVES  
To study the mould making techniques such as metal cutting, metal erosion, metal deposition, metal displacement and mould polishing.  

LAB REQUIREMENTS  
Shaping machine 5 No.  
Vertical milling machine 2 No.  
Horizontal milling machine 2 No.  
Lathe 15 No.  
Plain surface grinding machine 1 No.  
Bench grinder 2 No.  
Vernier caliper 2 No.  
Vernier height gauge 2 No.  
Sine bar 2 No.  
Sine center 1 No.  
Gear tooth vernier caliper 1 No.  

Experiments  
1) Exercise on Shaping machine – making square rod from round rod and cutting V-groove.  
2) Exercise on Plain Milling.  
3) Exercise on Vertical Milling.  
4) Screw Cutting on lathe – external thread.  
5) Exercise on Surface Grinding.  
6) Exercise on Slotting Machine.  
7) Grinding of Cutting tools.
8) Study of different types of Cutting tools.
9) Measurements using Micrometer, vernier, Height gauge and Slip gauge.
10) Measurement of angles and tapers.
11) Checking of straightness using auto collimeter.
12) Application of Dial gauge.
(Any 8 experiments from the above)

Demonstration Experiment: To make a simple mold for hand molding machine

TOTAL: 45 PERIODS
REFERENCES

PT2301 FLUID MECHANICS LT P C 4 0 0 4

UNIT I
State of Aggregation and phase states of matter Molecular motion in Polymers Transition relaxation processes in Polymers. Glass Transition, Theories to determine the glass transition i.e. Dilatometric, Heat capacity, measurement, Thermo mechanical, Measurement of modulus of elasticity, effect of Tg on molecular mass, kinetic chain flexibility and chemical constituent, Importance of Tg and Tm, HDT.

UNIT II
Viscoelastic behavior of Polymer solution and melts stress-strain curves for Polymers, creep of Polymeric material, elastic deformation, and irrecoverable follow deformation. Rubber like deformation, Time-temp superposition (WLF Equation) Models of viscoelasticity such as Maxwell and kelvin model. Types of viscosity, stress relaxation.

UNIT III
Introduction and Basic concept of Rheology, classification of fluids, Newtonian and non Newtonian fluids, shear stress, shear strain and shear rate, shear modulus, bulk modulus, Zero shear viscosity, Dependence of viscosity with temp, shear stress, shear rate fluid through channel, characteristic parameter during shear deformation.

UNIT IV
Methods to determine shear viscosity by capillary Rheometer, cone and plate viscometer, Cup and bob viscometer, Measurement of normal stresses. Theories of viscosities of dilute (Debye Bueche theory) and conc. Solutions (Grasselley’s entanglement theory), (Entanglement concern)

UNIT V
Rheology of dilute and concentrated suspensions, effect of Rheology during Injection, moulding Extrusion: Film extrusion, sheet Extrusion and Blow mouldings of polymers Rheometer, Bubble inflation rheometer, compression rheometers, stress relaxation instruments. Torque rheometers, rotational & sliding surface rheometers and their use in determining processability

L : 45, T: 15, TOTAL: 60 PERIODS
REFERENCES
6. Physical Chemistry of Polymers - Tager.
7. Polymer Sc. and Tech. of Plastics and Rubber ; D.Ghosh.
8. Melt Rheology and its Role in Plastics Processing : Dealy

PT2302 ANALYSIS AND CHARACTERISATION OF POLYMERS

AIM
To familiarize the techniques of identification and analysis of polymers

OBJECTIVES
To prepare the students with methodology for facing the industrial and academic challenges in
- Identifying various polymers
- Controlling the quality of incoming raw materials and processing
- Characterizing different fluid of polymers
- Analyzing polymers through various instrumental methods

UNIT I IDENTIFICATION AND ANALYSIS
Identification of rubbers and plastics by simple physical methods by chemical analysis, application of instrumental techniques for identification of polymers and additives Thermoplastics – melting point, density, viscosity, melt flow index, K-value. Thermo sets – moisture analysis, particle size, apparent density, spiral flow test, cup flow test, gel time and peak exothermic temperature. Resins – acid value, hydroxyl value, isocyanate index, epoxy equivalent

UNIT II SPECIFICATIONS, QUALITY CONTROL AND PROCESS ABILITY TESTS
Rubber latex and dry rubber – cup viscosity, total alkalinity, total solids, dry rubber content, volatile matter, KOH number, mechanical stability and heat stability, Plasticity, plasticity retention index (PRI), scorch time and cure characteristics (plastimeter, Mooney viscometer, oscillating disc rheometer)

UNIT III MOLECULAR CHARACTERIZATION OF POLYMERS
Determination of molecular weight, viscometry, end group analysis, colligative property, osmometry light scattering technique, determination of molecular weight and molecular weight distribution, gel permeation chromatography
UNIT IV  THERMAL ANALYSIS OF POLYMERS
Differential thermal analysis (DTA), differential scanning calorimetry (DSC), thermo gravimetric analysis (TGA), thermo mechanical analysis (TMA), dynamic mechanical thermal analysis (DMTA)

UNIT V  PHYSICAL METHODS OF ANALYSIS
X-ray diffraction (Wide angle and small angle), Infrared spectroscopy (IR & FTIR), and Nuclear magnetic resonance spectrometer (NMR), GC – Mass spectrometer, optical microscopy, scanning electron microscopy, and transmission electron microscopy

TOTAL: 45 PERIODS

TEXT BOOK

REFERENCES
2. ASTM - 9.01 & 9.02; 8.01 & 8.04, 2000
3. Kampff, Characterization of Plastics using physical methods, Experimental Techniques and practical applications

PT2303  COMPUTER PROGRAMMING

AIM
To learnt “C” and java programming.

OBJECTIVES
To understand Preparing methodologies, basics of C++, classes, inheritance, and polymorphism templates and brief details on java programming

UNIT I  INTRODUCTION
Programming methodologies – comparison – Object oriented concepts – Basics of C++ environment.

UNIT II  CLASSES
Definition – Data members – Access specifiers – Constructors – Default constructors – Copy constructors – Destructors – Static members – This pointer – Constant members – Free store operators – Control statements.

UNIT III  INHERITANCE AND POLYMORPHISM
Overloading operators – Functions – Friends – Class derivation – Virtual functions – Abstract base classes – Multiple inheritance

UNIT IV  TEMPLATES
Class templates – Function templates – Exception handling – Streams
UNIT V  JAVA PROGRAMMING  9
Java environment – Classes – Definition – Field methods – Object creation – Constructors – Overloading methods – Static members – This keyword – Nested classes Extending classes – members accessibility – overriding – methods – Abstract classes – Interfaces

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

PT2304  PROCESSING TECHNOLOGY – I  L T P C
3 0 0 3

AIM
To learn the basic processing methods employed for plastics.

OBJECTIVES
To study different plastic processing techniques such as injection, blow moulding and thermoforming to learn about various compounding machinery and technology

UNIT I  9
Introduction to polymer processing – Plastics processing techniques – Selection of plastic materials – Selection of additives - General considerations in formulation – Methods of incorporation of additives - Mixing and compounding equipment.

UNIT II  9

UNIT III  9
Types Injection unit & Elements of plasticating process – Classification of screw – Screw design – Process control – Clamping unit – Classification of Machine Hydraulics – Ancillary equipment – Computer operation

UNIT IV  9
UNIT V 9

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

PT2305 POLYMERIC MATERIALS II L T P C
3 0 0 3

AIM
To understand the manufacture, properties and applications of polymeric materials.

OBJECTIVES
To study the manufacturing technology, properties and applications of thermoplastics, thermosets and elastomers.

UNIT I 9
Manufacture, properties and applications - polyethylene, polypropylene, polystyrene Polyvinylchloride, polyvinyl alcohol, polyacetal, fluorooplastics.

UNIT II 9
Manufacture, properties and applications - polyethyleneterephthalate, polybutylene terephthalate, polycarbonate, polyacrylate, liquid crystalline polyesters.

UNIT III 9
Manufacture, properties and applications-aliphatic polyamides-polyamide thermoplastic Elastomer-aromatic polyamides, polyimides

UNIT IV 9
Manufacture, properties, curing and applications- phenolics,aminoplastics, epoxy,Unsaturated polyester, vinyl ester resins, BMI.

UNIT V 9
Manufacture, properties and applications –NR, polybutadiene, styrene-butadiene rubber-nitrile rubber, polyisoprene, polychloroprene, silicone rubber, EPDM rubber, chlorosulfonated polyethylene, acrylic rubbers, polyurethane and fluoroelastomers.

TOTAL : 45 PERIODS
AIM
Globalization has brought in numerous opportunities for the teeming millions, with more focus on the students’ overall capability apart from academic competence. Many students, particularly those from non-English medium schools, find that they are not preferred due to their inadequacy of communication skills and soft skills, despite possessing sound knowledge in their subject area along with technical capability. Keeping in view their pre-employment needs and career requirements, this course on Communication Skills Laboratory will prepare students to adapt themselves with ease to the industry environment, thus rendering them as prospective assets to industries. The course will equip the students with the necessary communication skills that would go a long way in helping them in their profession.

OBJECTIVES

- To equip students of engineering and technology with effective speaking and listening skills in English.
- To help them develop their soft skills and interpersonal skills, which will make the transition from college to workplace smoother and help them excel in their job.
- To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment exercises.

I. PC based session (Weightage 40%) 24 periods

A. ENGLISH LANGUAGE LAB (18 Periods)

1. LISTENING COMPREHENSION: (6)
   Listening and typing – Listening and sequencing of sentences – Filling in the blanks - Listening and answering questions.

2. READING COMPREHENSION: (6)
   Filling in the blanks - Close exercises – Vocabulary building - Reading and answering questions.
3. SPEAKING:


Conversations: Face to Face Conversation – Telephone conversation – Role play activities (Students take on roles and engage in conversation)

B. DISCUSSION OF AUDIO-VISUAL MATERIALS (6 PERIODS)

(Samples are available to learn and practice)

1. RESUME / REPORT PREPARATION / LETTER WRITING (1)
   Structuring the resume / report - Letter writing / Email Communication - Samples.

2. PRESENTATION SKILLS: (1)
   Elements of effective presentation – Structure of presentation - Presentation tools – Voice Modulation – Audience analysis - Body language – Video samples

3. SOFT SKILLS: (2)
   Time management – Articulateness – Assertiveness – Psychometrics – Innovation and Creativity - Stress Management & Poise - Video Samples

4. GROUP DISCUSSION: (1)
   Why is GD part of selection process ? - Structure of GD – Moderator – led and other GDs - Strategies in GD – Team work - Body Language - Mock GD -Video samples

5. INTERVIEW SKILLS: (1)
   Kinds of interviews – Required Key Skills – Corporate culture – Mock interviews- Video samples.

II. Practice Session (Weightage – 60%) 24 periods

1. Resume / Report Preparation / Letter writing: Students prepare their Own resume and report. (2)
2. Presentation Skills: Students make presentations on given topics. (8)
3. Group Discussion: Students participate in group discussions. (6)
4. Interview Skills: Students participate in Mock Interviews. (8)

REFERENCES
LAB REQUIREMENT
1. Teacher console and systems for students.
2. English Language Lab Software
3. Career Lab Software

Guidelines for the course

GE2321 COMMUNICATION SKILLS LABORATORY

1. A batch of 60 / 120 students is divided into two groups – one group for the PC-based session and the other group for the Class room session.

2. The English Lab (2 Periods) will be handled by a faculty member of the English Department. The Career Lab (2 Periods) may be handled by any competent teacher, not necessarily from English Department

3. Record Notebook: At the end of each session of English Lab, review exercises are given for the students to answer and the computer evaluated sheets are to be compiled as record notebook. Similar exercises for the career lab are to be compiled in the record notebook.

4. Internal Assessment: The 15 marks (the other 5 marks for attendance) allotted for the internal assessment will be based on the record notebook compiled by the candidate. 10 marks may be allotted for English Lab component and 5 marks for the Career Lab component.

5. End semester Examination: The end-semester examination carries 40% weightage for English Lab and 60% weightage for Career Lab.

Each candidate will have separate sets of questions assigned by the teacher using the teacher-console enabling PC–based evaluation for the 40% of marks allotted.

The Career Lab component will be evaluated for a maximum of 60% by a local examiner & an external examiner drafted from other Institutions, similar to any other lab examination conducted by Anna University.

Requirement for a batch of 60 students

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<th>Description of Equipment</th>
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| 3. | Handicam Video Camera (with video lights and mic input)                               | 1 No.
| 4. | Television - 29"                                                                      | 1 No.
| 5. | Collar mike                                                                           | 1 No.
| 6. | Cordless mikes                                                                         | 1 No.
| 7. | Audio Mixer                                                                           | 1 No.
| 8. | DVD Recorder/Player                                                                   | 1 No.

**PT2307**  
**COMPUTER PROGRAMMING LAB**

**LAB REQUIREMENT**
1. Computer Systems 30 Nos
2. Softwares for C++ and Java

**C++ PROGRAMMING**
- Simple C++ program
- Function overloading
- Operator overloading
- Inheritance
- Virtual functions and Dynamic binding
- File handling
- Exception handling
- JAVA PROGRAMMING
- Simple Java programs
- Inheritance
- Event handling programs

**TOTAL: 45 PERIODS**

**PT2308**  
**POLYMER PREPARATION AND CHARACTERIZATION LABORATORY**

**AIM**
To familiarize the techniques of identification and analysis of polymers

**OBJECTIVES**
To prepare the students with Methodology for facing the Industrial and academic challenges in
- Identifying various polymers
- Controlling the quality of incoming raw materials and processing
- Analyzing polymers through various instrumental methods
LAB REQUIREMENT
- Magnetic stirrer: 10 Nos.
- Thermostatic Water bath: 2 Nos.
- Vacuum Pump: 1 No.
- Heating Mantle: 10 Nos.
- Water distillation set up: 1 No.
- Bunsen burner: 15 Nos.
- Electronic balance: 2 Nos.
- Air oven: 1 No.
- Melting point apparatus: 1 No.
- Retard stands: 15 Nos.

- Preparation of phenol – formaldehyde (Novalac) resin.
- Preparation of phenol – formaldehyde (Resol) resin.
- Preparation of Urea formaldehyde resin.
- Preparation of Bisphenol – An epoxy resin.
- Preparation of Unsaturated polyester resin.
- Preparation of a polyester using Diethylene glycol & adipic acid.
- Bulk polymerization of styrene.
- Emulsion Polymerization of styrene.
- Solution Polymerization of acrylonitrile.
- Solution Polymerization of vinyl acetate.
- Suspension Polymerization of Methyl methacrylate.
- Copolymerization of styrene and methyl methacrylate.

TOTAL: 45 PERIODS

PT2351
MOULD AND DIE DESIGN

AIM
To get a basic understanding in design of moulds

OBJECTIVES
To learn the design of moulds such as injection, compression, transfer, blow and extrusion dies and moulds.

UNIT I

UNIT II
Classification of Compression Moulds – Factors that Influence Thermoset Moulding – Materials Selection in Relation to Moulding Conditions, Design of Mould Cavity – Advantages and Disadvantages of Compression moulds

UNIT III
Transfer Moulding – Types, principles, Design of Pot and Plunger, Feed System, Economic determination of the number of cavities, Technological determination of the number of cavities, design of mould cavity, design of loading chamber, Heat losses and energy requirement to heat the mould – Advantages and disadvantages of Transfer mould.

48
UNIT IV

UNIT V
Extrusion die design–Construction features of an extruder, Process, Characteristics of Polymer melt, Die geometry, Die head Pressure, characteristics of land length to Profile thickness, Extrudate die swell, Die materials, Classification of dies-Dies for Solid Section, Dies for Hollow Profiles, Blown film dies, Flat film dies, Parison dies, Wire and cable Coating dies, Spiral mandrel die, Fish tail die, Adjustable Core die.

TEXT BOOKS

REFERENCE

PT2352 POLYMER RHEOLOGY

AIM
To learn the flow characteristics of polymers

OBJECTIVES
To understand Mechanical behaviour of polymeric materials under applied load for short term and long term Flow behavior of polymer melts and the experimental techniques for measuring the rheological properties.

UNIT I

UNIT II

UNIT III
UNIT IV

UNIT V
Rheological behaviour of important thermoplastics (PE, PVC, PS, PP, nylons and PC)-Applications of rheology to polymer processing (injection moulding, extrusion and blow moulding)

REFERENCES
2. P.N. Cogswell, Polymer Melt Rheology, A guide for Industrial Practice, George Godwin

AIM
To learn about the various testing methods employed for polymers.

OBJECTIVES
- To familiarize the students with standards and methodology in
- Preparing various polymers specimen
- Testing raw materials and components for evaluating various properties
- Testing products for predicting product performance

UNIT I STANDARDS AND SPECIMEN PREPARATION
Standards and specifications and their importance with reference to polymer Preparation of test specimen by various techniques for thermoplastics, thermo sets, and elastomers conditioning and test atmospheres

UNIT II MECHANICAL PROPERTIES

UNIT III THERMAL AND RHEOLOGICAL PROPERTIES
Transition temperatures, Vicat softening temperature, heat distortion temperature, coefficient of expansion, specific heat, thermal conductivity, shrinkage, brittleness temperature, thermal stability, and flammability, melt flow index, viscosity (Rotational viscometer, MPT, capillary rheometer, and torque rheometer)
UNIT IV ELECTRICAL, OPTICAL AND OTHER PROPERTIES
Volume and surface resistivity, dielectric constant and power factor, dielectric strength, arc resistance, tracking resistance, static charge. Refractive index, light transmission, transparency, haze, gloss clarity, and birefringence. Environmental stress crack resistance (ESCR) - water absorption, weathering and chemical resistance, aging, ozone resistance, permeability, adhesion.

UNIT V TESTING OF PRODUCTS
Plastic films, sheeting, pipes, laminates, foams, containers, and cables. Rubber hose, Microcellular sheet, wire and cables, foams, gloves, tyres and tubes

TOTAL: 45 PERIODS

TEXT BOOKS
2. ASTM: 8.01 & 8.04; 9.01 & 9.02, 2000

REFERENCES

PT2354 PROCESS CONTROL & INSTRUMENTATION

L T P C
3 0 0 3

AIM
To understand the concepts of process control and instrumentation

OBJECTIVES
To study the basic concepts of instrumentation and control systems covering measurement of temperature, pressure, flow and level. To understand process control systems with related examples

UNIT I GENERAL CONCEPTS OF MEASUREMENTS
Variables and their measurements signals, the three stages of generalized measurement system, some common terms used in the measurement systems, mechanical loading, impedance matching, frequency response. Factors considered in selection of instruments – error analysis and classification, source of error. Transducer: classification, displacement & velocity transducers, potentiometer, LVDT, variable reluctance transducers, capacitive transducers, tachometer. Types of electric strain gauges – strain gauge bridges. Calibration of strain gauges

UNIT II TEMPERATURE MEASUREMENT
Platinum resistance thermometers, thermistors, thermocouple, total radiation pyrometers, optical pyrometer, temperature measuring problems in flowing fluids.
Pressure measurement: Manometers, Elastic transducers, elastic diaphragm transducers, McLeod gauge, thermal conductivity gauges, calibration of pressure gauge using dead weight tester, dynamic characteristics of pressure measuring systems.
UNIT III FLOW & MISCELLANEOUS MEASUREMENTS 9
Venturi, Orifice & nozzle meters, Pitot tube, turbine type meters, hot wire anemometer, magnetic flow meters. Level measurement: float level meters & electrical conductivity meters.

UNIT IV CONTROL SYSTEMS 9
Open loop and closed loop controls, elements of closed loop control systems. Mathematical models for mechanical & electrical systems, transfer function, block diagram representation, signal flow graphs, control system components.

UNIT V PROCESS CONTROL 9

TOTAL : 45 PERIODS

TEXT BOOKS
1. T.G. Beckwith and N.L. Buck, Mechanical measurements, Addition Wesley Publishing company ltd. 1995

REFERENCES

PT2355 PROCESSING TECHNOLOGY- II L T P C
3 0 0 3

AIM
To learn the various processing methods for plastics and composites.

OBJECTIVES
To study different plastic processing techniques such as extrusion, compression moulding, transfer moulding, calendaring, rotational moulding, FRP processing etc.

UNIT I 9

UNIT II 9
UNIT III
Compression moulding – types and procedure machinery and equipment moulding of thermoplastics – moulding of thermosets and rubber, Advantages & limitations, type of compression mould, Automatic compression molding - Transfer moulding advantages – Limitations.

UNIT IV
Rotational moulding – types of machines moulds – materials – part design – Calendering types of calendars - powder coating – manufacturing methods – Application methods. Types of powder coating

UNIT V
FRP - reinforcements, preforms, compounds & prepregs – Processes - benefits – Designing for spray up, hand layup, finishing and machining of plastics

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

PT2356 RUBBER ENGINEERING L T P C
4 0 0 4

AIM
To learn about the chemistry, manufacture, and applications of various elastomers

OBJECTIVES
To understand the chemistry and manufacturing technology of elastomers, compounding and vulcanization, properties and application

UNIT I NATURAL RUBBERS
Tapping latex, Processing of Latex - Dry rubber production (Smoked sheet, air dried sheet, Crepe etc.) - Grading of rubbers - Modified natural rubber, Reclaimed rubber - process of reclamation – applications.

UNIT II COMPOUNDING DESIGN AND VULCANIZATION
Sulphur vulcanization and non-sulphur vulcanization, vulcanization systems - accelerators, activators, promoters, antioxidants, antiozonants, processing aids, fillers and effect of fillers, Blowing agents etc.

UNIT III SYNTHETIC ELASTOMERS
Manufacturing, structure, properties, compounding, curing and applications - Polysoprene, Polybutadiene, SBR, EPDM, Butyl rubber, Neoprene, Nitrile rubber, Silicone rubber, Fluoro elastomer, Polysulphide rubber, polyurethane rubber, Acrylic rubber.
UNIT IV THERMOPLASTIC ELASTOMERS 12
Basic structure, Manufacture, Morphology, Commercial grades and Applications – Thermoplastic styrene block copolymers, Polyester thermoplastic elastomers, polyamide thermoplastic elastomer, Polyurethane thermoplastic elastomers

UNIT V RUBBER PRODUCT MANUFACTURING 12
Belting, Hoses, Footwear, Rubber metal bonded items, sports goods, cellular rubber

TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES
2. Maurice Morton, Rubber Technology

PT2357 POLYMER TESTING LAB – I L T P C
0 0 3 2

AIM
To learn about the various testing methods employed for polymers

OBJECTIVES
- To familiarizes the students with standards and methodology in
- Preparing the various polymers specimen
- Testing raw materials and components for evaluating various properties
- Testing products for predicting product performance

LAB REQUIREMENT
MFI tester 1 No
Carbon black content apparatus 1 No
Air oven 1 No
Muffle furnace 1 No
Soxhlet extraction set up 2 No
Oswald Viscometer 5 No
Stop watch 3 No
Magnetic stirrer 2 No

Determination of molecular weight of polymers by viscosity method.
Determination of epoxy equivalent.
Determination of acid value of polyester resin.
Determination of K – value of PVC resin.
Determination of apparent density and bulk density of polymers.
Determination of moisture and volatile content in plastics / rubbers.
Determination of water absorption.
Determination gel time and peak exothermic temperature for thermosetting resins.
Determination melt flow index.
Determination of soluble fraction of phenolics by acetone extraction.
Determination carbon black content in plastics / rubber.
Determination of non carbon black filler content in plastics / rubber.
Determination of total solid content of NR latex.
Determination dry rubber content of NR latex.
Determination of total alkalinity of NR latex.
(Any twelve experiments from the above)

TOTAL : 45 PERIODS

REFERENCES
2. ISO Handbook. on Plastics.

PT2358 PROCESSING TECHNOLOGY LAB

AIM
To learn the various processing methods for plastics and composites

OBJECTIVES
To study different plastic processing Techniques such as extrusion, compression moulding, Transfer moulding, calendaring rotational moulding, FRP processing etc.

LAB REQUIREMENT

EQUIPMENT FOR THERMOPLASTIC PROCESSING:
Hand injection moulding machine 3 No
Semi Automatic injection moulding machine 1 No
Fully automatic injection moulding machine 1 No
Extruder for compounding of thermoplastics 1 No
Hand blow moulding machine 1 No.
Fully automatic blow moulding machine 1 No
Air compressor 1 No
Scrap grinder 1 No
Crane for mould handling 1 No
Bench grinding and buffing machine 1 No
Bench vise 1 No
Sheet cutter 1 No
Moulds for hand injection moulding 5 No
Mould for automatic injection moulding 1 No
Mould for semiautomatic injection moulding 1 No
Mould for hand blow moulding 1 No
Mould for fully automatic blow moulding 1 No
Thermo Forming Unit 1 No

EQUIPMENTS FOR THERMOSETS AND RUBBER PROCESSING:
Compression moulding machine 1 No
Two roll mill for rubber mixing 1 No
Filament winding machine lab model 1 No

Moulds for rubber processing:
Moulds for sheet moulding 2 No
Moulds for M/C sheet moulding 1 No
Moulds for play ball moulding 1 No
Moulds for flex specimen moulding 1 No
Electronic balance 1 No
1. Compounding and Moulding of Rubbers
   NR, SBR, CR, BR and NBR as per ASTM standard
2. Preparation of dry rubber products
   Play ball, Hawai sheet, M. C sheet, sponge, hand made hose and rubber to metal bonded articles
3. Preparation of latex products
   Gloves and thread and adhesives
4. Preparation of Blow moulded products
5. Compression moulding of phenolic resin and SMC& BMC
6. Injection moulding of thermoplastics
7. Extrusion of thermoplastics
8. Compounding of plastics
9. Preparation of FRP laminates

TOTAL : 45 PERIODS

PT2401 POLYMER REACTION ENGINEERING L T P C
3 1 0 4

AIM
To know about the kinetics of reactions and design of polymer reactors

OBJECTIVES
To study the kinetics of different types of chemical reaction and design the reactors for chemical and polymer industries

UNIT I
Introduction to chemical kinetics. Representation of expression for reaction rate, Temperature dependent and concentration dependent Interpretation of Batch Reactor data for various types of reactions taking place in constant volume and variable volume batch reactors

UNIT II

UNIT III

UNIT IV

UNIT V

TOTAL: 60 PERIODS
TEXT BOOKS

REFERENCES

PT2402 POLYMER BLENDS AND COMPOSITES L T P C
4 0 0 4

AIM
To learn about polymer blends and composites

OBJECTIVES
- To understand the miscibility of polymers, characteristics of blends and mechanism of toughening
- To understand the basic concept of composites, matrix, reinforcement, properties of composites, fabrication methods and application

UNIT I 12

UNIT II 12

UNIT III 12
Toughening of polymers- mechanism of toughening of thermoplastics and thermosets.
Specific examples for toughened thermoplastics and thermosets- influence of processing on toughness. Industrial applications Composites

UNIT IV 12
Composition of composites – property correlation - Mechanical, Electrical, Thermal properties of composites. Processing of reinforced thermosets and thermoplastics:
Techniques for processing such as hand lay-up, Spray up, Continuous sheet manufacturing, Pultrusion – resin transfer molding – filament winding – vacuum bag moulding
UNIT V
Manufacture of structural and decorative laminates – preparation of sandwich structure
Troubleshooting related to the above techniques. Processing of short fibers reinforced thermoplastics. Designing with composites Post processing of composite products -
Application of composites

TOTAL: 60 PERIODS

TEXT BOOKS

REFERENCES
2. Utracki, “Polymer Blends and Alloys”, Hanser Publisher.

MG2351 PRINCIPLES OF MANAGEMENT
(Common to all Branches)
L T P C 3 0 0 3

UNIT I OVERVIEW OF MANAGEMENT 9

UNIT II PLANNING 9

UNIT III ORGANIZING 9

UNIT IV DIRECTING 9
Creativity and Innovation - Motivation and Satisfaction - Motivation Theories Leadership - Leadership theories - Communication - Hurdles to effective communication - Organization Culture - Elements and types of culture - Managing cultural diversity.

UNIT V CONTROLLING 9
Process of controlling - Types of control - Budgetary and non-budgetary control techniques - Managing Productivity - Cost Control - Purchase Control - Maintenance Control - Quality Control - Planning operations.

TOTAL : 45 PERIODS

58
TEXT BOOKS

REFERENCES

PT2404 POLYMER PRODUCT DESIGN

AIM
To design polymer products with knowledge of polymer properties and end use

OBJECTIVES
- To learn physical properties of polymers required for product design
- To design plastic parts such as static and dynamic loaded parts for electrical, optical and mechanical applications (gears, bearings, pipes, seals, couplings and vibration dampers)

UNIT I
Introduction to structure and physical properties of polymers, stress – strain behaviour of polymers, effect of fillers on properties of polymers, stress analysis of polymers, structural design of beams, plates and other structural members.

UNIT II
Dynamic load response of polymers, effects of cyclic loading, other forms of stress applied to polymer parts, design for stiffness, processing limitations on polymers product design. Material and process interaction and the effects on the performance of plastic parts and the resulting design limitations, performance in service and environmental exposure.

UNIT III
Design procedure for plastic parts, design of plastic structural parts for static loads, design of dynamically loaded plastic parts, design of plastic parts for electrical applications, design of plastic parts for optical applications.

UNIT IV
Gear Design materials strength and durability, moulded V/s cut plastic gearing inspection assembly and operation.
Bearings: Self lubricated plastic materials rubber bearing, type of bearings, designers check list.
PVC piping: Raw materials, pipe design, specification and test procedure, manufacturing process.
UNIT V
Elastomeric ring seals Basic configurations, design method, design consideration static
and dynamic seals. Vibration dampers: Basic vibration damping relations, Octave rule
for damped systems, Estimating damping in structures, controlling resonant peaks with
damping, response of damped structures to shock. Flexible Coupling – Vibration of two
mass system, specification and selection of couplings, types of couplings.

TEXT BOOKS
publication, Munich Vienna NY, 1995.

REFERENCES
2. Edward Miller, “Plastics Products Design Hand Book”, Marcel Dekker,

LAB REQUIREMENT
2. Software packages
   Auto cad - 1 No
   Pro-E - 1 No
   Mould flow - 1 No
3. Printer - 1 No.
4. CNC Lathe - 1 No.
5. CNC Milling machine - 1 No

Design Procedure, Dimensioning Mould Drawing, Fits & Tolerance, Allowances, Shrink
Allowances.
A) Injection mould design using CAD.

Design calculations: No. of cavities, Selection of injection moulding machine, shot
capacity, plasticizing rate, Clamping force, Injection pressure & Tool strength calculations
related to -
1. Two - plate mould.
2. Three - plate mould.
UNIT I  CNC PROGRAMME
CNC Programme for the Machining of Core & Cavity using CNC Lathe and CNC Milling of simple profiles.

UNIT II  SEMI - AUTOMATIC COMPRESSION MOUL
Design calculations: Economic determination of no. of cavities, flash thickness allowances, design of mould cavity, design of loading chamber, bulk factor, loading chamber depth & heat requirement for heating the mould related to –
1. Open-flash type compression mould.
2. Semi-positive horizontal and vertical type.
3. Fully positive type compression mould.

UNIT III  TRANSFER MOULD DESIGN USING CAD
Design calculations: Pot calculation, runner & gate dimensions, bulk factor & shrinkage allowances for thermo set plastics & Minimum moulding pressure related to –
1. Pot transfer mould.
2. Plunger transfer mould.

UNIT IV  BLOW MOULD DESIGN USING CAD
Design calculations: Clamping force, pinch-off, head die design and parison diameter calculations.

UNIT V  EXTRUSION DIE DESIGN USING CAD
1. For pipes.
2. For profiles.

UNIT VI  PART DESIGNS FOR AN INJECTION MOULDED COMPONENT USING MOULDFLOW
1. 3D Modeling using MOULD – FLOW / view, Flow analysis, Cooling analysis, Shrink / Wrap analysis, Stress analysis.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
3. Design calculations for Compression moulds, Machinery publications, Yellow series, U.K.
4. U.K.
AIM
To learn about the various testing methods employed for polymers

OBJECTIVES
- To familiarize the students with standard and methodology in
- Preparing various polymers specimen
- Testing raw materials and components for evaluating various properties

LAB REQUIREMENT
Universal tensile testing machine (UTM) 1 No
Humidity Chamber 1 No
Shore – A hardness tester 1 No
Shore – D hardness tester 1 No
Rockwell hardness tester 1 No
Izod and charpy impact tester 1 No
Falling dart impact tester 1 No
Din Abrader 1 No
Rebound Resilience tester 1 No
De-Mattia Flex Resistance tester 1 No
Vicat softening point tester (VSP) 1 No
HDT Tester 1 No
Dial gauge 1 No
Volume and surface resistivity tester 1 No
Arc resistance tester 1 No
Dielectric Strength tester 1 No
Refractometer tester 1 No
Environmental stress crack resistance tester (ESCR) 1 No

UNIT I TESTING OF MECHANICAL PROPERTIES OF PLASTICS AND RUBBERS
Tensile strength
Compression strength
Flexural strength
Tear strength.
Izod and Charpy impact strength.
Falling dart impact strength,
Hardness – Rockwell and Shore
Abrasion resistance,
Rebound resilience
Flex resistance.
(Any six experiments)

UNIT II TESTING OF THERMAL PROPERTIES
Vicat softening point
Heat distortion temperature

UNIT III TESTING OF ELECTRICAL PROPERTIES
Volume and surface resistivity
Arc resistance
Comparative tracking index
Dielectric strength
Dielectric constant
(Any three experiments)

UNIT IV  TESTING OF OPTICAL PROPERTIES  9
Refractive index.
Haze.
Gloss
(Any one experiment)

UNIT V  TESTING OF MISCELLANEOUS PROPERTIES  9
Environmental stress crack resistance
Chemical resistance.
Thermal ageing resistance.
Flammability.
Mould shrinkage
(Any three experiments)

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCE

PT2021  POLYMER RECYCLING  L T P C
3 0 0 3

AIM
To learn the various methods employed for recycling of polymers.

OBJECTIVES
To learn need for polymer recycling, plastic and rubber waste management, various methods of recycling technologies and the applications of recyclates.

UNIT I
Plastics production and consumption- Plastic wastes generation source and types – Plastic waste composition, quantities - Plastics identification methods physical, chemical and instrumental – sorting and separation technologies - disposal alternatives – Recycling methods – Primary, Secondary and tertiary recycling of plastics

UNIT II
Size reduction of recycled plastics – cutting / shredding, densification, pulverization and chemical size reduction processes- municipal solid waste and composition – recycling of plastics from urban solid wastes - household waste – industrial sector – rheology, density and mechanical properties of recyclable plastics and need for compatibilization – Processing of commingled / mixed plastic waste – super wood, plastic lumber
UNIT III

UNIT IV
Engineering thermoplastics and their major areas where engineering polymers are recycled – major recyclers of engineering plastics – GE/ Bayer/ MRC Polymers – PC, PBT, Nylon, PPO, ABS and polyacetals and their blends

UNIT V

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
2. “Plastics Waste Management (Ed)”, Nabil Mustafa, Marcel Dekker, New York

PL2023 PLASTICS PACKAGING TECHNOLOGY L T P C
3 0 0 3

AIM
To learn about the materials and processing methods in packaging

OBJECTIVES
To understand the concepts of materials used in packaging, machinery in packaging and testing of packaging material.

UNIT I

UNIT II
Conversion process – Compression & transfer for moulding, Injection moulding, Blow moulding, Extrusion, roto moulding, thermoforming, Lamination, metallizing, decoration process, Shrink wrapping, Pallet & stretch wrapping, sealing methods, Plasma barrier coatings. Energy requirement for conversion
UNIT III

UNIT IV
Thermoformed, moulded and rigid packages, Thermoforming packages: Position & thermoforming & wrap forming, variations in thermoforming and solid phase pressure forming, scrabbles, twin sheet & melt – to- mold thermoforming, skin packaging, thermoforming moulds, thermoforming fill- real, Aseptic thermoforming, advantages & disadvantages of moulding foams, other cushioning materials & distribution packaging – Polystyrene & other foams systems cushioning, Design of molded cushioning systems, plastic pallets, drums & other shipping containers.

UNIT V

TOTAL: 45 PERIODS

TEXT BOOKS

PT2023 FIBRE TECHNOLOGY L T P C
3 0 0 3

AIM
To understand the production and technology of fibre manufacture

OBJECTIVES
• To learn Production technologies of synthetic fibres such as nylon6, PET, PP and acrylic fibres
• Melt spinning, wet spinning, dry spinning, texturing and stretching methods; colouration techniques of fibres.
• Modification for low filling, flame retardant and hollow fibres

UNIT I
UNIT II

UNIT III

UNIT IV
Modified synthetic fibres – modified polyester, Nylon, PP, acrylics – Hydrophilic – Hollow – Low pilling – flame retardant- bicomponent fibres - Dyeability of synthetic fibres

UNIT V

TOTAL : 45 PERIODS

TEXT BOOK

PT2024 TYRE TECHNOLOGY L T P C
3 0 0 3

AIM
To learn about design and fabrication of tyres

OBJECTIVES
- To understand various components used and their function of tyres.
- To design and suitable compounding formulation for various tyre components
- To know the building & curing of tyres.

UNIT I
A historical introduction on the design and development of tyres of various kinds and types. The current status of tyre industry in India and its future prospectus. Tyre sizing and marking on the tyres. Different types of tyres – bias, bias belted radial, tube type abd tubeless tyres their basic features and performance comparison. Different components of a tyre, its geometry, basic functions. Functions of a pneumatic tyre – load carrying, vibration and noise reduction, the tyre function as a spring, contribution to driving control and road adhesion, the tyre friction contribution to driving control, steering control and self aligning torque.
UNIT II

UNIT III
Tyre wear, rubber friction and sliding mechanism, various factors affecting friction and sliding. Tyre stresses and deformation, tyre noise, mechanism of noise generation, effect of tread pattern, vehicle speed etc., on noise level, Tyre in plane dynamics. High frequency properties, basic yaw and camber analysis.

UNIT IV
Manufacturing techniques of various tyres like two wheeler and car tyres, truck tyres, OTR, Farm tyres, aircraft tyres. Principles of designing, formulations for various rubber components. Tyre reinforcement materials (Textile, steel, glass etc.). Criteria of selection, different styles and construction, textile treatment. Tyre mould design, green tyre design principles, methods of building green tyres for bias, bias belted, radial and tube-less tyres, green tyre treatments. Tyre curing methods, post cure inflation, quality control tests, Tyre related products, their design and manufacturing techniques, tubes, valves, flaps and bladders. Different types, their feature and operation of tyre building machines, bead winding machine, wire/glass processing machines, bias cutters, curing presses.

UNIT V
Measurement of tyre properties, dimension and size-static and loaded, Tyre construction analysis, Endurance test wheel and plunger tests, traction, noise measurements. Force and moment characteristics, cornering coefficient aligning torque coefficient, load sensitivity and load transfer sensitivity, Rolling resistance, non uniformity dimensional variations, force variations- radial force variation, lateral force variation concentricity and ply steer. Type balance, mileage, evaluations, tyre flaws and separations, X-ray holography etc., Foot print pressure distribution.BIS standards for tyres, tubes and flaps

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
AIM
To understand the mechanism of biodegradation and development of biodegradable polymers

OBJECTIVES
To understand the method of development of biodegradable polymers; the need of biodegradable and testing methods used for analyzing the biodegradability

UNIT I CHEMISTRY AND BIOCHEMISTRY OF POLYMER DEGRADATION

UNIT II PARTICULATE STARCH BASED PRODUCTS

UNIT III BIOPOLYESTERS

UNIT IV RECYCLING TECHNOLOGY FOR BIODEGRADABLE PLASTICS

UNIT V TEST METHODS & STANDARDS FOR BIODEGRADABLE PLASTICS
Introduction, defining biodegradability, criteria used in the evaluation of biodegradable polymers, tiered systems for evaluating biodegradability, choice of environment, choosing the most appropriate methodology, description of current test methods – screening test for ready biodegradability, tests for inherent biodegradability, tests for simulation studies, other methods for assessing biodegradability – petri dish screen – environmental chamber method – soil burial tests, Test method developments for the future.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
AIM
To understand the properties and applications of specialty polymers

OBJECTIVES
To learn properties and applications of special polymers such as high performance flame resistance, conducting and high temperature resistant polymers

UNIT I
High temperature and fire resistant polymers improving low performance polymers for high temperature use – polymers, for low fire hazards – polymers for high temperature resistance – Fluoropolymers. Aromatic polymers, polyphenylene sulphide, polysulphones, polyesters, polyamides, polyketones, Heterocyclic polymers

UNIT II
Polymers with electrical and electronic properties Conducting polymers, conducting mechanisms, polyacetylene, polyparaphenylene polypyrrole, organometallic polymers, photo conducting polymers, polymers in non-linear optics, polymers with piezoelectric pyroelectric and pyroelectric properties, photoresists for semi conductor fabrication – liquid crystalline polymers.

UNIT III
Ionic Polymers, synthesis, physical properties and applications, ion-exchange, Hydrophilicity, Ionomers based on polyethylene, elastomeric ionomers. Ionomers based on polystyrene, ionomers based on PTFE, ionomers with polyaromatic backbones, polyelectrolytes for ion exchange, polyelectrolytes based on carboxylates, polymers with integral ions, polyelectrolyte complexes. Biological and inorganic ionic polymers

UNIT IV
Polymer concrete, polymer impregnated concrete ultra high modulus fibres, polymers for biomedical applications, polymeric binders for rocket propellants, polymer supported reagents.

UNIT V
Polymers in telecommunications and power transmission, polymers as insulators – electrical breakdown strength – capacitance, dielectric loss and cable alteration, polymers in telecommunications – submarine, cable insulation, low fire risk materials, polymers in power transmission – Optical fibre telecommunication cables.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
AIM
To understand the properties and applications of specialty elastomers.

OBJECTIVES
To understand special properties of elastomers with respect to structure.
To study the manufacturing, compounding and processing of specialty elastomers such as silicone rubber, fluoro elastomers, acrylic rubber, EPDM etc.

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V

TOTAL: 45 PERIODS

TEXT BOOKS
AIM
To learn the production technology of polyurethanes

OBJECTIVES
To understand the basic variation between the raw materials used for polyurethane production, methods of polyurethane production and analysis of the raw materials products.

UNIT I
Introduction to polyurethane- chemistry and materials of polyurethane manufacture: basic reaction, cross linking in polyurethane, important building blocks for polyurethane (isocynates, polyols, amines and additives) - The manufacturer of polyurethanes (the process, parameters and controls).

UNIT II
Polyurethane processing-basic design principles of polyurethane processing equipment steps in the polyurethane processing Flexible foams-(production, properties and application slab stock foam, carpet backing, flexible molded foams & semi rigid molded foams. Reinforced RIM – trends in the use of RIM and RRIM.

UNIT III
Rigid polyurethane foams-chemistry of raw materials, manufacturing of rigid polyurethane (manufacturing of buns, panels, foaming of applications, molded rigid foams), properties, relationship between production methods and properties- application of rigid polyurethane Polyurethane skin integral foam- production, properties and applications.

UNIT IV
Solid polyurethane materials- polyurethane casting systems (cast elastomers and casting resins)-thermoplastic polyurethane elastomers: productions / processing, properties and applications, polyurethane, pains, technique and coatings, adhesives builders, elastomers fibers, manufacture / processing and applications.

UNIT V

TEXT BOOKS

TOTAL: 45 PERIODS
AIM
To design plastic products using CAD

OBJECTIVES
To learn CAD and NC programming; FEA, CAE for plastics and rapid prototyping

UNIT I
9
Surface finish – Functional / Aesthetic aspects of part shape-Safety aspects of part shape - Safety aspects if the part should burn - Safety aspects if the part should fail - Use of color and design to promote safety.

UNIT II
9

UNIT III
9

UNIT IV
9

UNIT V
9

TOTAL : 45 PERIODS

TEXT BOOKS
1. R.D.Beck Plastics Product Design,

REFERENCES
OBJECTIVES
To learn understand data structure, sorting techniques, operating system and their functions, software engineering – planning and cost information, software design concepts and guidelines and computer networks.

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
AIM
To learn about the degradation and stabilization of polymers

OBJECTIVES
To understand the various modes of thermal, mechanical, photo degradation & chemical degradation of polymers of the mechanism of degradation and stabilization of the degradation process

UNIT I INTRODUCTION AND THERMAL DEGRADATION 9

UNIT II MECHANICAL DEGRADATION AND ULTRASONIC DEGRADATION 9

UNIT III PHOTO DEGRADATION 9
Introduction - Mechanistic Aspects (Excited States, Free Radicals and Ionic Species, Energy Transfer and Energy Migration) - Degradation in the Absence of Oxygen (Norrish Types I & II Reactions) - Photo Oxidation (Auto Oxidative Process, Sensitized Degradation) - Stabilization - Application: Polymers with Predictable Life Time, Photo resists.

UNIT IV DEGRADATION BY HIGH ENERGY RADIATION AND BIODEGRADATION 9

UNIT V CHEMICAL DEGRADATION 9

TOTAL: 45 PERIODS

TEXT BOOKS
AIM
To learn the technology of adhesives and coatings

OBJECTIVES
To understand the following
- Adhesives – concepts of terminology, theories of adhesion
- Types of specialty adhesives and their application
- Adherend surfaces and joint design
- Surface coatings – constituents and classification
- Evaluation of properties of surface coatings

UNIT I
Adhesives – concepts and terminology, functions of adhesives, advantages and disadvantages of adhesive bonding, theories of adhesion - mechanical theory, adsorption theory, electrostatic theory, diffusion theory, weak-boundary layer theory, Requirements for a good bond, criteria for selection of adhesives.

UNIT II
Types of adhesives, structural adhesives, Urethane structured adhesives, Modified acrylic structural adhesives, phenolic adhesives and modifiers, anaerobic adhesives, cyanoacrylate adhesives, Hot melt adhesives, pressure sensitive adhesives, RTV Silicone adhesives, sealants, water based adhesives. Specialty adhesives, adhesives in aerospace, adhesive in automobile industry, conductive adhesives, adhesives in building construction, adhesive in electrical industry.

UNIT III
Joint design, stress, types of joints, selection of joint detail, joint criteria, surface preparation of adherends-metals, plastics and rubbers. Adhesive bonding process-methods for adhesives application and bonding equipment, adhesives for specific substrates, testing of adhesives, adhesive specifications and quality control.

UNIT IV
Introduction to surface coatings –Components of paints. Pigments, pigment properties, different types, extenders, solvents, oils, driers, diluents, lacquers, varnishes, paint preparation, formulation, factors affecting pigment dispersion, preparation of pigment dispersion. Different types of paints- classification based on polymeric resin, emulsion, oil and alkyd paints, acrylic paints, epoxy coatings, polyurethane, silicones, formaldehyde based resins, chlorinated rubbers, hydrocarbon resins. Classification based on application, fluropolymers, vinyl resins, appliance furnishes, automotive finishes, coil coatings, can coatings, marine coatings, aircraft coatings.

UNIT V

TOTAL: 45 PERIODS

TEXT BOOKS
REFERENCES

PT2035 FIBRE REINFORCED PLASTICS

AIM
To learn about the raw materials and processing of fibre reinforced plastics.

OBJECTIVES
To understand the basic materials in FRP system covering series of matrix resins and reinforcements, various processing methods of composites, post processing operations, various applications of composites and testing of FRP materials.

UNIT I MATRIX SYSTEM AND REINFORCEMENT MATERIALS
Fibre Reinforcements - Glass, carbon, aramide, natural fibres, Boron, Ceramic Fibers- Particulate Fillers.

UNIT II PROCESSING METHODS OF COMPOSITES
Prepregs, SMC, DMC etc. - Hand Lay-Up; Spray- Up; Bag Molding; Compression Molding, Injection molding, Resin Transfer Molding (RTM); Filament Winding; Pultrusion Auto Clave Molding; Processing of Thermoplastic Composites.

UNIT III POST PROCESSING METHODS
Cutting, Trimming, Machining, Water Jet Cutting, Abrasive Jet Cutting, Laser Cutting, Joining, Mechanical Fastening and Adhesive Bonding, Painting And Coating.

UNIT IV APPLICATION OF COMPOSITES

UNIT V TESTING OF COMPOSITES

TOTAL : 45 PERIODS

TEXT BOOKS
REFERENCES

PL2036 BIOMEDICALS PLASTICS

AIM
To learn the requirement properties of polymers to be used for biomedical applications

OBJECTIVES
- To understand tissue and blood compatibility of polymeric materials intended to use in biological systems
- To study various applications of polymeric biomaterials in biomedical areas like cardio vascular, ophthalnic, dental, orthopedic etc

UNIT I BIOMATERIALS

UNIT II BIOMEDICAL POLYMERS
Criteria for the Selection of Biomedical Polymers, Physicochemical Aspects of the Blood Compatibility of Polymeric Surface Biomedical Polymers from biological source, Poly hydroxy Alkanoic Acids, Microbial polysaccharides, Silk, Collagen, Microbial Cellulose, Hyaluronic Acid, Synthetic Polymers such as PMMA, Silicon Rubber, Polyethylene, Natural Rubber, Hydrogels

UNIT III BIOMEDICAL APPLICATIONS OF POLYMERS

UNIT IV POLYMERIC LENSES

UNIT V DENTAL POLYMERS
Dental applications, denture bases, dentate reliners, crown and bridge resins, plastic teeth, mouth protectors, maxillofacial prosthetic materials, restorative material, polyelectrolyte based restoratives, sealants, adhesives, dental impression and duplicating materials, agar, algmater elastomers.

TOTAL: 45 PERIODS
TEXT BOOKS

REFERENCES
1. Comprehensive Polymer Science Vol.7
2. Alcock, Contemporary Polymer Chemistry

GE2022 TOTAL QUALITY MANAGEMENT L T P C 3 0 0 3

UNIT I INTRODUCTION 9

UNIT II TQM PRINCIPLES 9
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 9

UNIT IV TQM TOOLS & TECHNIQUES II 9

UNIT V QUALITY SYSTEMS 9

TOTAL : 45 PERIODS
TEXT BOOK

REFERENCES

PT2037 CONDUCTING POLYMERS

AIM
To learn the mechanism, synthesis, characterization of conducting polymers

OBJECTIVES
To understand the basic concepts on conducting polymers, conduction mechanism, various methods of synthesis and characterization of conducting polymers and their applications

UNIT I
Introduction to conducting polymers – discovery of polyacetylene – concept of doing and n-type – polarons and bipolarons – conduction mechanism – redox type polymers (electro – active polymers)

UNIT II

UNIT III

UNIT IV

UNIT V
Recent trends in conducting polymers – functionalised conducting polymers (second generation polymers) – super conductors (inorganic – organic hybrid structures) – conducting polymers based on nano composites.

TOTAL: 45 PERIODS
TEXT BOOKS

REFERENCES
2. T. Asaka, S. Komabe and T. Momma, Conductive Polymers.

PT2038 NYLON TECHNOLOGY

AIM
To learn about the various the raw materials, manufacturing, preparation and properties of various nylons

OBJECTIVES
To understand Methods of manufacturing, properties and applications of commercial nylons such as Nylon 6, Nylon 6, 6, Nylon 6, 10, Nylon 4, 6, Nylon 11, Nylon 12 etc. Crystal structure and property relationship of nylons. Modified nylons through blends and alloys

UNIT I
Historical development of nylons – commercial nylons; Polyamidation – Principle of polyamidation – chemistry, polycondensation and equilibria – kinetics – molecular mass; Polycondensation process techniques – hydrolytic, ionic and solid phase polymerization

UNIT II
Commercial nylons – nylon 6, nylon 66, nylon 6, 10, nylon 4 6, nylon 11, nylon 12 – raw materials, method of manufacturing, properties and important applications – chemical attack and degradation of nylons – oxidative, thermal and hydrolytic degradation

UNIT III
Structure - property relationship in nylons – crystallization of nylons and crystal structure effect on molecular weight - melting temperature, Tg – crystallization growth, orientation, morphology Characterization of nylons – identification of nylons and their hydrolysis products for composition and moisture content by HPLC, DSC, Karl Fischer method, IR, NMR and X ray; Molecular weight and distribution by GPC and End group analysis method, solution viscosity method

UNIT IV
Processing of nylons - Rheology, PVT relationship – Effect of moisture, molecular mass, shear, temperature, additives on melt processing; Melt Processing techniques- extrusion into film and tube, injection moulding – RIM, blow moulding; other process techniques such as solution coating, powder coating, blending

UNIT V
Modification of nylons – transparent, toughened, flame retardant, plasticized and lubricated nylons, filled and reinforced grades; blends and alloys nylon with other polymers – nylon 66 –PPO (Noryl), nylon 6 – LDPE, EPDM Introduction to fibre technology – nylon 6 melt spinning, drawing into yarns - dye ability

TOTAL: 45 PERIODS
GE2023  FUNDAMENTALS OF NANOSCIENCE  L T P C
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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.

UNIT III  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  CHARACTERISATION 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

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES