1. **Program Educational Objectives (PEOs)**

   Bachelor of plastics technology curriculum is designed to prepare the graduates having attitude and knowledge to

1. Have successful professional technical career in the field of plastics and allied industries such as taking up the challenging positions in plastics material manufacturing industries, compounding industries, processing machinery manufacturing industries by offering specialized elective subjects and industry exposure.

2. Acquire a strong knowledge in basic sciences, engineering, mathematics and computational platforms by providing overall knowledge on the manufacturing of plastics materials, their properties, applications, processing, product design, mold design, testing & quality control and recycling through theory as well as practical training.

3. who will engage in lifelong learning or continuous education opportunities in the area of management such as TQM, Industrial costing and management, statistical quality control, professional ethics and environmental science to impart leadership qualities.

4. Meet the manpower requirements of plastics and allied industries in India and overseas.

2. **Program Outcomes (POs)**

   a) Ability to apply knowledge in Humanities, basic sciences, mathematics and engineering.
   b) This program would provide well trained professionals for the plastics and allied industries to meet the well trained man power requirements.
   c) The graduates will get skilled experience in various aspects of plastics technology viz. plastics materials manufacturing, properties, applications, processing, product design, mold design, testing & quality control, and recycling.
   d) The program will help the graduates to take up responsibilities in production, testing, design and marketing in the plastics industries and contribute for the growth of industry.
   e) The graduates with the knowledge of plastics technology can become entrepreneurs as they can easily start up processing, compounding, design and marketing units.
   f) Ability to understand the ethical and professional responsibilities and make them to work effectively in interdisciplinary groups.
   g) Ability to review, comprehend and report the technological development.
   h) An ability to identify, formulate and solve engineering problems and to gain knowledge in solving contemporary issues.
   i) An ability to use the techniques, skills and modern tools necessary for engineering practice.
   j) Recognition of need for and an ability to engage in continuous learning.
   k) The broad education necessary to understand the impact of engineering solutions in global, economic, environmental and societal context.
   l) Ability to design and realize a processing system to meet desired needs within realistic constraints such as economic, environmental, social, health and safety, manufacturability and sustain ability.
   m) Able to work professionally in the area of manufacturing / processing systems.
3. PEOs/POs MAPPING

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**TOTAL CREDITS: 179**

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EMPLOYABILITY ENHANCEMENT COURSES (EEC)
## B.TECH. PLASTICS TECHNOLOGY

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**SUMMARY**
OBJECTIVES:

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills.

UNIT I  SHARING INFORMATION RELATED TO ONESELF/FAMILY & FRIENDS  12

UNIT II  GENERAL READING AND FREE WRITING  12
Reading - comprehension-pre-reading-post reading- comprehension questions (multiple choice questions and /or short questions/ open-ended questions)-inductive reading- short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts)- register- Writing – paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures --Listening: telephonic conversations. Speaking – sharing information of a personal kind—greeting – taking leave. Language development – prepositions, conjunctions Vocabulary development: guessing meanings of words in context.

UNIT III  GRAMMAR AND LANGUAGE DEVELOPMENT  12
Reading: short texts and longer passages (close reading) Writing- understanding text structure-use of reference words and discourse markers-coherence-jumbled sentences Listening – listening to longer texts and filling up the table- product description- narratives from different sources. Speaking: asking about routine actions and expressing opinions. Language development: degrees of comparison- pronouns- direct vs indirect questions- Vocabulary development – single word substitutes- adverbs.

UNIT IV  READING AND LANGUAGE DEVELOPMENT  12
Reading: comprehension-reading longer texts- reading different types of texts- magazines Writing- letter writing, informal or personal letters-e-mails-conventions of personal email Listening- listening to dialogues or conversations and completing exercises based on them. Speaking: speaking about oneself- speaking about one’s friend- Language development- Tenses- simple present-simple past- present continuous and past continuous- Vocabulary development- synonyms-antonyms- phrasal verbs

UNIT V  EXTENDED WRITING  12
Reading: longer texts- close reading --Writing- brainstorming -writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing-Listening – listening to talks-conversations- Speaking – participating in conversations- short group conversations-Language development-modal verbs- present/ past perfect tense - Vocabulary development-collocations-fixed and semi-fixed expressions
TOTAL : 60 PERIODS

OUTCOMES:
At the end of the course, learners will be able to:
- Read articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English
- Write short essays of a general kind and personal letters and emails in English.

TEXT BOOKS:

REFERENCES:

MA8151 ENGINEERING MATHEMATICS I L T P C
4 0 0 4

OBJECTIVES:
- The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

UNIT I DIFFERENTIAL CALCULUS
Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

UNIT II FUNCTIONS OF SEVERAL VARIABLES
UNIT III INTEGRAL CALCULUS
Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT IV MULTIPLE INTEGRALS

UNIT V DIFFERENTIAL EQUATIONS

TOTAL: 60 PERIODS

OUTCOMES:
After completing this course, students should demonstrate competency in the following skills:

- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
- Apply various techniques in solving differential equations.

TEXT BOOKS:
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES:
OBJECTIVES:

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

UNIT I  PROPERTIES OF MATTER  9

UNIT II  WAVES AND FIBER OPTICS  9

UNIT III  THERMAL PHYSICS  9

UNIT IV  QUANTUM PHYSICS  9

UNIT V  CRYSTAL PHYSICS  9
Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

OUTCOMES:

Upon completion of this course,
- the students will gain knowledge on the basics of properties of matter and its applications,
- the students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,
- the students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,
- the students will get knowledge on advanced physics concepts of quantum theory and its
applications in tunneling microscopes, and
• the students will understand the basics of crystals, their structures and different crystal
growth techniques.

TEXT BOOKS:

REFERENCES:

CY8151 ENGINEERING CHEMISTRY L T P C
3 0 0 3

OBJECTIVES:
• To make the students conversant with boiler feed water requirements, related problems
and water treatment techniques.
• To develop an understanding of the basic concepts of phase rule and its applications to
single and two component systems and appreciate the purpose and significance of
alloys.
• Preparation, properties and applications of engineering materials.
• Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous
fuels.
• Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills
and fuel cells.

UNIT I WATER AND ITS TREATMENT
Hardness of water – types – expression of hardness – units – estimation of hardness of water by
EDTA – numerical problems – boiler troubles (scale and sludge) – treatment of boiler feed water –
Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) external
treatment – Ion exchange process, zeolite process – desalination of brackish water - Reverse
Osmosis.

UNIT II SURFACE CHEMISTRY AND CATALYSIS
Adsorption: Types of adsorption – adsorption of gases on solids – adsorption of solute from
solutions – adsorption isotherms – Freundlich’s adsorption isotherm – Langmuir’s adsorption
isotherm – contact theory – kinetics of surface reactions, unimolecular reactions, Langmuir -
applications of adsorption on pollution abatement.
Catalysis: Catalyst – types of catalysis – criteria – autocatalysis – catalytic poisoning and catalytic
promoters - acid base catalysis – applications (catalytic convertor) – enzyme catalysis– Michaelis
– Menten equation.

UNIT III ALLOYS AND PHASE RULE
Alloys: Introduction- Definition- properties of alloys- significance of alloying, functions and effect of
alloying elements - Nichrome and stainless steel (18/8) – heat treatment of steel. Phase rule: Introduction, definition of terms with examples, one component system - water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process.

UNIT IV FUELS AND COMBUSTION


UNIT V ENERGY SOURCES AND STORAGE DEVICES

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H₂-O₂ fuel cell.

TOTAL: 45 PERIODS

OUTCOMES:

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

TEXT BOOKS:


REFERENCES:


GE8151 PROBLEM SOLVING AND PYTHON PROGRAMMING

OBJECTIVES:

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
To use Python data structures — lists, tuples, dictionaries.
To do input/output with files in Python.

UNIT I ALGORITHMIC PROBLEM SOLVING
Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA, EXPRESSIONS, STATEMENTS
Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

UNIT V FILES, MODULES, PACKAGES
Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

OUTCOMES:
Upon completion of the course, students will be able to

- Develop algorithmic solutions to simple computational problems
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python Programs.

TOTAL : 45 PERIODS

TEXT BOOKS:

19
REFERENCES:

GE8152 ENGINEERING GRAPHICS

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

CONCEPTS AND CONVENTIONS (Not for Examination) 1
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREEHAND SKETCHING 7+12
Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

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

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12
Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 5+12
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.
UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+12

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

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12

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

TOTAL: 90 PERIODS

OUTCOMES:

On successful completion of this course, the student will be able to

- familiarize with the fundamentals and standards of Engineering graphics
- perform freehand sketching of basic geometrical constructions and multiple views of objects.
- project orthographic projections of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- visualize and to project isometric and perspective sections of simple solids.

TEXT BOOK:


REFERENCES:


Publication of Bureau of Indian Standards:


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

GE8161 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C
LABORATORY 0 0 4 2

OBJECTIVES:
- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

LIST OF PROGRAMS
1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton’s method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

PLATFORM NEEDED
Python 3 interpreter for Windows/Linux

OUTCOMES:
Upon completion of the course, students will be able to
- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

TOTAL :60 PERIODS
OBJECTIVES:

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

**LIST OF EXPERIMENTS: PHYSICS LABORATORY** (Any 5 Experiments)

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young’s modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser (b) Determination of acceptance angle in an optical fiber.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

**TOTAL: 30 PERIODS**

OUTCOMES:

Upon completion of the course, the students will be able to

- apply principles of elasticity, optics and thermal properties for engineering applications.

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

OBJECTIVES:

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

1. Estimation of HCl using Na₂CO₃ as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler’s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by lodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
12. Pseudo first order kinetics-ester hydrolysis.
14. Determination of CMC.
15. Phase change in a solid.
16. Conductometric titration of strong acid vs strong base.

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

TOTAL: 30 PERIODS

TEXTBOOKS:

HS8251 TECHNICAL ENGLISH L T P C
4 0 0 4

OBJECTIVES:
The Course prepares second semester engineering and Technology students to:
- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations, participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialisation.

UNIT I INTRODUCTION TECHNICAL ENGLISH 12
Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- Speaking – Asking for and giving directions- Reading – reading short technical texts from journals- newspapers- Writing- purpose statements – extended definitions – issue- writing instructions – checklists-recommendations-Vocabulary Development- technical vocabulary
Language Development – subject verb agreement - compound words.

UNIT II READING AND STUDY SKILLS 12
Listening- Listening to technical talks and completing exercises based on them-Speaking – describing a process-Reading – reading longer technical texts- identifying the various transitions in a text- paragraphing- Writing- interpreting graphs, graphs- Vocabulary Development-vocabulary used in formal letters/emails and reports Language Development- impersonal passive voice, numerical adjectives.

UNIT III TECHNICAL WRITING AND GRAMMAR 12
Listening- Listening to classroom lectures/ talks on engineering/technology -Speaking – introduction to technical presentations- Reading – longer texts both general and technical, practice in speed reading; Writing-Describing a process, use of sequence words- Vocabulary Development- sequence words- Misspelled words. Language Development- embedded sentences
UNIT IV REPORT WRITING

UNIT V GROUP DISCUSSION AND JOB APPLICATIONS
Listening- TED/Ink talks; Speaking –participating in a group discussion -Reading– reading and understanding technical articles Writing– Writing reports- minutes of a meeting- accident and survey-Vocabulary Development- verbal analogies Language Development- reported speech .

TOTAL :60 PERIODS

OUTCOMES: At the end of the course learners will be able to:

- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

TEXT BOOKS:

REFERENCES

Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.

MA8251 ENGINEERING MATHEMATICS II

OBJECTIVES:

- This course is designed to cover topics such as Matrix Algebra, Vector Calculus, Complex Analysis and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modelling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

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

UNIT II VECTOR CALCULUS
Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green’s, Gauss divergence and Stoke’s theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III ANALYTIC FUNCTIONS
Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions \( w = z + c, \frac{1}{z}, cz, \overline{z} \) - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION

UNIT V LAPLACE TRANSFORMS

TOTAL: 60 PERIODS

OUTCOMES:
After successfully completing the course, the student will have a good understanding of the following topics and their applications:

- Eigenvalues and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green’s theorems and their verification.
- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

TEXT BOOKS:

REFERENCES:
PH8254  PHYSICS OF MATERIALS
(Common to courses offered in Faculty of Technology except Fashion Technology)  

OBJECTIVES:
- To introduce the physics of various materials relevant to different branches of technology

UNIT I  PREPARATION OF MATERIALS  

UNIT II  CONDUCTING MATERIALS  

UNIT III  SEMICONDUCTING MATERIALS  

UNIT IV  DIELECTRIC AND MAGNETIC MATERIALS  

UNIT V  NEW MATERIALS AND APPLICATIONS  
OUTCOMES:
At the end of the course, the students will be able to

- gain knowledge on phase diagrams and various material processing methods,
- acquire knowledge on basics of conducting materials, superconductors and their applications
- get knowledge on the functioning of semiconducting materials and their applications in LED and solar cells,
- understand the functioning of various dielectric and magnetic materials,
- have the necessary understanding on various advanced materials.

TEXT BOOKS:

REFERENCES

CY8251 PHYSICAL AND ORGANIC CHEMISTRY  L T P C
3 0 0 3

OBJECTIVES:
- To understand the structure and reactivity of organic compounds.
- To study about reaction mechanisms and to study the concepts of chemical kinetics and catalysis

UNIT I REACTION MECHANISMS
Free radical substitutions, Electophilic addition, Aromatic Electrophilic substitutions, Nucleophilic additions, condensation reactions, nuclophilic substitutions in aliphatic and aromatic compounds, cyclo additions, Rearrangements-Beckmann, Curtius, Hofmann, cope and oxy-cope, Fries rearrangement reactions.

UNIT II HETROCYCLIC COMPOUNDS IN POLYMER TECHNOLOGY
Amines, heterocyclic compounds – furan, thiophene, pyrrole, pyridine, quinoline, isoquinoline, imidazoles, thiazoles preparation , properties and uses of simple monomers likeethylene, propylene, isobutylene, butadiene, styrene, methyl methacrylate , diisocyanates, glycols, polyols, epichlorohydrin, fluoro alkenes, acrylonitrile, vinyl chloride, vinyl acetate.

UNIT III STRUCTURE AND REACTIVITY IN ORGANIC COMPOUNDS
Bonding in Organic Compounds- Structure-property relationships - Electronic effects like inductive, mesomeric, electromeric and hyper conjugation effects – Free radicals, carbocations, carbanions,
elementary ideas about stereo chemistry RS-nomenclature and EZ- nomenclature- conformational isomers.

UNIT IV PHASE RULE

UNIT V ELECTRO CHEMISTRY AND CORROSION

TOTAL: 45 PERIODS

OUTCOME:
- Obtain knowledge in structure and reactivity of organic compounds.
- Familiarize the reaction mechanism and chemical kinetics.

REFERENCES

BE8251 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING L T P C
3 0 0 3

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

UNIT I ELECTRICAL CIRCUITS & MEASURMENTS

UNIT II ELECTRICAL MACHINES

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS

UNIT IV DIGITAL ELECTRONICS

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING

TOTAL: 45 PERIODS

OUTCOMES:
- Ability to identify the electrical components and explain the characteristics of electrical machines.
- Ability to identify electronics components and understand the characteristics

TEXT BOOKS:

REFERENCES:

PR8251 PRODUCTION PROCESSES

OBJECTIVES:
- To impart the knowledge about the various production technology available
- To expose the student on the principle and applications of the processes
- To make a decision on a relevant technology based on the merits and demerits.

UNIT I CASTING PROCESSES
Principles of metal casting: Pattern materials, types and allowance; Study of moulding, sand moulding, tools, moulding materials, description and operation of cupola: special casting processes e.g. die-casting, permanent mould casting, centrifugal casting, investment casting.
UNIT II SMITHY AND FORGING 12

UNIT III METAL JOINING 12
Welding principles, classification of welding techniques; Oxyacetylene Gas welding, welding, metal arc, Carbon arc, submerged arc and atomic hydrogen welding, Electric resistance welding - composition, properties and function; Electrodes, Types of joints and edge preparation, Brazing and soldering.

UNIT IV SHEET METAL WORK 12
Common processes, tools and equipments; metals used for sheets, standard specification for sheets, spinning, bending, embossing and coining.

UNIT V UNCONVENTIONAL MACHINING PROCESSES 12
Need for unconventional – Construction, working principle merits, demerits and applications only for AJM, USM, ECM, EDM, EBM, LBM and IBM.

TOTAL: 60 PERIODS

OUTCOMES:
- Has enough knowledge on the various process available to make a part.
- Confident to select the best process to based on cost of time and quantities.
- Can try the processes to use new materials by combining.

TEXT BOOK

REFERENCES
1. Hajra Chowdary, Elements of Manufacturing Technology Vol 1 and vol 2

GE8261 ENGINEERING PRACTICES LABORATORY

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

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE 13

Buildings:
(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.
Plumbing Works:

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise:
   Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise:
   Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE 18

Welding:

(a) Preparation of butt joints, lap joints and T-joints by Shielded metal arc welding.
(b) Gas welding practice

Basic Machining:

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

Sheet Metal Work:

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

Machine assembly practice:

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

Demonstration on:

(a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE 13

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
5. Measurement of energy using single phase energy meter.

IV  ELECTRONICS ENGINEERING PRACTICE

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

TOTAL: 60 PERIODS

OUTCOMES:
On successful completion of this course, the student will be able to
- fabricate carpentry components and pipe connections including plumbing works.
- use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundary and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

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

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

**ELECTRICAL**

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

**ELECTRONICS**

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

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**ME8261**  
**COMPUTER AIDED DRAFTING AND MODELING LABORATORY**  
**L T P C**  
**0 0 4 2**

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

**LIST OF EXERCISES USING SOFTWARE CAPABLE OF DRAFTING AND MODELING**

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

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

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

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Description of Equipment</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Pentium IV computer or better hardware, with suitable graphics facility</td>
<td>30 No.</td>
</tr>
<tr>
<td>2.</td>
<td>Licensed software for Drafting and Modeling.</td>
<td>30 Licenses</td>
</tr>
<tr>
<td>3.</td>
<td>Laser Printer or Plotter to print / plot drawings</td>
<td>2 No.</td>
</tr>
</tbody>
</table>

MA8391 PROBABILITY AND STATISTICS  L T P C
                                      4 0 0 4

OBJECTIVE:

• This course aims at providing the required skill to apply the statistical tools in engineering problems.
• To introduce the basic concepts of probability and random variables.
• To introduce the basic concepts of two dimensional random variables.
• To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
• To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

UNIT I   PROBABILITY AND RANDOM VARIABLES


UNIT II  TWO - DIMENSIONAL RANDOM VARIABLES

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTING OF HYPOTHESIS

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT IV   DESIGN OF EXPERIMENTS

One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.

UNIT V   STATISTICAL QUALITY CONTROL

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL: 60 PERIODS

OUTCOMES:

Upon successful completion of the course, students will be able to:
- Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
- Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

TEXT BOOKS:

REFERENCES:

PT8351 FUNDAMENTALS OF POLYMER SCIENCE

OBJECTIVE:
- To enable the students to understand the basic concept of polymer, mechanism and various techniques of polymerization, characterization of polymers by molecular weight, reactions and degradation of polymers.

UNIT I BASIC CONCEPTS OF POLYMER

UNIT II POLYMERIZATION MECHANISM
UNIT III COPOLYMERIZATION MECHANISM
Copolymerization - Mechanism and Kinetics of free radical - Ionic copolymerization
-Determination of Monomer reactivity ratios. Polymerization techniques - Bulk polymerization
-Solution polymerization - Suspension polymerization - Emulsion polymerization - Interfacial
condensation.

UNIT IV POLYMER MOLECULARWEIGHT
Molecular weight- Molecular weight averages - Molecular weight distribution - Unidispersity,
polydispersity, Degree of polymerization. Molecular weight determination - Basic concepts of end
group analysis, colligative properties, osmametry, light scattering, and gel permeation
chromatography - Viscosity of polymers solutions.

UNIT V REACTIONS OF POLYMERS
Chemical reactions of polymers – Addition and substitution reactions - Hydrolysis – Acidolysis –
Aminolysis — cross linking reactions. Polymer degradation – Mechanical degradation – Oxidative
degradation – Hydrolytic degradation – Photo degradation.

TOTAL: 45 PERIODS

OUTCOME:
Upon completion of this course,

- Students will be able to develop the knowledge in the concepts of polymers, their
  classifications and nomenclature.
- Students will able to evaluate the mechanism and kinetics of free radical cationic and
  anionic polymerization
- Students will able to appraise the mechanism and kinetics of copolymer free radical the
  synthesis techniques for polymer.
- Students will able to determine the molecular weight of the polymer and understand the
  techniques used for determination.
- Students will be aware about degradation mechanism of polymers and chemical reaction
  of polymers

TEXT BOOKS:
   Edition.
2. V.R. Gowariker,N.V. Viswanathan, Jayadev Sreedhar, “Polymer Science” – New Age
   Edition.

REFERENCES:
1. J.M.G. Cowie, “Polymers: Chemistry and Physics of Modern Materials”, Blackie, and
3. Premamoy Ghosh, “Polymer Science and Technology of Plastics and Rubbers”, Tata
   McGraw- Hill, New Delhi, 1990

GE8291 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
3 0 0 3

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

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

UNIT II  ENVIRONMENTAL POLLUTION
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 municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

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

UNIT IV  SOCIAL ISSUES AND THE ENVIRONMENT
From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental

UNIT V HUMAN POPULATION AND THE ENVIRONMENT


TOTAL: 45 PERIODS

OUTCOMES:

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXT BOOKS:


REFERENCES:


PT8353 MECHANICS OF SOLIDS L T P C 3 0 0 3

OBJECTIVES:

- To understand the fundamental concepts of stress & strain and its deformation under loads.
- To analyze the determinate beams and determine shear force and bending moment.
- To apply the mathematical knowledge to calculate the deformation behavior of beams.
- To understand the effect of torsion on shafts and springs.
- To analyze a complete two dimensional state of stress.

UNIT I STRESS AND STRAIN 9


UNIT II SHEAR AND BENDING IN BEAMS 9
Beams and Bending- Types of loads, supports – Shear Force and Bending Moment Diagrams for statically determinate beam – cantilever beam – Simply supported beam - with concentrated load - uniformly distributed load

UNIT III DEFLECTION OF BEAMS 9

UNIT IV TORSION 9
Torsion of Circular and Hollow Shafts – Stresses and Deflection in Circular Solid and Hollow Shafts – strain energy due to torsion – Power transmitted to shaft – Shaft in series and parallel – Closed and Open Coiled helical springs – Springs in series and parallel.

UNIT V THIN CYLINDERS AND THEORIES OF FAILURE 9
Thin cylinders – Stresses in thin cylindrical shell due to internal pressure – circumferential and longitudinal stresses - Theories of failure - maximum Principal stress - maximum Principal strain - Shear stress - Total strain energy - Energy distortion theories

TOTAL: 45 PERIODS

OUTCOMES
• Thorough understanding of the fundamental concepts of stress and strain
• Ability to analyze the determinate beams.
• Ability to apply the mathematical knowledge in determining the deformation behavior of beams
• Thorough understanding of the effect of torsion on shafts and springs.
• Ability to analyze a complex two dimensional state of stress and to analyze the failure mode.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To learn the fundamental operation involved in chemical engineering
- To attain the knowledge in the subject of fluid flow
- To gain the ideas in the field of heat transfer operation
- To learn the mass diffusion in polymers by the study of mass transfer operations

UNIT I  FLUID FLOW


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, cyclones and hydro cyclones. (Basic principles and equipment description only. Mathematical consideration not required)

UNIT III  HEAT TRANSFER

Modes of heat transfer; Heat transfer by conduction - Fourier’s law, conduction across composite walls. Heat transfer by natural & forced convection. Co current, counter current, shell & tube heat exchangers (Basic principles and equipment description only. Mathematical consideration not required)

UNIT IV  MASS TRANSFER

Principles of diffusion, theory of diffusion, Two film theory and mass transfer coefficients
Humidification - operation, humidity chart, equipment’s - cooling towers and spray chambers
Drying - Principles and definitions. Rate of batch drying- Equipment for drying (Basic principles and equipment description only. Mathematical consideration not required)

UNIT V  UNIT OPERATIONS

Absorption - Principle and equipment (packed towers and plate columns). Distillation - flash distillation, and Binary distillation. Industrial equipment for distillation Adsorption - Principle and equipment for adsorption. (Basic principles and equipment description only. Mathematical consideration not required)

OUTCOMES

On completion of the course, students

- Will attain the knowledge in fluid flow behaviors and mechanical separation.
- Will understand the conduction and convection modes of heat transfer.
- Will understand the concept of distillation equipment in the process industries.
- Will increase the ability of the student over the fundamentals of chemical engineering

TEXT BOOKS:


REFERENCES:


PT8354 POLYMER PHYSICS

OBJECTIVES:
- To make the students understand physical and conformational properties of polymeric materials.
- To know the molecular arrangement in polymers and their orientation under the influence of stress.
- To know the solubility behavior of polymers.

UNIT I FUNDAMENTALS OF POLYMER PHYSICS
Potential energy and conformational energy of molecules - conformations and configurations, Tactility, isomeric states and isomerism in polymers, stereoisomerism, geometric isomerism - Random coils and average end to end distance - (Derivation only)

UNIT II THERMODYNAMIC PROPERTIES
Laws of Thermodynamics - Freely jointed and freely rotating chain models - Entropy and enthalpy- Energy driven and entropy driven elasticity - Thermo elasticity -Thermodynamic treatment - entropic and energetic contributions (Derivation only).

UNIT III POLYMER CRYSTAL FORMATION

UNIT IV CHAIN ORIENTATION

UNIT V POLYMER SOLUTIONS
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) - solubility parameter,determination of solubility parameter of polymers - theta conditions.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completing this course, the students
- Will understand molecular arrangement in polymers.
- Will able to demonstrate the orientation processes in polymer.
- Will acquire the knowledge in solubility behavior of polymers.

TEXT BOOKS:
OBJECTIVE:
- To train on various techniques for reducing and separating of particles, flow properties of fluids.

LIST OF EXPERIMENTS:
1. To determine the pipe friction using Flow through rough and smooth pipes.
2. To determine the efficiency of pump using Centrifugal pump.
3. To determine the coefficient of discharge of orifice meter.
4. To find the efficiency of Air compressor.
5. To Calibrate the rotameter.
6. To find the Pressure drop in packed bed.
7. To study the concept of Fluidization by using fluidized bed.
8. To determine the coefficient of discharge of Venturi meter.
9. To find the Thermal conductivity of solids.
10. To find overall heat transfer coefficient of the Heat exchanger.
11. To find the Stefan-Boltzman constant.
12. To find the new surface area created by Jaw crusher.
13. To find the critical speed of Ball Mill.
14. To find the Screening efficiency.
15. To separate the component by Simple distillation.
16. To separate the component by using steam distillation.
17. To find the Particle size and Surface area of filler particles.
(Any nine Experiments)

TOTAL: 60 PERIODS

OUTCOMES:
Upon completing this course, the students
- Will be able to apply the different technique for size reduction.
- Will attain skill in function of fluid pressure apparatus.

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

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

REFERENCES:

PL8311 PLASTICS IDENTIFICATION AND ANALYSIS LABORATORY L T P C
0 0 4 2

OBJECTIVE:
• To train the student to identify plastics and rubbers by different methods

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. Polycetal
10. Polyphenylene oxide
11. Polyphenylene sulphide
12. Phenol Formaldehyde resin
13. Urea formaldehyde resin
14. Melamine formaldehyde resin

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. Iso butiene Isoprene Rubber (IIR)
6. Chloroprene Rubber (CR)
7. Acrylonitrile–Butadiene Rubber (NBR)
8. Silicone Rubber

OUTCOMES:
Upon completion of this course, the student will be able to
- Identify different types of plastics by their characteristics
- Identify different types of rubbers by their characteristics

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

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

REFERENCE:
1. Identification of plastics and rubbers by simple methods, CIPET publications 2002

HS8381 INTERPERSONAL SKILLS/LISTENING&SPEAKING

OBJECTIVES: The Course will enable learners to:
- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- improve general and academic listening skills
- Make effective presentations.

UNIT I
Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

UNIT II
Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

UNIT III
Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist- listen for detail
UNIT IV
Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuade.

UNIT V
Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

TOTAL: 30 PERIODS

OUTCOMES: At the end of the course Learners will be able to:
- Listen and respond appropriately.
- Participate in group discussions
- Make effective presentations
- Participate confidently and appropriately in conversations both formal and informal

TEXT BOOKS:

REFERENCES:

MA8491 NUMERICAL METHODS

OBJECTIVE:
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals in real life situations.
- To acquaint the student with understanding of numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.
- To understand the knowledge of various techniques and methods of solving various types of partial differential equations.
UNIT I  SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS  12

UNIT II  INTERPOLATION AND APPROXIMATION  12
Interpolation with unequal intervals - Lagrange's interpolation – Newton’s divided difference interpolation – Cubic Splines - Difference operators and relations - Interpolation with equal intervals - Newton’s forward and backward difference formulae.

UNIT III  NUMERICAL DIFFERENTIATION AND INTEGRATION  12

UNIT IV  INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS  12

UNIT V  BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS  12
Finite difference methods for solving second order two - point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace’s and Poisson’s equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

TOTAL: 60 PERIODS

OUTCOMES:
Upon successful completion of the course, students should be able to:

- Understand the basic concepts and techniques of solving algebraic and transcendental equations.
- Appreciate the numerical techniques of interpolation and error approximations in various intervals in real life situations.
- Apply the numerical techniques of differentiation and integration for engineering problems.
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

TEXT BOOKS:
REFERENCES:

PT8451 FLUID MECHANICS AND POLYMER RHEOLOGY L T P C
3 0 0 3

OBJECTIVES:
- To understand the basic concepts of rheology
- To analyze the flow behavior of polymer melts and to carry out the experimental techniques for measuring the rheological properties.
- To understand the basics of fluid mechanism and to analyze behavior of newtonian fluids.
- To experimental with instruments such as orifice meter, venturi meter and pitot tube.

UNIT I FLUID PROPERTIES
Units and dimensions-Properties of fluids-mass density, specific weight, specific volume, specific gravity, viscosity, surface tension and capillarity-Terminologies of fluid flow-Laminar and turbulent flow of newtonian fluids-Power law-Reynolds number and its significance

UNIT II FLUID FRICTION AND FLOW MESSUREMENT
Bernoulli’s equation–kinetic energy correction factor; head loss; friction factor; major and Minor losses- Flow measurement: Introduction; Orifice meter; Venturi meter; concept of area meters: rotameter; Local velocity measurement: Pitot tube

UNIT III FLUID RHEOLOGY
Introduction and Basic concepts 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, Viscoelasticity - effect of rate of strain, temperature and time on mechanical behaviour of polymeric materials

UNIT IV POLYMER RHEOLOGY

UNIT V MEASUREMENT OF POLYMER VISCOSITY

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, students
OBJECTIVES:
To enable the students
- To learn about the general methods of preparation of individual class of plastics Materials
- To study about the general properties, processing behavior and applications of different class of plastics materials
- To understand about the structure- property relation of different class of plastics materials.

UNIT I INTRODUCTION
Basic chemistry of polymers-nomenclature of polymers sources for raw materials. Methods of manufacturing –properties and applications of Natural Polymers - Shellac resin and natural rubber - Cellulosics - Cellulose nitrate, cellulose acetate, cellulose acetate butyrate, Ethyl cellulose and others.

UNIT II COMMODITY THERMOPLASTICS-I
Preparation- properties - and applications of Polyolefine-Polyethylene- LDPE -LLDPE- HDPE, HMWHDPE- UHMWHDPE - Crosslinked polyethylene- Chlorinated polyethylene –Polypropylene – Homo & Co polymer

UNIT III COMMODITY THERMOPLASTICS-II
Preparation - properties - and applications of Vinyl plastics - Polyvinyl chloride, C-PVC, Polyvinyl Acetate, Polyvinylidene chloride, Polyvinyl alcohol. Polystyrene

UNIT IV GENERAL PURPOSE THERMOSETS
Preparation - properties - and applications of: Phenol formaldehyde (PF) ,Amino plastics: Urea
formaldehyde (UF) - Melamine formaldehyde (MF), Unsaturated polyesters, Alkyd resins

UNIT V  ENGINEERING AND SPECIALITY THERMOSETS
Preparation - properties - and applications of: Epoxy Plastics, Polyurethane (PU) Silicones

OUTCOMES:
Upon completing this course, the students
- Will familiarize in natural polymer properties and its applications
- Will acquire skills in selecting additives for plastic materials for specific applications
- Will have knowledge of manufacturing, properties and applications of poly olefins.
- Will have knowledge of manufacturing, properties and applications of vinyl halogenated olefin based plastic materials
- Will have knowledge of manufacturing, properties and applications of special purpose plastics

REFERENCES:
1. V.R. Gowariker, “Polymer Science” – New Age International (P) Ltd, Publishers
5. Charles Gebelein, Biotechnological Polymers: Medical, pharmaceutical and industrial applications, CRC press, 1993

ME8391  ENGINEERING THERMODYNAMICS  L T P C
3 2 0 4

OBJECTIVE:
- To familiarize the students to understand the fundamentals of thermodynamics and to perform thermal analysis on their behavior and performance.
  (Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart and Psychrometric Chart permitted)

UNIT I  BASIC CONCEPTS AND FIRST LAW

UNIT II  SECOND LAW AND AVAILABILITY ANALYSIS

UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE 9 + 6

UNIT IV IDEAL AND REAL GASES, THERMODYNAMIC RELATIONS 9 + 6

UNIT V GAS MIXTURES AND PSYCHROMETRY 9 + 6
Mole and Mass fraction, Dalton’s and Amagat’s Law. Properties of gas mixture – Molar mass, gas constant, density, change in internal energy, enthalpy, entropy and Gibbs function. Psychrometric properties, Psychrometric charts. Property calculations of air vapour mixtures by using chart and expressions. Psychrometric process – adiabatic saturation, sensible heating and cooling, humidification, dehumidification, evaporative cooling and adiabatic mixing. Simple Applications

TOTAL : 75 PERIODS

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Apply the first law of thermodynamics for simple open and closed systems under steady and unsteady conditions.
CO2 Apply second law of thermodynamics to open and closed systems and calculate entropy and availability.
CO3 Apply Rankine cycle to steam power plant and compare few cycle improvement methods
CO4 Derive simple thermodynamic relations of ideal and real gases
CO5 Calculate the properties of gas mixtures and moist air and its use in psychrometric processes

TEXT BOOKS :

REFERENCES:
PT8453 PROCESS INSTRUMENTATION FOR POLYMER TECHNOLOGIST

OBJECTIVE:

- To enable the students to learn the basic measurements system
- To understand the concepts of temperature pressure and flow measurements system.
- To understand the instrumentation applications in polymer analytical techniques.

UNIT I GENERAL CONCEPTS OF MEASUREMENTS

Measurement -The three stages of generalized measurement system, Transducer: classification. Factors considered in selection of Transducers classification of errors, potentiometer, LVDT, tachometer. Strain gauge Types of electric strain gauges. Calibration of strain gauges, Non conduct measurements

UNIT II TEMPERATURE AND PRESSURE MEASUREMENTS

Thermometer, Resistance Temperature Detector, thermistor, thermocouple, total radiation pyrometers, optical pyrometer, Pressure measurement: Manometers, Elastic transducers, McLeod gauge, thermal conductivity gauges, calibration of pressure gauge using dead weight tester.

UNIT III FLOW AND MISCELLANEOUS MEASUREMENTS

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 INDICATING AND RECORDING INSTRUMENTS


UNIT V INSTRUMENTATION IN ANALYTICAL TECHNIQUE

IR spectroscopy, Gas chromatography, X-ray spectrometer, Thermoanalytical method, Thermal conductivity analyzer, Measurement of color.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completing this course, the students

- Will be able to understand the general concept of measurements.
- Will acquire the knowledge in instruments for measurement
- Will familiarize with the indicating and recording instruments used in industry machinery
- Will understand the role of process control in polymer machinery.

TEXT BOOKS:


REFERENCES:

OBJECTIVE:
- To impart knowledge on mould making techniques such as metal cutting, metal erosion,
- To provide knowledge of metal deposition, surface texturing and measurements in mold making.
- To understand the electro forming process

UNIT I           FUNDAMENTALS OF MOLD MAKING

UNIT II          ELECTRICAL DISCHARGE MECHANISMS
Electrical discharge machining – Principle, Types of EDM - Die Sinking & Wire Cut EDM, Machining Process, Requirements of dielectric fluid, Applications of EDM in mold making.

UNIT III         ELECTRO FORMING PROCESS
Electroforming for mold manufacturing - discussion of the process, materials for electroforming, design & materials for models, machining for electroformed mold cavities, Advantages, Disadvantages.

UNIT IV         HOBBING AND CHEMICAL TEXTURING
Hobbing for mold cavity making - Discussion of the hobbing process, elements of hobbing, materials used for cavity, lubrication, and depth of hobbing, advantages and disadvantages.
Surface Texturing of molds – Chemical Texturing, Process description, Advantages- Limitations of chemical texturing.

UNIT V          METROLOGY AND INSPECTION
Metrology and inspection: Vernier caliper, Micrometer, Vernier height gauges, Surface plate, Slip gauges, Sine Bar, Rockwell Hardness, Optical profile projectors and Optical flat.

OUTCOMES:
Upon completing this course, the students
- Will demonstrate mold making process
- Will know about the Electro discharge machining process
- Will have the knowledge in surface texturing of mold
- Will attain knowledge in electroforming process
- Will acquire skills in inspection of mold

TEXT BOOKS:
2. HMT Production Technology, Tata Mc Graw Hill (India), 1992
REFERENCES:

PT8461 MOULD MANUFACTURING TECHNOLOGY LABORATORY L T P C
0 0 4 2

OBJECTIVE:
• To train the students about the mould making techniques such as metal cutting, metal erosion, metal deposition, metal displacement and mould polishing.

LIST OF EXPERIMENTS
1. Exercise on Shaping machine - making stepped block
2. Exercise on Shaping machine - making beveled block
3. Exercise on Horizontal Milling-Gear cutting
4. Exercise on Vertical Milling
5. Exercise on lathe - external thread
6. Exercise on lathe- taper turning
7. Exercise on Surface Grinding.
8. Exercise on Slotting Machine.
9. Grinding of Cutting tools.
10. Study of different types of Cutting tools.
11. Measurements using Micrometer, vernier, Height gauge and Slip gauge.

(Any 8 experiments from the above)

TOTAL: 60 PERIODS

OUTCOMES:
Upon completing this course, the students
• Will understand the mould parts manufacturing technique
• Will attain knowledge in turning operations
• Will attain knowledge in slotting and milling operations
• Will know about the grinding methods
• Will understand the measuring instruments

DEMONSTRATION EXPERIMENT:
To make a simple mold for hand molding machine

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS
<table>
<thead>
<tr>
<th>Equipment</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaping machine</td>
<td>2 Nos.</td>
</tr>
<tr>
<td>Vertical milling machine</td>
<td>1 No.</td>
</tr>
<tr>
<td>Horizontal milling machine</td>
<td>1 No.</td>
</tr>
<tr>
<td>Lathe</td>
<td>10 Nos.</td>
</tr>
</tbody>
</table>
Plain surface grinding machine 1 No.
Bench grinder 2 Nos.
Vernier caliper 2 Nos.
Vernier height gauge 2 Nos.
Vernier Depth Gauge 1 No
Micrometer 2 Nos
Sine bar 1 No.

HS8461 ADVANCED READING AND WRITING L T P C
0 0 2 1

OBJECTIVES:
- Strengthen the reading skills of students of engineering.
- Enhance their writing skills with specific reference to technical writing.
- Develop students’ critical thinking skills.
- Provide more opportunities to develop their project and proposal writing skills.

UNIT I
Reading - Strategies for effective reading-Use glosses and footnotes to aid reading comprehension- Read and recognize different text types-Predicting content using photos and title
Writing-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence –Write a descriptive paragraph

UNIT II
Reading-Read for details-Use of graphic organizers to review and aid comprehension Writing-State reasons and examples to support ideas in writing- Write a paragraph with reasons and examples- Write an opinion paragraph

UNIT III
Reading- Understanding pronoun reference and use of connectors in a passage- speed reading techniques-Writing- Elements of a good essay-Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

UNIT IV
Reading- Genre and Organization of Ideas- Writing- Email writing- visumes – Job application-project writing-writing convincing proposals.

UNIT V
Reading- Critical reading and thinking- understanding how the text positions the reader- identify Writing- Statement of Purpose- letter of recommendation- Vision statement

TOTAL: 30 PERIODS

OUTCOMES: At the end of the course Learners will be able to:
- Write different types of essays.
- Write winning job applications.
- Read and evaluate texts critically.
- Display critical thinking in various professional contexts.
PL8501 ADDITIVES AND COMPOUNDING L T P C

OBJECTIVES:
To enable the students
• To know various drawbacks of polymer materials and suitable remedies.
• To understand the mechanism of degradation of polymers and stabilizing additives
• To know the various compounding methodologies for plastics materials and learn the maintenance of compounding machinery.

UNIT I FILLERS, STABILIZERS, PIGMENTS 9
Fillers and Reinforcement– Antioxidants-Thermal Stabilisers, Ultraviolet stabilizer– Impact Modifiers/ Toughening agents. Colourants-Fire retardants-Coupling agents-blowing-agents

UNIT II PLASTICIZERS 9

UNIT III FUNDAMENTALS OF COMPOUNDING 9

UNIT IV COMPOUNDING MECHANISMS 9
Compounding Machineries specifications - temperature control system – operating characteristics and working details of continuous mixers - - Single Screw extruder - Twin Screw extruder- house keeping and maintenance of compounding machines.
UNIT V CASE STUDIES

Case studies on preference of one plastics to other and co-relation of properties of conventional materials and blends and alloys - case studies on application of blends and alloys.

TOTAL: 45 PERIODS

OUTCOMES:
- Students will have clear understanding of various types of additives for plastics and their merits and demerits.
- Students can learn about various compounding methods used in the manufacturing of compounded thermoplastics and thermosets.

TEXT BOOKS:

REFERENCES:

PL8502 PLASTICS TESTING I L T P C
3 0 0 3

OBJECTIVES:
- To develop the knowledge of National & International standards for testing methods.
- To create the knowledge about the different testing techniques and its basic concepts for evaluating the chemical, mechanical, electrical, optical, thermal, and permanence properties of plastic materials.
- To enable the students to identify and compare the properties of different plastics materials.
- To enable the students to learn about the property of the plastic material for several

UNIT I TESTING STANDARDS 5
Importance of testing, Standard and specifications- National and International standards-BIS, ASTM, ISO, BS, DIN, JIS etc- Laboratory accreditations – NABL, NABCB, APLAC etc.

UNIT II IDENTIFICATION OF PLASTICS 9
Identification of plastics by simple methods e.g., visual inspection, density, effects of heat, combustion and solvents analysis, melting & Softening point, elemental analysis, confirmation test-analytical techniques used for identification and quantification of additives and fillers.

UNIT III TESTING OF MECHANICAL PROPERTIES 12
Preconditioning and test atmosphere, Specimen preparation techniques – Moulding, Contour cutting, contour punching, etc. Techniques for testing of Short term mechanical properties of Plastics – Stress – Strain curve, toughness, brittle and ductile nature of materials, Tensile, Flexural, Compression, Shear, Impact strength, Tear, abrasion, Hardness and friction test.
UNIT IV TESTING OF THERMAL AND OPTICAL PROPERTIES
Techniques for testing of Thermal properties – Melting Point, Specific heat capacity, HDT, VSP, Flammability (Rate of burning, UL 94, LOI), Ignition properties of plastics.
Thermal conductivity, Coefficient of Thermal Expansion, Brittleness Temperature
Optical properties – Luminous transmittance, Haze, Specular Gloss, Refractive Index, colour measurement, optical microscopy

UNIT V TESTING OF ELECTRICAL AND FLOW PROPERTIES
Techniques for testing of Electrical properties – Surface & Volume Resistivity, Arc Resistance, CTI, Dielectric Strength, Dielectric constant and Dissipation factor- Rheological properties – Melt flow Index, Melt viscosity (as function of temperature and shear rate)

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course,
- Students will learn how the plastics materials are tested for its chemical, mechanical, electrical, optical, thermal, and permanence properties.
- Students will be able to identify the plastic materials for some specified applications based on its property.
- Students will able to understand the basic principle of polymer testing machines.

TEXT BOOKS:

REFERENCES:

PL8551 PLASTICS MATERIALS II

OBJECTIVES:
- To learn about the general methods of preparation of individual class of plastic materials
- To study the general properties, processing behavior of plastics materials.
- To provide the knowledge in applications of different class of plastics materials.

UNIT I ENGINEERING PLASTICS & ITS APPLICATIONS - I
Preparation- properties - and applications: Styrene copolymers – High Impact Polystyrene (HIPS), Acrylonitrile Butadiene Styrene (ABS), Styrene acrylonitrile (SAN), Acrylic plastics - Polymethyl Methacrylate, Polyacrylonitrile, Ethylene Vinyl Alcohol (EVA).

UNIT II ENGINEERING PLASTICS & ITS APPLICATIONS – II
Preparation- properties - and applications: Polyamides - Nylons 6, (6,6), (6,10), 11, 12, Polyesters – Polyethylene terephthalate, polybutylene terephthalate, Polycarbonate, Polyacetals.
UNIT III  HIGH PERFORMANCE PLASTICS - I  9
Preparation - properties - and applications: Aromatic ether - Polyphenylene oxide (PPO),
Aromatic thioether - Polyphenylenesulphide (PPS), Polysulfone, Aromatic polyamides

UNIT IV  HIGH PERFORMANCE PLASTICS - II  9
Preparation - properties - and applications: Polyimidides (PI) Polyamideimide (PAI), Polyimidazoles,
Fluoropolymers – Polyvinyl fluoride (PVF), Polyvinylidene fluoride (PVDF), Polytetrafluoroethylene
(PTFE), Polychlorotrifluoroethylene (PCTFE).

UNIT V  WATER SOLUBLE POLYMERS AND BIO DEGRADABLE POLYMERS  9
Preparation- properties and applications of Biodegradable polymers - poly ω-caprolactone -
poly(lactic acid- Bacterial polyhydroxyalkonates– poly(vinylpyrrolidone – polyacrylic acid and its
homolog’s – polyacrylamide –polyethylene oxide – polyethylene amine-Polyvinyl alcohol

OUTCOMES:
Upon completing this course, the students
• Will have the knowledge of manufacturing methods, properties of special purpose polymers applied in special application
• Will have knowledge of manufacturing methods and correlate the high performance polymer properties for special purpose
• Will acquire skills in selection of conducting polymer to suitable application
• Will have the knowledge of manufacturing methods, properties and applications of ionic polymers
• Will have the knowledge of manufacturing methods, properties and applications of water soluble and bio degradable polymers

TEXT BOOKS:

REFERENCES:
5. Birley; Arthur W. and Scott; Martyn J., Plastics Materials: Properties and Applications,
7. Biron; Michel, Thermoplastics and Thermoplastic Composites: Technical Information for
OBJECTIVES:
To enable the students
- To understand the various processing techniques of plastic materials.
- To learn the fundamentals and compression molding and transfer molding of thermoset plastics.
- To learn the basic processing of thermoplastics by injection molding, extrusion and blow molding.

UNIT I  INTRODUCTION
8
Basic principles of processing - shape and size – Effect of polymer property on processing – Newtonian and Non-Newtonian fluids - Rheology of polymer melts.

UNIT II  COMPRESSION MOULDING & TRANSFER MOULDING
11
Basic principles of compression and transfer moulding-Meaning of terms-Bulk factor and flow properties as applied to moulding materials-The methods adopted for estimating these properties and their limitations Process variables-Inter relation between flow properties-Curing time-Mould temperature and Pressure requirements-Preforms and preheating-Techniques of preheating-Machines used-Types of compression mould-Common moulding faults and their correction-Finishing of mouldings.


UNIT III  INJECTION MOULDING
15
Principles processing outline - Process variables - Mould cycle - Machinery used – Parts and functions –Specifications - Construction and maintenance - Start-up and shut down procedures - Cylinder nozzles - Press capacity projected area -Shot weight Basic theoretical concepts and their relationship to processing - Interaction of moulding process aspect effects in quoted variables - Introduction to trouble shooting.

UNIT IV  EXTRUSION
14

UNIT V  BLOW MOULDING
12
Basic principles and definitions- Processer – viz, Injection Blow moulding, extrusion blow moulding, Accumulation blow moulding, Merits & Demerits - Development of blow moulding industry Processing Parameters-Temperature-Pressure and cycle time Components – Materials requirements related to process and product performance- Materials used-Limitations in product
design presented by process characteristics- Design guide lines for optimum product performance and appearance-Equipment used- Hand and power operated equipment. Screw and Plunger Systems-Cross head and die design-Blow moulding machine features and operation including hydraulic and electrical control systems-faults, causes and remedies. Parison programming, blow mould construction, cooling methods, mould venting, blow moulding of difficult articles like fuel tanks, odd shaped containers with handles, limitation in blow moulding, decoration of blow moulding products, hot stamping-multi colour printing-faults, causes and remedies.

TOTAL: 60 PERIODS

OUTCOMES:
- On completing this course, the students would acquire the knowledge of processing of plastic materials by injection moulding, extrusion, and blow moulding.
- Students can will understand processing techniques like compression molding and transfer moulding of thermoset plastics.

TEXT BOOKS:
4. Extrusion of Plastics By Fisher
5. Plastics Extrusion Technology By Grief

REFERENCES:
1. A Guide to Injection Molding of Plastics By Bolur, P.C.,
6. Injection Molding Technology By V.D.I.
9. Compression Molding By Iyesew, A.I.

PL8511 PLASTICS PROCESSING LABORATORY I

OBJECTIVE:
- To practice the students in different types of moulding machines.

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Name of M/c/ Equipment/ Mould</th>
<th>Description of Practical Exercise to be done</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hand operated</td>
<td>(i) Study of Machine in Idle-Run Observation (IRO), Parts&amp;</td>
</tr>
</tbody>
</table>
|   | Injection Moulding Machine | functions, operating principle, Free sketch of Machine- parts eg. Nozzle, Torpedo, Hopper, Rack & Pinion Barrel etc., shot capacity definition  
(ii) Operation practice to produce moulding on Different and injection moulds. Recording the observation and results in practical record books. |
|---|---|---|
| 2 | Injection Moulding Semi Automatic | (i) Study of Semi Automatic Injection Moulding M/cs of all types in IRO. Comparative study of Pneumatic type & Hydraulic type of M/cs, Operating Principle of M/cs. Line diagrams of M/cs with nomenclature of parts, M/cs specifications.  
(ii) Operation of Pneumatic & Hydraulic type of Semi automatic Injection moulding M/cs, to produce components in different moulds. Cycle-time analysis, observations of Process-Parameters & Procedure to be recorded |
| 3 | Extrusion Processes on Extruders | (i) Study of Extruders in IRO, Free sketch of machines, their parts and parts-function, List of products manufactured by Extrusion-Process. Study of different types of extrusion process.  
(ii) Operation-Practice by Trainee on setting up of Process parameter to produce Blown-Film on Film-plant, observations on extruder output, size of film produced and technical specifications of machines to be recorded |
(ii) Operating Principle of Hand Compression Press, mould setting-procedure & parameter setting, operation practice on different compression moulds, M/c specification observations and recording |
| 5 | Blow Moulding and recording Hand Operated | (i) Study of Hand Blow Moulding M/cs, Free-sketch of M/c with parts & study of part-function, Specification of M/c, Study of Parison-die with sketch.  
(ii) Die-centering practice by Trainees, operation of Hand Blow Machines, to produce components observations, cycle time analysis Procedure of operation and observations. |
| 6 | Scrap Grinding | (i) M/c Study in IRO, specification of M/c, study of parts & function, Line Diagram of M/c.  
(ii) Operation-practice with different materials and output study in Kg/hour for different materials. |
| 7 | Injection Moulding M/c.- Automatic | Study of M/c Parts & function, Study of clamping systems in M/cs, Technical spec. of M/c, study of process sequence in Machine, Study & definitions of terms related to M/c operation e.g. M/c Day light, Locating –Ring Dimensions, ejector-stroke, Tie-Bar distance, M/c Platen sizes & mould clamping arrangements. Definitions of all Processing Parameters & study of controls in M/cs. |
| 8 | Compression & Transfer Moulding- Semi Automatic | Technical specification of M/c, Mould clamping on M/c, Parameter setting, operation-practice on different compression & Transfer Moulds, Cycle-time analysis, observation & Procedure of start-up & shut down of M/c. |
Technical specification of M/c, Mould clamping on M/c, operation Practice with different moulds, Familiarisation with control-switches/ valves on the M/c, cycle-time analysis & procedure of operation of M/c.

Basic knowledge of Hydraulic & Pneumatic systems, Electrical system, Definition of terms- Hydraulic fluid, viscosity Directional Valves, Resistance, Current, Voltage, Power, Hydraulic Pumps - Types & function, electrical heaters, thermocouples and temp control parameters and timers, electrical Motors - Types & fn.

Study of Different Types of Moulds & its Parts and function, free hand drawing practice, exposure to tool room machines.

**LIST OF EQUIPMENTs/MACHINERY FOR BATCH OF 30 STUDENTS**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of M/c/ Equipment/ Mould</th>
<th>No. of machine required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hand operated Injection Moulding Machine</td>
<td>01</td>
</tr>
<tr>
<td>2</td>
<td>Injection Moulding Semi-Automatic</td>
<td>01</td>
</tr>
<tr>
<td>3</td>
<td>Extrusion Processes on Extruders</td>
<td>01</td>
</tr>
<tr>
<td>4</td>
<td>Compression moulding –Hand Operated</td>
<td>01</td>
</tr>
<tr>
<td>5</td>
<td>Blow Moulding and recording – Hand Operated</td>
<td>01</td>
</tr>
<tr>
<td>6</td>
<td>Scrap Grinding</td>
<td>01</td>
</tr>
<tr>
<td>7</td>
<td>Injection Moulding M/c.- Automatic</td>
<td>01</td>
</tr>
<tr>
<td>8</td>
<td>Compression&amp; Transfer Moulding- Semi Automatic</td>
<td>01</td>
</tr>
<tr>
<td>9</td>
<td>Blow-Moulding Semi-Automatic</td>
<td>01</td>
</tr>
<tr>
<td>10</td>
<td>Introduction to Maintenance</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>Introduction to Moulds, Tool Room M/c &amp; Drawing Practice</td>
<td>-</td>
</tr>
</tbody>
</table>

TOTAL: 60 PERIODS

**OUTCOME:**
- Upon completing this practical course, the student will have hands on experience on different types of moulding machines.

**PT8561 POLYMER PREPARATION LABORATORY**

**OBJECTIVE:**
- To prepare the students with Methodology for facing the Industrial and academic challenges in Identifying various polymers and Controlling the quality of incoming raw materials and processing

**LIST OF EXPERIMENTS**

**Preparation**
1. Preparation of phenol - formaldehyde (Novalac) resin.
2. Preparation of phenol - formaldehyde (Resol) resin.
3. Preparation of Urea formaldehyde resin.
5. Bulk polymerization of styrene.
7. Solution Polymerization of acrylonitrile.
8. Bulk Polymerization of Methyl methacrylate.
9. Copolymerization of styrene and methyl methacrylate.
10. Ring opening polymerization of Caprolactone
11. Solution Polymerization of Vinyl acetate.

(Any Nine of the above)

TOTAL: 60 PERIODS

OUTCOMES:
Upon completing this course, the students
• Will acquire skills in preparation of polymers using various polymerization techniques.
• Will develop the conversion of polymeric materials into product.

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Magnetic stirrer 10 Nos.
Thermostatic Water bath 2 Nos.
Vacuum Pump 1 No.
Heating Mantle 8 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.
Burette
Pipette
Funnel

HS8581 PROFESSIONAL COMMUNICATION L T P C
0 0 2 1

OBJECTIVES:
The course aims to:
• Enhance the Employability and Career Skills of students
• Orient the students towards grooming as a professional
• Make them Employable Graduates
• Develop their confidence and help them attend interviews successfully

UNIT I
Introduction to Soft Skills— Hard skills & soft skills - employability and career Skills—Grooming as
a professional with values—Time Management—General awareness of Current Affairs

UNIT II
Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the
topic – answering questions – individual presentation practice— presenting the visuals effectively
– 5 minute presentations
UNIT III
Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic — questioning and clarifying – GD strategies- activities to improve GD skills

UNIT IV
Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview & panel interview – FAQs related to job interviews

UNIT V
Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes

OUTCOMES:
At the end of the course Learners will be able to:
• Make effective presentations
• Participate confidently in Group Discussions.
• Attend job interviews and be successful in them.
• Develop adequate Soft Skills required for the workplace

Recommended Software
1. Globearena
2. Win English

REFERENCES:

PL8601 PLASTICS MOULDS AND DIES DESIGN L T P C 3 0 0 3

OBJECTIVES:
• To learn the design concepts for various mould elements.
• To learn the basic design aspects related to Injection Mould, Compression Mould, Transfer Mould, Blow Mould and Extrusion Dies.

UNIT I BASICS OF MOULD DESIGN & INJECTION MOULDS 13
Mould Design: Introduction to Molding process and Moulds – Classification of moulds- Factors considered for Mould Design-Shot Capacity-Plasticizing Rate-Clamping Force- Injection Time – Cooling Time - Number of Cavities – Layout of Cavities.


UNIT II  DESIGN OF FEED & EJECTION SYSTEM  8

Ejection System: Requirements – Elements of Ejection system - Ejector grid, Ejector plate assembly, Ejection techniques – Ejection from fixed half - Sprue Pullers- Ejection Force Calculation - Ejection Assembly Actuation

UNIT III  DESIGN OF MOULD TEMPERATURE CONTROL SYSTEM  6

UNIT IV  DESIGN OF COMPRESSION & TRANSFER MOULD  8

Transfer Mould Design: Introduction - Types – Design of Pot and Plunger - Calculations of Projected area, Transfer Pressure, clamping force - Design of Pressure pad and Feed system - Advantages, Disadvantages and Applications of Transfer Mould

UNIT V  DESIGN OF OTHER MOULDS & DIES  10
Blow Mould Design: Introduction- Types of blow moulds - Blow ratio - Parison design – Pinch off design - parting line - Mould cooling - Mould alignment- Advantages, Disadvantages and Applications
Extrusion Die Design: Principles of extrusion - construction of die - die geometry - die swell - die land design - sizing die - Advantages, Disadvantages and Applications.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course,

• The students will understand the basics of Plastics mould design and also product design.
• They also acquire knowledge about various moulds for different processing techniques.

TEXT BOOKS:

REFERENCES:
1. Injection Mould Design Fundamentals (Vol. I & II) - By Glanvill & Denton
2. Plastics Moulds & Dies - By Sors et al., Second Edition

PL8602 CAD/CAM/CAE FOR PLASTICS ENGINEERING L T P C
3 0 0 3

OBJECTIVES:
To enable the students
- To provide an overview of how computers are being used in Design of Plastic Component, Manufacturing of Tool and Analysis of mould flow.
- To develop the knowledge of computer aided manufacturing.

UNIT I COMPUTER GRAPHICS
Fundamentals: Output primitives (Points, lines, curves, etc.,) - 2-D and 3D Transformations- Homogeneous Coordinates- Windowing, Viewing and clipping transformation- Introduction to curves- Analytical Curves- Circle and conics- Synthetic Curves - Bezier and B-spline curves.

Graphics Standards: Standards for computer graphics- Graphical Kernel System (GKS) - standards for exchange images- Open Graphics Library (OpenGL) - Data exchange standards - IGES, STEP, CALS etc. - Communication standards

UNIT II SURFACE MODELING AND SOLID MODELING
Surface modeling: Bezier and B-Spline surface- Bi- linear surface- Boundary Representation- Sweep representation.
Solid modeling: Primitives- Boolean set operations- Boundary Representation - Constructive Solid Geometry, User interface for solid modeling, Introduction to Parametric and Variation modeling, Creation of prismatic and lofted parts based on software packages.

Assembly Modeling: Assembly of parts, Tolerance analysis, Mass property calculations, and Interference Checking

UNIT III COMPUTER AIDED MANUFACTURING
Integrating CAD with CAM - NC - CNC - DNC- NC programming – Basics, Languages, G Codes & M Codes and APT – Part programming for CNC Turning Center and CNC Machining Center- CAM software packages –Tool Path generation and verification.

UNIT IV CAE – STRUCTURAL ANALYSIS
FEA: Introduction to Finite Element Analysis - Types of analysis - Procedure for finite element analysis – Mesh generation - Finite Element Analysis packages and its application.
Structural Analysis: Types - Analysis of One Dimensional Bar elements- Derivation of Shape function and Stiffness matrix and force vector – Assembly of matrix – Field problems.

UNIT V CAE – FLOW ANALYSIS
Mold Flow Analysis: Introduction - Product design and Mold flow - Sequence of analysis- Mold flow concepts- Meshes used in Mold flow analysis- Types, Requirement- Geometry Creation- Importing Geometry- 3D Modelling using MF/view- Mold flow design procedure- Analysis steps framework- Evaluate an Initial design- optimized the design-
Types of Analysis: Flow analysis- Cooling analysis - Shrink/Warp analysis - Stress analysis-
Case studies – Interpretation of results - Part defects

TOTAL: 45 PERIODS

OUTCOMES:
- Upon completion of this course, the students will acquire the knowledge of computer aided
design and manufacturing for moulds for plastics processing.
- Knowledge on various CNC machining processes used in Mould manufacturing.
- They also learn about various types of analysis involved in Mould flow.

TEXT BOOK:

REFERENCES:
1. Chris McMahon and Jimmie Browne “CAD/CAM Principles", "Practice and
International Publisher
2014.
10, Hanser, 2006

PL8603 PLASTICS TESTING II L T P C
3 0 0 3

OBJECTIVES:
- To impart knowledge of National & International standards for testing methods.
- To create the knowledge about the different testing techniques and its basic concepts for
evaluating the chemical, mechanical, electrical, optical, thermal, and permanence of
plastic materials.
- To enable the students to identify and compare the properties of different plastics
materials.
- To enable the students to learn about the property of the plastic material for several
applications.

UNIT I TESTING OF MECHANICAL AND PERMANANCE PROPERTIES
Mechanical Properties: Fatigue properties-burst strength- folding endurance, Compression set,
Long term mechanical properties: -creep & Stress relaxation. Permanence Properties: Water
absorption-soluble and insoluble matter-chemical resistance- environmental stress cracking
resistance-ageing-gas permeability-water vapour permeability.

UNIT II TESTING OF THERMAL AND WEATHERING PROPERTIES
Thermal Properties: Thermal endurance, thermal stability, thermal ageing, glass transition
temperature, Marten’s heat resistance test, flexibility test, shrinkage. Weathering properties-
Weather and Climatic impact on properties of plastics-UV-A and UV-B weathering- Accelerated
weathering-Xenon arc weatherometer.
UNIT III ANALYTICAL TECHNIQUES
Characterization Principles and analysis of polymer samples- FTIR, DSC, TGA, DMA, XRD, SEM, GPC,TMA, GC, AAS, TEM, XRF.

UNIT IV PRODUCT TESTING

UNIT V FAILURE ANALYSIS
Failure analysis of products and its measurement techniques Concepts of non-destructive testing.

OUTCOMES:
Upon completion of this course,
- Students will learn how the plastics materials are tested for its chemical, mechanical, electrical, optical, thermal, and permanence properties.
- Students will be able to identify the plastic materials for some specified applications based on its property.

TEXT BOOKS:
1. Allen; W.S and Baker; P.N, Hand Book of Plastics Technology, Volume 2, Identification,

REFERENCES:

PL8604 PLASTICS PROCESSING TECHNOLOGY II L T P C
OBJECTIVES:
To enable the students
- To understand the processing techniques like thermoforming, calendaring, and rotational moulding.
- To learn the manufacturing of cellular plastics.
- To learn the basic of machining and joining of plastics by various adhesion and welding techniques.

UNIT I THERMOFORMING AND CALENDERING
Basic principles –Raw materials & types of thermoforming processes, Thermoforming moulds-processing parameters—faults, causes and remedies. Calendering - Principle and process description, types of calender units 2, 3 and 4 rolled calenders, Design of calender roll, Heating and temp control, roll crown, roll crossing and roll bending, materials for calendering, calendering sheets and films, embossing, coating and lamination by calender, comparison between calendering and extrusion.
UNIT II FRP & LAMINATES
Introduction, FRP Processing methods-contact moulding-hand lay up, Spray up method-vacuum bag & pressure bag moulding, Autoclave- filament winding, Centrifugal casting, pultrusion, pulforming matched die moulding – Laminates, definition of terms-high, medium and low pressure laminating process, types of machinery, impregnation systems – decorative and industrial laminates, continuous high pressure laminating process, application.

UNIT III CELLULAR PLASTICS
Introduction-process to create foam in resins-mechanical foaming, chemical foaming, physical foaming-processes to shape and solidify foams – low Pressure foam moulding, high pressure foam moulding, RIM Casting foams, steam chest moulding structural foam moulding–applications – Foamed extrusion.

UNIT IV ROTATIONAL MOULDING, CASTING AND COATING PROCESS
Coating Process - Introduction-Roller coating methods, powder coating-fluidized bed coating, Electro static spray coating-Equipment, process and applications.

UNIT V POST MOULDING / SECONDARY PROCESS ON PLASTICS PRODUCTS

OUTCOMES:
Upon completion of this course,
- The students will acquire the knowledge of specific processing techniques such as thermoforming, calendaring, and rotational moulding.
- They also learn the machining and joining of plastic materials.

TEXT BOOKS:

REFERENCES:
4. Basic Principle of rotational molding - By Crawford, R.J & Throne, J.L.
5. Basic Principle of Rotational Molding - By Bruins.
6. Basic Principle of Thermoforming - By Brycle, D.M
OBJECTIVES:
- To provide the students with basic knowledge on the natural rubber and various synthetic rubbers and their processing.
- To enable the students to understand the need of various additives and compounding of rubbers and vulcanization.
- To enable the students to learn the basic processing of rubber products like hose conveyor belts etc.

UNIT I  NATURAL RUBBER
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 - Polyisoprene, Polybutadiene, SBR, EPDM, Butyl rubber, Neoprene, Nitrile rubber, Silicone rubber, Fluoroelastomer, Polysulphide rubber, polyurethane rubber, Acrylic rubber.

UNIT IV  THERMOPLASTIC ELASTOMERS
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
Manufacturing of Belting, Hoses, Footwear, Rubber metal bonded items, sports goods, cellular rubber, tyres etc.

TOTAL: 45 PERIODS

OUTCOMES:
- Upon completion of this course, the students will acquire the knowledge of natural rubber and other synthetic elastomers.
- They learn the basics of rubber compounding and vulcanization and rubber products manufacturing.

TEXT BOOKS:

REFERENCES:
**OBJECTIVE:**

- To practice the students in different types of semi auto / automatic moulding machines.

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Name of M/c / Equipment/ Mould</th>
<th>Description of Practical Exercise to be done</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Automatic Injection Moulding M/C</td>
<td>Idle-run observation (IRO) &amp; study of Injection Unit, Clamping Unit, Process- Control knobs, safety precautions, start-up Procedure, Shut-down Procedure, Sketch of Machine Platens, Clamping system, type of nozzle used in M/c etc., study of Hydraulic System used in the M/c. M/c Operation- Practice, Process parameter setting for a particular mould on the Machine, Operation of Machine in Hand, Semi Automatic &amp; Automatic- mode to produce components, observations of all parameters, cycle-time analysis, use of different plastics material for moulding &amp; comparison, Moulding faults analysis for causes and remedies.</td>
</tr>
<tr>
<td>2</td>
<td>Micro-Processor Controlled Injection Moulding M/C</td>
<td>Study of Basic concepts of Micro processor control, Comparison of Micro Processor- Controlled M/cs with Conventional M/Gs, Machine Setting Procedure, Procedure for Process-Parameter setting on monitor or control Panel. Operation of M/c with Mould fixing &amp; setting on the M/c with different plastics materials, cycle- time analysis, Analysis of Product defects, causes &amp; remedies during M/c operation, listing of important operating procedure points, safety precautions through M/C Instruction/Manual operating.</td>
</tr>
<tr>
<td>3</td>
<td>Extrusion Process on Blown Film Extruder Pipe/Tube Extruder</td>
<td>Procedure for setting up of Process-parameters eg. Temperature on different zones, Screw-Speed, Nip-roller speed, Winder Speed, Blow-ratio, control of cooling-Air on bubble, Methodology &amp; practice by trainees to fix the Blown Film die on M/C familiarization of Die-parts &amp; their function, Technical specification of M/cs, defects, causes &amp; remedies, Practice of operating M/c to produce different sizes of Blown Film. Study of the Machine-parts &amp; function from Screw drive to the Cater pillar. Practice of Die setting on the machine, sizing techniques, Procedure for setting up of parameters &amp; operation practice in running the Machine to produce pipe/ Tube/ film.</td>
</tr>
<tr>
<td>4</td>
<td>Compression &amp; Transfer Moulding (Semi-Automatic)</td>
<td>Setting up procedure for operation of M/c, safety precautions, Type of Mould Clamping arrangement available on M/c- Platen, Mould Clamping procedure on M/c, Operation of M/c by setting the optimum Temperature, curing time, clamping force, ejector- stroke etc. on continuous basis, Analysis of Product defects &amp; remedies, Analysis of Cycle-time, Practice on operation of compression &amp; Transfer moulds with thermostet</td>
</tr>
<tr>
<td>5</td>
<td>Automatic Blow Moulding Machine</td>
<td>Machine-setting Procedure, Parameter-setting Procedure, Method of Mould fixing &amp;parison-die setting on the M/c, Practice by trainees to remove&amp; fix the parison die to produce on appropriate Parison for blowing, type of blowing systems, operation-practice on different moulds, cycle-time analysis, process-faults &amp; remedies.</td>
</tr>
<tr>
<td>6</td>
<td>Thermoforming</td>
<td>Study of Process Principle, type of moulds &amp; material used,</td>
</tr>
</tbody>
</table>
(Vacuum forming) Familiarisation with the M/c controls for operation, Operation Practice by trainee, observation on Cycle-time, processing- defects & remedies

<table>
<thead>
<tr>
<th>7</th>
<th>Rotational Moulding</th>
<th>Machine study in IRO, Process Principle &amp; sequence Of operation, Raw materials used, Mould-clamping practice on the M/c, operation practice to produce Roto moulded components, Cycle-time analysis, Comparison of process with other processing processes.</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Moulds Study</td>
<td>Study of different types of moulds injection moulds, Mould maintenance &amp; storage</td>
</tr>
<tr>
<td>10</td>
<td>FRP Demonstration Facility</td>
<td>Study of types of Resin, fibres used in the process, sequence of Process operation in Hand-lay up process, operation Practice for Hand-lay up Process for producing FRP-products, Precautions during the process, Process-defects &amp; analysis for the remedies.</td>
</tr>
<tr>
<td>11</td>
<td>Maintenance Work on Processing M/cs</td>
<td>Practical exposure to the preventive maintenance checkpoints for all processing M/cs. Daily startup and shut down maintenance checks, housekeeping checking hydraulics and electrical circuit for safety, routine faults and remedies.</td>
</tr>
</tbody>
</table>

TOTAL: 60 PERIODS

OUTCOME:
- Upon completing this practical course, the student will have hands on experience on different types of automatic & Semiautomatic moulding machines

PL8612 PLASTICS TESTING LABORATORY I L T P C 0 0 4 2

OBJECTIVE:
- To train the students on testing of plastic materials

LIST OF EXPERIMENTS

<table>
<thead>
<tr>
<th>S. No.</th>
<th>EXPERIMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Preparation of test specimen using Injection moulding, Contour cutting, and Contour punching.</td>
</tr>
<tr>
<td>2.</td>
<td>Determination of Rate of flow of plastics (Melt flow index)</td>
</tr>
<tr>
<td>3.</td>
<td>Determination of Tensile Properties of rigid &amp; flexible plastic materials</td>
</tr>
<tr>
<td>4.</td>
<td>Determine the flexural properties of rigid Plastic materials</td>
</tr>
<tr>
<td>5.</td>
<td>Determine the compressive strength of rigid plastics and polymeric foams.</td>
</tr>
<tr>
<td>6.</td>
<td>Determine the compression set for rubber materials</td>
</tr>
<tr>
<td>7.</td>
<td>Determine the hardness (Shore A &amp; D, Barcol and Rockwell) of plastic materials</td>
</tr>
<tr>
<td>8.</td>
<td>Determine the abrasion resistance of Plastic materials</td>
</tr>
<tr>
<td>9.</td>
<td>Determine the impact strength (Izod and Charpy) of Plastic materials</td>
</tr>
<tr>
<td>10.</td>
<td>Determine the Density, moisture content and water absorption for plastic materials.</td>
</tr>
</tbody>
</table>
OUTCOMES:
Upon completion of this course, the students would be able to
- Determine important properties of plastic materials
- Prepare specimen by injection moulding and contour cutting

TEXT BOOKS:

REFERENCES:

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the Equipment</th>
<th>Quantity Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Melt Flow Index Tester</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Universal testing machine</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Tear strength tester</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Impact strength tester</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Dart Impact tester for Films and laminates</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Shore A – Hardness tester</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Shore D – Hardness tester</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Rockwell Hardness tester</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Barcol Hardness tester</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Q-UV weatherometer</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>For specimen preparation</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Melt Flow Index Tester</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>Injection moulding machine</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>Compression moulding machine</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>Two roll mill</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>Contour cutter</td>
<td>1</td>
</tr>
</tbody>
</table>

OBJECTIVES:
- To enable the students to understand the basic materials in FRP system.
- To understand the raw materials for matrix resins and reinforcements.
- To acquire knowledge about various processing methods of composites
- To understand the post processing operations, various applications of composites
- To understand the various testing of FRP materials
UNIT I  REINFORCEMENTS FOR COMPOSITES  9
Composites - classifications - metal matrix composites, ceramic matrix composites, Polymer Composites - general properties and applications - Reinforcements: Properties and applications of various types of glass fiber, carbon fibers, aramid fibers, boron fibers, natural fibers.

UNIT II  GENERAL PURPOSE RESINS  9
Methods of manufacturing - properties, curing characteristics and applications of unsaturated polyesters - vinyl ester - phenol formaldehyde resin - urea formaldehyde resin - melamine formaldehyde resin.

UNIT III  SPECIAL PURPOSE THERMOSETS  9
Methods of manufacturing, properties, curing characteristic and applications of epoxy resins, Polyimide, Thermoset polyurethanes and Cyanate esters resins.

UNIT IV  PROCESSING OF COMPOSITES  9
Composites Processing techniques - Hand Lay-Up, Spray- Up, Bag Molding, Resin Transfer Molding (RTM), Filament Winding, Pultrusion, Prepregs, SMC, DMC.

UNIT V  LAMINATES & TESTING OF COMPOSITES  9

TOTAL: 45 PERIODS

OUTCOMES:
Upon completing this course, the students
- Will familiarize about the resins used in FRP system
- Will attain the knowledge of reinforcement mechanism
- Will able to understand the processing methods of composites
- Will attain the knowledge post processing operations of composites
- Will develop the knowledge in testing of composites

TEXT BOOKS:

REFERENCES:

PL8701  PLASTICS PRODUCT DESIGN  L T P C  3 0 0 3

OBJECTIVES:
To enable the students
- To understand the concepts and features of Plastic Product design.
• To learn the basic concepts of designing with plastics for various loading applications, structural elements and joints.
• To understand the concepts of composite product design.

UNIT I  PRODUCT DESIGN REQUIREMENT

UNIT II  PRODUCT DESIGN FEATURES
Wall thickness – variations in wall thickness – suggested wall thickness for various plastics materials – Taper & Draft – Design of radii, fillets, ribs and bosses- Shrinkage - Fits & Tolerances- External & Internal Undercuts

UNIT III  HOLES & THREADS

UNIT IV  ASSEMBLY FEATURES

UNIT V  DESIGN FOR COMPOSITES
Design Criteria for Composites- Cost, Size, Mechanical Properties, Repeatability and Precision, Damage Tolerance and Durability, Environmental Constraints - Design allowables- Need for Design allowables- development of design allowables- Important factors that affect the selection of allowables - Specific techniques used in the statistical development of allowable values.

TOTAL: 45 PERIODS

OUTCOMES:
• Students will acquire the knowledge and principles of basic product design
• Students can able to design the plastics for various applications.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
To enable the students
- To learn about the general methods of preparation of individual class of advanced plastic materials
- To study about the general properties, processing behavior and applications of different class of advanced plastic and polymeric materials
- To understand about the structure-property relation of different class of plastic materials

UNIT I THERMOPLASTIC ELASTOMERS 9
Polyurethane elastomers, polyolefin elastomers, polyester elastomers styrene elastomers, polyamide elastomers, elastomer-thermoplastic blends, dynamic vulcanisites.

UNIT II SPECIALITY POLYMERS 9

UNIT III POLYMER BLENDS AND ALLOYS 9
Definition, advantages of polymers, blends and alloys, role of composition, properties and applications of parameters for compatibility. PVC – Nitrile rubber, ABS-PVC and PP-EPDM.

UNIT IV FILLED POLYMERS 9
Polyolephines, Nylons & Polycarbonates with fillers like Glass, Mica, Talc, CaCO₃, etc Polymer Concretes & Advanced ceramic

UNIT V SPECIALITY POLYMERS 9
Preleminary concepts of new materials such as electrically active polymers, Optoelectronic plastics, Bio-polymers, membrane plastics in bio medical applications.

TOTAL: 45 PERIODS

OUTCOMES:
Students gather knowledge on various methods of preparation of different plastic materials.
- They also understand about the properties of speciality polymers based on the structure.
- They learn about various processing techniques suitable for particular end use applications.
- They can also select the individual advanced plastic materials based on end use applications.

TEXT BOOKS:

REFERENCES:
5. Davidson; Theodore, Polymers in Electronics, ACS Symposium Series 242, American

PL8711 PLASTICS TESTING LABORATORY - II

OBJECTIVES:
- To understand the mechanical and electrical properties of plastics
- To familiarize with various testing standards

LIST OF EXPERIMENTS

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Preparation of polymer blends using twin screw extruder, and preparation of test specimens.</td>
</tr>
<tr>
<td>2.</td>
<td>Preparation of polymer compounds using two roll milling and preparation of test specimens.</td>
</tr>
</tbody>
</table>
| 3.     | Testing of electrical properties of plastics  
|        | a) Arc resistance  
|        | b) Surface and Volume resistance  
|        | c) Comparative tracking index (CTI)  
|        | d) Dielectric strength  
|        | e) Dielectric constant and dissipation factor |
| 4.     | Testing of HDPE and UPVC pipes as per IS:4984 and IS:4985 |
| 5.     | Testing of LDPE Films as per IS: 2508 |
| 6.     | Testing of HDPE/PP Woven Sacks and tapes as per IS:14887 and IS:11197 |
| 7.     | Testing of roto moulded Water Storage Tanks as per IS 12701 |
| 8.     | Testing of Plastic pouches as per IS 15609 |

TOTAL: 60 PERIODS

OUTCOMES:
Upon completion of this lab student should able to
- Carry out testing independently
- Understand the operating procedure of various testing machines

TEXT BOOKS:

REFERENCES:
Equipment required

<table>
<thead>
<tr>
<th>Mechanical and Product Testing</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>1. Universal testing machine</td>
<td>1</td>
<td></td>
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<tr>
<td>2. Tear strength tester</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3. Impact strength tester</td>
<td>1</td>
<td></td>
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<tr>
<td>4. Abrasion resistance tester</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5. Burst strength tester</td>
<td>1</td>
<td></td>
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<tr>
<td>6. Humidity chamber</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7. Gas permeability tester</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8. Hydrostatic bursting pressure tester</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>9. Reversion tester</td>
<td>1</td>
<td></td>
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<tr>
<td>10. Falling Dart Impact Tester for films and Pipes</td>
<td>1</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Electrical and Optical Properties</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>11. Volume and Surface resistivity</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>12. Dielectric strength</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>13. Arc Resistance</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>14. Haze meter</td>
<td>1</td>
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</tr>
</tbody>
</table>

**PL8712**

**CAD/CAM/CAE LABORATORY**

**L T P C**

**0 0 4 2**

**OBJECTIVE:**
- To practice the students in Computer Aided Design, Manufacturing and Engineering software for mould design

**LIST OF EXPERIMENTS**

I. Mold Design using CAD

a) Injection Mould design
Design calculations for No. of cavities, Selection of injection moulding machine, shot capacity, plasticizing rate, Clamping force and 2 D / 3 D Modeling for Two plate, Three Plate and split Moulds

b) Compression Mould Design
Design calculations for No. of cavities, Flash thickness allowances, Design of loading chamber, Bulk factor, Pressure pad, Heaters and 2 D / 3 D Modeling for Compression Mould.

c) Transfer Mould Design
Design calculations for Pot, Bulk factor, Heaters and 2 D / 3 D Modeling for Pot and Plunger transfer Moulds.

d) Blow Mould Design
Design calculations for Clamping force, pinch-off, Head die design, Parison dimensions and 2 D / 3 D Modeling for Blow Mould.

II CAM Programming
Programming and Machining of mould elements (Core, Cavity, Guide Pillar and Guide Bush) using CNC Turning Center and CNC Machining Center.
III Mould flow Analysis

- Modeling, Mesh Creation, Mesh Checking, Surface repair, Creating Feed system and cooling system.
- Analysis: Gate location, Molding window Fill, Flow, Cool, Pack, Warp, Shrinkage, Stress

OUTCOME:
- At the end of this course, the students can design and develop the moulds using CAD/CAM/CAE softwares

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

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<th>S. No.</th>
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<tr>
<td>1</td>
<td>Computer Systems</td>
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<tr>
<td>2</td>
<td>2D &amp; 3D Modeling Software</td>
<td>30 Licenses</td>
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<tr>
<td>3</td>
<td>Flow Simulation software</td>
<td>30 Licenses</td>
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<tr>
<td>4</td>
<td>CNC Turning Center</td>
<td>2 Nos.</td>
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<td>5</td>
<td>CNC Machining Center</td>
<td>2 Nos.</td>
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<tr>
<td>6</td>
<td>Printer</td>
<td>1 No.</td>
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</table>

REFERENCES:
5. Design calculations for Compression moulds, Machinery publications, Yellow series, U.K.

PL8713 COMPREHENSION

In the VII Semester a comprehension test will be conducted with at least one written test in the middle of the Semester with Objective type of questions and a terminal viva-voce test in order to evaluate the comprehension of the students in all the subjects covered in the all previous semester subjects.

PL8811 PROJECT WORK

Each student will be assigned a project involving some design and fabrication work as well as theoretical and experimental studies on issues related to Polymer Technology. Continuous internal assessment marks for the project will be given during project review meeting. The student has to
prepare and present a detailed project report at the end of the semester and give a presentation about the work done. End semester examination mark will be based on viva voce examination.

**PT8073**

**PLASTICS PACKAGING TECHNOLOGY**

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**OBJECTIVES:**

- To study about the functions of packaging.
- To enable the students to understand the concepts testing of packaging material.
- To know about the different packaging materials like cans, bottles, flexible films etc.
- To study about the various methods of packaging to improve the shelf life of the products.
- To learn about the testing of packaging.

**UNIT I    SELECTION CRITERIA FOR PACKAGING MATERIALS**

Introduction to plastics packaging: functions of packaging, advantages of plastic packaging, special requirements of food and medical packaging,. Packaging as a system: Elements, approach, package, design, relation criteria for packaging materials, packaging equipment checklist, case histories Major packaging plastics Introduction - PE, PP, PS, PVC, polyesters, PVA, EVA, PA, PC, ionomers & fluoro polymers.

**UNIT II    CONVERSION PROCESS FOR PACKAGING MATERIALS**

Conversion process - Compression & transfer for moulding, Injection moulding, Blow moulding, Extrusion, roto moulding, thermoforming, Lamination, metallizing, decoration process, Shrink wrapping, Pallet & stretch wrapping

**UNIT III    PROCESS FOR FLEXIBLE PACKAGING**


**UNIT IV    PROCESSES FOR RIGID PACKAGING**

Thermoformed, moulded and rigid packages, Thermoforming packages: Position & thermoforming & wrap forming, solid phase pressure forming, scrabbles, twin sheet & melt - to- mold thermoforming, skin packaging, Polystyrene & other foams systems cushioning, plastic pallets, drums, shipping containers.

**UNIT V    TESTING OF PLASTIC PACKAGING**


**TOTAL: 45 PERIODS**

**OUTCOMES:**

Upon completing this course, the students

- will Apply and examine the knowledge of properties for selection of packaging materials
- will Select between different techniques of packaging
- Will familiarize in testing of plastic packaging

**TEXT BOOKS:**

REFERENCES:

OBJECTIVES:
To enable the students
- To learn about the production technologies of synthetic fibres such as melt spinning, wet spinning, dry spinning, texturing and stretching methods; colouration techniques of fibres.
- To learn about modification and testing fibre

UNIT I CRITERIA FOR FIBRE FORMING POLYMERS
Development of synthetic - commercial synthetic fibres, Raw materials manufacture. DMT, TPA, MEG, caprolactum, adipic acid, hexamethylene diamine, acrylonitrile, polymerisation - types of polymers - criteria for fibre forming polymers - production of polyethylene terephthalate polymer - polyamides - production of nylon 66 polymer -nylon 6 polymer.

UNIT II FIBRE PRODUCTION METHODS-1

UNIT III FIBRE DRAWING PROCESSES

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

UNIT V TESTING OF YARN AND FIBRES

OUTCOMES:
Upon completing this course, the students
- Will have knowledge of polymer used in fiber formation.
• Will demonstrate the processing techniques for fiber formation.
• Will able to prepare a fiber forming polymers
• Will able fiber stretching polymers
• Will attain the knowledge of testing of fiber.

TEXT BOOK:

REFERENCES:

GE8071 DISASTER MANAGEMENT L T P C
3 0 0 3

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

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

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR)
Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj

Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT
Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.
UNIT IV DISASTER RISK MANAGEMENT IN INDIA

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

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

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

TOTAL: 45 PERIODS

OUTCOMES:
The students will be able to

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

TEXT BOOKS:

REFERENCES:
1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005

PL8072 BIODEGRADABLE POLYMERS

OBJECTIVES:
- To enable the students to understand the method to develop biodegradable polymers
- To get knowledge on need of biodegradable polymer.
- To enrich various testing methods used for analyzing the biodegradability.

UNIT I CHEMISTRY AND BIOCHEMISTRY OF POLYMER DEGRADATION

Introduction, enzymes - enzyme nomenclature - enzyme specificity - physical factors affecting the activity of enzymes - enzyme mechanism, Chemical degradation initiates biodegradation, Hydrolysis of synthetic biodegradable polymers.
UNIT II  PARTICULATE STARCH BASED PRODUCTS
Development of Technology, Current objectives, relative starch technology, Manufacture of master batch, Conversion technology - processing precautions - moisture and temperature - rheological considerations, cyclic conversion process, physical properties of products - sample preparation - physical testing methods

UNIT III  BIOPOLYESTERS
Introduction, History, biosynthesis, Isolation - solvent extraction - sodium hypo chloride digestion, enzymatic digestion, Properties - crystal structure - nascent morphology, degradation-Intracellular biodegradation - extra cellular biodegradation - thermal degradation - hydrolytic degradation - environmental degradation -

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, choosing the most appropriate methodology, description of current test methods - screening test for ready biodegradability, tests for inherent biodegradability, tests for simulation studies, - petri dish screen - environmental chamber method - soil burial tests

TOTAL: 45 PERIODS

OUTCOMES:
Upon completing this course, the students
- Will develop biodegradable polymer by various methods.
- Will understand mechanism of degradation of rubber compounds.
- Will assess bio-degradability of polymers.
- Will do recycle of biodegradable polymer.
- Will understand standards for biodegradable polymer.

TEXT BOOKS:

REFERENCES:

PL8075  POLYURETHANE TECHNOLOGY  L T P C
3 0 0 3

OBJECTIVES:
- To enable the students to understand the principles of PU chemistry and its applications.
- To get the knowledge in PU raw materials and processing techniques.
- To understand the concepts of PU foams, coatings and adhesives.
UNIT I PRINCIPLES OF PU CHEMISTRY AND APPLICATIONS
Reactions of isocyanate group-building blocks for PUs-polyols, isocyanates, chain extenders – Preparation methods like prepolymer process, one shot process-preparation of aqueous two phase systems – Special areas like ionomers, LCP based on PUs, hydrogels, promoters- Uses in medical areas, bio technology, optical lenses etc Structure-property relationships in hard and soft segments - Morphology of domains-Effect of cross links on PU properties, structure-property relationships in ionomers

UNIT II RAW MATERIALS AND AN OVERVIEW OF PROCESSING OF PU
Polyols, isocyanates – Their preparation and characteristics, conversion products of the raw materials – Additives – Industrial hygiene – Principles of PU processing

UNIT III PU FOAMS

UNIT IV SOLID PU MATERIALS
Solid polyurethane materials- polyurethane casting systems (cast elastomers and casting resins)- thermoplastic polyurethane elastomers: productions / processing, properties and applications- elastomers fibers, manufacture / processing and applications.

UNIT V PU COATINGS AND ADHESIVES
Solvent based coatings, air dried coatings, solvent free paints and coatings, applications of PU based coatings two components and one component adhesives based on PUs, solvent based adhesives, dispersion adhesives, hot melts, PU binders.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completing this course, the students
- Know about building blocks for Polyurethanes
- Learn about Various types of raw materials used in preparation of PU
- Study about the production of flexible and rigid polyurethane foam
- Will have the knowledge of production, properties and uses of solid polyurethane
- Will have the knowledge of PU applications as coatings and adhesives

TEXT BOOK:

REFERENCES:
OBJECTIVES:
To enable the students
- To know various sources of plastics waste generation
- To know segregation methods for recycling the plastics
- To know recycling codes of commodity and engineering plastics.
- To learn about primary recycling techniques with examples/case studies.
- To understand the recycling of various commodity and engineering plastics.

UNIT I  PLASTIC WASTE GENERATION & SEPARATION TECHNIQUES  9

UNIT II  PROCESSING OF COMMINGLED PLASTIC WASTE  9
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 –density and mechanical properties of recyclable plastics– Processing of commingled / mixed plastic waste – super wood, plastic lumber

UNIT III  RECYCLING OF POLYOLEFINS, PET & PVC  9

UNIT IV  RECYCLING OF ENGINEERING THERMOPLASTICS  9
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  RECYCLING OF THERMOSET COMPOSITES  9

TOTAL: 45 PERIODS

OUTCOMES:
- Will understand the impact of plastic waste on environment
- Will able to recycle of both commercial and engineering plastics.
- Will through with policies related to environmental issues of plastics waste.
- Will know legislations related to environmental issues of plastic waste.

TEXT BOOKS:
REFERENCES:
2. John Schiles, Polymer Recycling.

PT8074 POLYMER NANOCOMPOSITES

OBJECTIVES:
To enable the students
- To understand the basics and chemistry of nano size materials and their synthesis, characterization and applications.
- To know the manufacturing and processing of clay/polymer nanocomposites.
- To learn about the flow behavior of nanofiller/polymer systems and their processing and applications.

UNIT I INORGANIC AND ORGANIC POLYMER NANOMATERIALS

UNIT II POLYMER/GRAPHENE NANOCOMPOSITES

UNIT III POLYMER/CLAY NANOCOMPOSITES
Clay/Polymer Nanocomposites: Physical and chemical properties of clay nanoparticles; Synthesis; Potential Applications

UNIT IV POLYMER/METAL NANOCOMPOSITES
Metal/Polymer Nanocomposites: Physical and chemical properties of metal nanoparticles; Synthesis; Potential Applications. Carbon Nanotubes Polymer nanocomposites: Structure, Properties, Synthesis Methods; Potential Applications

UNIT V POLYMER NANOCOMPOSITES APPLICATIONS
Rheology and processing, Applications and economics of polymer nanocomposites.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completing this course, the students
- will have a clear understanding of nanocomposites
- will demonstrate clay /polymer nanocomposites, carbon nanotube polymer composites and metal/polymer nanocomposites
- will correlate the processing and economics of polymer nanocomposites compared to conventional polymer composites.

TEXT BOOKS:
2. Polymer-clay nanocomposites / edited by T.J. Pinnavaia and G.W. Beall, Chichester;


REFERENCE:

GE8075  INTELLECTUAL PROPERTY RIGHTS L T P C
3 0 0 3

OBJECTIVE:
- To give an idea about IPR, registration and its enforcement.

UNIT I  INTRODUCTION
9
Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO – TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II  REGISTRATION OF IPRs
10
Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad.

UNIT III  AGREEMENTS AND LEGISLATIONS
10

UNIT IV  DIGITAL PRODUCTS AND LAW
9

UNIT V  ENFORCEMENT OF IPRs
7
Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL: 45 PERIODS

OUTCOME:
- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
- To enable the students to understand the miscibility of polymers, characteristics of blends and mechanism of toughening

UNIT I CLASSIFICATION OF POLYMER BLENDS AND ALLOYS

UNIT II PREPARATION OF POLYMER BLENDS AND ALLOYS

UNIT III TYPES OF POLYMER BLENDS
Liquid Crystalline Polymer, Blends-Ternary Polymer – Elastomer, Blends-Polymer blends containing block copolymers— Biodegradable polymer blends- Recycled polymer blends

UNIT IV TOUGHENED THERMOPLASTICS AND THERMOSETS
Toughened polymers- Specific examples for toughened thermoplastics and thermosets - specific interaction - hydrogen bonding interaction, dipole-dipole interaction, ion–dipole & ion-ion interaction and additional specific interaction

UNIT V APPLICATION OF BLENDS AND ALLOYS
Application of Blends in Emerging technology - Photovoltaic, Light Emitting Diode, Electro chromic, Electric conductivity polymer and blends, Lithium battery & Fuel cells Applications

TOTAL: 45 PERIODS

OUTCOMES:
Upon completing this course, the students
- Able to express the basic concepts of polymer blend
- Able to infer the thermodynamic of polymer -polymer miscibility
- Able to classify the types of polymer blends
- Able to interpret the characterized polymer blends
- Able to discover the application of polymer blends

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To enable the students to understand the structural properties of thermoplastic elastomers.
- To study the synthesis method, compounding, processing characteristics and application of elastomeric blends.

UNIT I  THERMOPLASTIC STYRENIC BLOCK COPOLYMER

Synthesis, morphology, Properties, formulating, compounding and application of styrenic block copolymers

UNIT II  THERMOPLASTIC POLYURETHANE


UNIT III  THERMOPLASTIC POLYAMIDES AND POLYESTERS


UNIT IV  THERMOPLASTIC POLYOLEFINS AND BLENDS


UNIT V  THERMOPLASTIC ELASTOMERS PROCESSING


OUTCOMES:

Upon completing this course, the students

- Will be able to understand the synthesis methods of various thermoplastic elastomers.
- Will be able to analyze the properties of elastomers based on their morphology and structure.
- Will be able to understand the properties and applications of blends of thermoplastic elastomers.
- Will be able to recognize the processing methods for different thermoplastic elastomers.

TEXT BOOKS:

REFERENCES:

PL8001 WOVEN SACKS TECHNOLOGY L T P C 3 0 0 3

OBJECTIVES:
• To learn about the manufacturing process of weaving fabrics and its types
• To learn about the testing and quality control of woven sacks

UNIT I MATERIALS FOR FILAMENT AND YARN 9
Materials for filaments/ Yarns- High Density Polyethylene (HDPE), Polypropylene (PP), Polyester-
Properties – Tenacity, Denier, Elongation at break, thermal shrinkage- Dimensional stability.

UNIT II HYBRID YARNS 9
Hybrid Yarns For Thermoplastic Composites: Types of hybrid yarns. Manufacture of thermoplastic composites with hybrid yarns. Compaction and consolidation of hybrid yarns Hybrid yarn structure – composite property relations. Potential application areas of thermoplastic composites. Trends in thermoplastic composite applications

UNIT III MANUFACTURING PROCESS OF WEAVING 9
Manufacturing process of weaving- Circular (Narrow width) Fabric, Wide Round Fabric, Flat
Woven Fabric- Types of Weaving - Plain weave, Twill weave, Satin weave, Basket weave, Leno weave, Mock Leno weave- Properties and its applications

UNIT IV TYPES OF WOVEN FABRICS 9
Types of woven fabrics – Laminated and un laminated woven sacks- Sacks with and without liner-

UNIT V TESTING OF WOVEN SACKS 9
Testing and Quality control of woven sacks- Dimension – inner and outer, ends & picks per decimeter, Mesh number, Breaking strength, Elongation at break, Bottom Seam strength, UV resistance- Ash content- Over all migration.

TOTAL: 45 PERIODS

OUTCOME:
• At the end of the course student will be able to know the weaving process and applications of filaments, yarns. Have clear idea about the testing and quality control of woven sacks as per Std.

TEXT BOOKS:
REFERENCES:
2. ISI 14887 – Testing of HDPE woven sacks.

PL8002 POLYMERS IN FUEL CELLS L T P C 3 0 0 3

OBJECTIVES:
To enable the students to understand the following:
- Fuel cells - concepts of terminology, theories
- Types of specialty fuel cells and their application
- Technology - Fabrication and characterisation

UNIT I BASICS OF FUEL CELL 12
Fuel cell definition, Difference between batteries and fuel cells, fuel cell history, components of fuel cells, principle of working of fuel cells Fuel cell thermodynamics - second law analysis of fuel cells, efficiency of fuel cells fuel cell electrochemistry - Nernst equation, Electrochemical kinetics, Butler-Volmer equation Fuel cell types - Classification by operating temperature/electrolyte type, Fuel Cell Performance, Activation, Ohmic and Concentration over potential Fuel cell design and components - Cell components, stack components, system components

UNIT II OVERVIEW OF INTERMEDIATE/HIGH TEMPERATURE FUEL CELLS 12
Solid oxide fuel cells (SOFC), Molten carbonate fuel cells (MCFC), Phosphoric acid fuel cells (PAFC) Polymer Electrolyte fuel cells (PEFC) - Heat and mass transfer in polymer electrolyte fuel cells, water management in PEFCs, Current issues in PEFCs Direct methanol fuel cells (DMFC) - Electrochemical kinetics methanol oxidation, Current issues in DMFCs, Fuel crossover in DMFCs, Water management in DMFCs, high methanol concentration operation, limiting current density

UNIT III PEM FUEL CELL TECHNOLOGY 12

UNIT IV FABRICATION AND CHARACTERISATION 9
Fabrication and characterisation of micro PEM fuel cells – PEM fuel cell with hydrogen, methanol and formic acid

TOTAL: 45 PERIODS

OUTCOMES:
- Will attain the knowledge in terminology, theories of fuel cells
- Will familiarize about the Types of specialty fuel cells and their application
- Will demonstrate the Technology - Fabrication and characterisation

TEXT BOOKS:

REFERENCES:

GE8076  PROFESSIONAL ETHICS IN ENGINEERING  L T P C
3 0 0 3

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

UNIT I  HUMAN VALUES

UNIT II  ENGINEERING ETHICS

UNIT III  ENGINEERING AS SOCIAL EXPERIMENTATION
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV  SAFETY, RESPONSIBILITIES AND RIGHTS

UNIT V  GLOBAL ISSUES

TOTAL: 45 PERIODS
OUTCOME:
- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXT BOOKS:

REFERENCES:

Web sources:
1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

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

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

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

UNIT III NANOMATERIALS
Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-

UNIT IV CHARACTERIZATION TECHNIQUES 9

UNIT V APPLICATIONS 7

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

PL8073 BIOMEDICAL PLASTICS L T P C 3 0 0 3

OBJECTIVES:
- To understand various natural and synthetic polymers used for biomedical applications and their compatibility with biological system
- To learn about the plastics that is used as implants in cardiovascular, ophthalmology, and other artificial organs.

UNIT I BIOMATERIALS 9

UNIT II BIOMEDICL POLYMERS 9
Biomedical Polymers from biological source, Poly hydroxyl Alkanoic Acids, Microbial polysaccharides, Silk, Collagen, Microbial Cellulose, Hyaluronic Acid, Synthetic Polymers such as PMMA, Silicone Rubber, Polyethylene, Natural Rubber, Hydrogels.

UNIT III BIOMEDICAL APPLICATIONS OF POLYMERS

UNIT IV POLYMERIC LENSES

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

TOTAL: 45 PERIODS

OUTCOMES:
- Able to describe the criteria for selection of biomedical polymers
- Able to explain the biomedical applications of polymers
- Able to be familiarized with the polymers used in dental applications
- Able to attain the skill on polymeric lenses used in medical applications

TEXT BOOKS:
2. J S Brydson, Plastics Materials –.

REFERENCES:
3. Chiellini; Emo, Sunamoto; Junzo, Migliaesi; Claudio, Ottebrite; Raphael and Cohn; Daniel (Eds.), Biomedical Polymers and Polymer Therapeutics, Kluwer Academic/Plenum Publishers, New York (2001).
4. Galaev; Igor and Mattiasson; Bo (Eds.), Smart Polymers; Applications inBiotechnology and Biomedicine, CRC Press, Boca Raton (2008).

PL8003 ADVANCED MOULD AND DIE MANUFACTURING TECHNIQUES

OBJECTIVES:
- To impart knowledge on various Cutting Tools and CNC Machines
- To develop the knowledge on elements of the mould and manufacturing processes with CAD/CAM/CAE
- To learn the application of additive manufacturing in mould development
To acquire skills in advanced measuring instruments for inspection of mold

UNIT I CNC MACHINING CENTERS

UNIT II CNC TURNING CENTERS

UNIT III CNC DIE SINKING EDM AND WIRE EDM


UNIT IV RAPID TOOLING
Introduction to Additive manufacturing - Difference between rapid tooling & conventional tooling - Development of mould elements with RP- conformal cooling of mold elements – silicon moulds for Vacuum Casting - Epoxy Tooling System.

UNIT V ADVANCED METROLOGY

TOTAL:45 PERIODS

OUTCOMES:
Upon completing this course, the students
- will have the knowledge in CNC Machine Tools for mould manufacturing
- will acquire skills in 3 D printing and Rapid tooling
- will acquire skills in advanced measuring equipment for inspection of mold

TEXT BOOKS:
PT8075 POLYMERS FOR ENERGY STORAGE APPLICATIONS L T P C 3 0 0 3

OBJECTIVE:
- To enable the students to understand the basic concepts on conducting polymers, conduction mechanism, various methods of synthesis and characterization of conducting polymers and their applications

UNIT I ELECTROCHEMISTRY OF CONDUCTING POLYMERS 8

UNIT II GENERAL SYNTHESIS OF CONDUCTING POLYMERS 9

UNIT III CHARACTERIZATION OF CONDUCTING POLYMERS 8
Characterization of conducting polymers – electro analytical techniques – cyclic voltammetry, chronoamperometry and chronocoulometry, spectral methods - use of UV-vis, Raman, XRD and NMR.

UNIT IV SYNTHESIS, PROCESSABILITY AND APPLICATIONS 10
Synthesis, processability and applications of acetylene, aniline, pyrrole, thiophene and para – phenylene based conducting polymers.

UNIT V APPLICATIONS OF CONDUCTING POLYMERS 10
Conducting polymers in microelectronics – corrosion and ESD protection, EMI shielding and...

TOTAL: 45 PERIODS

OUTCOMES:
They should be able to:
- Draw the molecular structure of common conducting polymer monomers/polymers
- Know basic synthetic methods
- Understand the concept of doping and dedoping
- Be familiar with common applications of conducting polymers and the science behind them
- Be familiar with the history of the field, some leading scientists and classical references, and some current research activities in the field

REFERENCES

PT8071 CONDUCTING POLYMERS L T P C
3 0 0 3

OBJECTIVE:
- To enable the students to understand the basic concepts on conducting polymers, conduction mechanism, various methods of synthesis and characterization of conducting polymers and their applications

UNIT I ELECTROCHEMISTRY OF CONDUCTING POLYMERS 9
Introduction to conducting polymers - discovery of polyacetylene - concept of doing and n-type - polaron and bipolaron - conduction mechanism - redox type polymers (electro - active polymers)

UNIT II GENERAL SYNTHESIS OF CONDUCTING POLYMERS 9
Synthesis of conducting polymers - Chemical synthesis - electrochemical synthesis -template synthesis - precursor synthesis - soluble polymers (colloids and dispersions) - advantages and disadvantages of various synthesis methods.

UNIT III CHARACTERIZATION OF CONDUCTING POLYMERS 9
Characterization methods - elemental analysis for dopants - IR - UV (electro chemical) scanning electro microscopy (SEM) - electro chemical characterization - cyclic voltometry- electrochemical quartz crystal microbalance (EQCM) - probe beam deflection (PBD) - Langmuir - blodgett technique.

UNIT IV SYNTHESIS, PROCESSABILITY AND APPLICATIONS 9
Applications tested - rechargeable batteries, lights emitting diodes - gas sensors - bio sensors - photo voltaic energy devices - micro electronics (PCB fabrications) electro catalysis - applications - proposed - antistatic coatings - electro chem. Mechanical devices - super capacitors
UNIT V  APPLICATIONS OF CONDUCTING POLYMERS

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

OUTCOMES:
Upon completing this course, the students
- Will understand the basic concepts and the mechanism of conduction in polymers
- Will synthesis conducting polymers by various method.
- Will characterize the conduction in polymers
- Will understand the application of conductivity polymer in various devices.
- Will be familiar in the recent and future trend of conducting polymers.

TEXT BOOKS:

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

GE8074  L T P C
HUMAN RIGHTS  3 0 0 3

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

UNIT I

UNIT II

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

UNIT IV
Human Rights in India – Constitutional Provisions / Guarantees.

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

TOTAL: 45 PERIODS

OUTCOME:
• Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

PL8004 ADDITIVE MANUFACTURING IN PLASTICS PRODUCTS  L T P C
3 0 0 3

OBJECTIVES:
• To educate students with fundamental and advanced knowledge in the field of Additive
  manufacturing technology for plastics product
• To learn the fundamentals process of additive manufacturing process.

UNIT I INTRODUCTION
6
Introduction to Additive Manufacturing (AM)- AM evolution- Distinction between AM & CNC
machining- Advantages of AM- AM process chain- Conceptualization- CAD- conversion to STL-
Transfer to AM- STL file manipulation- Machine setup- build -removal and clean up-post
processing- Classification of AM processes.

UNIT II DESIGN FOR AM
9
Motivation- DFMA concepts and objectives- AM unique capabilities- Exploring design freedoms-
Design tools for AM- Part Orientation- Removal of Support- Hollowing out part- Inclusion of
Undercuts and Other Manufacturing Constraining Features- Interlocking Feature- Reduction of
Part Count in an Assembly- Identification of markings / numbers etc.

UNIT III SOLID & LIQUID BASED AM
9
Liquid Based AM: Stereolithography Apparatus (SLA) - Solid Ground Curing (SGC) - Principle,
pre-build process, part-building and post-build processes, resins, Advantages, limitations and
applications

Solid Based AM: Fused deposition Modeling (FDM) - Laminated Object Manufacturing (LOM) -
Principles, details of processes, materials, advantages, limitations and applications.

UNIT IV POWDER BASED AM
9
Selective Laser Sintering (SLS) - Laser Engineered Net Shaping (LENS) - Principles, details of
processes, materials, advantages, limitations and applications.
Other Additive Manufacturing Systems: Principles of Shape Deposition Manufacturing (SDM),
Ballastic Particle Manufacturing (BPM), Selective Laser Melting, Electron Beam Melting.

UNIT V POST PROCESSING & APPLICATIONS OF AM
12
Post processing of AM parts: Support material removal - Surface texture improvement-
Accuracy improvement - Aesthetic improvement - Preparation for use as a pattern- Property
enhancements using non-thermal and thermal techniques.
Applications of AM: Functional models- Pattern for investment and vacuum casting - Medical models - art models - Engineering analysis models- Rapid tooling ( Direct and Indirect method- New materials development- Bi-metallic parts- Re-manufacturing- Application examples for Aerospace, defense, automobile, Bio-medical and general engineering industries;
TOTAL: 45 PERIODS

OUTCOMES:
Upon completing this course, the students
• Will learn about a variety of Additive Manufacturing (AM) technologies, their potential to support design and manufacturing
• Will learn the important research challenges associated with AM and its data processing tools

REFERENCES:

PL8071 ADVANCED PLASTICS PROCESSING

OBJECTIVES:
• To understand the specialized injection moulding process viz., Co-injection moulding, Two-colour injection moulding process, Gas assisted Injection Moulding, Reaction Injection Moulding, Liquid injection moulding, structural foam moulding and to understand the effect of shrinkage, merit & demerits of the process
• To understand advanced blow moulding process & advanced Extrusion process. To expertise the student with sufficient background for selection of processing techniques.

UNIT I SPECIALIZED INJECTION MOULDLING PROCESS - I 9

UNIT II SPECIALISED INJECTION MOULDLING PROCESS – II 9
Multi-layer Moulding, Counter flow moulding, Liquid Injection Moulding processes. Structural foam moulding - Low pressure and high pressure processes - Merits &demerits.

UNIT III ADVANCED BLOW MOULDLING - I 9

UNIT IV ADVANCED BLOW MOULDLING – II 9
UNIT V  ADVANCED EXTRUSION PROCESSES  


OUTCOME:

- At the end of the course, the students will have knowledge on advance processing technique, end product application & it’s importance with industrial relevance.

TEXT BOOKS:


REFERENCES:

11. Schar, J., Press blowing option for tough to blow parts, SPE ANTEC April’87.

PL8005  ELECTRICAL DEVICES  L T P C  3 0 0 3

OBJECTIVES:

- To develop knowledge and understanding of electrical devices including programmable devices, sensors and actuators.
- To develop understanding of signal conditioning techniques and signal conversion devices.

UNIT I  INTRODUCTION

Electrical Device-definition and symbols of electrical devices, operation of basic electrical devices-
fuse, switches, circuit breaker, relay, meters- ammeter, voltmeter, energy meter, ohmmeter,
generator, and motor.

UNIT II ELECTRICAL SENSORS AND ACTUATORS

Function and operation of electrical sensors used to measure a range of physical properties i.e.
Light- photo-diode, phototransistor, temperature -thermistor, thermocouple, force/pressure - strain
gauge, load cell, position - optical encoder, linear variable differential transformer, hall effect
sensor, speed -. tacho-generator, Doppler effect sensor, flow -. vane controlled potentiometer,
sound – microphone, electric linear actuator , electric rotary actuator , linear solenoid actuator .

UNIT III PROGRAMMABLE DEVICES

Function of programmable logic devices (PLDs) -programmable logic array (PLA),programmable
array logic (PAL) , field programmable gate array (FPGA), static random access memory (SRAM)
,electrically programmable read only memory (EPROM) ,flash memory , internal architecture and
typical system configurations (e.g. input ports, output ports, peripheral devices) for circuits using
programmable devices -microprocessor ,microcontroller ,programmable interface controller (PIC)
,programmable logic controller (PLC) .

UNIT IV SIGNAL CONDITIONING TECHNIQUES AND SIGNAL CONVERSION DEVICES

Signal conditioning and interfacing - sensor output signal type i.e. voltage , current , filtering
using operational amplifier (op-amp) circuits - low-pass filter , high-pass filter, function and
operation of signal conversion devices - analogue to digital conversion , digital to analogue
conversion, parallel to serial conversion ,serial to parallel conversion , calculation of baud and bit
rate for a serial data signal .

UNIT V MATERIALS USED IN ELECTRICAL DEVICES

Classification of Electrical Engineering Materials, Physical Properties of Materials, Mechanical
properties of engineering materials, Chemical Properties of Materials, Selection of material for
Engineering Material for engineering application, Low Resistivity or high conductivity of conducting
material, High resistivity or low conductivity of conducting material, Factors effecting the resistivity
of electrical materials, Materials used for heating elements ,bimetal, piezoelectricity, dielectric
materials.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completing this course, the students

- Will gain knowledge about various electrical devices.
- Will have knowledge about the materials used in electrical devices.

TEXT BOOK:

1. Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, by

REFERENCES:

2. Mechatronics Systems, sensors and actuators, Fundamentals and modelling by Robert
PL8006 ADHESIVES AND SURFACE COATINGS

OBJECTIVES:
To enable the students to understand the following:
- 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
Surface preparation and paint application. Paint properties and their evaluation - mechanism of film formation, factors affecting coating properties, methods used for film preparation - barrier properties, optical properties, ageing properties, rheological properties and adhesion properties of coatings.

OUTCOMES:
Upon completing this course, the students
- Will attain the knowledge in mechanism of adhesion
- Will familiarize about the compounding of paints
- Will demonstrate the adhesive types and application

TOTAL: 45 PERIODS
TEXT BOOKS:

REFERENCES:

GE8077 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:
• To facilitate the understanding of Quality Management principles and process.

UNIT I INTRODUCTION

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

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

UNIT IV TQM TOOLS AND TECHNIQUES II
Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V QUALITY MANAGEMENT SYSTEM

TOTAL: 45 PERIODS

OUTCOME:
• The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.
TEXT BOOK:
1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe 
and Rashmi Urdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised 

REFERENCES:
1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 
Hall (India) Pvt. Ltd., 2006.
2006.
4. ISO9001-2015 standards

GE8072 FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT

OBJECTIVES:
- To understand the global trends and development methodologies of various types of products and services
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT

UNIT II REQUIREMENTS AND SYSTEM DESIGN

UNIT III DESIGN AND TESTING
UNIT IV SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT


UNIT V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY


OUTCOMES:
Upon completion of the course, the students will be able to:

- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Gain knowledge of the Innovation & Product Development process in the Business Context
- Work independently as well as in teams
- Manage a project from start to finish

TEXTBOOKS:
1. Book specially prepared by NASSCOM as per the MoU.

REFERENCES: