Programme Educational Objectives (PEOs)

PEO 1: Career Development: Graduates of the programme will have successful technical and professional careers in Rubber and Plastics industry, research and management.

PEO 2: Lifelong learning: Graduates of the programme will have sustained interest to continuously learn and adapt new technology and development to meet the changing industrial scenarios.

Programme Outcomes (POs)

a. Graduate will demonstrate strong basics in mathematics, science and engineering.

b. Graduate will demonstrate the ability to design and conduct experiments, as well as to analyze and interpret data.

c. Graduate will demonstrate the ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

d. Graduate will become familiar with modern engineering tools and analyze the problems within the domains of rubber and plastics as the members of multidisciplinary teams.

e. Graduate will acquire the capability to identify, formulate and solve complex engineering problems related to rubber and plastics technology.

f. Graduate will demonstrate an understanding of professional and ethical responsibility with reference to their career in the field of polymers.

g. Graduate will be able to communicate effectively both in verbal and non-verbal forms.

h. Graduate will be trained towards developing and understanding the impact of development of rubber and plastics on global, economic environmental and societal context.

i. Graduate will be capable of understanding the value for life-long learning.

j. Graduate will demonstrate knowledge of contemporary issues focusing on the necessity to develop new material, design, process, testing and solution for environmental related problems related to their field.

k. Graduate will demonstrate the ability to use the techniques, skills and modern engineering tools necessary for engineering practice in the field of rubber and plastics.

l. Graduate will have a firm scientific, technological and communication base that helps them either to find a desire placement or to become an entrepreneur and explore their knowledge in their field.

m. Graduate will be capable of doing higher studies and research in inter and multidisciplinary areas.
Mapping between POs and PEOs

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UNIVERSITY DEPARTMENTS
B.TECH. RUBBER AND PLASTICS TECHNOLOGY
REGULATIONS – 2015
CHOICE BASED CREDIT SYSTEM
CURRICULA AND SYLLABI I – VIII SEMESTERS

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To enable students pursue Project work in an Industry outside Chennai, students may be permitted to advance an elective in VI or VII Semester

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COURSE DESCRIPTION:
This course aims at developing the language skills necessary for the first year students of Engineering and Technology.

OBJECTIVES:
- To develop the four language skills – Listening, Speaking, Reading and Writing.
- To improve the students’ communicative competence in English.
- To teach students the various aspects of English language usage.

CONTENTS

UNIT I  GREETING AND INTRODUCING ONESELF 12
Listening – Types of listening – Listening to short talks, conversations; Speaking – Speaking about one’s place, important festivals etc. – Introducing oneself, one’s family/ friend; Reading – Skimming a passage – Scanning for specific information; Writing – Guided writing - Free writing on any given topic (My favourite place/ Hobbies/ School life, writing about one’s leisure time activities, hometown, etc.); Grammar – Tenses (present and present continuous) -Question types - Regular and irregular verbs; Vocabulary – Synonyms and Antonyms.

UNIT II  GIVING INSTRUCTIONS AND DIRECTIONS 12
Listening – Listening and responding to instructions; Speaking – Telephone etiquette - Giving oral instructions/ Describing a process – Asking and answering questions; Reading – Reading and finding key information in a given text - Critical reading - Writing – Process description( non-technical)- Grammar – Tense (simple past& past continuous) - Use of imperatives – Subject – verb agreement – Active and passive voice; - Vocabulary – Compound words – Word formation – Word expansion (root words).

UNIT III  READING AND UNDERSTANDING VISUAL MATERIAL 12
Listening – Listening to lectures/ talks and completing a task; Speaking – Role play/ Simulation – Group interaction; Reading – Reading and interpreting visual material; Writing – Jumbled sentences – Discourse markers and Cohesive devices – Essay writing (cause & effect/ narrative); Grammar – Tenses (perfect), Conditional clauses – Modal verbs; Vocabulary – Cause and effect words; Phrasal verbs in context.

UNIT IV  CRITICAL READING AND WRITING 12
Listening - Watching videos/ documentaries and responding to questions based on them; Speaking – Formal and formal conversation; Reading – Critical reading (prediction & inference); Writing – Essay writing (compare & contrast/ analytical) – Interpretation of visual materials; Grammar – Tenses (future time reference); Vocabulary – One word substitutes (with meanings) – Use of abbreviations & acronyms – Idioms in sentences.

UNIT V  LETTER WRITING AND SENDING E-MAILS 12
Listening – Listening to programmes/broadcast/ telecast/ podcast; Speaking – Giving impromptu talks, Making presentations on given topics- Discussion on the presentation; Reading – Extensive reading; Writing – Poster making – Letter writing (Formal and E-mail) ; Grammar – Direct and Indirect speech – Combining sentences using connectives; Vocabulary – Collocation;

TEACHING METHODS:
Interactive sessions for the speaking module.
Use of audio – visual aids for the various listening activities.
Contextual Grammar Teaching.
EVALUATION PATTERN:
Internals – 50%
End Semester – 50%
TOTAL:60 PERIODS

LEARNING OUTCOMES:
- Students will improve their reading and writing skills
- Students will become fluent and proficient in communicative English
- Students will be able to improve their interpersonal communication

TEXTBOOK:

REFERENCES:
3. Redston, Chris & Gillies Cunningham Face2Face (Pre-intermediate Student’s Book& Workbook) Cambridge University Press, New Delhi: 2005

MA7151 MATHEMATICS – I

COURSE OBJECTIVES
- The goal of this course is for students to gain proficiency in calculus computations. In calculus, we use three main tools for analyzing and describing the behavior of functions: limits, derivatives, and integrals. Students will use these tools to solve application problems in a variety of settings ranging from physics and biology to business and economics.
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I DIFFERENTIAL CALCULUS
12
Representation of functions - New functions from old functions - Limit of a function - Limits at infinity - Continuity - Derivatives - Differentiation rules - Polar coordinate system - Differentiation in polar coordinates - Maxima and Minima of functions of one variable.

UNIT II FUNCTIONS OF SEVERAL VARIABLES
12

UNIT III INTEGRAL CALCULUS
12
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
Method of variation of parameters – Method of undetermined coefficients – Homogenous equation of Euler’s and Legendre’s type – System of simultaneous linear differential equations with constant coefficients.

TOTAL: 60 PERIODS

COURSE OUTCOMES
- Understanding of the ideas of limits and continuity and an ability to calculate with them and apply them.
- Improved facility in algebraic manipulation.
- Fluency in differentiation.
- Fluency in integration using standard methods, including the ability to find an appropriate method for a given integral.
- Understanding the ideas of differential equations and facility in solving simple standard examples.

TEXT BOOKS

REFERENCE BOOKS

PH7151 ENGINEERING PHYSICS
(Common to all branches of B.E / B.Tech programmes)

OBJECTIVE:
- To introduce the concept and different ways to determine moduli of elasticity and applications.
- To instill the concept of sound, reverberation, noise cancellation, and ultrasonic generation, detection and applications.
- To inculcate an idea of thermal properties of materials, heat flow through materials and quantum physics.
To promote the basic understanding of interferometers, principles and applications of lasers, optical fibers and sensors
To establish a sound grasp of knowledge on the basics, significance and growth of single crystals

UNIT I  PROPERTIES OF MATTER

UNIT II  ACOUSTICS AND ULTRASONICS

UNIT III  THERMAL AND MODERN PHYSICS

UNIT IV  APPLIED OPTICS

UNIT V  CRYSTAL PHYSICS
Single crystalline, polycrystalline and amorphous materials – Single crystals: unit cell, crystal systems, Bravais lattices, detecions and planes in a crystal, Miller indices - interplanar distance for a cubic crystal - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - structure and significance of NaCl, CsCl, ZnS and graphite - crystal imperfections: point defects, line defects – Burger vectors, dislocations and stacking faults – Growth of single crystals: Bridgman and Czochralski methods.

TOTAL: 45 PERIODS

OUTCOME:
• The students will understand different moduli of elasticity, their determination and applications.
• The students will gain knowledge on the properties of sound, noise cancellation, and production, detection and applications of ultrasonics
• The students will acquire sound knowledge on thermal expansion and thermal conductivity of materials. Further they will gain an idea of quantum physics.
• The students will gain knowledge on interferometers, lasers and fiber optics
• The students will secure knowledge on the basics of crystal structures and their significance. Further they gain basic ideas of growing single crystals.
TEXTBOOKS:

REFERENCES:

CY7151 ENGINEERING CHEMISTRY L T P C
3 0 0 3

OBJECTIVES
- To develop an understanding about fundamentals of polymer chemistry.
- Brief elucidation on surface chemistry and catalysis.
- To develop sound knowledge photochemistry and spectroscopy.
- To impart basic knowledge on chemical thermodynamics.
- To understand the basic concepts of nano chemistry.

UNIT I POLYMER CHEMISTRY
Introduction: Functionality-degree of polymerization. Classification of polymers- natural and synthetic, thermoplastic and thermostetting. Types and mechanism of polymerization: addition (free radical, cationic, anionic and living); condensation and copolymerization. Properties of polymers: Tg, tacticity, molecular weight-weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension.

UNIT II SURFACE CHEMISTRY AND CATALYSIS

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY

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

UNIT V NANO CHEMISTRY
Basics-distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Preparation of nanoparticles – sol-gel and solvothermal. Preparation of carbon nanotube by chemical vapour deposition and laser ablation. Preparation of nanowires by VLS growth, electrochemical deposition and electro spinning. Properties and uses of
nanoparticles, nanoclusters, nanorods, nanotubes and nanowires.

TOTAL : 45 PERIODS

OUTCOMES
• Will be familiar with polymer chemistry, surface chemistry and catalysis.
• Will know the photochemistry, spectroscopy and chemical thermodynamics.
• Will know the fundamentals of nano chemistry.

TEXT BOOKS

REFERENCE BOOKS

GE7151 COMPUTING TECHNIQUES
(Common to all branches of Engineering and Technology)

OBJECTIVES:
• To learn programming using a structured programming language.
• To provide C programming exposure.
• To introduce foundational concepts of computer programming to students of different branches of Engineering and Technology.

UNIT I INTRODUCTION
Introduction to Computers – Computer Software – Computer Networks and Internet - Need for logical thinking - Problem formulation and development of simple programs - Pseudo code - Flow Chart and Algorithms.

UNIT II C PROGRAMMING BASICS

UNIT III ARRAYS AND STRINGS

UNIT IV POINTERS
Macros - Storage classes -Basic concepts of Pointers- Pointer arithmetic - Example Problems - Basic file operations

UNIT V FUNCTIONS AND USER DEFINED DATA TYPES

TOTAL : 45 PERIODS
OUTCOMES
At the end of the course, the student should be able to:
• Write C program for simple applications
• Formulate algorithm for simple problems
• Analyze different data types and arrays
• Perform simple search and sort.
• Use programming language to solve problems.

TEXTBOOKS:

REFERENCES:

GE7152 ENGINEERING GRAPHICS

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

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

UNIT I PLANE CURVES AND FREE HANDSKETCHING 14
Basic Geometrical constructions, Curves used in engineering practices-Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles – Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 14
Orthographic projection- principles-Principal planes-First angle projection-Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes- Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 14
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to both the principal planes by rotating object method and auxiliary plane method.
UNIT IV  PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES
Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section.
Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes.

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

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY)
Introduction to drafting packages and demonstration of their use.

L=45+T=30, TOTAL: 75 PERIODS

OUTCOMES:
On Completion of the course the student will be able to

- Perform free hand sketching of basic geometrical shapes and multiple views of objects.
- Draw orthographic projections of lines, Planes and Solids
- Obtain development of surfaces.
- Prepare isometric and perspective views 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.
4. The examination will be conducted in appropriate sessions on the same day.
PHYSICS LABORATORY: (Any Seven Experiments)

OBJECTIVE:
- To inculcate experimental skills to test basic understanding of physics of materials including properties of matter, thermal and optical properties.
- To induce the students to familiarize with experimental determination of velocity of ultrasonic waves, band gap determination and viscosity of liquids.

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of disc
2. Non-uniform bending - Determination of young’s modulus
3. Uniform bending – Determination of young’s modulus
4. Lee’s disc Determination of thermal conductivity of a bad conductor
5. Potentiometer-Determination of thermo e.m.f of a thermocouple
6. Laser- Determination of the wave length of the laser using grating
7. Air wedge - Determination of thickness of a thin sheet/wire
8. a) Optical fibre - Determination of Numerical Aperture and acceptance angle
    b) Compact disc- Determination of width of the groove using laser.
9. Acoustic grating- Determination of velocity of ultrasonic waves in liquids
10. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
11. Post office box - Determination of Band gap of a semiconductor.
13. Viscosity of liquids - Determination of co-efficient of viscosity of a liquid by Poiseuille’s flow

TOTAL: 30 PERIODS

OUTCOME:
Upon completion of the course, the students will be able
- To determine various moduli of elasticity and also various thermal and optical properties of materials.
- To determine the velocity of ultrasonic waves, band gap determination and viscosity of liquids.

CHEMISTRY LABORATORY:

(Minimum of 8 experiments to be conducted)

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 iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline/thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
12. Pseudo first order kinetics-ester hydrolysis.
14. Determination of CMC.
15. Phase change in a solid.
TEXTBOOKS


GE7161 COMPUTER PRACTICES LABORATORY

OBJECTIVES

- To understand the basic programming constructs and articulate how they are used to develop a program with a desired runtime execution flow.
- To articulate where computer programs fit in the provision of computer-based solutions to real-world problems.
- To learn to use user-defined data structures.

LIST OF EXPERIMENTS

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

TOTAL: 60 PERIODS

OUTCOMES

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

- Write and compile programs using C programs.
- Write program with the concept of Structured Programming
- Identify suitable data structure for solving a problem
- Demonstrate the use of conditional statement.

LABORATORY REQUIREMENTS FOR BATCH OF 30 STUDENTS

30 Systems with C compiler

HS7251 TECHNICAL ENGLISH

OBJECTIVES

- To enable students acquire proficiency in technical communication.
- To enhance their reading and writing skills in a technical context.
- To teach various language learning strategies needed in a professional environment.

CONTENTS

UNIT I ANALYTICAL READING

Listening- Listening to informal and formal conversations; Speaking – Conversation Skills(opening, turn taking, closing)-explaining how something works-describing technical functions and applications; Reading – Analytical reading, Deductive and inductive reasoning; Writing- vision statement–structuring paragraphs.
UNIT II  SUMMARISING  12
Listening—Listening to lectures/ talks on Science & Technology; Speaking –Summarizing/ Oral Reporting, Reading – Reading Scientific and Technical articles; Writing—Extended definition –Lab Reports – Summary writing.

UNIT III  DESCRIBING VISUAL MATERIAL  12
Listening—Listening to a panel discussion; Speaking – Speaking at formal situations; Reading – Reading journal articles - Speed reading; Writing—data commentary-describing visual material-writing problem-process- solution-the structure of problem-solution texts-writing critiques

UNIT IV  WRITING/ E-MAILING THE JOB APPLICATION  12
Listening—Listening to/ Viewing model interviews; Speaking –Speaking at different types of interviews – Role play practice ( mock interview); Reading – Reading job advertisements and profile of the company concerned; Writing– job application – cover letter –Résumé preparation.

UNIT V  REPORT WRITING  12
Listening—Viewing a model group discussion; Speaking –Participating in a discussion - Presentation; Reading – Case study - analyse -evaluate – arrive at a solution; Writing– Recommendations- Types of reports (feasibility report)- designing and reporting surveys- Report format.- writing discursive essays.

TEACHING METHODS:
Practice writing
Conduct model and mock interview and group discussion.
Use of audio – visual aids to facilitate understanding of various forms of technical communication.
Interactive sessions.

EVALUATION PATTERN:
Internals – 50%
End Semester – 50%
TOTAL:60 PERIODS

LEARNING OUTCOMES
• Students will learn the structure and organization of various forms of technical communication.
• Students will be able to listen and respond to technical content.
• Students will be able to use different forms of communication in their respective fields.

TEXTBOOK:

REFERENCES:
MA7251  MATHEMATICS – II  L  T  P  C  4 0 0 4  
(Common to all branches of B.E. /B.Tech. Programmes in II Semester)

COURSE OBJECTIVES
- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To acquaint the student with the concepts of vector calculus, needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I  MATRICES  12

UNIT II  VECTOR CALCULUS  12
Gradient and directional derivative – Divergence and Curl – 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 FUNCTION  12
Analytic functions – Necessary and sufficient conditions for analyticity - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions $w = z+c, az, \frac{1}{z}, z^2$ - Bilinear transformation.

UNIT IV  COMPLEX INTEGRATION  12

UNIT V  LAPLACE TRANSFORMS  12

TOTAL : 60 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
- Evaluate real and complex integrals using the Cauchy integral formula and the residue theorem.
- Appreciate how complex methods can be used to prove some important theoretical results.
- Evaluate line, surface and volume integrals in simple coordinate systems.
• Calculate grad, div and curl in Cartesian and other simple coordinate systems, and establish identities connecting these quantities
• Use Gauss, Stokes and Greens theorems to simplify calculations of integrals and prove simple results.

**TEXT BOOKS**

**REFERENCE BOOKS**

**PH7252 MATERIALS SCIENCE FOR TECHNOLOGISTS**

L T P C (Common to E & I and Rubber and Plastics Technology Branches) 3 0 0 3

**OBJECTIVE:**
- To make the students to understand the basics of phase diagrams and various crystal growth techniques
- To equip the students to have a knowledge on different types of electron theory, basics of applied quantum mechanics and about superconductors
- To introduce the importance of semiconducting materials, physics of semiconducting materials and applications of semiconductors in device fabrication
- To familiarize the students to magnetic materials, theory and types of magnetizations, dielectric materials and their application.
- To provide the students a sound platform towards learning about advanced materials and their applications.

**UNIT I MATERIALS PREPARATION AND PROCESSING**

**UNIT II CONDUCTING MATERIALS**

**UNIT III SEMICONDUCTING MATERIALS**
Origin of band gap in solids (qualitative) - Concept of effective mass of electron and hole – Carrier concentration in an intrinsic semiconductor (derivation) – Fermi level – Variation of Fermi level with temperature – electrical conductivity – Band gap determination – Carrier concentration in n-type and p-type semiconductors (derivation) – Variation of Fermi level.

UNIT IV MAGNETIC AND DIELECTRIC MATERIALS 9

UNIT V NEW MATERIALS AND APPLICATIONS 9

TOTAL: 45 PERIODS

OUTCOME:
Students will be able to
- acquire knowledge of phase diagram and important crystal growing techniques.
- familiarize with conducting materials, and properties and applications of superconductors.
- gain knowledge on semiconducting materials based on energy level diagrams, its types, temperature effect. Also, fabrication methods for semiconductor devices will be understood.
- realize with theories of magnetic materials, understand the dielectric behavior of insulating materials and ferroelectric materials.
- familiarize with ceramics, FRP, shape memory alloys and important technological applications.

REFERENCES:

GE7153 ENGINEERING MECHANICS L T P C
4 0 0 4

OBJECTIVE :
The objective of this course is to inculcate in the student the ability to analyze any problem in a simple and logical manner and to predict the physical phenomena and thus lay the foundation for engineering applications.

UNIT I STATICS OF PARTICLES 12
UNIT II  EQUILIBRIUM OF RIGID BODIES  12

UNIT III  DISTRIBUTED FORCES  16
Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration , Theorems of Pappus-Guldinus, Distributed Loads on Beams, Center of Gravity of a Three-Dimensional Body, Centroid of a Volume, Composite Bodies, Determination of Centroids of Volumes by Integration. Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration , Polar Moment of Inertia , Radius of Gyration of an Area , Parallel-Axis Theorem , Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates, Determination of the Moment of Inertia of a Three-Dimensional Body by Integration.

UNIT IV  FRICTION  8
The Laws of Dry Friction, Coefficients of Friction, Angles of Friction, Wedges, Wheel Friction, Rolling Resistance, Ladder friction.

UNIT V  DYNAMICS OF PARTICLES  12

L – 45 + T – 15 TOTAL: 60 PERIODS

OUTCOMES:
- Upon completion of this course, students will be able to construct meaningful mathematical models of physical problems and solve them.

TEXT BOOK

REFERENCES

PR7251  PRODUCTION PROCESSES  L  T  P  C
(Common to Aero/Auto/Rubber and Plastics)  3  0  0  3

OBJECTIVES:
- To impart the knowledge about the various production processes available
- To expose the student on the principle and applications of the processes
- To make a decision on a relevant process based on the merits and demerits.
UNIT I  CASTING PROCESSES  10

UNIT II  METAL FORMING PROCESSES  8

UNIT III  MACHINING PROCESSES  9
Machine and machine tool – construction, types operations in the following machines with block diagrams – Lathe, Milling, Drilling and Grinding – Concept of NC/CNC machines – Comparison of CNC with conventional machines – sample manual part programming for CNC Lathe and milling.

UNIT IV  WELDING PROCESSES  9

UNIT V  UNCONVENTIONAL MACHINING PROCESSES  9
Need for unconventional – Construction, working principle merits, demerits and applications with block diagram only for AJM, AWJM, USM, CHM, ECM, EDM, EB, LBM, PAM and IBM.

TOTAL: 45 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 BOOKS
1. Serope Kalpakjian, Steven R. Schmid, Manufacturing Engineering and Technology - Anna University, 4/e, Pearson Education, 2014

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

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

UNIT I REACTION MECHANISMS
9 Free radical substitutions, electrophilic addition, aromatic electrophilic substitutions, nucleophilic additions, condensation reactions, nucleophilic 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
9 Amines, heterocyclic compounds – furan, thiophene, pyrrole, pyridine, quinoline, isoquinoline, imidazoles, thiazoles preparation, properties and uses of simple monomers like ethylene, propylene, isobutylene, butadiene, styrene, methyl methacrylate, disocyanates, glycols, polyls, epichlorohydrin, fluoro alkenes, acrylonitrile, vinyl chloride, vinyl acetate.

UNIT III STRUCTURE AND REACTIVITY IN ORGANIC COMPOUNDS
9 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

TEXT BOOKS

REFERENCE BOOKS

LIST OF EXPERIMENTS:
1. Programs using Functions and Pointers in C
2. Programs using Files in C
3. Programs using Classes and Objects
4. Programs using Operator Overloading
5. Programs using Inheritance, Polymorphism and its types
6. Programs using Arrays and Pointers
7. Programs using Dynamic memory allocation
8. Programs using Templates and Exceptions
9. Programs using Sequential and Random access files

TOTAL : 60 PERIODS

LABORATORY REQUIREMENTS FOR BATCH OF 30 STUDENTS
30 Terminals with C and C++ Compiler

GE7162 ENGINEERING PRACTICES LABORATORY
(Common to all Branches of B.E. / B.Tech. Programmes) 0 0 4 2

COURSE 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 & ELECTRICAL)

1. CIVIL ENGINEERING PRACTICES

PLUMBING
• Basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings. Preparation of plumbing line sketches.
• Laying pipe connection to the suction side of a pump.
• Laying pipe connection to the delivery side of a pump.
• Practice in connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK
• Sawing, planing and making joints like T-Joint, Mortise and Tenon joint and Dovetail joint.

STUDY
• Study of joints in door panels and wooden furniture
• Study of common industrial trusses using models.

2. ELECTRICAL ENGINEERING PRACTICES

• Basic household wiring using Switches, Fuse, Indicator and Lamp etc.,
• Stair case light wiring
• Tube – light wiring
• Preparation of wiring diagrams for a given situation.
• Study of Iron-Box, Fan Regulator and Emergency Lamp

GROUP – B (MECHANICAL AND ELECTRONICS)

3. MECHANICAL ENGINEERING PRACTICES

WELDING
• Arc welding of Butt Joints, Lap Joints, and Tee Joints
• Gas welding Practice.
• Basic Machining - Simple turning, drilling and tapping operations.
• Study and assembling of the following:
  a. Centrifugal pump
  b. Mixie
  c. Air Conditioner.
DEMONSTRATION ON FOUNDRY OPERATIONS.

4. ELECTRONIC ENGINEERING PRACTICES
   - Soldering simple electronic circuits and checking continuity.
   - Assembling electronic components on a small PCB and Testing.
   - Study of Telephone, FM radio and Low Voltage Power supplies.

   TOTAL: 60 PERIODS

COURSE OUTCOMES
   - Ability to fabricate carpentry components and to lay pipe connections including plumbing works.
   - Ability to use welding equipments to join the structures
   - Ability to do wiring for electrical connections and to fabricate electronics circuits.

AE7353 SOLID MECHANICS

OBJECTIVE:
   - To introduce various behavior of structural components under various loading conditions. Also to introduce about the deflection of beams, stresses and strains in torsional members.

UNIT I STRESS-STRAIN – AXIAL LOADING
   Definition of stress and strain- Stress-Strain relation- Relation between material constants.- Bar under axial loading- Statically determinate and indeterminate cases – Thermal stress- Impact Loading

UNIT II STRESSES IN BEAMS
   Types of beams and loadings – Relation between shear force and bending moment - Shear force and bending moment diagrams – Euler beam theory - Bending stress in beams – Shear stress in beam – Composite beam.

UNIT III DEFLECTION OF BEAM

UNIT IV TORSION –SPRINGS
   Shear stress and twist relation for circular section – Comparison of hollow shaft and solid shaft – Compound shaft – Power transmission by circular shafts – Springs – Deflection expression for close coiled helical spring – Stress in springs.

UNIT V BIAXIAL STRESS
   Thin walled cylinder under internal pressure – Principal stresses for general biaxial stress field – Mohr’s circle - Stresses in combined loading

   TOTAL: 45 PERIODS

OUTCOMES:
   At the end of the course
   - Students will be familiarizing with the fundamentals of deformation, stresses, and strains in structural elements and pressure vessels.
   - Students will be familiarizing the beam of different cross sections for shear force, bending moment, slope and deflection.

TEXT BOOKS:
REFERENCES:

MA7357 PROBABILITY AND STATISTICS
(Branch specific course)

L T P C
4 0 0 4

OBJECTIVES:
- To make the students acquire a sound knowledge in statistical techniques that model engineering problems.
- The Students will have a fundamental knowledge of the concepts of probability.

UNIT I RANDOM VARIABLES
Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions - Functions of a random variable.

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 TESTS OF SIGNIFICANCE

UNIT IV DESIGN OF EXPERIMENTS
Completely randomized design – Randomized block design – Latin square design - 2² - factorial design - Taguchi’s robust parameter design.

UNIT V STATISTICAL QUALITY CONTROL
Control charts for measurements ( X̄ and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL : 60 PERIODS

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
To impart knowledge on
• Electric circuit laws, single and three phase circuits and wiring
• Working principles of Electrical Machines
• Various electronic devices and measuring instruments

UNIT I ELECTRICAL CIRCUITS
Basic principles involved in power generation, transmission and distribution, Ohms Law, Kirchoff’s Law, steady state solution of DC circuits, Thevinin’s Theorem, Norton’s Theorem, Superposition Theorem.

UNIT II AC CIRCUITS
Introduction to AC circuits – waveforms and RMS value – power and power factor, single phase and three-phase balanced circuits, housing wiring, industrial wiring, materials of wiring.

UNIT III ELECTRICAL MACHINES
Principles of operation and characteristics of DC machines. Transformers (single and three phase), Synchronous machines, three phase and single phase induction motors.

UNIT IV ELECTRONIC DEVICES & CIRCUITS

UNIT V MEASUREMENTS & INSTRUMENTATION
Introduction to transducers: pressure, temperature, position, electrical measurements, Classification of instruments – moving coil and moving iron Ammeter and Voltmeter – multimeters – dynamometer type Wattmeter – three-phase power measurements – energy meter – megger – instrument transformers (CT and PT)

TOTAL : 45 PERIODS

OUTCOMES:
Ability to
• Understand electric circuits and working principles of electrical machines
• Understand the concepts of various electronic devices
• Choose appropriate instruments for electrical measurement for a specific application

REFERENCES
OBJECTIVES:
To the study of nature and the facts about environment.
- To find and implement 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  14
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  8
Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards– soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.
Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III  NATURAL RESOURCES  10
Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and 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  7
From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

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 environment at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions.
- Development and improvement in standard of living has lead to serious environmental disasters.

TEXT BOOKS:

REFERENCES:

RP 7302 THEORY OF MACHINES AND MECHANISMS L T P C 3 1 0 4

OBJECTIVES
- To understand the basic concepts of mechanisms and machinery, its linkages, friction and balancing.

UNIT I MECHANISMS 14

UNIT II FRICTION 12
Types of friction – friction in screw and nut – screw jack – pivot, collar and thrust bearings – belt (Flat & V) and rope drives – creep in belts – open and crossed belt drives – Ratio of tensions – Effect of centrifugal and initial tensions – condition for maximum power transmission.
UNIT III  GEARING AND CAMS  12
Gear – Types and profile – nomenclature of spur & helical gears – laws of gearing – interference – requirement of minimum number of teeth in gears –Cam – Types of cams and followers – Cam design for different follower motions.

UNIT IV  BALANCING  11
Static and dynamic balancing – single and several masses in different planes – primary and secondary balancing of reciprocating masses – Balancing of single and multi cylinder engines.

UNIT V  VIBRATION  11

L 45, T : 15, TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES
UNIT V  DIMENSIONS OF MACROMOLECULES

Size and shape of the macromolecules – Solubility parameter – Polymer/solvent interaction parameter – Flory Huggins Theory of Polymer Solutions – Thermodynamics of Polymer dissolution - Theta temperature – Size and molecular weight of polymer from the solution properties of polymers

TOTAL : 45 PERIODS

REFERENCES

EE7261  ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

OBJECTIVE:
- To train the students in performing various tests on electrical drives, sensors and circuits.

LIST OF EXPERIMENTS:
1. Load test on separately excited DC shunt generator
2. Load test on DC shunt moor
3. Load test on S Transformer
4. Load test on Induction motor
5. Regulation of 3 Alternator
6. Study of CRO
7. Logic gates
8. Operational amplifiers
9. Time constant of RC circuit
10. Characteristics of LVDT
11. Calibration of Rotometer
12. RTD and Thermistor
13. Flapper Nozzle system

TOTAL : 60 PERIODS

ME7362  MECHANICAL SCIENCES LABORATORY

OBJECTIVE:
- To train the students in testing and quantifying the mechanical properties of Engineering Materials, Engines.

LIST OF EXPERIMENTS:
Material Testing Lab
- Tension Test
- Torsion Test
- Testing of springs
- Impact test i) Izod, ii) Charpy
- Hardness test i) Vickers, ii) Brinell, iii) Rockwell, iv) Shore
- Deflection of Beams
- Dye Penetrant Test
- Tensile testing of polymers.
- Flex Fatigue test for Elastomers.
- Injection moulding machine operation.

**IC Engines Lab**
- Performance test on a 4 stroke engine
- Viscosity determination of the given fluid
- Moment of inertia of connecting rod
- Determination of Effectiveness of a parallel and counter flow heat exchangers.
- Valve timing of a 4 stroke engine and port timing of a 2 stroke engine.
- Determination of Flash point and Fire point of the given oil.

**TOTAL : 60 PERIODS**

**OUTCOME:**
- Upon completion of this course, the students can able to apply determine the strength materials and thermal properties.

**MA 7354**

**NUMERICAL METHODS**

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

**UNIT I**

**SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS**


**UNIT II**

**INTERPOLATION AND APPROXIMATION**

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

**UNIT III**

**NUMERICAL DIFFERENTIATION AND INTEGRATION**


**UNIT IV**

**INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS**


**UNIT V**

**BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS**

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

TOTAL: 60 PERIODS

OUTCOMES:
- Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions.
- Apply numerical methods to obtain approximate solutions to mathematical problems.
- Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
- Analyse and evaluate the accuracy of common numerical methods.

TEXT BOOKS:

REFERENCES:

RP7402 FUNDAMENTALS OF CHEMICAL ENGINEERING OPERATIONS L T P C 3 0 0 3

UNIT I HEAT TRANSFER

UNIT II BASIC THERMODYNAMICS

UNIT III MASS TRANSFER

UNIT IV AGITATION AND DRYING
Drying – Principles and definitions, Rate of batch drying, Equipments for drying. Humidification –dry bulb and wet bulb temperatures, Equipment — cooling towers, spray chambers
Agitation of liquids – Types of impellers, Selection criteria, Power consumption calculations for agitated vessel Absorption – Principle and equipment (packed towers and plate columns). Adsorption – Principles and equipment for adsorption

UNIT V  SEPARATION PROCESSES

TOTAL : 45 PERIODS

REFERENCES
REFERENCES

RP 7404 PLASTICS MATERIALS – I

UNIT I INTRODUCTION TO PLASTICS 12
Plastics – Classification – Structure – Property relationship (effect on thermal, mechanical, optical, chemical, electrical properties)

UNIT II OLEFINIC PLASTICS 12
Manufacturing methods – structure / property relationships, processing & applications of PE, PP & Copolymers of PE & PP – Metallocene polymers

UNIT III STYRENCIS & ACRYLICS 12
Styrenics: Manufacturing methods – Structure - property relationship, processing & applications of PS, SAN, ABS, HIPS & EPS.
Acrylics: Manufacturing Methods – Structure - property relationship processing & applications of PAN, PMMA & their copolymers

UNIT IV PVC TECHNOLOGY 9
Manufacturing, Structure - property relationship, additives for PVC - Processing applications of pPVC, uPVC, PVC pastes, co polymers of PVC, blends & alloys of PVC, Testing of PVC resin, PVC compounds & Products

UNIT V ADDITIVES FOR PLASTICS 15

TOTAL : 60 PERIODS

REFERENCES

RP7405 RUBBER MATERIALS

UNIT I STRUCTURE-PROPERTY RELATIONSHIPS IN RUBBERS 12
Rubber Elasticity – Requirements for rubber elasticity – Effect of chemical structure on the performance properties of rubbers – Effect of structure on processing properties of elastomers

UNIT II NATURAL RUBBER AND OTHER GENERAL PURPOSE RUBBERS 12
Origin – Natural Rubber Latex, tapping, processing, properties and applications – Conversion of Latex into dry rubber – Properties of dry rubber – Classification based on
technical specifications – Modifications of Natural Rubber–Applications – Synthetic polyisoprene- SBR-BR-Polyalkenamers and polynorbornene

UNIT III  SPECIAL PURPOSE ELASTOMERS  12
Nitrile Rubber and its modified forms, Butyl Rubber, Polychloroprene Rubbers – Ethylene Propylene Rubber and Ethylene – Vinyl acetate copolymers – Elastomers based on modified polyethylene – Acrylate rubbers Polysulphide rubbers- polyether rubbers – Polyurethane elastomers

UNIT IV  HIGH PERFORMANCE ELASTOMERS  4
Fluoroeslastomers and silicone elastomers- Preparation, structure, properties and applications

UNIT V  THERMOPLASTIC ELASTOMERS  5

TOTAL : 45 PERIODS

TEXT BOOK

REFERENCES

RP 7401  FLUID MECHANICS AND POLYMER RHEOLOGY  L T P C
3 0 0 3

UNIT I  FLUID FLOW PHENOMENA  9
Fluid as a continuum, Terminologies of fluid flow, velocity – local, average, maximum, flow rate – mass, volumetric, velocity field; flow visualization – streamline, path line- laminar and turbulent flows of Newtonian fluids - power law – general treatment of isothermal viscous flow in tubes – Reynolds number—its significance

UNIT II  FLOW MEASUREMENT  9
Bernoulli’s equation–kinetic energy correction factor; head loss; friction factor; major and Minor losses- Flow Meters - general equation for internal flow meters; Orifice meter; Venturimeter;concept of area meters: rotameter; Local velocity measurement: Pitot tube

UNIT III  INTRODUCTION TO RHEOLOGY  9
classification of fluids, Newtonian and non Newtonian fluids, shear stress, shear strain and shear rate, shear modulus, bulk modulus, Zero shear viscosity, Dependence of viscosity with temp, shear stress, shear rate fluid through channel- Viscoelasticity - effect of rate of strain, temperature and time on mechanical behaviour of polymeric materials

UNIT IV  MECHANICAL MODELS  9
UNIT V  MEASUREMENT OF RHEOLOGICAL PROPERTIES

Viscosity of polymer melts - die-swelling and melt fracture - Weissenberg effect - Elongational viscosity. Capillary rheometers – cone and plate viscometer - torque rheometers - Mooney viscometer - Applications of rheology to polymer processing (injection moulding, extrusion and blow moulding)

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

RP7412  POLYMER CHEMISTRY LABORATORY  L T P C  0 0 4 2

OUTCOMES
- Capability to identify plastics materials
- Able to synthesize various types of polymers
  - Able to measure viscosity of polymer solutions.

LIST OF EXPERIMENTS
2. Bulk polymerization - Preparation of Polymethyl methacrylate.
3. Solution Polymerization - Preparation of polyacrylamide
4. Preparation of Phenol-Formaldehyde, UF and MF resins.
5. Density Determination
6. Identification of Polymers
8. Determination of K value of PVC
10. Determination of EEW
11. Study of Molecular weight distribution (GPC).
12. Study of Thermal Stability of polymers

TOTAL : 60 PERIODS

REFERENCES

RP 7411  COMPUTER AIDED PARTS AND ASSEMBLY DRAWING  L T P C  0 0 4 2

OBJECTIVE
- To make the students to understand the concepts of drawing and construction of machine elements and assembly drawing by computer drafting.
• Train the students to allocate geometrical tolerances and to develop part drawing.

INTRODUCTION
Introduction to machine drawing & production drawing - classification of drawing - Standardization – Orthographic and isometric projections - Conversion of orthographic to isometric drawing and vice versa - sectional views. Reviews of the concepts of limits, tolerance, fits, surface roughness, and symbols terminology used in Production drawing.

COMPUTER AIDED PRODUCTION DRAFTING
Detailed part drawing and assembly drawings (with suitable tolerances, machine symbols, specification of fit).
1. Screw jack
2. Shaper tool head
3. Plummer block
4. Machine vice
5. Four jaw chuck of lathe
6. Lathe tail stock
7. Universal coupling and knuckle joint
8. Hydraulic & Pneumatic Assembly
9. Injection moulding toggle type clamping
10. Snap fit and ribbed plate

TOTAL : 60 PERIODS

TEXT BOOK

REFERENCES

RP7504 RUBBER COMPOUNDING  L T P C
UNIT I STANDARDS AND PRACTICES 3 0 0 3
Need for standardized rubber formulation - Specification data – Line call out - Mix Design – essentials and auxiliaries – order of addition, handling, storage - Compounding ingredients, physical form, viscosity, dispersive quality - Process safety, rate, state, stability

UNIT II CROSSLINKERS: MATERIALS AND MECHANISM 9
Cross linking of rubber, methods, materials & Mechanisms - Sulphur based systems - Classification of systems, activators, accelerators - Cure inhibitors, incipient cross linking - Organic peroxides as curatives – additives - Organic peroxides – mechanisms and applications - Metal oxides (ZnO, MgO) and activators - Curing of butyl by phenolic resins – materials, method and mechanism - Self cross linking systems - Blends of accelerators – synergism - Role of semi EV, modified EV - Crosslink density, optimization, role of cross link density on properties

UNIT III REINFORCERS, DILUENTS AND PROCESS ENABLERS 12
carbon resin, synthetic resin as tackifiers, inorg, org, blowing agent, types – efficiency, pigments and organic dyes for coloration.

UNIT IV FORMULATION FOR PERFORMANCE REQUIREMENTS 12
Hardness requirements – low compression set – For damping application – Compounding to meet bonding requirements with metals – Compounding to meet processing – Economics of compounding – Cost estimation.

UNIT V FORMULATIONS: EXAMPLES AND JUSTIFICATION 9
NR formulation low hardness for automotive, non-automotive applications - NR for moderate hardness (50 – 30) for tyre carcass, tread, engine mounting, diaphragms, - NR for conveyor cover compound, bridge bearing - SBR BR for tyre tread - NBR for processing and performance - CR, CSM and FKM for weather, ozone, solvent, resistance application – ACM and HNBR Food and Drug contact, amine free additives - REACH regulations, PAH, synthetic process aids - TLV, LD50, environmental regulations.

TOTAL : 45 PERIODS

REFERENCES
UNIT V CHROMATOGRAPHIC CHARACTERIZATION
Molecular weight distribution using GPC, HPLC– Biological Separations - Analysis of antioxidant, process oil and additives in Polymer Compounds –Analysis of Decomposition products using GC – Pyrolysis Gas Chromatography

TOTAL : 45 PERIODS

REFERENCES

RP7502 PLASTICS PROCESSING AND MACHINERY

UNIT I MELT PROCESSING OF PLASTICS
Flow behavior – Viscosity and polymer processing, Newtonian and non newtonian flow, Melt flow index, capillary rheometer -thermal behaviour, crystallization, orientation.

UNIT II EXTRUSION PROCESS & BLOW MOULDING
Extruder components and their functions – Geometry & various types of extruder screws-Barrier screws, flow analysis with extruder, two stage, vented extruders; – Plastics compounding and its machinery. Pipe Extrusion Profile extrusion – Sheet extrusion, flat sheet extrusion – trouble shooting
Blow molding-Extrusion blow molding – Injection Blow moulding – Stretch Blow moulding – Co extrusion Blow moulding – Wall thickness and parison thickness relationship-causes and remedies

UNIT III INJECTION MOULDING OF PLASTICS

UNIT IV COMPRESSION, TRANSFER AND ROTATIONAL MOULDING OF PLASTICS
Thermosetting compounds-properties and uses; compression molding-perform and preheating-curing-process control; transfer molding-integral and auxiliary mould-process control-mould; Rotational molding –materials , process control and troubleshooting - Sintering

UNIT V THERMOFORMING, CALENDARING AND FINISHINGOF PLASTICS

TOTAL : 45 PERIODS

REFERENCES
1. Harold Belofsky, “Plastics product design and process engineering” Hanser publishers, 1995
RP 7501 PLASTICS MATERIALS - II

UNIT I ENGINEERING PLASTICS 10
Polyamides, (nylons), modified polyamides, polyesters – PET, PBT, Polyacetals, PC and its blends – Preparation, properties & applications, LCP’s, IPN’s

UNIT II HIGH TEMPERATURE PLASTICS 10
Fluorine containing Plastics – Preparation, properties & uses of PTFE, PCTFE, PVDF, other high performance plastics like PPO, PPS, polysulphones, PEEK, Polyimides, Polybenzimidazoles, aromatic polyamides – Kevlar, Nomex – Preparation, properties & applications.

UNIT III SPECIALITY POLYMERS 10
Polymers for electronic applications, conducting polymers – Photoresists, polymers in optoelectronics polymers with piezoelectric, pyroelectric & ferroelectric properties, Polymers in telecommunication and power transmission

UNIT IV THERMOSETS 9
PF, UF and MF Resins – Preparation properties and uses – Moulding powders – Additives, Epoxy, Unsaturated Polyester, Vinyl Ester, Cyanate Ester – Preparation properties and applications

UNIT V POLYMERS FOR BIO MEDICAL APPLICATIONS 6
Bio-compatible and bio degradable polymers, Controlled drug release, tissue engineering, orthopaedic application, dentistry.

TOTAL : 45 PERIODS

REFERENCES

RP 7512 RUBBER MATERIALS LABORATORY

LIST OF EXPERIMENTS
1. Determination of T.S., D.R.C., V.F.A number of Latex
2. Estimation of total alkalinity of the latex
3. Determination of volatile matter, dirt, ash content in Rubber from Natural sources
4. Estimation of Cu, Fe and Mn in rubber by colorimetry
5. Rubber identification pyrolysis and spot test by specific reagents
6. Soxhlet extraction – determination of total extractables
7. Rapid reflux extract
8. Chemical analysis of synthetic rubber components and vulcanisates
9. Determination of structure of carbon black
   (i) DBP absorption
   (ii) IAN
   (iii) Surface area Calculation
10. Estimation of total and free sulphur in rubber products
11. Estimation of process oils
   (i) Aniline point
   (ii) Flash point
   (iii) Viscosity
   (iv) Density
13. Knowledge about Spectroscopy – UV – Vis and FTIR
14. TGA / DSC analysis of Rubber Compounds.
15. TLC Analysis

TOTAL : 60 PERIODS

RP 7511 PLASTICS PROCESSING AND TESTING LABORATORY

LIST OF EXPERIMENTS

PLASTICS PROCESSING
1. Compounding and Mixing of plastic and their characteristics.
2. Semi and Fully Automatic Injection Molding-Piston Type.
3. Injection moulding
4. Extrusion of plastics-Single screw and Twin screw extruder
5. Compression moulding
6. Composites-Hand lay-up technique Gelation
7. Study of Injection and Compression molds.
8. Study of machining of plastics
9. Study of Adhesive materials
10. Determination of gel point

TOTAL : 60 PERIODS

RP 7603 RUBBER PROCESSING AND MACHINERY

UNIT I COMPOUNDING AND MIXING OPERATIONS

UNIT II FORMING OPERATIONS

UNIT III MOULDING AND OTHER VULCANISING TECHNIQUES
Compression, transfer and injection moulding – Blanks & pre-heating techniques, preparation of surfaces for bonding. Curing: Autoclaves, Hot air chambers, curing of built up
articles, continuous vulcanization, L.C.M. (Liquid Curing Media), Fluidized Bed, microwave curing. Hand building and forming equipment for tank, pipe lining, roller covering.

UNIT IV PROCESSING METHODS FOR VARIOUS RUBBER PRODUCTS 15

UNIT V FINISHING OF RUBBER COMPONENTS – SAFETY IN RUBBER MACHINERY 5

TOTAL : 45 PERIODS

REFERENCES

RP 7604 RUBBER PRODUCT DESIGN

UNIT I DEFORMATION, LOADING AND RESPONSE
Spring rates- creep- stress relaxation- rubber in compression- simple geometries- blocks- geometry and materials on spring characteristics- metal bonded rubber assemblies- design for spring rates.

UNIT II DESIGN FOR COMBINED DEFORMATION
Rubber product in simple shear- axial shear- rotary shear- sleeves- bush for torsion loads- shear spring rates- compression and shear in combination- material selection.

UNIT III RUBBER DESIGN FOR DAMPING AND DYNAMIC CONDITION
Dynamic mechanical properties and media- hysteresis- heat generation- vibration control- damping- engine mounts, bearings and earthquake resistant bearings- compound design.

UNIT IV SEALS AND SEALABILITY OF RUBBER AND PRODUCT DESIGN
Rubber in fluid sealings- type of seals- static seals, gaskets- couplings, hose- profile- beltings- conveyor and power transmission- failure mechanism and remedial measures.

UNIT V DESIGN FOR THERMAL, SHEAR AND FLOW DEPENDENT REQUIREMENTS
Moulds for rubber products- compression molds- transfer molds- injection molds- rubber products for specialty applications- nuclear- aerospace- naval fields.

TOTAL : 45 PERIODS

REFERENCES

RP 7602 RUBBER AND PLASTICS TESTING

UNIT I PRINCIPLES OF SPECIFICATION

UNIT II TESTS ON RUBBER COMPOUNDS
UNIT III TESTS ON RUBBER VULCANISATES
Cured properties – Mechanical: Static properties –Hardness, tear, tensile application of test data and abrasion.
Fatigue – Flex cracking and cut growth – Heat build up – Principle and applications. Effect of environment – Oxygen, heat, ozone, low temperature and swelling media; Rubber to non-rubber substrate adhesions – Product and standard methods of testing.

UNIT IV PLASTICS TESTING - I

UNIT V PLASTICS TESTING- II

TOTAL : 60 PERIODS

REFERENCES

HS7551 EMPLOYABILITY SKILLS L T P C
3 0 0 3

COURSE DESCRIPTION
This course aims to help the students acquire the employability skills necessary for the workplace situations. It also attempts to meet the expectations of the employers by giving special attention to language skills, presentation skills, group discussion skills and soft skills. This will be achieved through expert guidance and teaching activities focusing on employability skills.

COURSE OBJECTIVES
- To enhance the employability skills of students with a special focus on presentation skills, group discussion skills and interview skills
- To help them improve their reading skills, writing skills, and soft skills necessary for the workplace situations
- To make them employable graduates

CONTENTS
UNIT I READING AND WRITING SKILLS
Reading: skimming & scanning strategies – note making skills – interpreting visual material (charts & tables) – critical reading – fast reading necessary for reading letters & files - preparing job applications - writing covering letter and résumé - applying for jobs online - email etiquette – writing official letters (placing an order, letters to consumers, etc. ) writing reports – collecting, analyzing and interpreting data
UNIT II  
SOFT SKILLS
9
Hard skills & soft skills – soft skills: self-management skills & people skills - training in soft 
skills - persuasive skills – sociability skills – interpersonal skills – team building skills – 
leadership skills – problem solving skills – adaptability - stress management – motivation 
techniques – life skills –

UNIT III  
PRESENTATION SKILLS
9
Preparing slides with animation related to the topic – organizing the material - Introducing 
one self to the audience – introducing the topic – answering questions – individual 
presentation practice— presenting the visuals effectively – 5 minute presentation

UNIT IV  
GROUP DISCUSSION SKILLS
9
Participating in group discussions – understanding group dynamics - brainstorming the topic 
— questioning and clarifying – GD strategies (expressing opinions, accepting or refusing 
others opinions, turn taking) – activities to improve GD skills – viewing recorded GD - mock 
GD

UNIT V  
INTERVIEW SKILLS
9
Interview etiquette – dress code – body language – mock interview –attending job 
interviews – answering questions confidently – technical interview – telephone/Skype 
interview - practice in different types of questions – one to one interview & panel interview – 
FAQs related to job interview- Emotional and cultural intelligence.

LEARNING OUTCOMES
• Students will be able to make presentations and participate in group discussions with 
high level of self-confidence.
• Students will be able to perform well in the interviews
• They will have adequate reading and writing skills needed for workplace situations

TOTAL : 45 PERIODS

REFERENCES:
1. Cornelissen, Joep. How to Prepare for Group Discussion and Interview. New Delhi: 
2. Dabreo, Desmond A. Group Discussion and Team Building. Mumbai: Better Yourself 
3. Ramesh, Gopalswamy, and Mahadevan Ramesh. The ACE of Soft Skills. New Delhi: 
5. Van Emden, Joan, and Lucinda Becker. Presentation Skills for Students. New York: 

EXTENSIVE READING
1. Covey, Stephen R. The 7 Habits of Highly Effective People. New York: Free Press, 
2013.

WEB RESOURCES
1. www.humanresources.about.com
2. www.careerride.com
The students will prepare using the rubber & rubber materials as appropriate using the process machinery and perform the tests for the properties as suggested in the following titles

Ex No: 1 Mixing behaviour of NR on two roll mill
Ex No: 2 Mixing study of carbon black filled NR
Ex No: 3 Mixing study of carbon black filled SBR
Ex No: 4 Mixing study of carbon black filled SBR & NR blend
Ex No: 5 Mixing study of carbon black filled EPDM
Ex No: 6 Mixing study of carbon black filled NBR
Ex No: 7 Extrusion characteristics of a filled rubber mix- NR
Ex No: 8 Extrusion characteristics of a filled rubber mix- SBR
Ex No: 9 Extrusion characteristics of a filled rubber mix- NBR
Ex No: 10 Extrusion characteristics of a filled rubber mix- EPDM
Ex No: 11 Curing Process of Rubber Compound- NR filled
Ex No: 12 Curing Process of Rubber Compound- SBR filled
Ex No: 13 Curing Process of Rubber Compound- NBR filled
Ex No: 14 Curing Process of Rubber Compound- EPDM filled

Note: 1. The students will be required to perform at least 12 experiments as listed above to qualify for practical examination.
2. The cured specimens prepared will be tested for hardness, resilience, tensile properties, tear strength, fatigue (crack initiation and propagation), abrasion resistance and hot air aging.
3. In the testing, the students will be required to perform at least one set of testing for NR and a synthetic rubber.

TOTAL : 60 PERIODS

UNIT I INTRODUCTION AND MATERIALS USED IN PMCs

UNIT II PROCESSING METHODS FOR FRPs

UNIT III MECHANICS OF COMPOSITES

UNIT IV TESTING AND CHARACTERISATION OF COMPOSITES
Mechanical properties- General test methods for tension, flexural, interlaminates shear stress, compression tests – elevated temperature tests – shear modulus, void content, resin content, fibre content, impact strength tests- Fractography

UNIT V APPLICATIONS OF COMPOSITES
Applications in aerospace, automotive, marine, civil engineering and electrical industry- Composite tooling - Rapid prototyping and Tooling.
REFERENCES

REFERENCES
UNIT I  INTRODUCTION TO RECYCLING  6

UNIT II  SORTING TECHNIQUES  8

UNIT III  RECYCLING MATERIALS- I  12
Nylon recycling – Chemical recycling – Mechanical recycling – applications Depolymerization-case studies (PMMA, PS, polyacetals)

UNIT IV  RECYCLING MATERIALS- II  11

UNIT V  RUBBER RECYCLING  8

TOTAL : 45 PERIODS

REFERENCES
All the students have to undergo practical industrial training of **Two weeks** duration in recognized establishments, at the end of which they have to submit a report. The internal assessment will be based on the report and presentation and the examination marks, on viva voce examination.

**TOTAL : 30 PERIODS**

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.

**TOTAL : 30 PERIODS**

**LIST OF EXPERIMENTS**

**I. DESIGN AND DRAWING OF MOULDS**
1. Hand Mould
2. Semi – Injection Mould
3. Automatic Mould – with working area calculations
4. Multi Cavity – Multiday Light Mould
5. Split Cavity – Finger Cam Mechanism
6. Split Cavity – Dog Leg Cam Mechanism
7. Split Cavity – Cam tract Actuation
8. Side Core – Hydraulic Actuation
9. Collapsible core – Mechanism
10. Gear Core – Mechanism
11. Compression Mould
12. Transfer Mould

**1. DESIGN AND DRAWING OF EXTRUSION DIES**
1) Hot and Cold Extrusions
2) Extrusion of Tubes and profiles

**II. ANALYSIS OF INJECTION MOULDING OF SIMPLE PRODUCTS USING MOULD ANALYSIS SOFTWARES**

**TOTAL : 60 PERIODS**
Each student will be assigned a project involving some design and fabrication work as well as theoretical and experimental studies on issues related to Rubber and Plastics 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.

TOTAL : 300

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 – electroanalytical techniques – cyclic voltammetry, chronamperometry 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

TOTAL : 45 PERIODS

REFERENCES
UNIT I  FUNDAMENTALS OF ADHESION  8
Adhesives – Fundamentals – types of substrates – mechanisms of setting, adhesive strength – thermodynamics of adhesives – concepts of surface energy, contact angle etc – types of joints – joint selection

UNIT II  NON REACTIVE ADHESIVES  10

UNIT III  REACTIVE ADHESIVES  10
Phenolics, epoxies, acrylics, anaerobics, cyanoacrylates – uses of adhesives in civil Engineering, automobile, aerospace, electrical & electronic industries.

UNIT IV  SURFACE COATINGS  9
Components of Paints – Preparations formulations, pigment dispersion, drying & film formation mechanisms, types of paints – based on emulsion, oil, alkyls, epoxies, PF, UF etc, Urethanes, Silicones – Primers like chlorinated rubber – applications, powder coatings.

UNIT V  SURFACE PREPARATION  8
Surface preparation for adhesion & painting, powder coatings, factors affecting coating properties, barrier properties – rheology & its importance, paint & adhesion performance testing.

REFERENCES

TOTAL : 45 PERIODS

RP7002  ADVANCED PLASTICS PROCESSING  L T P C  3 0 0 3

OBJECTIVES
To familiarize students with the latest plastics processing technologies.

UNIT I  ADVANCED INJECTION MOULDING PROCESS - I  9

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

UNIT III  ADVANCED BLOW MOULDING - I  9

UNIT IV ADVANCED BLOW MOULDING – II 9

UNIT V ADVANCED EXTRUSION PROCESSES 9

TOTAL : 45 PERIODS

OUTCOMES
At the end of the course, the students able to analysis the advance processing technique, end product application & it’s importance

REFERENCES

RP 7003 BIOPOLYMERS AND POLYMERS FROM RENEWABLE RESOURCES L T P C
3 0 0 3

UNIT I GREEN CHEMISTRY FOR POLYMERS 9

UNIT II RESOURCES FOR BIOPOLYMERS 9
Polysaccharide based polymers – Gelatinization – Starch based blends - Biodegradation of Starch based Polymers - Production of Lactic acid and Polylactide - Properties and applications of Polylactides – Introduction to Polyhydroxyalkanoates and their derivatives – Applications – Chitin & Chitosan and its derivatives as biopolymers

UNIT III PROTEINS, HEMICELLULOSE AND CELLULOSE BASED POLYMERS 9
Plant and animal based Proteins – Solution casting of proteins – Processing of proteins as plastics – preparation and properties of hemicellulose – Cellulose based Composites – Surface and Chemical modifications of Cellulose fibers

UNIT IV PACKAGING APPLICATIONS OF BIOPOLYMERS 9

UNIT V BIOPOLYMER APPLICATIONS FOR AGRICULTURE 9
Biopolymer Films – Biodegradable mulching – Advantages and Disadvantages - Chemical sensors – Biosensors - Functionalized Biopolymer Coatings and Films – Applications of biopolymers in horticulture

TOTAL : 45 PERIODS

REFERENCES

PR7551 STATISTICAL QUALITY CONTROL AND RELIABILITY ENGINEERING L T P C
3 0 0 3

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

UNIT I  STATISTICAL PROCESS CONTROL

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

UNIT III  EXPERIMENTAL DESIGN AND TAGUCHI METHOD

UNIT IV  RELIABILITY AND ITS PREDICTION

UNIT V  FAILURE DATA ANALYSIS
Real time distribution, exponential, normal, log normal, gamma and weibull – reliability data requirements – Graphical evaluation.

OUTCOME:
- Enable student to apply tools of statistics in analysis of experiments and data of industrial management interest.

TEXT BOOKS:

REFERENCES:

RP 7007  
FRACUTURE MECHANICS  
L T P C  
3 0 0 3  

UNIT I  
FATIGUE OF STRUCTURES  

UNIT II  
STATISTICAL ASPECTS OF FATIGUE BEHAVIOUR  
Low cycle and high cycle fatigue - Coffin - Manson’s relation - Transition life - cyclic strain hardening and softening - Analysis of load histories - Cycle counting techniques - Cumulative damage - Miner’s theory - Other theories.

UNIT III  
PHYSICAL ASPECTS OF FATIGUE  
Phase in fatigue life - Crack initiation - Crack growth - Final Fracture - Dislocations - fatigue fracture surfaces.

UNIT IV  
FRACTURE MECHANICS  
Strength of cracked bodies - Potential energy and surface energy - Griffith’s theory - Irwin - Orwin extension of Griffith’s theory to ductile materials - Stress analysis of “cracked bodies - Effect of thickness on fracture toughness” - Stress intensity factors for typical geometries.

UNIT V  
FATIGUE DESIGN AND TESTING  
Safe life and Fail-safe design philosophies - Importance of Fracture Mechanics in aerospace structures - Application to composite materials and structures.

REFERENCES  

RP 7008  
LATEX SCIENCE AND TECHNOLOGY  
L T P C  
3 0 0 3  

UNIT I  
LATEX CHARACTERISTICS AND CONCENTRATION METHODS  
Definition of Latex, classification, Latex particle size and distribution, stability and destabilization of lattices, Comparison between lattices and polymer solution; Natural rubber latex –origin, tapping, bulking and preservation, composition of field latex, properties, preservation, methods of concentrating latex - creaming, centrifuging, & evaporation,— Specification and testing- (National and ISO) for latex grades (ASTM D 1076 )

UNIT II  
LATEX COMPOUNDING  
Latex compounding-Ingredients, Preparation of Dispersions, Emulsion, Slurries; Machineries- Ball mill, Pearl mill; Preparation of latex compound and maturation; Prevulcanized latex, MG Latex, -Preparation, properties and application; Evaluation of the latex compound- Chloroform number, swelling index test; Design for latex products formulation.
UNIT III LATEX DIPPING PROCESS
Principle and types of dipping process, Dipping plant design, formers, sequence of operation, post processing; Manufacture of Condoms, Gloves, Catheters, Balloons-formulations, process, specification, testing and troubleshooting.

UNIT IV LATEX FOAM, SHEETING AND SPRAYING
Principle and Manufacture of Foam-Dunlop and Talalay process, Compound design-Process details, Foam properties, testing and defects, foam applications;
Latex sheeting; latex binders and carpet backing- Basics and process.

UNIT V EXTRUSION AND PRODUCTS BASED ON SYNTHETIC LATEX
Principle and Manufacture of latex elastic threads; latex tubing; latex casting process specification and testing, defects.
Synthetic latex- Types, properties, and application- surface coatings, adhesives, paper industries.

TOTAL : 45 PERIODS

REFERENCES

RP 7010 POLYMERS IN PACKAGING TECHNOLOGY

UNIT I INTRODUCTION TO PACKAGING
Definition, functions of packaging, types and selection of package, packaging hazards, interaction of package and contents, materials and machine interface, environmental and recycling considerations-Life cycle assessment; Package design-Fundamentals, factors influencing design, stages in package development.

UNIT II DIFFUSION AND PERMEABILITY
Diffusion-Types of diffusion, Fick’s law of diffusion and applications; Diffusion coefficients of gas, liquid and vapour in polymers and packaging films, techniques to measure diffusion coefficient in polymer interface; Polymer permeability, gaseous transport in polymers, permeability measurement.

UNIT III VARIOUS PACKAGING TECHNIQUES
PE,PP,EVA,EVOH,PVC,PVDC,PS,ABS,EPS,Polyester,Polyamide,PC,PPE,,Cellulosics,PEEK,TPE and PEN,PEI and LCP ;Biodegradable polymers- PLA,PGA,PCL,PHA and PHB and Foam based on PE,PP & PU -Properties and applications. Flex. and Rigid Packaging-Extrusion- Blown film, cast film, multi-layer film and sheet, lamination; Injection moulding; Blow moulding ;Thermoforming; Surface treatment for printing and printing processes.

UNIT IV SPECIALITY PACKAGING
Aerosol packaging, shrink and stretch wrapping, blister packaging, antistatic packaging, aseptic packaging, active packaging, modified atmospheric packaging, ovenable package, cosmetic package, hardware packaging, food packaging, textile packaging, health care packaging, export packaging.

UNIT V TESTING OF PACKAGING MATERIALS
Package Testing- Mechanical properties – Tensile and tear properties, Impact properties, Burst strength, Stiffness, Crease or flex resistance; Co-efficient of friction, Blocking Orientation and Shrinkage; Optical Properties – Clarity, Haze and gloss; Barrier Properties – Oxygen transmission, Water vapour transmission rate migration; Chemical resistance tests

TOTAL: 45 PERIODS

REFERENCES
UNIT I  PRINCIPLES OF PU CHEMISTRY AND SPECIAL APPLICATIONS  12
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  6
Polyols, isocyanates – Their preparation and characteristics, conversion products of the raw materials – Additives – Industrial hygiene –Principles of PU processing

UNIT III  PU FOAMS  9
Flexible foams-Their production-Equipment and process, properties and uses
Rigid foams-Production and properties-Relationship between production methods and properties, uses – Integral skin foams- RIM

UNIT IV  SOLID PU MATERIALS  9
Casting of PUs, TPUs- Chemistry, manufacturing, processing, compounding and uses, millable PUs-preparation, properties and uses

UNIT V  PU COATINGS AND ADHESIVES  9
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.

REFERENCES
Career planning and management.

UNIT IV DIRECTING
Foundations of individual and group behaviour—motivation—motivation theories—
motivational techniques—job satisfaction—job enrichment—leadership—types and theories
of leadership—communication—process of communication—barrier in communication—
effective communication—communication and IT.

UNIT V CONTROLLING
System and process of controlling—budgetary and non-budgetary control techniques—use
of computers and IT in Management control—Productivity problems and management—
control and performance—direct and preventive control—reporting.

TOTAL: 45 PERIODS

OUTCOMES:
- The student would have gained the ability to learn the different principles and
  techniques of management in planning, organizing, directing and controlling.

TEXT BOOKS:
2. JAF Stoner, Freeman R.E and Daniel R Gilbert “Management”, Pearson Education,

REFERENCES:

RP 7013 RUBBER COMPONENTS IN AUTOMOBILES

UNIT I INTRODUCTION
Identification of plastics/rubber components in automobiles—Function—Selection criteria.

UNIT II STRUCTURE-PROPERTY RELATIONSHIPS IN RUBBERS
Resilience, creep, hysteresis and damping, stability, set and stress relaxation, behaviour in
dynamic applications.

UNIT III VIBRATION AND RUBBER SPRING
Principles of vibration isolation—Rubber mounts—Spring design—Comparison with
metallic springs—Shape factor and its effect—Forced and free vibrations with damping—
Typical mounts, compounding and manufacture.

UNIT IV FLUID SEALINGS AND FLEXIBLE COUPLINGS AND HOSES
Seals for static and dynamic applications—Effect of heat/oil ageing—Frictional behaviour—
Fundamental of sealability.

UNIT V COMPOUNDING AND MANUFACTURE
Types of couplings—Specification and selection—Torque vs deflection relationship—Brake
fluid/hydraulic hoses, materials and manufacture.

TOTAL: 45 PERIODS

REFERENCES
3. Blow, C.M. and Hepburn C., “Rubber Technology and Manufacture”, Butterworth-
   Heinemann, 1982.
The scope of the subject will include studies on the following components:

- Cylinder head gasket: ACM, Silicon
- Oil Pan gasket: ACM
- Blow-by Circuit hose: NBR / PVC, CM, FKM/EVA, FKM/VMQ
- Vacuum Hose: CR, CM, AEM
- Oil Circuit and blow-by seals: AEM, FPM, HNBR
- Oil hose: AEM
- Oil filter base gasket: NBR, AEM and ACM
- Dipstick guide: HNBR
- Dipstick seal: NBR ,FPM
- Drain plug seal: NBR, ACM
- Air filter intake duct: TPV-(EPDM+PP)
- Throttle valve intake duct: TPV-(EPDM+PP), EPDM, NBR/PVC, CM, ECO
- Throttle valve seals: NBR
- Air intake manifold seals: NBR
- Cooling Hose: EPDM
- Cooling Seals: EPDM

GE7652 TOTAL QUALITY MANAGEMENT

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

OBJECTIVES
- To understand the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- To understand the TQM Principles.
- To learn and apply the various tools and techniques of TQM.
- To understand and apply QMS and EMS in any organization.

UNIT I INTRODUCTION
Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality - Definition of TQM - Basic concepts of TQM - Gurus of TQM (Brief introduction) - TQM Framework - Barriers to TQM - Benefits of TQM.

UNIT II TQM PRINCIPLES

UNIT III TQM TOOLS & TECHNIQUES I

UNIT IV TQM TOOLS & TECHNIQUES II
Quality circles -- Quality Function Deployment (QFD) -- Taguchi quality loss function -- TPM -- Concepts, improvement needs -- Performance measures-- Cost of Quality - BPR.
UNIT V QUALITY MANAGEMENT SYSTEM


TOTAL: 45 PERIODS

OUTCOMES:

Ability to apply TQM concepts in a selected enterprise.
Ability to apply TQM principles in a selected enterprise.
Ability to apply the various tools and techniques of TQM.
Ability to apply QMS and EMS in any organization.

TEXT BOOK:

REFERENCE BOOKS:

AE7071 EXPERIMENTAL STRESS ANALYSIS

OBJECTIVE:
- To study the various experimental techniques involved for measuring displacements, stresses, strains in structural components.

UNIT I EXTENSOMETERS AND DISPLACEMENT SENSORS

Principles of measurements, Accuracy, Sensitivity and range of measurements, Mechanical, Optical, Acoustical and Electrical extensometers and their uses, Advantages and disadvantages, Capacitance gauges, Laser displacement sensors.

UNIT II ELECTRICAL RESISTANCE STRAIN GAUGES

Principle of operation and requirements, Types and their uses, Materials for strain gauges, Calibration and temperature compensation, cross sensitivity, Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators, Rosette analysis, stress gauges, load cells, Data acquisition, six component balance.

UNIT III PHOTOELASTICITY

Two dimensional photo elasticity, Photo elastic materials, Concept of light - photoelastic effects, stress optic law, Transmission photoelasticity, Jones calculus, plane and circular polariscopes, Interpretation of fringe pattern, Calibration of photoelastic materials, Compensation and separation techniques, Introduction to three dimensional photo elasticity.

UNIT IV BRITTLE COATING AND MOIRE TECHNIQUES

Relation between stresses in coating and specimen, use of failure theories in brittle coating, Moire method of strain analysis.
UNIT V  NON – DESTRUCTIVE TESTING
Fundamentals of NDT, Acoustic Emission Technique, Radiography, Thermography, Ultrasonics, Eddy Current testing, Fluorescent Penetrant Testing,

TOTAL: 45 PERIODS

OUTCOMES:
- Knowledge of stress and strain measurements in loaded components.
- Acquiring information's the usage of strain gauges and photo elastic techniques of measurement.
- Knowledge in NDT in stress analysis.

TEXT BOOKS:

REFERENCES:

RP 7006  FINITE ELEMENT ANALYSIS FOR POLYMERS  L T P C
3 0 0 3

UNIT I  INTRODUCTION  8
Review of various approximate methods – Raleigh Ritz’s, Galerkin and finite difference methods- Governing equation and convergence criteria of finite element method.

UNIT II  DISCRETE ELEMENTS  10
Bar elements, uniform sections, mechanical and thermal loading, varying section, truss analysis, Beam element- problems for various loadings and boundary conditions – longitudinal and lateral vibration – use of local and natural coordinates

UNIT III  CONTINUUM ELEMENTS  8
Plane stress, plane strain and axisymmetric problems. Derivation of element matrices for constant and linear strain triangular elements and axisymmetric elements

UNIT IV  ISOPARAMETRIC ELEMENTS & FIELD PROBLEM  10
Definitions, shape function for 4,8 nodal quadrilateral elements, stiffness matrix and consistent load vector, Gaussian integration Heat transfer problems, steady state fin problems

UNIT V  NON LINEAR ANALYSIS  9
Elastomers- Elastic material model correlation-Terminology-Types of FEA models-Model building- Non linear material behavior- Boundary conditions-Applications-case studies

TOTAL : 45 PERIODS

REFERENCES

RP 7005 ENTREPRENEURSHIP DEVELOPMENT L T P C
3 0 0 3

UNIT I INTRODUCTION

UNIT II FEASIBILITY STUDY

UNIT III PRODUCT DESIGN AND DEVELOPMENT
Physical reliability – Functional aesthetic, production and economic cost aspect value analysis – Product analysis and specifications.

UNIT IV DISTRIBUTION
Sales strategies – Sales organization – Distribution channels – After sales service.

UNIT V FINANCE AND CAPITAL REQUIREMENTS
Price fixation – Cash flow statement – Return on investment – Sources of finance – Execution of project and commencement of production – Organization and institutions promoting entrepreneurship in India.

TOTAL : 45 PERIODS

REFERENCES
1. Mossis Asimow, Engineering Design.
2. Woodson, T.T., Introduction to Engineering.

RP7014 TECHNOLOGY OF FOOTWEAR L T P C
3 0 0 3

UNIT I PRODUCTION OF FOOTWEAR
Operations involved in making footwear – ‘Built-up’ footwear – DVP/DIP (Direct Vulcanising / Direct injection Moulding) process – Materials used in manufactures of footwear (Other than rubber)

UNIT II ADHESIVES AND SYNTHETIC FABRICS IN FOOTWEAR
Fabrics used – Cotton, Rayon, Nylon, Polyester – treatment of textiles for combining with rubber – types of adhesives water, chloroprene, NBR, PU passed adhesives – NR and synthetic rubber latex based adhesives.

67
UNIT III  CELLULAR AND MICROCELLULAR MATERIALS  10
Natural and Synthetic Rubber based microcellular materials – PU, PVC, EVA in microcellular
soling – Direct vulcanizing / injection processes.

UNIT IV  MANUFACTURE OF FOOTWEAR COMPONENTS  8
Process manufacture of different footwear – traditional and modern methods

UNIT V  SPECIALITY SHOES  8
Sports / athletics shoes, mountaineering / hiking shoes, fireman, hospital (operating theatre)
and oil refinery shoes.

TOTAL : 45 PERIODS

REFERENCES
   1970.
2. Blakeman, J., “An Introduction to applied Science for Boot and Shoe Manufacture”, The

GE7073  FUNDAMENTALS OF NANOSCIENCE  L T P C  3 0 0 3

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

UNIT I  INTRODUCTION  8
Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and
Engineering-Classifications of nanostructured materials- nano particles- quantum dots,
nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on
properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to
properties and motivation for study (qualitative only).

UNIT II  GENERAL METHODS OF PREPARATION  9
Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical
Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering,
Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III  NANOMATERIALS  12
Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, 92 Single
wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of
synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property
Relationships applications- Nanometal oxides-ZnO, TiO_2, MgO, ZrO_2, NiO, nanoalumina,
CaO, AgTiO_2, Ferrites, Nanoclays-functionalization and applications-Quantum wires,
Quantum dotspreparation, properties and applications

UNIT IV  CHARACTERIZATION TECHNIQUES  9
X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques,
Transmission Electron Microscopy including high-resolution imaging, Surface Analysis
techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

UNIT V  APPLICATIONS  7
NanInfoTech: Information storage- nanocomputer, molecular switch, super chip,
nanocrystal, Nanobiotechnology: nanoprobes in medical diagnostics and biotechnology, Nano
medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems
(MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver
for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar
cell, battery

TOTAL : 45 PERIODS
OUTCOMES:
Upon completing this course, the students
• Will familiarize about the science of nanomaterials
• Will demonstrate the preparation of nanomaterials
• Will develop knowledge in characteristic nanomaterial

TEXT BOOKS

REFERENCES

RP 7004 DESIGN OF MACHINE ELEMENTS L T P C
3 0 0 3

OBJECTIVE
• To expose the students to the design and theory of common machine elements and to practice the students in solving design problems involving various machine elements.

UNIT I INTRODUCTION

UNIT II DESIGN OF JOINTS
Design of Bolts under Static load, Design of bolt with tightening/initial stress, Design of bolts subjected to fatigue – keys – types, selection of square and flat keys – Design of riveted joints and welded joints

UNIT III DESIGN OF SHAFTS, COUPLINGS AND BRAKES
Design of shaft – for static and varying loads, for strength and rigidity – Design of Coupling – types- flange, Muff and flexible rubber bushed coupling – Design of Brakes - Block and Band brakes

UNIT IV DESIGN OF TRANSMISSION ELEMENTS
Design of Spur, Helical, Bevel and Worm gear drives – Design of belt drives – flat and V belts

UNIT V SPRINGS AND BEARINGS

TOTAL : 45 PERIODS

TEXT BOOK
REFERENCES

RP 7012 PRODUCTION DESIGN AND COST ESTIMATION

UNIT I INTRODUCTION TO PRODUCT DEVELOPMENT

UNIT II PROCESS PLANNING

UNIT III ESTIMATING, COSTING AND ELEMENTS OF COST

UNIT IV ANALYSIS OF OVERHEAD EXPENSES

UNIT V AN OVERVIEW ON INTELLECTUAL PROPERTY RIGHTS

TOTAL : 45 PERIODS

REFERENCES

GE7071 DISASTER MANAGEMENT

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

UNIT I  INTRODUCTION TO DISASTERS  9
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don’ts during various types of Disasters.

UNIT II  APPROACHES TO DISASTER RISK REDUCTION (DRR)  9
Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional 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  9
Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV  DISASTER RISK MANAGEMENT IN INDIA  9
Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V  DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS  9
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:
The students will be able to
• Differentiate the types of disasters, causes and their impact on environment and society
• Assess vulnerability and various methods of risk reduction measures as well as mitigation.
• Draw the hazard and vulnerability profile of India, Scenarios in the Indian context,
• Disaster damage assessment and management.

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

GE7074  HUMAN RIGHTS  L T P C  3 0 0 3

OBJECTIVES:
• To sensitize the Engineering students to various aspects of Human Rights.

UNIT I  9
Human Rights – Meaning, origin and Development. Notion and classification of Rights
Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural
Rights; collective / Solidarity Rights.

UNIT II  9

UNIT III  9
Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV  9
Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V  9
Human Rights of Disadvantaged People – Women, Children, Displaced persons and
Disabled persons, including Aged and HIV Infected People. Implementation of Human
Rights – National and State Human Rights Commission – Judiciary – Role of NGO’s,
Media, Educational Institutions, Social Movements.

TOTAL : 45 PERIODS

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

REFERENCES:

GE7072  FOUNDATION SKILLS IN INTEGRATED PRODUCT  L T P C  3 0 0 3
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

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UNIT I  FUNDAMENTALS OF PRODUCT DEVELOPMENT  
9  

UNIT II  REQUIREMENTS AND SYSTEM DESIGN  
9  

UNIT III  DESIGN AND TESTING  
9  

UNIT IV  SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT  
9  

UNIT V  BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY  
9  

TOTAL: 45 PERIODS

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:  