DEPARTMENT OF CHEMISTRY
ANNA UNIVERSITY, CHENNAI

VISION
The Department of Chemistry at Anna University shall strive towards attaining world class status and recognition by producing students with sound knowledge, professional skills, high levels of integrity and ethical values. The Department shall provide an outstanding ambience for teaching, research and consultancy. The Department shall perform frontier research and create knowledge base in theoretical and applied chemistry, polymeric and catalytic materials, fuel and energy related processes and materials, environmental chemistry and other transdisciplinary areas of technological importance.

MISSION
The Department of Chemistry, Anna University shall contribute to the educational, economic and social development:

- By producing postgraduates and Doctorates who are equipped with thorough knowledge in Chemistry, analytical thinking, practical skills and ethics.
- By inspiring the students to be creative thinkers, inspirational role models and citizens with environmental and social consciousness.
- By introducing high quality academic and research programmes in Chemistry and enabling interaction with experts from around the world in the fields of Chemistry.
- By ensuring a supportive ambience in the Department with dynamic leadership and growth opportunities to meet the needs of the students, faculty and staff.
- By promoting the development of technologically and socially relevant processes and products in the fields of catalysis, polymers, corrosion resistance coatings and energy conversion through academic and sponsored research, in collaboration with global research groups.
- By sharing the intellectual resources and infrastructural facilities of the Department of Chemistry among the academic fraternity of the University campus and other Institutions, among the industrial research groups, funding agencies and the Government.
- By facilitating collaborative partnership with industries and other institutions and catalyse innovation, transfer of technology and commercialization towards fulfilling societal developments.
- By benchmarking the teaching-learning and research processes and their outcomes against the Global standards and improvising on them with a clear view towards continuous development.
ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS

M. Phil. CHEMISTRY
REGULATIONS – 2019
CHOICE BASED CREDIT SYSTEM

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

• To provide a specialization in pre-doctoral degree with advanced understanding in the concepts of organic, inorganic and physical chemistry.
• To impart the necessity of literature survey for research and a broad understanding of atomic and molecular spectroscopy and familiarize with crystal chemistry, stereochemistry, catalysis and photophysical processes.
• To provide comprehensive knowledge on chemical kinetics, polymeric materials, specialty polymers, thermal and chromatographic techniques.
• To gain knowledge on electro-analytical methods, water pollution, sludge handling and disposal and applications of nano-materials.

PROGRAMME OUTCOMES (POs):

• Candidates completing the Master of Philosophy in Chemistry will be acquired knowledge, general competence and analytical skills at an advanced level targeting future employment in research, industry, teaching or public administration.
• In-depth chemical knowledge and research experience within a specialized field of chemistry through a supervised master project.
• Knowledge on relevant methods applied for solving analytical and chemical problems within topical research fields.
• Students get motivated to handle sophisticated instruments and their take up highlighted jobs in industry.
### ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS

M. Phil. CHEMISTRY

REGULATIONS – 2019

CHOICE BASED CREDIT SYSTEM

CURRICULA AND SYLLABI

#### SEMESTER I

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**TOTAL NUMBER OF CREDITS TO BE EARNED FOR THE AWARD OF DEGREE – 33**

#### PROGRAM CORE COURSES (PCC)

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Total Credits: 17

### SUMMARY

#### M.PHIL. CHEMISTRY (FT)

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OBJECTIVES

- To train students in kinetics of homogeneous reactions and electro analytical methods and its applications.
- To impart knowledge on organometallic compounds and reactive intermediates.
- To know the students about reagents in organic synthesis.

UNIT I  KINETICS

UNIT II  ELECTRO ANALYTICAL METHODS

UNIT III  ORGANOMETALLIC COMPOUNDS
Organometallic compounds: Nomenclature, structure, reactivity, basicity - synthesis and applications of organolithium, organoboron, organoaluminium, organoberyllium, organomagnesium,organotin and organosilicon compounds, bioorganic metallic compounds, fluxional organometallic compound.

UNIT IV  REACTIVE INTERMEDIATES

UNIT V  REAGENTS IN ORGANIC SYNTHESIS
Reagents in organic synthesis: Uses of NBS, lithium diisopropylamide, aluminium isopropoxide, lithium aluminium hydride, potassium tertiary butoxide and trimethylsilyl iodide. Reagents containing P,S, B, Si - protecting groups – hydroxyl, amino, carbonyl and carboxylic acid.synthetic analysis and planning – control of stereochemistry.

TOTAL: 60 PERIODS

OUTCOMES

- Will have an understanding of the various methods available in all branches of chemistry.
- Will be able to use organometallic compounds appropriately
- Will capable of running an organic synthesis process

REFERENCE:


CX5102 RESEARCH METHODOLOGY AND ANALYTICAL TECHNIQUES

OBJECTIVES

- To make the student conversant with the literature for research and atomic spectroscopy for qualitative and quantitative analysis.
- To enable students know about the molecular spectroscopy for qualitative and quantitative analysis and also advanced spectroscopy.
- To acquire knowledge of thermal and chromatographic techniques.

UNIT I LITERATURE FOR RESEARCH


UNIT II ATOMIC SPECTROSCOPY FOR QUALITATIVE AND QUANTITATIVE ANALYSIS

Atomic energy levels-flame emission spectrophotometry – Theory, Instrumentation(Source, Types of burners, types of fuels, etc.), Interferences (Chemical, radiation and excitation interferences), qualitative, quantitative analysis (Standard addition method, internal standard method) and applications. Atomic absorption Spectroscopy – Theory(Different processes in flame), Instrumentation, (Hollow cathode lamp, chopper etc.), background correction qualitative, quantitative and applications.

UNIT III MOLECULAR SPECTROSCOPY FOR QUALITATIVE AND QUANTITATIVE ANALYSIS

Molecular energy levels - electronic transitions UV- Vis spectroscopy – Beer-Lambert’s law (applications and limitations), quantitative analysis of Fe, Ni and nitrite, electronic transitions in organic and inorganic molecules– Woodward Fieser rules for dienes and carbonyl compounds-Spectrophotometric titrations – Multicomponent analysis.IR Spectroscopy – principles, instrumentation and qualitative analysis by IR, FTIR spectrophotometer.

UNIT IV MAGNETIC RESONANCE SPECTROSCOPY AND MASS SPECTROSCOPY

UNIT V THERMAL METHODS AND CHROMATOGRAPHIC TECHNIQUES

Thermal methods – TGA, DTA and DSC techniques – principles, instrumentation and applications -chromatographic techniques – CC, TLC, GC, PC and HPLC.

OUTCOMES

- Will become adept in mining information from literature source available
- Will gain a broad idea about spectroscopy for qualitative and quantitative analysis of material
- Will be conversant with thermal and chromatographic techniques.

REFERENCES:


CX5001 ADVANCED ORGANIC CHEMISTRY

OBJECTIVES

- To familiarize the students with the stereochemistry and reactive intermediates.
- To provide the importance of industrial applications of oxidation and reduction reactions
- To provide exposure to the students in understanding organometallic and organic synthesis and applications of spectral techniques.

UNIT I STEREOCHEMISTRY

Introduction to molecular symmetry and point groups. Topicity and prostereoisomerism, nomenclature of stereotopic ligands and faces, stereoheterotopic ligands – centre of chirality, assignment of absolute stereochemistry, axial chirality, planar chirality and helicity. Conformational analysis – acyclic systems, cyclic systems, cyclohexane and decalins. Conformation and reactivity with examples. Stereoselectivity – classification, terminology, principle of stereoselectivity, examples of diastereoselectivity and enantiomeric selectivity including few examples from pericyclic reactions.

UNIT II REACTIVE INTERMEDIATES

Formation, stability and reactions involving carbonium ions, carbanions, carbenes, nitrenes and radicals – Generation of enolates, enolateselectivities, alklylation of enolates and stereochemistry of enolate alkylation. Mechanism of ester hydrolysis (only $B_{AC}^2$, $A_{AC}^2$ and $A_{AL}^1$). Alklylation of active methylene compounds. Assymmetric alkylation (Evans, Enders and Meyers procedures). Preparation and synthetic utility of enamines - Finkelstein reaction.
UNIT III  OXIDATION AND REDUCTION REACTIONS  12
Oxidation with Cr and Mn reagents – oxidation with LTA, DDQ and SeO₂ – oxidation using DMSO either with DCC or Ac₂O or oxaly chloride, oxidation using Dess – Martin reagent – vicinal hydroxylation of olefinic double bonds – Woodward and Prevost procedures – epoxidation using peracids including Sharpless procedure, ozonolysis. Reduction using various reagents – hydrogenation, hydration of carbon – carbon double and triple bonds – asymmetric reduction of carbonyl functions

UNIT IV  ORGANOMETALLIC CHEMISTRY FOR ORGANIC SYNTHESIS  12
Fundamental concepts in transition metal chemistry for organic synthetic transformations – metal carbenes, synthesis, reactivity, cycloaddition reactions of metal carbenes, synthesis of fused ring systems, Dotz reaction, mechanism of ring formation, application of cobalt carbonyls in organic synthesis, PausonKhandreaction, Volhardt reaction, Pearson reaction, use of Organoiron complexes for stereo specific synthesis of substituted cyclic compounds

UNIT V  APPLICATIONS OF SPECTRAL TECHNIQUES  12
Principles and applications of UV – Visible, IR, NMR, EPR, XRD and Mass spectrometry in the determination of structure of organic molecules-Optical rotatory dispersion and its applications.

TOTAL: 60 PERIODS

OUTCOMES
- Will be capable of applying stereochemistry and reactive intermediates.
- Will be able to appreciate the significance of oxidation and reduction reactions.
- Will get a general idea about organometallic and organic synthesis and applications of spectral techniques.

REFERENCES

CX5002  ADVANCED PHYSICAL CHEMISTRY  L  T  P  C
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OBJECTIVES
- To familiarize the students with the catalysis and photochemistry.
- To provide the importance of industrial applications of photochemistry and bio-physical chemistry.
- To provide exposure to the students in understanding macromolecular dynamics.

UNIT I  CATALYSIS  12
UNIT II  PHOTOCHEMISTRY  12
Interaction of light with molecules, radiative and non-radiative processes. Fluorescence-
mechanism – resonance fluorescence – sensitized fluorescence – Quenching of fluorescence

UNIT III  INDUSTRIAL APPLICATIONS OF ELECTROCHEMISTRY  12
Electrometallurgy – electrowinning – electrowinning of gold, copper, electrorefining of
– Li-ion battery, gel lead acid battery.

UNIT IV  BIO-PHYSICAL CHEMISTRY  12
Thermodynamics of biochemical reactions – binding of oxygen by hemoglobin. Electrophoresis-
types – paper electrophoresis – cellulose acetate electrophoresis – gel electrophoresis – applications
– analytical use – uses in molecular biology.

UNIT V  MACROMOLECULAR DYNAMICS  12
Smoluchowski equation – thermodynamics of polymers solution – Flory – Huggin theory.

TOTAL: 60 PERIODS

OUTCOMES
• Will be capable of applying catalyst and photochemistry in an industry.
• Will be able to appreciate the significance of photochemistry and bio-physical chemistry
  in an industry.
• Will get a general idea about macromolecular dynamics.

REFERENCES
   (2000).
5. C.M. Starks, Phase transfer catalysis – Principles and Techniques Academic Press,
   (2004).

CX5003  ADVANCES IN NANOCHEMISTRY AND NANOTECHNOLOGY  L T P C
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OBJECTIVES
• To introduce the students about nanochemistry and nanomaterials synthesis.
• To teach the importance of characterization of nanomaterials
• To teach the students importance of applications of nanomaterials.

UNIT I  INTRODUCTION TO NANOCHEMISTRY  12
Importance of surface – particle shape and surface – surface and volume – atomic structure
and particle orientation – energy at nanoscale – the material continuum (zero, one and two
dimensional materials) – nanothermodynamics – chemical interactions at the nanoscale –
supermolecular chemistry.
UNIT II   NANOMATERIALS SYNTHESIS  

UNIT III   NANOMATERIALS CHARACTERIZATIONS  
Structural characterization (XRD, SAXS, SEM, TEM, SPM) – chemical characterization (optical spectroscopy, electron spectroscopy, ionic spectrometry) – surface characterization (XPS, AES, SIMS).

UNIT IV   ADVANCED NANOMATERIALS AND PROPERTIES  

UNIT V   APPLICATIONS OF NANOMATERIALS  
Nanocatalysis (transition metal nanoparticles in catalysis, aerogel supported nanoparticle in catalysis, multi metallic nanoparticles in catalysis) – organic/polymeric field–effect–transistors (FET) – polymer based nanocomposites – nano biosensors and energy materials.

TOTAL:60 PERIODS

OUTCOMES
• Will be aware of the synthesis of nanomaterials.
• Will have clear understanding of nano tube, nano wires and nano composites.
• Will have an idea of the various fields where nanotechnology can be applied.

REFERENCES
OBJECTIVES

- To impart knowledge on metal ions in biological systems and metalloenzymes.
- The students must know about oxygen transport and proteins in electron transport.
- To make the student conversant with the chemotherapy.

UNIT I  METAL IONS IN BIOLOGICAL SYSTEMS  12
Survey of metal ions, metal ion transport – passive and active transport – sodium and potassium ion pumps; transport proteins – ionophores; storage proteins – iron, copper and calcium.

UNIT II  METALLOENZYMES  12
Structure, active site and general mechanism of catalytic activity – kinetic aspects – ATP hydrolysis, acid catalysis – carboxypeptidases, oxaloacetate decarboxylase.

UNIT III  OXYGEN TRANSPORT  12
Hemoglobin, myoglobin, iron coordination chemistry – Perutz mechanism; hemocyanin, hemeerythrin. Ferredoxin and Rubredoxin

UNIT IV  PROTEINS IN ELECTRON TRANSPORT  12

UNIT V  CHEMOTHERAPY  12
Toxicity and carcinogenicity of metal ions – deficiency, defects and therapy – role of metal ions in diagnosis and treatment – metal complexes and chelating agents in medicine.

TOTAL: 60 PERIODS

OUTCOMES

- Will gain in-depth understanding of the role of metal ions in biological systems.
- Understands the function of oxygen transport and proteins in electron transport.
- Will have a wide knowledge about chemotherapy.

REFERENCES


OBJECTIVES

- Students should be conversant with the overview of bio separations and enzyme isolation.
- Students must know about the enzyme purification and also about electro kinetic methods.
- To teach finishing operations.
UNIT I  OVERVIEW OF BIO SEPARATIONS

UNIT II  ENZYME ISOLATION
Isolation of products – membrane process – dialysis, ultra filtration, reverse osmosis and electro dialysis; adsorption – adsorption isotherms, batch and fixed bed adsorption, extraction and aqueous two phase extractions, precipitation – salting out, organic solvent mediated precipitation, selective denaturation and large scale precipitations.

UNIT III  ENZYME PURIFICATION
Product purification – Chromatography – principles of chromatographic separation – gel filtration, reversed phase, hydrophobic interaction, ion exchange IMAC and bio affinity chromatographic techniques.

UNIT IV  ELECTRO KINETIC METHODS
Electrophoretic separation – gel electrophoresis – analytical and preparative scale, capillary electrophoresis, isoelectronic focusing.

UNIT V  FINISHING OPERATIONS
Final product purification and formulation – crystallization; drying and lyophilisation; formulation strategies.

TOTAL: 60 PERIODS

OUTCOMES
• Will be capable of employing bio separations and enzyme isolation practices available.
• Will gain in depth knowledge about enzyme and its action.
• Will be capable of planning final product purification and formulation processes.

REFERENCES
OBJECTIVES

- To make the students conversant with the fundamentals of catalysis and also catalyst synthesis.
- To make the students knowledgeable in catalysts characterization and catalytic reactors.
- To familiarize the students with the catalytic reactions.

UNIT I  FUNDAMENTALS OF CATALYSIS


UNIT II  SYNTHETIC METHODS


UNIT III  CATALYSTS CHARACTERIZATION

BET – surface area and pore size distribution - XRD, XPS, Auger electron spectroscopy, X-ray absorption spectroscopy EXAFS, X-ray fluorescence, Electron probe micro analysis - Electron microscopy, Mossbauer spectroscopy, Temperature programmed techniques – TPD, TPR, TPS, TPO - MAS NMR - $^{29}\text{Si}, ^{31}\text{P}, ^{27}\text{Al}$-, LEED, EELS scanning probe microscopy, STM, AFM, SEM, TEM, DRS UV-Vis and DRIFT spectroscopy.

UNIT IV  CATALYTIC REACTORS

Integral and fixed bed reactors – Two-Phase Reactors, Three- Phase Reactors, Suspension Reactors – Reactors for Homogeneously Catalyzed Reactions. Stirred flow reactors – micro catalytic reactors of pulse type - static reactors - Reaction monitoring by GC.

UNIT V  CATALYTIC REACTIONS


TOTAL: 60 PERIODS

OUTCOMES

- Will have in depth knowledge about the catalyst available and their application.
- Will know the characterization techniques.
- Will be able to define conditions of catalytic activity in the industrial environment.

REFERENCES

OBJECTIVES
- The students should be conversant with the Chemistry of environmental toxicology
- To impart knowledge on water pollution and wastewater treatment.
- To know the students about Sludge handling and disposal.

UNIT I  ENVIRONMENTAL SEGMENTS 12

UNIT II  CHEMICAL TOXICOLOGY 12

UNIT III  WATER POLLUTION 12
Water quality parameters and standards – turbidity, color, pH, acidity, solids, hardness, chlorides, residual chlorine, sulphates, fluorides, phosphates, iron and manganese, nitrogen, DO, BOD, COD, grease, volatile acids – analytical techniques in water analysis – soil pollution.

UNIT IV  WASTEWATER TREATMENT 12

UNIT V  SLUDGE HANDLING AND DISPOSAL 12

TOTAL: 60 PERIODS

OUTCOMES
- Will have a clear understanding of environmental pollution.
- Will be able to discuss pollution abatement methods.
- Will be capable of developing skills and technology towards green chemistry.

REFERENCES
OBJECTIVES

- To impart knowledge on enzyme isolation and enzyme immobilization.
- To make the student conversant with enzyme catalysis and industrial enzymes.
- To acquaint the student with enzyme reactors.

UNIT I  ENZYME ISOLATION 12
Sources of enzymes; enzyme extraction; principles of enzyme assays and kinetics studies; effects of enzyme concentration; expression of enzyme activity; effect of substrate concentration.

UNIT II  ENZYME IMMOBILIZATION 12
Immobilization techniques; Adsorption; entrapment; covalent cross – linking with bi or multifunctional reagents; covalent coupling to polymeric supports.

UNIT III  ENZYME CATALYSIS 12
Immobilized enzyme catalytic reactor design, enzyme catalysis in aqueous and non-aqueous solvents, polymerization esterification, ester hydrolysis; peptide synthesis.

UNIT IV INDUSTRIAL ENZYMES 12
Production, applications in various industries, food processing; bakery products, dairy products, brewing; leather industry detergents, enzyme in medicine diagnostics, enzyme sensors, Biosensors; Use of enzymes in analysis – types of sensing – gadgetry and method, Use of unnatural substrates – artificial enzymes – enzyme mimicking.

UNIT V  ENZYME REACTORS 12
Design and operation of ideal reactors – CSTR and PER; design and packed bed and fluidized – bed immobilized enzyme reactors: membrane reactors for immobilized enzyme systems.

TOTAL: 60 PERIODS

OUTCOMES

- Will gain in depth knowledge about enzyme and its action.
- Will gain in knowledge of enzymes, their kinetics and action in general
- Will be a position to use enzymes in the industry.

REFERENCES

OBJECTIVES

- Impart knowledge on chemical kinetics and isotopic effects on kinetics.
- The students must know about structure and reactivity relationship.
- To make the student conversant with organic reaction mechanisms and photochemical reactions.

UNIT I CHEMICAL KINETICS


UNIT II KINETIC ISOTOPE EFFECTS


UNIT III STRUCTURE AND REACTIVITY RELATIONSHIP


UNIT IV ORGANIC REACTION MECHANISMS


UNIT V PHOTOCHEMICAL REACTIONS


OUTCOMES

- Will be able to apply kinetics to study organic reaction mechanisms.
- Will be capable of correlating structure and reactivity of a compound.
- Will get a general idea about photochemical processes.

REFERENCES

OBJECTIVES

- To make the students conversant with the basic concepts of polymer science and copolymerization.
- To familiarize the students with the crystalline and amorphous polymers and also processing of polymers.
- To acquaint the students with the specialty polymers.

UNIT I  BASIC CONCEPTS OF POLYMER SCIENCE  12
Classification of polymers – chain polymerization – mechanism of free radical, cationic, anionic and co-ordination polymerization – Living polymers- atom transfer radical polymerization (ATRP)– chain transfer reaction and constant – Alfin catalysts – Initiator – Step-growth polymerization-kinetics of esterification in presence and absence of external catalyst.

UNIT II  COPOLYMERIZATION  12

UNIT III  CRYSTALLINE AND AMORPHOUS POLYMERS  12
Crystalline and amorphous polymers-factors affecting crystallinity and crystallizability -effect on polymer properties. Glass transition temperature- thermal transitions -Determination of Tg and Tm – factors affecting Tg Polymer characterization by IR, NMR, TGA, DTA and DSC – Molecular weight of polymers and its distribution – molecular weight determination by GPC and Viscosity measurement- Mark – Houwink equation.

UNIT IV  SPECIALTY POLYMERS  12

UNIT V  PROCESSING OF POLYMERS  12
Compounding of polymers, moulding techniques – compression, injection, extrusion, blow moulding, rotational moulding, thermoforming, vacuum forming, calendaring, casting, reaction injection moulding, injection blow moulding and lamination.

TOTAL: 60 PERIODS
OUTCOMES

- Will be aware of preparation and properties of polymers at length.
- Will be able to methodically discuss moulding techniques.
- Will develop capacity to characterize polymers and draw a parallel to their properties

REFERENCES


CX5011 PRINCIPLES OF BIOCHEMISTRY L T P C
4 0 0 4

OBJECTIVES

- To provide exposure to the students to understand concepts of carbohydrates and lipids and also proteins..
- To make the students conversant with enzymes and also nucleic acids.
- To impart knowledge on metabolism and energetics

UNIT I CARBOHYDRATES AND LIPIDS
Basic concepts of biochemistry – Biomolecules and their interactions with water and other biological substances, carbohydrates – Mono, di,oligo and polysaccharides, complex carbohydrates, Lipids – properties and structure of glycerolipids, phospholipids, sphingolipids, glycolipiods, steroids and prostaglandin.

UNIT II PROTEINS
Properties and structure of amino acid, peptides, proteins and conjugated proteins. Protein conformation: Native conformation of protein molecules, the secondary structure of fibrous protein, the alpha helix, beta pleated sheet, collagen helix, tertiary structure of globular proteins, quaternary structure of oligomeric proteins.

UNIT III ENZYME KINETICS
Enzyme synthesis, isolation and purification, effect of charge and hydrophobicity, activity and turnover number. Enzyme kinetics: Michaelis–Menton equation, K_m, enzyme denaturation, enzyme regulation and activities; occurrence, structure, properties and functions of coenzymes and cofactors.
UNIT IV  NUCLEIC ACIDS  12

UNIT V  METABOLISM AND ENERGETICS  12
Carbohydrate, lipid, protein and nucleic acid metabolism inter-conversion of biological substance, glycolysis, TCA cycle, oxidation of fatty acids in animal tissues, urea cycle, respiratory chain, ATP cycle and other energy rich compounds.

TOTAL: 60 PERIODS

REFERENCES

CX5012  PROPERTIES OF POLYMERIC MATERIALS  L T P C
4 0 0 4

OBJECTIVES
- To provide exposure to the students to understand the mechanical properties and also thermal and electrical properties.
- To make the students conversant with optical properties and polymeric materials characterizations.
- The students should be conversant with quality control and testing organizations.

UNIT I  MECHANICAL PROPERTIES  12

UNIT II  THERMAL AND ELECTRICAL PROPERTIES  12

UNIT III  OPTICAL PROPERTIES  12

UNIT IV  POLYMERIC MATERIALS CHARACTERIZATIONS  12
UNIT V  QUALITY CONTROL AND TESTING ORGANIZATIONS


TOTAL: 60 PERIODS

OUTCOMES
- Will be aware of preparation and properties of polymers at length.
- Will be able to methodically discuss moulding techniques.
- Will develop capacity to characterize polymers and draw a parallel to their properties

REFERENCES

CX5013  SOLID STATE CHEMISTRY

OBJECTIVES
- The students should be conversant with the crystal chemistry and preparative methods.
- To impart knowledge on characterization of solids and electrical properties.
- To teach the students about magnetic, optical and thermal properties.

UNIT I  CRYSTAL CHEMISTRY
Structures of complex oxides and related compounds – defects in solids – origin and types of defects, non-stoichiometry – defects and physical properties – ionic conductivity and optical properties.

UNIT II  PREPARATIVE METHODS
Polycrystalline materials by solid state, precipitation, precursor, ion exchange, sol-gel, intercalation methods – high pressure synthesis, preparation of single crystals – different methods – preparation of thin films, amorphous and nano crystalline materials.

UNIT III  CHARACTERIZATION OF SOLIDS

UNIT IV  ELECTRICAL PROPERTIES
UNIT V MAGNETIC, OPTICAL AND THERMAL PROPERTIES


TOTAL: 60 PERIODS

OUTCOMES

- Gets a general understanding of the essentials of crystal chemistry and their applications
- Understands the structure of solids and methods to characterize them.
- Is conversant with basics of magnetic, optical and thermal properties.

REFERENCES