

- To understand the various methods of halogenations of carbonyl compounds, benzylic and allylic halogenations.
- To get a good understanding of isolation, classification, methods of structure elucidation and synthesis of various types of alkaloids, terpenoids and steroids with suitable examples.
- To understand the chemistry of various types of steroidal hormones, steroidal oral contraceptives and transformations in steroids and steroidal hormones.

UNIT-I: [15Hours]

Reduction Reactions: Catalytic hydrogenation-Introduction, catalysts and solvents, mechanisms and stereochemistry of catalytic hydrogenations. Hydrogenolysis and homogeneous catalytic hydrogenation.

Metal hydride reduction: Reduction with LiAlH_4 and NaBH_4 , Stereo chemistry of reduction, Reduction with diborane and related reactions.

Dissolving Metal Reductions: Mechanisms of reduction of carbonyl compounds, Bimolecular reductions of esters, Birch reduction, Wolf-Kishner reduction and reduction with diimide. **Oxidation reactions:** Mechanism of oxidation reaction with chromium and manganese salts, Osmium tetroxide, peracids, periodic acid and Lead tetra acetate.

Halogenation: Halogenation of carbonyl compounds. Benzylic and Allylic halogenations.

UNIT -II: [15 Hours]

Alkaloids: Introduction of isolation, classification, general methods of structure elucidation. Structure and synthesis of the following alkaloids: Papaverine, Adrenaline, Ephedrine, Piperine, Morphine, Yohimbine, Reserpine.

Terpenoids: Introduction, classification, isoprene rule, methods of structure determination. Structure and synthesis of Geraniol, Menthol, α -Pinene, Camphor, Farnesol, Zingiberene and α -Santonin.

UNIT- III: [15 Hours]

Steroids: Introduction and Nomenclature of steroids, Blanc's rule, Barbier-Wieland degradation, Oppenauer oxidation, Diel's hydrocarbon, Chemistry of Cholesterol, Ergosterol, Vitamin-D & bile acids.

Steroidal Hormones: Chemistry of Oestrone, Oestradiol, Oestriol and their chemical relationship. Chemistry of Progesterone, Androsterone and Testosterone. Structure and Synthesis of Cortisone, Cortisol and Aldosterone. Steroidal oral contraceptives. Transformations in steroids and hormones.

References:

1. Modern Organic Reactions- H.O.House.
2. Advanced Organic Chemistry-IV-Ed. Part A & B-F.J.Carrey & R.J.Sundberg(Kluwer) 2001.
3. Modern Methods of Organic Synthesis-N.Carruthers (Cambridge University), 1996.
4. Natural Products Chemistry Vol-I & II. G. R. Chatwal (Himalaya Bombay) 1990.
5. Chemistry of Natural Products – Vol-I & II – O. P. Agarwal(Goel Gorakhpur), 1985.
6. Organic Chemistry-Vol-I & II- I. L. Finar (Longmann ELBS London), 2000.
7. Chemistry of Natural Products: A Unified Approach-N R Krishnaswamy (University Press) 1999.
8. Chemistry of Natural Products-[Sujata V. Bhat](#), [B.A. Nagasampagi](#), [MeenakshiSivakumar](#) (Springer-Narosa) 2005.

AC H 553: CHEMISTRY OF SOLID STATE AND NANO MATERIALS

COURSE OUTCOME:

It is an interdisciplinary course falling at the boundary of physics and chemistry. It is aimed at understanding the properties of solids and their possible applications in materials science as superconductors, semiconductors, liquid crystal materials and as magnetic materials. Importance has been given to the methods of preparation of solids, understanding the structure-property relationships and their possible applications. Importance has also been given to the advanced topics of nanomaterials. Preparation of nanosized materials and their potential applications in nanotechnology will be discussed. This course also contains topics of supramolecular chemistry and pharmacokinetics.

UNIT-I:

[15 Hours]

Surface morphology: Structure of solid surfaces and adsorbed layers. Mechanism of surface reactions. Study of surface morphology (LEED, AFS and SEM). **Crystal Defects and Non-Stoichiometry:** Perfect and imperfect crystals, intrinsic and extrinsic defects- point, line and plane defects. Vacancy, Schottky and Frenkel defects. Thermodynamics of Schottky and Frenkel defect formation, colour centres, non-stoichiometry and defects –

Structures of UO_2 , FeO and TiO . Solid State Reactions: General Principles, Wagner's theory. Order-disorder transitions in solids- Bragg-William's theory. Mechanism of diffusion, Kirkendall effect. **Preparative Methods:** Ceramic, sol-gel, precursor and chemical vapour deposition (CVD) methods. Nucleation & crystal growth techniques-pulling, zoning, flame fusion & skull melting. Basic methods of preparation of thin films.

UNIT – II :

[15 Hours]

Ionic Conductors: Types of ionic conductors, mechanism of ionic conduction, diffusion, superionic conductors; phase transitions and mechanism of conduction in superionic conductors,

examples- β -alumina, AgI, halide and oxide ion conductors. 4 hrs **Superconductivity:** Meissner effects; Types I and II superconductors, Features of superconductor,

isotope effect, high T_c materials. Principle of low temperature superconductivity. 4 hrs **Liquid Crystals:** Mesomorphic behaviour, thermotropic liquid crystals, positional order, bond orientational order, nematic and smectic mesophases; smectic – nematic transition and clearing temperature- homeotropic, planar & schlieren textures, twisted nematics chiral nematics, molecular arrangements in smectic A and C phases. Optical properties of liquid crystals 4hrs.

Magnetic properties: Classification of magnetic materials-dia, para, ferro, ferri, antiferro & antiferri magnetic types Langevin diamagnetism. Selected magnetic materials such as spinels & garnets. 3 hrs

UNIT-III:

[15 Hours]

Nano Materials : Introduction, Definition and terminology, consequences of the nanoscale (Nanoparticle, Morphology, Geometric structure, Electronic structure, Optical properties), Nanolayers, Carbon nanotubes, Nanowires, Quantum dots. Nanotechnology and its business applications, Introduction to nanoscale, Potential applications of nanomaterials, Challenges and opportunities scope of nanotechnology, Commercialization scope Nanotechnology research in 21st century, Basic nanotechnology science and chemistry concepts, basic nanostructures, nanocomposites, Thin films, nanofoam, nanoclusters, smart nanostructures, manufacturing techniques of nanomaterials. 7 hrs. **Supra Molecular Chemistry** Introduction, Cryptands, Cyclophanes, Crown ether, Calixerenes, Cyclodextrines, Molecular self assembly: Catenanes and Rotaxanes, Supramolecular reactivity

and catalysis, Supramolecular devices. 4hrs

Pharmaco kinetics: Introduction, Plasma concentration - time curve, protein binding and drugs, drug dissolution rate, pharmacokinetics applied to one compartment open model (calculation of elimination rate constant & metabolism constant). 4 hrs.

References:

1. Solid state Chemistry, D. K. Chakrabarty (New Age) 1996.
2. Principles of the solid state, H.V. Keer (Wiley Eastern) 1993.
3. Solid state chemistry and its applications, A.R. West (Wiley) 1984.
4. L. Smart and E. Moore, Solid State Chemistry – An Introduction (Chapman & Hall) 1992.
1. V. Raghavan, Material science and Engineering (3rd Ed), (Prentice Hall India) 1993.
6. Thermotropic Liquid Crystals, Ed. G.W. Gray, Wiley.
7. S. Chandrasekhar, Liquid Crystals, Cambridge University Press (2nd ed), 1994.
8. Basics of Nano Chemistry, Mamta V Sachdeva, Anmol Publishers, New Delhi. 2011.
9. Modern heterogeneous Oxidation Catalysis, Wd. Noritaka Miguno, Wiley, Weinheim, 2009
10. Nanoscale materials, Ed-L.M. Liz-Marzan and P.V. Kamath (Kulwer), 2003.
11. Introduction to Nanotechnology, C P Poole and F J Owens (Wiley Intersci), 2006.
12. Introduction to Petrochemicals, Sukumar Maiti (Oxford & IBH, Delhi), 1992.

AC S 554: Synthetic Polymers, Dyes and Pesticides

COURSE OUTCOME:

Enable the students:

- To acquire detailed knowledge in classification and nomenclature of polymers, methods of polymerization,
- To study the mechanism and stereochemistry, properties, structure, synthesis and applications of synthetic polymers, polyesters, polyamides, phenol-formaldehyde, urea-formaldehyde and epoxy resins, polyurethanes, polycarbonates, synthetic rubber, manufacture and structural features of natural rubber and regenerated cellulose.
- To understand the modern theories of colour and constitution, classification of dyes, methods of applying dyes to the fabrics, Synthesis and applications of various types of azo dyes, triphenyl methane dyes, cyanin dyes, reactive dyes, optical brighteners and pigments.
- To gain knowledge about classification, mode of action and synthesis of several organophosphorous and organochlorine insecticides, natural pyrethroid insecticides, isolation and structure of natural pyrethrins, synthetic pyrethroids, Synthesis and uses of insect pheromones in pest control, fungicides and herbicides, fumigants and repellants, mechanism of action and toxicities of insecticides, fungicides and herbicides.

UNIT-I:

[12 Hours]

Synthetic polymers: Classification and Nomenclature. Methods of polymerization, Mechanism and Stereochemistry, Addition polymerization (Anionic, Cationic and Free radical process), Condensation and Stepwise polymerization, Coordination polymerization, Ring opening polymerization. Mechanism of co polymerization. Properties, Structure and applications of Polythene, Polypropylene, PVC, Polystyrene & Acrylic polymers, Teflon, polyesters, polyamides, Phenol-Formaldehyde resins, Urea-Formaldehyde resins, Epoxy resins, Polyurethanes, Polycarbonates, Synthetic rubber. Structural features and manufacture of natural rubber and Regenerated cellulose. Ziegler-Natta catalyst.