SEMESTER –IV

ORGANIC POLYMERS, DYES AND PIGMENTS

THEORY

Programme: M.Sc. **Max.Maks: 100**
Course Code: P20/CHE/DSE/402 **Max Hours/ week: 4**
Type of course: DSE –6
No. of credits : 4

COURSE OBJECTIVES:

- Introduction, Classification of Polymers, Types of polymerization and Natural and synthetic rubbers.
- Different functional polymers and membranes
- Introduction, nomenclature and classification of synthetic dyes
- Introduction to Fluorescence dyes, laser dyes and Pigments

COURSE OUTCOMES:

CO1: Classify Polymers and study of Types of polymerization methods with mechanism
CO2: Understand Different functional polymers and membranes
CO3: Acquire the knowledge about the different types of Dyes
CO4: Discuss Fluorescence dyes, laser dyes and Pigments

MODULE I -ORGANIC POLYMERS – I(15 Hrs)

Introduction, Classification of Polymers – according to origin, structure, intermolecular interactions.Types of polymerization – addition, condensation, radical, ionic and coplymerization with mechanism, Ziegler-Natta polymerization with mechanism. Stereochemistry of polymers, Plasticity – types of plastics. Molecular mass of polymers. Resins and plastics – Polystyrene and styrene copolymers, poly(vinyl chloride/vinyl acetate)and related polymers, acrylic polymers, polyesters, phenol-formaldehyde polymers, polyurethanes and epoxide polymers with examples. Natural and synthetic rubbers.

MODULE II - ORGANIC POLYMERS - II (15 Hrs)

1.Functional polymers :

i) Electrically conducting polymers: Introduction, basic principles. Brief description of polyanilines, polypyrroles, polyacetylenes, polythiophenes and their applications.

ii) Photoconductive polymers: Liquid crystal polymers, smectoc, nematicamdcholesteric Structures, ion-exchange polymers – cationic, anionic exchange polymers and their uses.

iii)Smart materials: Uses in sensing device and communication networks.

iv) Biodegradable polymers: Definition, classification. Brief description polyhydroxyalkanoates, polycaprolactones, polyactic, polyvinyl alcohol and their applications.

v) Membranes: Filtration, micro, ultra, nano filtration. Separation of gases- Permeselectivityand gas permeability representative polymers. Liquid separation- dialysis, electroosmosis and reverse osmosis.

vi) Fire retarding polymers and photonic polymers.Polymers in biomedical application, artificial organs and controlled drug delivery

MODULE III - DYES – I

(15 Hrs)

Synthetic and Natural dyes

Introduction, nomenclature and classification of synthetic dyes. Color and constitution - chromospheres and auxochromes with suitable examples, Witt's theory, Armstrong's theory, Baeyer's theory, Nietzki's theory, Waston's theory, Modern theories, Valence Bond Theory and Molecular orbital theory. Chemistry and synthesis of triphenylmethanedyes [malachite green, rosaniline, para aniline blue, crystal violet methyl violet, hydroxytriphenyl methane dyes, Aurin, chrome violet], Azo dyes - types of azo dyes, synthesis of acidic and basic azo dyes, mono azo, di azo, tri azo and poly azo dyes. Chemistry and synthesis of cyanine dyes. Natural dyes – structure determination and synthesis of alizarine, Quinazarin and Indigo.

MODULE—IVDYES–II AND PIGMENTS:

a) **Introduction to Fluorescence dyes:** Interaction of organic molecules with electromagnetic radiation.Energydiagram.Activation and deactivation of organic molecules by light. Fluorescence and delayed fluorescence. Effect of molecular structure on fluorescence.General properties of fluorescent dyes and their requirements.Triplet-triplet absorption of organic molecules. Fluorescent quantumyields and factors affecting them. Synthesis of Fluorescent aromatic hydrocarbons.and Fluorescent heteroaromatic compounds.

b) **Introduction to laser dyes**. Synthesis of Oligophenylenes. Oxazoles and benzoxzoles. StilbenoidcompoundsCoumarin laser dyes, Rhodamine laser dyes

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Pigments: Introduction, Structures of Porphyrins , Bile pigments. Synthesis of Haeminand Chlorophyll. Synthetic pigments – preparation of Phthalocyanines.

ReferenceBooks

1. Organic polymer chemistry by K.J.Sanders.
2. Polymer syntheses, Vol.I by S.R.Sandler and W.Karo
3. The elements of Polymer Science and Engineering by A.Rudin
4. Principles of Polymer Chemistry by A.Ravve
5. Polymer Science by V.R.Gowariker , N.V.Viswanathan and J.Sreedhar
6. Polymer Chemistry by C.E.Carraher , Jr.
7. A text book of polymers, Vol. I,II,III, M.S. Bhatnagar , S. Chand
8. Polymer Chemistry, B. Vollmert
9. Textbook of Polymer Science, F. W. BillmeyerJr, John Wiley & sons
10. Organic Chemistry , Vol.1,2 by I.L.Finar
11. Color and constitution of organic molecules by J.Griffiths
12. Functional Dyes, Elsevier BV 2006,,,,,,S H.KIM
13. Colorants for non-textile Applications, Elsevier BV 2000 …H S Freeman and A T Peters
14. Industrial Dyes-Chemistry, Properties, Applications. WILEY-VCH Verlag, 2003
15. Introduction to Fluorescence Sensing, Springer 2009, by A P Demchenko
16. Natural Dyes and their Applications in Textiles by M. L. Gulrajani, IIT Delhi
17. Handbook on Natural Dyes for Industrial Applications by P. S. Vankar, National Institute of Industrial Research
18. Steroelectronic Effects in Organic Chemistry by Pierre Deslongchams, Pergamon Press
19. Chemistry and Biochemistry of plant pigments, Vol. 2, by T.W.Goodwin
20. Contemporary Polymer Chemistry, H. R. Alcock& F. W. Lambe, Prentice Hall
21. Materials scince and engineering an introduction by William D Callister, Jr. Wiley Publishers