

6th SEMESTER

DISCIPLINE SPECIFIC ELECTIVES (DSEs)

OPTION – I

ICH616DA: INDUSTRIAL CHEMISTRY: POLYMER CHEMISTRY

CREDITS: THEORY: 4, PRACTICAL: 2

Unit-I Introduction:

(15 Contact hours)

Introduction: Polymer structure; Stereochemistry; Nomenclature of Polymer based on source, structure and trade.

Molecular interactions and Polymer Crystals; Rheology & Solubility of Polymers.

Molecular weight of polymers: Number average, weight average and viscosity; Osmometry, light scattering ; End group analysis & Gel permeation chromatography .

Naturally occurring polymers: Proteins , Nucleic acids and Polysaccharides.

Unit-II Polymerization Reactions:

(15 Contact hours)

Polycondensation / Step reaction polymerization: interfacial , homogenous & ring opening polymerization.

Chain reactions / Addition/Radical polymerization: radical chain polymerization, polymerization techniques, ionic polymerization and complex catalysis systems; polyenes.

Copolymerization: Kinetics of copolymerization and composition of co-polymers; Block co-polymers and graft co-polymers.

Inorganic polymers (Brief introduction) .

Unit-III Characterization and Processing of polymers:

(15 Contact hours)

Characterization: UV-Visible spectrophotometry, IR , NMR , ESR , X-ray, Electron diffraction, Thermal analysis and Chromatography.

Processing: Compression molding, injection molding, extrusion & blow molding, fabrication and finishing.

Additives: Fillers, Reinforcements, Plasticizers, Antioxidants , Thermal stabilizers , UV – stabilizers and Colorants.

Unit-IV Polymer Technology and Applications :

(15 Contact hours)

Fibers , Textile properties, Spinning, Fiber- after treatment, Elastomers , Films , Coatings , Adhesives, Laminates , Cellular Polymers , Polyelectrolytes, Plastic pipes and molded Plastics, Vulcanization, , ,

Thermosetting Resins: Phenolic Resins , Amino resins , Unsaturated polyester resins Epoxy resins, Ion exchange resins and Zeolites.

Books Recommended:

1. Introduction to polymer chemistry; Raymond B- Seymour; McGraw Hill Book Company; 1971.
2. Textbook of polymer science, 2nd edition; Fred W. Billmeyer, Jr ; Wiley interscience New York ; 1974.
3. Physical Chemistry of polymers; 2nd edition; A. Tager; Mir Publishers Moscow; 1978
4. Principles of Polymerizations, 4th edition Wiley; Odian , G, 2004
5. Seymour/ Carraher's Polymer Chemistry; 9th edition; Charles E. Carraher, Jr. ; 2013
6. Inorganic Polymers; James E. Mark; Harry R. Allcock & Robert West; 1992

POLYMER CHEMISTRY PRACTICALS (2 CREDITS)

1. Preparation of Bio-plastic samples using plant starch.
2. Preparation of urea formaldehyde resin.
3. Preparation of phenol formaldehyde resin.
4. Preparation of nylon 6,6 and its hydrolysis to recover the raw material.
5. Preparation of polystyrene using styrene.
6. Determination of saponification value of a given plastic material.
7. Determination of acid value of a given plastic material.
8. Determination of hydroxyl value of a given plastic material.
9. Determination of carbonyl value of a given plastic material.
10. Determination of iodine value of a given plastic material.
11. Determination of the molecular weight of a high polymer (polystyrene) by viscosity measurement.

Books Recommended:

1. Polymer Synthesis and Characterization: A Laboratory Manual. 1st Edition, Stanley R. Sandler, Wolf Karo, JoAnne Bonesteel, Eli M. Pearce.
2. A Laboratory Manual of Polymers, 2/e. S.M. Ashraf, Sharif Ahmad & Ufana Riaz -I. K. Interbational Publishing House-2011.
3. Laboratory manual on engineering chemistry. S.K. Bhasin, Sudha Rani; Dhanpat Rai Publishing Company-Reprint 2015.

6th SEMESTER

DISCIPLINE SPECIFIC ELECTIVES (DSEs)

OPTION – II

ICH616DB: INDUSTRIAL CHEMISTRY: ICH618DB CHEMICAL PROCESS ECONOMICS AND ENTREPRENEURSHIP

CREDITS: THEORY: 4, PRACTICAL: 2

Unit I

Introduction to economic evaluations.

Cost structures of chemical plants and fundamental concepts of engineering economics.

Prediction of fixed capital investment.

Health, safety and environmental regulations in chemical process industries.

Unit II

The concept of depreciation, its estimation and integration into the cash flows.

Prediction of working capital investment and total cost of manufacturing.

Concepts of investment, interest and time value of money.

Effects of inflation and other uncertainties on the economics of a project.

Unit III

Entrepreneurship in Industrial Chemistry

Need, scope and characteristics of entrepreneurship, special schemes for technical/Chemical entrepreneurs development (STCED). Criteria for principles of products selection and developments. Schemes for Professional Industrial Chemists under J&KEDI.

Unit IV

Choice of technology: plant and equipments. Techno-economic feasibility of the projects.

Resources management: men, machine and materials. Creativity and Innovations.

Quality control, quality assurance and testing of the product.

Sickness in small scale Industries and their remedial measures. Licensing and registration.

Important provisions of Factory Act, sales of goods Act, partnership Act.

Books Recommended:

1. Engineering Economics. Dr. O.N.Pandey, Bhupesh Aneja; S. K Kataria and Sons-2015.
2. Technology Ventures: From Idea to Enterprise, 2nd Ed. Dorf, R. C. and Byers, T. H. (2007), New York: McGraw Hill
3. Engineering Economics: 4th Ed. James Riggs; Tata McGraw Hill.
4. Fundamentals of Engineering Economics. 3rd Ed. Chan S. park ; Pearson Publicaion.

PRACTICAL: CHEMICAL PROCESS ECONOMICS AND ENTREPRENEURSHIP (2 CREDITS)

5. Synthesis of common industrial compounds involving two step reactions, e.g. 4-bromo aniline, 3-nitroaniline, 4-amino benzoic acid, 4-nitro benzoic acid, paracetamol.
6. Determination of acid value, Iodine value and saponification value.
7. Instrumental methods of analysis – colorimeter.
8. Preparation of urea formaldehyde resin.
9. **Industrial analysis** – analysis of common raw materials as per the industrial specifications such as phenol, aniline, formaldehyde, hydrogen peroxide, acetone, etc.
10. Determination of sulphate ash, loss on drying of drugs.
11. Identification of dyes and amino acids by TLC.

Books Recommended:

1. Polymer Synthesis and Characterization: A Laboratory Manual. 1st Edition, Stanley R. Sandler, Wolf Karo, JoAnne Bonesteel, Eli M. Pearce
2. Laboratory manual on engineering chemistry. S.K. Bhasin, Sudha Rani; Dhanpat Rai Publishing Company-Reprint 2015.
3. Practical industrial chemistry, Zeba N. Siddiqui, Anmol publications Pvt. Ltd New Delhi