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- Sidhwani, Tucker I.; Chowdhury, S. et al., DU Journal of Undergraduate Research and Innovation 2016, Volume 2, Issue 2, 70-79.
- Dhingra, S., Angrish, C. Qualitative organic analysis: An efficient, safer, and economical approach to preliminary tests and functional group analysis. Journal of Chemical Education, 2011, 88(5), 649-651. Ranganna, S. (2017). Handbook of analysis and quality control for fruits and vegetable products, 2nd Edn., McGraw Hill Education.

Teaching Learning Process:

- Conventional chalk and board teaching,
- Class interactions and discussions
- Power Point Presentations
- Interactive Sessions

Assessment Methods:

- Class Tests at Periodic Intervals.
- Written assignment (s) / Presentation by individual students
- End semester University Theory and Practical Examination

Keywords: Green Chemistry, 12 Basic Principles of Green Chemistry, Atom Economy, Waster Prevention, Catalyst, Solvent Free synthesis, Green Solvents.

11.2.3. Course Code: ANALYTICAL CHEMISTRY3 (DSE-AC3) Course Title: POLYMERS

Total Credits: 04 (Credits: Theory-02, Practical-02)
(Total Lectures: Theory- 30, Practical-60)

Objectives: To acquaint students with knowledge of molecules and macromolecules. To study about molecular weight determination and the solution properties of polymers.

Learning Outcomes:

By the end of this course, students will be able to:

- Learn about the molecules, macromolecules and polymers
- Learn about properties of polymer solutions.
- Learn about the differentiation between molecule and polymer.
- Learn about the properties of polymers.

Unit 1: Introduction to Polymers

Introduction of polymeric materials, classification of polymers, Various structures of copolymers such as linear branched and cross-linked polymers and their types, Molecular forces and chemical bonding in polymers

(Lectures: 04)

Unit 2: Polymerization

Criteria for synthetic polymer formation, Types of polymerizations, Relationships between functionality, extent of reaction and degree of polymerization.

(Lectures: 04)

Unit 3: Molecular Weight of Polymers

Nature and structure of polymers: structure-property relationships, molecular weight of polymers (M_n, M_w), molecular weight distribution, polydispersity, and determination of molecular weight by viscosity, end group analysis, cryoscopy, ebulliometry, osmometry, light scattering & ultracentrifugation method

(Lectures: 10)

Unit 4: Solution Properties of Polymers

Criteria for polymer solubility, Polymer solution – solubility parameter, properties of dilute solutions and their criteria, Thermodynamics of polymer solutions, entropy, enthalpy, and free energy change. Flory- Huggins theory.

(Lectures: 08)

Unit 5: Glass Transition Behaviour of Polymers

Glass transition temperature (T_g), factors affecting the glass transition temperature, WLF equation.

(Lectures:04)

PRACTICALS (Credits: 2, Laboratory periods: 60)

1. Free radical solution polymerization of

   (i) Styrene (St) (ii)Methyl Methacrylate (MMA) (iii) MethylAcrylate (MA).

2. IR , ^{1}H NMR studies of polymers (PSt, PMMA, PMA, PEG, PVOH)

3. Thermal studies of polymers (PSt, PMMA, PMA, PEG, PVOH)

4. To check the solubility of the given polymeric sample in different solvents.

5. Preparation of nylon-6,6

6. Determination of the viscosity-average molecular weight of poly(vinyl alcohol).

7. Determination of the fraction of head-to-head monomer linkages in of poly(vinyl alcohol)

9. Determination of molecular weight by end group analysis.

10. Chemical identification of polymers- (i) Unsaturation (ii) Testing of functional groups (associated with polymers).

11. Determination of hydroxyl number of a polymer using colorimetric method.

12. i) Preparation of urea-formaldehyde resin

ii) Separation of monomers from polymers by solvation-technique.

REFERENCES:

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- Fred W. Billmeyer (1984) Textbook of Polymer Science, 3rd ed. Wiley-Interscience,
- L. H. Sperling (2005) Introduction to Physical Polymer Science, 4th ed. John Wiley & Sons (2005)
- Malcolm P. Stevens (2005) Polymer Chemistry: An Introduction, 3rd ed. Oxford University Press.
- Gowarikar V.R., (2010) Polymer Science, New Age International Publishers Ltd.
- Ghosh P., (2010) Polymer Science and Technology: Plastics, Rubbers, Blends and Composites, Tata McGraw Hill.

Teaching Learning Process:

- Conventional chalk and board teaching,
- Class interactions and discussions
- Power point presentation on important topics.

Assessment Methods:

- Class Tests at Periodic Intervals.
- Written assignment (s) / Presentation by individual students
- End semester University Theory and Practical Examination

Keywords: Degree of polymerization, Glass Transition Temperature, Molecular Weight Distribution, Viscosity Average Molecular Weight.

11.2.4. Course Code: ANALYTICAL CHEMISTRY (DSE-AC4)
Course Title: Food Chemistry, Nutrition and Additives
Total Credits: 04 (Credits: Theory-02, Practical-02)
(Total Lectures: Theory- 30, Practical-60)

Objectives: The introductory course on food chemistry, nutrition and additives is designed in such a manner that the students develop a basic understanding of the sources, importance, stability, and transformations of food components during handling and processing.

Learning Outcomes: