

V - SEMESTER

Course 15 A Analysis of Organic Compounds

Credits: 03

I. Learning Outcomes:

Students after successful completion of the course will be able to:

- 1) Identify the importance of mass spectrometry in the structural elucidation of organic compounds.
- 2) Acquire the knowledge on structural elucidation of organic compounds.
- 3) Understand various chromatography methods in the separation and identification of organic compounds.
- 4) Demonstrate the knowledge gained in solvent extraction for the separate the organic compounds.

II. Syllabus:

Unit-I: Nuclear Magnetic Resonance (NMR) spectroscopy 9 h

Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, NMR splitting of signals - spin-spin coupling, coupling constants. Applications of NMR with suitable examples - ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate, toluene and acetophenone.

Unit II Mass Spectrometry 9hrs

A brief introduction to analysis of organic compounds

Basic principles, Instrumentation - Mass spectrometer, electron Ionization (Electron Impactionization, EI), Molecular ions, metastable ions, Isotope abundance. Basic fragmentation types. Fragmentation patterns in Toluene, 2-Butanol, Butaldehyde, Propionic acid.

Unit-III : Structural elucidation of organic ompounds using IR,NMR & mass spectral data- 9 hours

2,2,3,3-Tetramethyl butane, Butane-2,3-dione, Propionic acid and methyl propionate.
Phenyl acetylene, acetophenone, cinnamic acid and p-nitroaniline.

Unit-IV: Separation techniques-19 hours

Solvent extraction-Principle and theory, Batch extraction technique, application of batch extraction in the separation of organic compounds from mixture- acid & neutral, base & neutral.

Chromatography – Principle and theory, classification, types of adsorbents, eluents, R_f values and factors affecting R_f values. Thin layer chromatography - principle, experimental procedure, advantages and applications.

Unit-5: Separation techniques - 29 hours

Paper chromatography- Principle, experimental procedure, ascending, descending, radial and two dimensional, applications.

Column chromatography - Principle, classification, experimental procedure and applications.
HPLC-Principle, Instrumentation – block diagram and applications.

III. Suggested Co-Curricular Activities:

- 1) Training of students by related industrial experts.
- 2) Assignments, Seminars and Quiz (on related topics), collection of relevant videos and material.
- 3) Visits to laboratories, firms, research organizations etc.
- 4) Invited lectures and presentations on related topics by field / industrial experts.

IV. List of Reference books:

- 1) Organic Spectroscopy by William Kemp, Third Edition, Palgrave USA.
- 2) Introduction to Spectroscopy by Pavia, Lampman, Kriz and Vyvyan, Fifth edition, Cengage.
- 3) Organic Spectroscopy: Principles and Applications by Jag Mohan, Second edition, Alpha Science.
- 4) Spectroscopy of Organic Compounds by P.S.Kalsi, Seventh edition, New Age

International.

- 5) Spectroscopic Methods in Organic Chemistry by Ian Fleming and Dudley Williams, Seventh edition, Springer.
- 6) Fundamentals of Analytical Chemistry by F.James Holler, Stanley R Crouch, Donald M.West and Douglas A.Skoog, Ninth edition, Cengage.
- 7) Analytical Chemistry by Gary D.Christian, Purnendu K.Dasgupta and KevinA.Schug, Seventh edition, Wiley.
- 8) Quantitative analysis by R.A.DayJr.andA.L.Underwood, Sixth edition, Pearson.
- 9) Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.

V - SEMESTER

Course – 15 A Analysis of Organic Compounds

Credits: 01

V. Learning Outcomes:

On successful completion of this practical course, student shall be able to:

- 1) Prepare acetanilide using the green synthesis.
- 2) Demonstrate the preparation of an azo dye.
- 3) Acquire skills in the separation of organic compounds in the given mixture using solvent extraction

VI. Laboratory course Syllabus:

- 1) Identification of various equipment in the laboratory.
- 2) Acetylating of 1^oamine by green method : Preparation of acetanilide
- 3) Rearrangement reaction in green conditions : Benzil-Benzilic acid rearrangement
- 4) Radical coupling reaction : Preparation of 1,1-bis-2-naphthol
- 5) Green oxidation reaction: Synthesis of adipic acid
- 6) Preparation and characterization of biodiesel from vegetable oil/waste cooking oil.
- 7) Photo reduction of Benzophenone to Benzopinacol in the presence of sunlight.
- 8) Separation of organic compounds in a mixture(acidic compound + neutral compound) using solvent extraction.
- 9) Separation of organic compounds in a mixture (basic compound+ neutral compound) using solvent extraction.

VII. Suggested Co-Curricular Activities:

Mandatory: (*Lab / field training of students by teacher:(lab:10+field:05):*

- 1) For Teacher: Training of students by teacher in laboratory and field for not less than 15 hours on the field techniques/skills of preparation of acetanilide, preparation of azo dye, use of separating funnel for solvent extraction, separation of organic compounds in a mixture.
- 2) For Student : Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for the separation of organic compounds. Write their observations and submit a hand written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.
- 3) Max marks for Fieldwork / project work Report: 05.
- 4) Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*
- 5) Unit tests (IE).

VIII. List of Reference books :

- 1) Vogel A.I. Practical Organic Chemistry, Longman Group Ltd.
- 2) Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley-Eastern.
- 3) Ahluwalia V. K. and Aggarwal R. Comprehensive Practical Organic Chemistry, University press.
- 4) Mann F.G and Saunders B.C, Practical Organic Chemistry, Pearson Education.