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, Propionicacid.

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,Propionicacid and methyl propionate.
Phenyl acetylene, acetophenone, cinnamic acid and p-nitroaniline.

Unit-IV: Separation techniques-1 9 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, Rfvalues and factors affecting Rfvalues. Thin layer chromatography - principle, experimental procedure, advantages and applications.

Unit-5: Separation techniques - 2 9 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, Lamp man, 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 1^0amine 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 lessthan15 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 exceeding10 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) MannF.G and Saunders B.C, Practical Organic Chemistry, Pearson Education.