FORMEN CHRISTIAN COLLEGE, LAHORE
(A Chartered University)
Chemistry Department

Spectroscopy Organic Compounds CHEM 462
Credits: 04 (3+1)
Prerequisite
CHEM 260 or CHEM 261 or CHEM 361

Course Instructor: Dr Seemal Jelani
Email: seemaljelani@fccollege.edu.pk
Visiting hours: 12:00-1:00 pm (except Wednesday)

Organic spectroscopy course. Undergraduate organic students only see the "tip of the iceberg" of spectroscopy. This course will teach students how spectroscopic methods reveal complex organic molecule structures.

This is a course in Organic Spectroscopy. Spectroscopy is presented in undergraduate organic classes, but students only see the proverbial “tip of the iceberg” in their undergraduate classes. This course is intended to give students a more complete picture of how spectroscopic methods are used to elucidate the structure of complex organic molecules

This course is designed to enhance student knowledge and skills in the specific area of Organic spectroscopic studies. This covers Study of IR spectroscopy, Mass spectroscopy and NMR spectroscopy in order to acquire the skills of sstructure elucidation, functional groups identification by IR spectroscopy and fragmentation pattern of main classes of organic compounds. This course covers 1-D proton NMR, C-13 NMR, and basic 2-D NMR techniques.

Laboratory classes use standard lab equipment, modern instrumentation, and classical methods to conduct experiments. Learn data interpretation and conclusion-drawing.

Outcomes as per the course objectives:

At the end of the course a student is expected to:

- Use spectroscopic equipment such as UV, MS, IR, NMR spectrometers.
- Identify organic compounds by analysis and interpretation of spectral data.
- Explain common terms in NMR spectroscopy such as chemical shift, coupling constant, and anisotropy and describe how they are affected by molecular structure
- Analyze and interpret 1D and 2D NMR spectra.
- Understand mass spectrometry, ionization techniques, fragmentation pattern of main classes of organic compounds.
- Perform the most commonly used NMR experiments, and to interpret and document their results

Catalogue Course Content

Study of IR, Mass and NMR spectroscopy as tools of structure elucidation, functional groups identification by IR spectroscopy, fragmentation pattern of main classes of organic compounds, 1-D proton and C-13 NMR spectroscopy and fundamental 2-D NMR techniques.

Reading Material:

- Organic Structural Spectroscopy, 2nd ed. by Lambert, et al. (ISBN 978-0-321-59256-9)
- Introduction to Spectroscopy 5th Edition Donald L. Pavia
- Uundergraduate organic text (Solomons, Wade, etc.).

Laboratory skills:

Students will learn basic organic spectroscopic laboratory techniques used for the preparation, isolation, purification and identification of organic compounds. Some instrumental techniques would also be studied by students (e.g. gas chromatography, infrared spectroscopy, and nuclear magnetic resonance spectrometry). Students will also be expected to maintain a lab-grade notebook

SLO's

The interpretation of UV, IR and NMR data in the elucidation of the structure of an unknown compound is emphasized in a laboratory experiment which reinforces the concepts of UV, IR MS and NMR spectroscopy.

Before starting lab work, students must learn about procedures, chemicals, equipment, risks, safety, and disposal. The student must complete the pre-laboratory activity to work in the lab. No makeup labs exist. Students must clean their lab space before leaving or their grade will drop

Assessment

No	Rubric	Weightage %
1	Attendance & Class participation	05
3	Quizzes	10
4	Assignment	10
5	Lab-assignment	10
6	Presentation	10
7	Mid exam	15
7	Final lab exam	15
8	Final Exam	25
9	Total	100

Eligibility criteria

A student must be regular and punctual. Generally, he or she should attend all classes. 80 percent attendance is expected to sit for the final exam.

Week Plan/Semester Breakup

Week	Course content	Assessment
Week-01	Introduction to Organic Spectroscopic Techniques Discussing course outlines Students' introduction Introduction to electromagnetic radiations Introduction to NMR Types of interaction (EMR) with matter Absorption Based Spectroscopy	
Week -02-03	Introduction to NMR Theory of NMR Magnetic shielding by electrons The NMR spectrometer Chemical shift The number of signals Area of peak Spin-Spin Splitting, Complex splitting Coupling constants Stereochemical nonequivalence of protons Interpretation of Proton NMR spectra Further discussion	Quiz-01 Assignment 1
Week-04-06	NMR-Factors affecting shielding effect/chemical shift Electronegativity, Hybridization, Magnetic Anisotropy, Hydrogen bonding, Angle strain How to find structures by Chemical shifts How to find structures by Spectra Introduction to C-13 Spectroscopy Theory of C-13 NMR Interpretation of C-13 Spectra Problems solving strategy Discussion	Quiz-02 Assignment 2 An academic visit that must be approved by the visit site
Week-07-08	1D spectroscopy and 2D spectroscopy Fundamental 2D NMR techniques COSY HETCOR HMBC HSQC	Mid Exam
Week-09-10	General Introduction of IR Spectroscopy Types of Molecular rotations Why Molecules rotate? Factors affecting molecular rotation, Types of IR Spectra Regions of IR Spectra Important functional groups and their IR absorption bands. Discussion and Interpretation of different IR Spectra.	Assignment 3
Week-11-12	Mass spectrometry Mass spectrometers Ionization techniques Different fragmentation patterns Structure elucidation	Assignment 4 Quiz-03
Week-13	UV introduction.	Assignment 5

		Quiz-04
Week 14-15	Combined use of UV, IR, NMR & Mass spectrometric data for structure elucidation of organic compounds having basic complexity Presentations	
Week-16	Recapping the course/ Discussions/ Final Exam	