Course No.	Course Name	L-T-P-Credits
CY 402	**Pericyclic Reactions, Photochemistry and Applied Spectroscopy**	**4-0-0: 4**

Prerequisite: NIL

Course Objectives: The main objective of the course to describe the basics of pericyclic and photochemical reactions. The students will learn different types of pericyclic and photochemical reactions. The course will also help the students to understand the principles of NMR, Mass spectrometry and EPR and also will be able to apply the concepts for structure elucidation of organic compounds

Course Outcomes: After successful completion of the course, students will be able to:

1. Understand basic concepts of pericyclic and photochemical reactions.
2. Understand different types of pericyclic and photochemical reactions.
3. Understand the principles of NMR, Mass and EPR.
4. Application of NMR, Mass spectrometry for structure elucidation of organic compounds.

SYLLABUS

Module	Contents	Hours
I	**Pericyclic Reactions** Orbital symmetry, selection rules (FMO and PMO approach, Woodward-Hofmann rules); Electrocyclic reaction (1,3-butadiene-cyclobutene and 1,3,5-hexatriene-cyclohexadiene systems); cycloaddition: [2+2], [2+4] and [6+2] systems; stereoselectivity of the reactions; heterocycloaddition reactions; 1,3-dipolar cycloaddition; cheletropic reactions and sigmatropic rearrangements (Sommelet-Hauser, Cope, Fries and Clasien rearrangements).	12
II	**Photochemistry** Basic principles, Jablonski diagram; photochemistry of olefinic compounds, *cis–trans* isomerization; photochemistry of carbonyl compounds (Norrish type I and type II reactions), Paterno-Buchi reaction, photoreduction of saturated aryl alkyl and unsaturated ketones; Photorearrangement reactions: di–π methane rearrangement, rearrangement of cyclohexadienes, Barton reaction; reactions and synthetic applications of singlet oxygen, Hoffman-Löffler rearrangement.	12
III	**Nuclear magnetic resonance spectroscopy** Basic principles of NMR spectroscopy, chemical shifts, factors affecting the chemical shifts, spin-spin coupling, coupling constant, spin – spin interaction between different interacting nuclei (first	12

	order spectra), relaxation processes, nuclear magnetic double resonance, nuclear Overhouser effect (NOE), two dimensional NMR, NOESY, DEPT, INEPT spectra, shift reagents, instrumentation, FT NMR and introduction to MRI and solid state NMR.	
IV	**Mass spectrometry** Basic principles and instrumentation; ionization techniques, molecular ion peak, isotopic peaks, metastable peak, recognition of molecular ion peak, fragmentations patterns – general rules, structure elucidation of organic compounds.	8
V	**EPR spectroscopy** Basic principles, origin of g-shifts, isotropic and anisotropic hyperfine coupling, zero field splitting, Kramer degeneracy, ESR analysis of some organic compounds.	4

Essential Readings:

1. F. A. Carey and R. J. Sundberg, "Advanced Organic Chemistry Part A and B", Springer India Pvt. Ltd., 5th Edition, 5th Edition, 2007.
2. I. Flaming, "Molecular Orbitals and Organic Chemical Reaction", Wiley, Student Edition, 2009.
3. D. L. Pavia, G. M. Lampman, G.S. Kriz and J. R. Vyvyan, "Introduction to Spectroscopy", Cengage Learning, 5th Edition, 2014.
4. W. Kemp, "Organic Spectroscopy", Palgrave Macmillan, 3rd Edition, 2008.

Supplementary Readings:

1. T. H. Lowry and K. S. Richardson, "Mechanism and Theory in Organic Chemistry", Addison Wesley Longman, 3rd Edition, 1998.
2. P. S. Kalsi, "Organic Reactions and Their Mechanisms", New Age International Publishers, 4th Edition, 2017.
3. R. S. Drago, Physical Methods in Inorganic Chemistry, East-West Press Pvt. Ltd., 1st Edition, 2012.