



**GLA**  
UNIVERSITY  
MATHURA  
Established vide U.P. Act 21 of 2010.

# Course Curriculum

**Ph.D. (Chemistry)**

**[DEPARTMENT OF CHEMISTRY]**

**PAC9001: RECENT ADVANCES IN CHEMISTRY**

**Credits: 04**

**Semester I**

**L-T-P : 4-0-0**

**Object:** *This course deals with the application of structure and theory of the study of organic reaction mechanisms; Stereochemical features including conformation and stereoelectronic effects and reaction dynamics. Recent development in supramolecular and green chemistry is also dealt with in this course*

| Module No. | Content  | Teaching Hours (Approx.) |
|------------|--|--------------------------|
| I          | <b>Organic reaction intermediates:</b> generation, stability and reactivity, aromaticity and nonaromaticity, organic reaction mechanisms involving addition, elimination and substitution reactions.   | 16                       |
| II         | Concepts of acid-base, hard-soft acid base concept. Transition elements and co-ordination compounds: structure, bonding theories, spectral and magnetic properties, reaction mechanisms and stability of metal complexes.<br><b>Supramolecular Chemistry:</b> Definition, supramolecular host-guest compounds, Molecular recognition, Applications in Transport process and carrier design, Biomolecules in daily life.  | 16                       |
| III        | <b>Stereochemistry:</b> principles of stereochemistry, configurational and conformational isomers in acyclic and cyclic compounds. Stereogenicity, stereoselectivity, enantioselectivity, diastereoselectivity and asymmetric induction.<br><b>Green Chemistry:</b> Principles and applications, Green solvents.<br><b>Common named reactions and rearrangements.</b> Organic transformations and reagents-applications in organic synthesis (Chemo, region and stereo selective transformations). | 16                       |

**Reference Books/ Text Books:**

- *Essentials of Physical Chemistry:* Bahl & Tuli S.Chand & Co.
- *Elements of Physical Chemistry:* S. Glasstone D. Van Nostrand company, inc., 1946
- *Organic Chemistry* T. W. Graham Solomons, Craig B. Fryhle, and Scott A. Snyder John wiley & Sons
- *Stereochemistry of Organic Compounds* E. L. Eliel and S H Wilen John wiley & Sons
- *Organic Chemistry* Morrison & Boyd:
- *Molecular reactions and photochemistry* Charles H. DePuy and Orville L. Chapman
- *Advance organic chemistry* FA Carey & RA Sundberg, Springer

### Intended Outcomes

1. *Students will be able to get deeper conceptual understanding of different reaction intermediates, acids, bases and metal complexes.*
2. *Students will be able to articulate and apply advanced concepts in stereocontrol in modern organic reactions.*
3. *Students will be able to get understanding of the concepts of green chemistry and supramolecular chemistry in material synthesis as well as the importance of molecules in daily life.*

**PAC9002: SPECTROSCOPY AND ANALYTICAL TECHNIQUES**

**Credits: 04**

**Semester I**

**L-T-P: 4-0-0**

**Object:** *To develop overall deeper understanding of the latest spectroscopic techniques, in material characterization and analysis and to develop the conceptual framework of nanotechnology in the field of chemistry.*

| Module No. | Content   | Teaching Hours (Approx.) |
|------------|---|--------------------------|
| I          | Nanoscience and nanotechnology in chemistry<br>Fundamentals of SEM/TEM techniques.  | 16                       |
| II         | Ultraviolet Spectroscopy: Introduction. Studies of conjugated and extended conjugated systems etc. Woodward rules. Electronic spectra of transition metal complexes.<br>Atomic Absorption spectroscopy: basic concepts and applications<br>Infrared Spectroscopy: Introduction. Identification of functional groups, hydrogen bonding etc., metal ligand vibrations.  | 16                       |
| III        | Nuclear Magnetic Resonance Spectroscopy: Introduction. Application of $^1\text{H}$ and $^{13}\text{C}$ NMR spectroscopy including COSY, NOESY, NOE techniques in the structural determination of complex organic systems.<br>Mass Spectrometry: Basic concepts. Fragmentation and rearrangements (including McLafferty rearrangement) of different classes of organic molecules. Isotope effects etc.<br>Chromatography: Basic concepts and Classification, column chromatography (GC, HPLC). | 16                       |

**Reference Books/ Text Books:**

- *Modern Methods of Organic Synthesis* W. Carruthers, Iain Coldham, Cambridge University Press
- *B. K. Sharma*, Krishna Prakashan Media
- *Organic Spectroscopy* William Kemp, Macmillan
- *Organic Chemistry* T. W. Graham Solomons, Craig B. Fryhle, and Scott A. Snyder John Wiley & Sons
- *Introduction to nanoscience and nanotechnology* by K K Chattopadhyay PHI learning pvt ltd.
- *Spectroscopy of Organic compound* by P S Kalsi New Age International

**Intended outcomes:**

1. *Students will be able to analyze nuclear magnetic resonance spectroscopy, mass spectrometry, infrared spectroscopy and UV-Visible spectroscopy for organic structure elucidation.*
2. *Students will be able to develop basic concepts of nanoscience and nanotechnology and analyze the synthesized material with the help of SEM and TEM techniques.*
3. *Students will learn theoretical concepts of various chromatographic techniques for purification of compounds.*