Course Plane

Jay Guru

Name of the department: **Chemistry**

Name of the Faculty**:** **Dr. N.N.Chaudhary**

Academic Session**: 2021 - 2024**

Year**: 2024**

Programme: **Chemistry Honours**

Semester: 06

Course Type: **Core course**

Course**: Organic Chemistry**

Course Code**: C-14**

Total Credits**: 6 (**Theory-**04 + Pr-02)**

Syllabus:

1. **Organic Spectroscopy:**

General principles Introduction to absorption and emission spectroscopy.

UV Spectroscopy: Types of electronic transitions, λ_{max}, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption; Application of Woodward Rules for calculation of λmax for the following systems: α,β-unsaturated aldehydes, ketones, carboxylic acids and esters; Conjugated dienes: alicyclic, homo-annular and hetero-annular; Extended conjugated systems (aldehydes, ketones and dienes); distinction between cis and trans isomers.

IR Spectroscopy: Fundamental and non-fundamental molecular vibrations; IR absorption positions of O, N and S containing functional groups; Effect of H-bonding, conjugation, resonance and ring size on IR absorptions; Fingerprint region and its significance; application in functional group analysis.

NMR Spectroscopy: Basic principles of Proton Magnetic Resonance, chemical shift and factors influencing it; Spin – Spin coupling and coupling constant; Anisotropic effects in alkene, alkyne, aldehydes and aromatics, Interpretation of NMR spectra of simple compounds. Applications of IR, UV and NMR for identification of simple organic molecules.

2. **Carbohydrates**

Occurrence, classification and their biological importance. Monosaccharides: Constitution and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani- Fischer synthesis and Ruff degradation;

Disaccharides – Structure elucidation of maltose, lactose and sucrose. Polysaccharides – Elementary treatment of starch, cellulose and glycogen.

3. **Dyes**:

Classification, Colour and constitution; Mordant and Vat Dyes; Chemistry of dyeing; Synthesis and applications of: Azo dyes – Methyl Orange and Congo Red (mechanism of Diazo Coupling); Triphenyl Methane Dyes -Malachite Green, Rosaniline and Crystal Violet; Phthalein Dyes – Phenolphthalein and Fluorescein; Natural dyes –structure elucidation and synthesis of Alizarin and Indigotin; Edible Dyes with examples.

4. **Polymers**:

Introduction and classification including di-block, tri-block and amphiphilic polymers; Number average molecular weight, Weight average molecular weight, Degree of polymerization, Polydispersity Index. Polymerization reactions -Addition and condensation -Mechanism of cationic, anionic and free radical addition polymerization; Metallocene-based Ziegler-Natta polymerization of alkenes; Preparation and applications of plastics – thermosetting (phenol-formaldehyde, Polyurethanes) and thermosetting (PVC, polythene);

Fabrics – natural and synthetic (acrylic, polyamido, polyester); Rubbers – natural and synthetic: Buna-S, Chloroprene and Neoprene; Vulcanization; Polymer additives; Introduction to liquid crystal polymers; Biodegradable and conducting polymers with examples.

Program Outcomes (Pos)

1. **Proficiency in Spectroscopic Techniques**: Graduates will demonstrate proficiency in the principles and application of various spectroscopic techniques, including UV spectroscopy, IR spectroscopy, and NMR spectroscopy, allowing them to identify and characterize simple organic molecules accurately.
2. **Understanding of Electronic Transitions**: Students will understand the types of electronic transitions in UV spectroscopy, including λmax, chromophores, and auxochromes, and apply Woodward Rules to calculate λmax for different systems, facilitating the analysis of conjugated systems and isomeric forms.
3. **Interpretation of IR Spectra**: Upon completion of the course, students will be able to interpret IR spectra, including the positions of absorption peaks for functional groups containing O, N, and S, and understand the effects of hydrogen bonding, conjugation, resonance, and ring size on IR absorptions.
4. **Application of NMR Spectroscopy**: Graduates will be able to apply the principles of NMR spectroscopy to interpret proton magnetic resonance spectra, including chemical shift, spin-spin coupling, and coupling constants, enabling them to identify and analyze simple organic compounds accurately.
5. **Comprehensive Knowledge of Carbohydrates**: Students will acquire comprehensive knowledge of carbohydrates, including their occurrence, classification, and biological

importance, as well as the constitution, configuration, and interconversions of monosaccharides and the structures of disaccharides and polysaccharides.

6. **Understanding of Dye Chemistry**: Upon completion of the course, students will understand the classification, color, and constitution of dyes, as well as the chemistry of dyeing and the synthesis and applications of various classes of dyes, including azo dyes, triphenyl methane dyes, phthalein dyes, and natural dyes.
7. **Knowledge of Polymer Classification and Properties**: Graduates will possess knowledge of polymer classification, including di-block, tri-block, and amphiphilic polymers, as well as polymer properties such as number average molecular weight, weight average molecular weight, degree of polymerization.

Program Specific Outcomes (PSOs):

1. **Spectroscopic Analysis Proficiency**: Graduates will demonstrate proficiency in the interpretation of UV, IR, and NMR spectra, enabling them to identify functional groups, structural motifs, and molecular configurations in organic compounds accurately.
2. **Carbohydrate Structure Elucidation Skills**: Students will develop skills in elucidating the structures of monosaccharides, disaccharides, and polysaccharides using chemical and spectroscopic methods, including determination of ring size, configuration, and anomeric forms.
3. **Dye Synthesis and Application Competence**: Upon completion of the course, students will be competent in the synthesis of various classes of dyes and their applications in dyeing processes, including understanding mechanisms of diazo coupling and the chemistry behind mordant and vat dyes.
4. **Polymer Classification and Material Design Aptitude**: Graduates will demonstrate an understanding of polymer classification and properties, allowing them to design and select appropriate polymers for specific applications, including plastics, fabrics, and rubbers, based on their structure-property relationships.
5. **Innovation in Polymer Science**: Students will develop the ability to innovate in polymer science, including the exploration of new polymerization techniques, the development of biodegradable and conducting polymers, and the application of liquid crystal polymers in advanced materials, contributing to the advancement of polymer science and technology.

Course Outcomes (COs):

1. **Mastery of Spectroscopic Techniques**: Upon completion of the course, students will demonstrate mastery of UV, IR, and NMR spectroscopic techniques, including the ability to interpret spectra accurately and utilize spectroscopic data for the structural elucidation of organic molecules.
2. **Understanding of Electronic Transitions in UV Spectroscopy**: Students will develop a deep understanding of electronic transitions in UV spectroscopy, including the factors influencing λmax, chromophores, and auxochromes, enabling them to predict and interpret spectra for various conjugated systems and functional groups.
3. **Proficiency in IR Spectroscopy Interpretation**: Graduates will be proficient in the interpretation of IR spectra, including the identification of functional groups and the effects of hydrogen bonding, conjugation, resonance, and ring size on IR absorptions, facilitating the analysis of complex organic molecules.
4. **Application of NMR Spectroscopy Principles**: Upon completion of the course, students will be able to apply the principles of proton NMR spectroscopy, including chemical shift, spin-spin coupling, and coupling constants, to interpret spectra and identify structural features in organic compounds accurately.
5. **Comprehensive Knowledge of Carbohydrates**: Students will acquire comprehensive knowledge of carbohydrates, including their occurrence, classification, and structural features, as well as their biological importance and interconversions, enabling them to understand the role of carbohydrates in biological systems.
6. **Dye Chemistry Understanding and Synthesis Skills**: Upon completion of the course, students will understand the chemistry of dyes, including their classification, color, and synthesis, and develop practical skills in dye synthesis, allowing them to apply dye chemistry principles in industrial applications.
7. **Polymer Classification and Properties Knowledge**: Graduates will possess a thorough understanding of polymer classification, including the principles of addition and condensation polymerization, as well as polymer properties such as molecular weight, degree of polymerization, and polydispersity index, enabling them to select and design polymers for specific applications.
8. **Application-Oriented Polymer Science**: Students will develop application-oriented knowledge in polymer science, including the preparation and applications of plastics,

fabrics, and rubbers, as well as the understanding of polymer additives, polymerization mechanisms, and the synthesis of specialty polymers, preparing them for careers in materials science, engineering, and related fields.

Correlation Between Pos and Cos For Paper C-14

POs → ***Cos ↓***	***PO1***	***PO2***	***PO3***	***PO4***	***PO5***	***PO6***	***PO7***	***PSO1***	***PSO2***	***PSO3***	***PSO4***
CO1	*2*	*1*	*-*	*1*	*2*	*2*	*1*	*2*	*2*	*3*	*-*
CO2	*2*	*2*	*3*	*2*	*3*	*3*	*-*	*2*	*3*	*2*	*1*
CO3	*2*	*1*	*3*	*2*	*2*	*2*	*-*	*3*	*2*	*1*	*1*
CO4	*2*	*1*	*1*	*2*	*2*	*1*	*-*	*3*	*2*	*2*	*2*
CO5	*3*	*2*	*2*	*1*	*2*	*3*	*1*	*3*	*2*	*3*	*1*
CO6	*1*	*2*	*1*	*1*	*1*	*1*	*2*	*1*	*-*	*1*	*1*
CO7	*1*	*2*	*1*	*2*	*1*	*1*	*2*	*2*	*1*	*2*	*1*
CO8	*2*	*1*	*1*	*2*	*1*	*1*	*1*	*2*	*1*	*1*	*2*

1. Weak ***2. Moderate*** ***3. Strong***

COURSE TEACHING AND LEARNING ACTIVITIES

A. PEDAGOGY

- ***i. Whiteboard***
- ***ii. Flipped Class***
- ***iii. Online Class***

B. COURSE COMPLETION PLAN

UNIT	NO. OF LECTURES		TEST / QUIZ / ASSIGNMENT		
	THEORY	TUTORIAL			
1	25	5	1		1
2	20	5	1		1
3	10	2			1
4	10	2			1

C. COURSE DELIVERY PLAN:

UNIT	*Topic*	*NO. OF LECTURES*		*CO addressed*	*TEST*	*QUIZ*	*ASSIGNMENT*
		Lectures	*Tutorial*				
1	**Organic Spectroscopy**	*24*	*05*	*CO1,CO5*	*1*		*1*
2	**Carbohydrates**	*16*	*05*	*Co2, Co3*	*1*		*1*
3	**Dyes**	*08*	*01*	*CO4*	*1*		*1*
4	**Polymers**	*12*	*2*	*CO4,CO7, CO8*	*1*		*1*

D. REMEDIAL CLASSES

S. NO	ROLL. NO. & SESSION (2021-24)	NAME OF THE STUDENT	MARKS OF MID SEM / CLASS TEST	REMEDIAL CLASSES HELD			TERM EXAM	IMPROVEMENT (Y/S)
				DATE	TIME	MODE		
1.	1	Divya Kumari						
2.	4	Vishal Kumar						

A. SUGGESTED READINGS

a. TEXT BOOKS :

1. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Graham Solomons, T.W. Organic Chemistry, John Wiley & Sons, Inc.
3. Billmeyer, F. W. Textbook of Polymer Science, John Wiley & Sons, Inc.

b. REFERENCE BOOKS

1. *1.* Kalsi, P. S. Textbook of Organic Chemistry 1st Ed., New Age International (P) Ltd. Pub.
2. Gowariker, V. R.; Viswanathan, N. V. & Sreedhar, J. Polymer Science, New Age International (P) Ltd. Pub.
3. Singh, J.; Ali, S.M. & Singh, J. Natural Product Chemistry, Prajati Prakashan (2010).

c. VIDEO RESOURCE

1. ***https://youtu.be/Vwfb47aOPhw***
2. ***https://youtu.be/7beCObJpdqc?si=JF8VGfNp0T-oL4Ot***
3. ***https://youtu.be/9TeuBCd9OOk?si=vfVndFBDYwyrdnEs***

Reference Books:

4. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
5. Clayden, J.; Greeves, N.; Warren, S.; Wothers, P.; Organic Chemistry, Oxford University Press.
6. Kemp, W. Organic Spectroscopy, Palgrave .