

Teaching Plan (2023-2024)
B.Sc. (H) Chemistry Semester VI and B.Sc. Physical Science Semester VI Sec A
(18-Jan-24 to 10-May-24)

Dr. Radhika Gupta

Department of Chemistry, Shyam Lal College

Dates	Topics Covered	
	B.Sc. (H) Chemistry Semester VI DSE-4 Green Chemistry	B.Sc. Physical Science Semester VI Sec A DSE-2 Polynuclear Hydrocarbons and UV, IR Spectroscopy
18-Jan-24 to 25-Jan-24	Unit 3: Green Synthesis of adipic acid, catechol and disodium iminodiacetate.	Unit 4: Structure elucidation of naphthalene, preparation and properties of naphthalene and anthracene.
29-Jan-24 to 02-Feb-24	Unit 3: Green Reagents: Non-phosgene Isocyanate Synthesis, Selective Methylation using dimethylcarbonate.	
12-Feb-24 to 16-Feb-24	Unit 3: Microwave assisted solvent free synthesis of copper phthalocyanine.	Unit 4: Preparation and Properties of the following compounds with reference to electrophilic and nucleophilic substitution: furan, pyrrole, thiophene, and pyridine.
19-Feb-24 to 23-Feb-24	Unit 3: Microwave assisted reactions in water: Hofmann Elimination, methyl benzoate to benzoic acid and Decarboxylation reaction.	
26-Feb-24 to 01-Mar-24	Unit 3: Ultrasound assisted reactions: sonochemical Simmons-Smith Reaction	
04-Mar-24 to 08-Mar-24	Unit 4: Surfactants for Carbon Dioxide – replacing smog producing and ozone depleting solvents with CO ₂ for precision cleaning and dry cleaning of garments.	Unit 5: Preparation: Claisen ester condensation, Keto-enol tautomerism. Unit 5: Reactions: Synthetic uses of ethylacetoacetate (preparation of non-heteromolecules having up to 6 carbons).
11-Mar-24 to 15-Mar-24	Unit 4: A new generation of environmentally advanced wood preservatives: Getting the chromium and Arsenic out of pressure treated wood.	
18-Mar-24 to 22-Mar-24	Unit 4: An efficient, green synthesis of a compostable and widely applicable plastic (polylactic acid) made from corn.	
24-Mar-24 to 31-Mar-24	MID SEMESTER BREAK	

<p>01-Apr-24 to 05-Apr-24</p>	<p>Unit 4: Healthier Fats and oils by Green Chemistry: Enzymatic Inter esterification for production of No Trans-Fats and Oils. Development of Fully Recyclable Carpet: Cradle to Cradle Carpeting. INTERNAL ASSESSMENT TEST</p>	<p>Unit 6: UV-Visible and infrared spectroscopy and their application to simple organic molecules. Electromagnetic radiations and their properties; double bond equivalence and hydrogen deficiency.</p>
<p>08-Apr-24 to 12-Apr-24</p>	<p>Unit 4: Using a naturally occurring protein to stimulate plant growth, improve crop quality, increase yields, and suppress disease.</p>	<p>Unit 6: UV-Visible spectroscopy (electronic spectroscopy): General electronic transitions, λ_{\max} & ϵ_{\max}, chromophores & auxochromes, bathochromic & hypsochromic shifts.</p>
<p>15-Apr-24 to 19-Apr-24</p>	<p>Unit 5: Oxidation reagents and catalysts</p>	<p>Unit 6: Application of Woodward rules for calculation of λ_{\max} for the following systems: conjugated dienes - alicyclic, homoannular and heteroannular; α,β-unsaturated aldehydes and ketones, charge transfer complex.</p>
<p>22-Apr-24 to 26-Apr-24</p>	<p>Unit 5: Biomimcry and green chemistry, Biomimetic, Multifunctional Reagents. INTERNAL ASSESSMENT TEST</p>	<p>Unit 6: Infrared (IR) Spectroscopy: Infrared radiation and types of molecular vibrations, significance of functional group & fingerprint region.</p>
<p>29-Apr-24 to 03-May-24</p>	<p>Unit 5: Mechanochemical and solvent free synthesis of inorganic complexes.</p>	<p>Unit 6: IR spectra of alkanes, alkenes, aromatic hydrocarbons (effect of conjugation and resonance on IR absorptions)</p>
<p>06-May-24 to 10-May-24</p>	<p>Unit 5: Co crystal controlled solid state synthesis (C2S 3); Green chemistry in sustainable development.</p>	<p>Unit 6: IR spectra of simple alcohols (inter and intramolecular hydrogen bonding and IR absorptions), phenol, carbonyl compounds, carboxylic acids and their derivatives (effect of substitution on $>C=O$ stretching absorptions).</p>

SYLLABUS

B.Sc. (H) Chemistry Semester VI

DSE-4 Green Chemistry

Course Code: CHEMISTRY –DSE-8

Course Title: Green Chemistry

Total Credits: 06

(Credits: Theory-04, Practical-02)

(Total Lectures: Theory- 60, Practical-60)

Unit 3:

Examples of Green Synthesis/ Reactions

- Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis).
- Green Reagents: Non-phosgene Isocyanate Synthesis, Selective Methylation using dimethylcarbonate.
- Microwave assisted solvent free synthesis of copper phthalocyanine
- Microwave assisted reactions in water: Hofmann Elimination, methyl benzoate to benzoic acid and Decarboxylation reaction
- Ultrasound assisted reactions: sonochemical Simmons-Smith Reaction (Ultrasonic alternative to Iodine)

(Lectures:10)

Unit 4:

Real world case studies based on the Presidential green chemistry awards of EPA

- Surfactants for Carbon Dioxide – replacing smog producing and ozone depleting solvents with CO₂ for precision cleaning and dry cleaning of garments.
- A new generation of environmentally advanced wood preservatives: Getting the chromium and Arsenic out of pressure treated wood.
- An efficient, green synthesis of a compostable and widely applicable plastic (polylactic acid) made from corn.
- Healthier Fats and oils by Green Chemistry: Enzymatic Inter esterification for production of No Trans-Fats and Oils.
- Development of Fully Recyclable Carpet: Cradle to Cradle Carpeting.
- Using a naturally occurring protein to stimulate plant growth, improve crop quality, increase yields, and suppress disease.

(Lectures:10)

Unit 5:

Future Trends in Green Chemistry

Oxidation reagents and catalysts; Biomimcry and green chemistry, Biomimetic, Multifunctional Reagents; mechanochemical and solvent free synthesis of inorganic complexes; co crystal controlled solid state synthesis (C²S³); Green chemistry in sustainable development.

(Lectures:10)

Course Code: CHEMISTRY –DSE-12

Course Title: Organometallics, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy

Total Credits: 06

(Credits: Theory-04, Practical-02)

(Total Lectures: Theory- 60, Practical-60)

Section B: Organic Chemistry (Lectures:30)

Unit 4:

Polynuclear and heteronuclear aromatic compounds:

Structure elucidation of naphthalene, preparation and properties of naphthalene and anthracene.

Preparation and Properties of the following compounds with reference to electrophilic and nucleophilic substitution: furan, pyrrole, thiophene, and pyridine.

(Lectures: 13)

Unit 5:

Active methylene compounds

Preparation: Claisen ester condensation, Keto-enol tautomerism.

Reactions: Synthetic uses of ethylacetoacetate (preparation of non-heteromolecules having up to 6 carbons).

(Lectures: 5)

Unit 6:

UV-Visible and infrared spectroscopy and their application to simple organic molecules.

Electromagnetic radiations and their properties; double bond equivalence and hydrogen deficiency.

UV-Visible spectroscopy (electronic spectroscopy): General electronic transitions, λ_{max} & ϵ_{max} , chromophores & auxochromes, bathochromic & hypsochromic shifts. Application of Woodward rules for calculation of λ_{max} for the following systems: conjugated dienes - alicyclic, homoannular and heteroannular; α,β -unsaturated aldehydes and ketones, charge transfer complex.

Infrared (IR) Spectroscopy: Infrared radiation and types of molecular vibrations, significance of functional group & fingerprint region. IR spectra of alkanes, alkenes, aromatic hydrocarbons (effect of conjugation and resonance on IR absorptions), simple alcohols (inter and intramolecular hydrogen bonding and IR absorptions), phenol, carbonyl compounds, carboxylic acids and their derivatives (effect of substitution on $>C=O$ stretching absorptions).

(Lectures: 12)