UNIVERSITY OF MADRAS

B.Sc. DEGREE PROGRAMME IN CHEMISTRY

SYLLABUS WITH EFFECT FROM 2023-2024

<table>
<tr><td>Title of the Course</td><td colspan="7">ORGANIC CHEMISTRY – I</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core IX(CC9)</td></tr>
<tr><td>Category</td><td>Core</td><td>Year</td><td>III</td><td>Credits</td><td>4</td><td>Course Code</td><td>324C5A</td></tr>
<tr><td></td><td></td><td>Semester</td><td>V</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td>Total</td></tr>
<tr><td></td><td>4</td><td>1</td><td colspan="3">-</td><td>5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry I,II, III and IV</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide an understanding of
stereoisomerism in chirals and geometric isomerism in olefins, conformations of ethane and butane
preparation and properties of aromatic and aliphatic nitro compounds and amines
preparation of different dyes, food colour and additives
preparation and properties of five membered heterocycles like pyrrole, furan and thiophene
preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I
Stereochemistry

Fischer Projection, Newmann and Sawhorse Projection formulae and their inter conversions;
Geometrical isomerism: cis–trans, syn-anti isomerism, E/Z notations.

Optical Isomerism: Optical activity, specific rotation, asymmetry, enantiomers, distereo isomers, meso structures - molecules with one and two chiral centres, racemisation- methods of racemisation; resolution-methods of resolution. C.I.P rules. R and S notations for one and two chirality (stereogenic) centres.

Molecules with no asymmetric carbon atoms – allenes and biphenyls.
Conformational analysis of ethane and butane.</td></tr>
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	UNIT II **Chemistry of Nitrogen Compounds – I** **Nitroalkanes** Nomenclature, isomerism, preparation from alkyl halides, halo acids, alkanes; physical properties; reactions – reduction, halogenations, Grignard reagent, Pseudo acid character. Nitro - aci nitro tautomerism. **Aromatic nitro compounds** Nomenclature, preparation – nitration, from diazonium salts, physical properties; reactions - reduction of nitrobenzene in different medium, Electrophilic substitution reactions, TNT.
	Amines: Aliphatic amines Nomenclature, isomerism, preparation – Hofmanns' degradation reaction, Gabriel's phthalimide synthesis, Curtius Schmidt rearrangement. Physical properties, reactions – alkylation, acylation, carbylamine reaction, Mannich reaction, oxidation, basicity of amines.

UNIT III
Chemistry of Nitrogen Compounds – II

Aromatic amines – Nomenclature, preparation – from nitro compounds, Hofmann's method; Schmidt reaction, properties - basic nature, ortho effect; reactions – alkylation, acylation, carbylamine reaction, reaction with nitrous acid, aldehydes, oxidation, Electrophilic substitution reactions, diazotization and coupling reactions; sulphanilic acid - zwitter ion formation.

Distinction between primary, secondary and tertiary amines - aliphatic and aromatic
Diazonium compounds

Diazomethane, Benzene diazonium chloride - preparations and synthetic applications.

Dyes
Theory of colour and constitution; classification based on structure and application; preparation –Martius yellow, aniline yellow, methyl orange, alizarin, indigo, malachite green.
Industry oriented content

Dyes Industry, Food colour and additives

UNIT IV
Heterocyclic compounds
Nomenclature and classification. General characteristics - aromatic character and reactivity.
Five-membered heterocyclic compounds

Pyrrole – preparation - from succinimide, Paal Knorr synthesis; reactions – reduction, basic character, acidic character, electrophilic substitution reactions, ring opening.

Furan – preparation from mucic acid and pentosan; reactions – hydrogenation, reaction with oxygen, Diels Alder reactions, formation of thiophene and pyrrole; Electrophilic substitution reaction.

Thiophene synthesis - from acetylene; reactions –reduction; oxidation; electrophilic substitution reactions.

UNIT V
Six-membered heterocyclic compounds

Pyridine – synthesis - from acetylene, Physical properties; reactions -

	basic character, oxidation, reduction, electrophilic substitution reactions; nucleophilic substitution-uses Condensed ring systems Quinoline – preparation - Skraup synthesis and Friedlander's synthesis; reactions – basic nature, reduction, oxidation; electrophilic substitutions; nucleophilic substitutions – Chichibabin reaction Isoquinoline – preparation by the Bischler – Napieralski reaction, reduction, oxidation; electrophilic substitution.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1.M.K. Jain, S.C.Sharma, Modern Organic Chemistry, Vishal Publishing, fourth reprint, 2009. 2.S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., third edition,2009. 3. ArunBahl and B.S. Bahl, Advanced organic chemistry, New Delhi, S.Chand& Company Pvt. Ltd., Multicolour edition,2012. 4.P. L.Soni and H. M. Chawla, Text Book of Organic Chemistry, SultanChand&Sons,NewDelhi,twentyninthedition,2007. 5.C.N.Pillai, Text Book of Organic Chemistry, Universities Press (India) Private Ltd., 2009.

Reference Books	1.R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson Education, Asia, sixth edition,2012. 2. T.W.Graham Solomons, Organic Chemistry, John Wiley &Sons, eleventh edition, 2012. 3. A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, seventhedition,2009. 4. I. L. Finar, Organic Chemistry, Vol. (1& 2), England, Wesley Longman Ltd, sixth edition,2006. J.A.Joule, and G.F.Smith, Heterocyclic Chemistry, Wiley, Fifth Edition, 2010.
Website and e-learning sources	1. www.epgpathshala.nic.in 2. www.nptel.ac.in 3. http:/swayam.gov.in 4. Virtual Textbook of OrganicChemistry

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: assign RS notations to chirals and EZ notations to olefins and explain conformations of ethane and butane.

CO2: explain preparation and properties of aromatic and aliphatic nitro compounds and amines

CO3: explain colour and constitution of dyes and food additives

CO4: discuss preparation and properties of five membered heterocycles like pyrrole, furan and thiophene

CO5: discuss preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's