Semester	**6**
Course	**Major**
Paper Code	C3CH230612T / C3CH230612P
Paper Title	Organic Chemistry 5
No. of Credits	3 Theory+1 Practical
Theory / Practical / Composite	Composite
Minimum No. of preparatory hours per week a student has to devote	10
Number of Modules	03
Syllabus	**Module I: Organic Synthesis with retrosynthetic approach (12 Lectures)** *Retrosynthetic analysis:* disconnections; synthons, donor and acceptor synthons; natural reactivity and *umpolung*; latent polarity in bifunctional compounds: consonant and dissonant polarity; illogical electrophiles and nucleophiles; synthetic equivalents; functional group interconversion and addition (FGI and FGA); C-C disconnections and synthesis: one-group and two-group (1,2- to 1,5-dioxygenated compounds), reconnection (1,6-dicarbonyl); protection-deprotection strategy (alcohol, amine, carbonyl, acid). *Strategy of ring synthesis:* thermodynamic and kinetic factors; synthesis of large rings, application of high dilution technique. *Asymmetric synthesis*: stereoselective and stereospecific reactions; diastereoselectivity and enantioselectivity (only definition); enantioselectivity: kinetically controlled MPV reduction; diastereoselectivity: addition of nucleophiles to C=O adjacent to a stereogenic centre: Cram's and FelkinAnh models.

	Module II: Green chemistry and Chemistry of natural products (12 Lectures) Introduction, Definitions of Green Chemistry, Brief introduction of principles of Green Chemistry with examples, Special emphasis on atom economy, toxicity reduction, green solvents and subsequent use in organic synthesis, Green Chemistry and catalysis, reactions in micellar media, reactions in aqueous medium, reactions under solvent-free conditions, Enzyme catalyzed reactions, Examples of Green Synthesis/ Reactions: Aldol, Friedel-Crafts, Michael, Knoevenagel, Cannizzaro, Synthesis of adipic acid, catechol using green approach. *Natural products:* Alkaloids: Chemical transformation related to Morphine, Codeine; Synthesis of lead drug Naloxone, Naltrindole, Metopon. Terpenoids: Isoprene rule. Synthesis and physiological activity of representative examples of acyclic, monocyclic monoterpenoids. Steriods: Structural features, chemistry and physiological activity of steroids. **Module III: Dynamic stereochemistry (12 Lectures)** *Alicyclic compounds:* conformational analysis: Baeyer's strain theory, Cyclohexane: chair and boat conformations(symmetry elements and relative stabilities), symmetry properties and optical activity of mono and disubstituted cyclohexane systems; topomerisation: C_2-path and σ-path, relative stabilities of conformation in cyclohexane system considering steric and stereoelectronic effects- dipole-dipole

	interaction, anomeric effect, 2-alkyl ketone effect, 3-alkyl ketone effect, α-haloketone effect, $A^{1,2}$ strain; Conformation and reactivity in cyclohexane systems for the following reactions: hydrolysis of esters, elimination (E2, E1), nucleophilic substitution (S_N1, S_N2, S_Ni, NGP, merged substitution-elimination; rearrangement reactions; oxidation of cyclohexanol, reduction of cyclohexanone, esterification, lactonisation, epoxidation, pyrolytic *syn* elimination and fragmentation reactions; concept of I-strain. **Practicals** ***Multicomponent reactions & Multistep organic synthesis*** 1. Synthesis of 7-hydroxy-4-methyl coumarin from ethyl acetoacetate and resorcinol followed by nitration. 2. Synthesis of binol and its derivatives. 3. Synthesis of diphenyl acetic acid from benzoin. 4. Synthesis of quinoxaline derivative from benzoin. 5. Synthesis of glycine from phthalic anhydride. 6. Synthesis of 8-hydroxy quinolone and its derivative. 7. Multicomponent Biginelli reaction. 8. Microwave assisted synthesis of imidazoles from o-phenylene diamine and aldehydes.
Learning Outcomes	***Theory:*** Students will have *knowledge about* i) Organic Synthesis with retrosynthetic approach ii) Study about the basics of green chemistry and the chemistry of some natural products iii) Dynamic stereochemistry of cyclic compounds

	Practical: The students will learn to do advanced multistep and multicomponent organic synthesis.
Reading/Reference Lists	**Theory:** 1. Clayden, J., Greeves, N., Warren, S. *Organic Chemistry,* Second edition, Oxford University Press 2012. 2. Loudon, G. M. *Organic Chemistry*, Fourth edition, Oxford University Press, 2008. 3. Eliel, E. L. & Wilen, S. H. *Stereochemistry of Organic Compounds*, Wiley: London, 1994. 4. Nasipuri, D. *Stereochemistry of Organic Compounds,* Wiley Eastern Limited. 5. Finar, I. L. *Organic Chemistry (Volume 1 & Volume 2)* Pearson Education. 6. Agarwal, O. P. Organic Chemistry Natural Products, Krishna Prakashan Media (P) Ltd, 2015. 7. Warren, S. & Wyatt, P. Organic Synthesis: The Disconnection Approach, Wiley, 2008. 8. Robinson, M. J. T., *Stereochemistry*, Oxford Chemistry Primer, Oxford University Press, 2005. 9. Kar, R. K. Fundamentals of Organic Synthesis the Retrosynthetic Analysis, New Central Book Agency, 2014. 10. Clark, J., MacQuarrie, D. *Handbook of Green Chemistry & Technology*, Blackwell Publishing, 2002. 11. Lindström, U. M. Organic Reactions in Water: Principles, Strategies and Applications, Blackwell Publishing, 2007. 12. Pelter, A. Natural Products. 13. Cordell, G. F. The Alkaloids, Academic Press Inc.

<table>
<tr><td></td><td colspan="2">14. Kalsi, P. S. Pharmaceutical medicinal & natural product chemistry, Alpha Science International Ltd.
<u>Practical</u>
1. Vogel, A. I. Elementary Practical Organic Chemistry, Part 1: Small scale Preparations, CBS Publishers and
Distributors.
2. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G. N. University of Calcutta, 2003.
3. Practical Workbook Chemistry (Honours), UGBS, Chemistry, University of Calcutta, 2015
4. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012).
5. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education.</td></tr>
<tr><td>Evaluation</td><td>Theory: 60
Internal: 15 (CIA: 10;
Other form of Assessment: 2; Attendance: 3)
Semester Exam: 45</td><td>Practical: 40
CA: 38; Attendance:2</td></tr>
<tr><td>Paper Structure for Theory Semester Exam</td><td colspan="2">Answer THREE out of FOUR questions, of 15 marks each.</td></tr>
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