Semester	**4**
Course	**Major**
Paper Code	C2CH230412T/ C2CH230412P
Paper Title	Organic Chemistry 3
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: Aromatic Substitution 12L** *Aromatic electrophilic substitution:* General mechanism and evidences in favour of it. ArES reactions: nitration, nitrosation, sulfonation, halogenation, Friedel-Crafts reaction; chloromethylation reactions with mechanism. Orientation and reactivity towards electrophilic substitution for mono-substituted aromatic compounds. Named reactions based on ArES: Gatterman-Koch, Gatterman, Houben-Hoesch, Vilsmeier-Haack, Reimer-Tiemann, Kolbe-Schmidt. *Ipso* substitituion. *Nucleophilic aromatic substitution:* Mechanism and evidences in favour of it; S_NAr mechanism; Meisenheimer complex; cine substitution through benzyne intermediate. **Module II: Carbonyl compounds-II 12L** *Exploitation of acidity of α-H of C=O:* formation of enols and enolates; kinetic and thermodynamic enolates; reactions (mechanism with evidence): halogenation of carbonyl compounds under acidic and basic conditions, Hell-Volhard-Zelinsky (H. V. Z.) reaction, nitrosation, SeO_2 (Riley) oxidation; condensations (mechanism with evidence): Aldol, Tollens', Knoevenagel, Claisen-Schmidt, Claisen ester including Dieckmann, Stobbe; Mannich reaction, Perkin reaction, Favorskii rearrangement; alkylation of active methylene compounds; preparation and synthetic applications of diethyl malonate and ethyl acetoacetate; specific enol equivalents (lithium enolates, enamines, aza-enolates and silyl enol ethers) in connection with alkylation, acylation and aldol type reaction.

	Nucleophilic addition to α,β-unsaturated carbonyl system: general principle and mechanism (with evidence); direct and conjugate addition, addition of enolates (Michael reaction), Stetter reaction, Robinson annulation. *Substitution at sp^2 carbon (C=O system):* mechanism (with evidence): $B_{AC}2$, $A_{AC}2$, $A_{AC}1$, $A_{AL}1$ (in connection to acid and ester); acid derivatives: amides, anhydrides & acyl halides (formation and hydrolysis including comparison). **Module III: Organometallic compounds and Carbocycles 12L** *Grignard reagent; Organolithiums; Gilman cuprates:* preparation and reactions (mechanism with evidence); addition of Grignard and organolithium to carbonyl compounds; substitution on -COX; directed ortho metalation of arenes using organolithiums, conjugate addition by Gilman cuprates; Corey-House synthesis; abnormal behavior of Grignard reagents; comparison of reactivity among Grignard, organolithiums, Organocadmium and organocopper reagents; Reformatsky reaction; Blaise reaction; base-nucleophile dichotomy in case of organometallic reagents. *Polynuclear hydrocarbons and their derivatives:* synthetic methods include Haworth, Bardhan-Sengupta, Bogert-Cook and other useful syntheses (with mechanistic details); fixation of double bonds and Fries rule; reactions (with mechanism) of naphthalene, anthracene, phenanthrene and their derivatives. Practical Single-step organic synthesis *Organic preparations and detection of final compounds by melting point and TLC by locating solvent front and calculating R_f values* 1. Nitration of aromatic compounds 2. Condensation reactions Synthesis of dibenzylidene acetone from benzaldehyde and acetone 3. Hydrolysis of amides/imides/esters 4. Benzoylation of phenols/aromatic amines

	5. Side chain oxidation of aromatic compounds: Synthesis of p-nitrobenzoic acid from p-nitrotoluene by potassium dichromate in concentrated sulphuric acid. 6. Bromination of aniline using green approach (Bromate-Bromide method) 7. Selective reduction of *m*-dinitrobenzene to *m*-nitroaniline
Learning Outcomes	Theory: To have knowledge about- i) Substitution reactions in aromatic compounds ii) Reaction and synthesis of Carbonyl and Related Compounds iii) Brief idea about organometallic compounds and carbocycles Practical: Single-step organic synthesis
Reading/Reference Lists	Theory: 1. Clayden, J., Greeves, N., Warren, S. Organic Chemistry, Second edition, Oxford University Press 2012. 2. Sykes, P. A guidebook to Mechanism in Organic Chemistry, Pearson Education, 2003. 3. Smith, J. G. Organic Chemistry, Tata McGraw-Hill Publishing Company Limited. 4. Carey, F. A. & Sundberg, R. J. ADVANCED ORGANIC CHEMISTRY: PART A STRUCTURE AND MECHANICSMS, Fifth edition, Springer, 2008. 5. Carey, F. A. & Sundberg, R. J. ADVANCED ORGANIC CHEMISTRY: PART B REACTIONS AND SYNTHESIS, Fifth edition, Springer, 2008. 6. Loudon, G. M. Organic Chemistry, Fourth edition, Oxford University Press, 2008. 7. Nasipuri, D. Stereochemistry of Organic Compounds, Wiley Eastern Limited. 8. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 9. Finar, I. L. Organic Chemistry (Volume 1) Pearson Education. 10. Maskill, H., Mechanisms of Organic Reactions, Oxford Chemistry Primer, Oxford University Press. 11. Norman, R. O. C. & Coxon, J. M. Principles of Organic Synthesis, Nelson Thornes Ltd, 1993. Practical 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. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009).

	4. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. Practical Organic Chemistry, 5th Ed. Pearson (2012). 5. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000). 6. Practical Workbook Chemistry (Honours), UGBS, Chemistry, University of Calcutta, 2015.	
Evaluation	Theory: 60 Internal: 15 (CIA: 10; Other form of Assessment: 2; Attendance: 3) Semester Exam: 45	Practical: 40 CA: 38; Attendance:2
Paper Structure for Theory Semester Exam	Answer THREE out of FOUR questions, of 15 marks each.	