Course: Generic Elective (Set 1)

Semester ____	3
Paper Number	**HCHGE3032T (60 MARKS) & HCHGE3032P (40 MARKS)**
Paper Title	Inorganic & Organic Chemistry
No. of Credits	
Theory/Composite	Composite
No. of periods assigned	Th: 4; Pr: 2
Name of Faculty member(s)	Dr. Ankur Ray Dr. Rahul Sharma Mr. Dipankar Das
Course description/objective	***The primary aim is to give a flavour of the basic concepts of Inorganic & Organic Chemistry to the students of other discipline***
Syllabus	Annexure GE Set 1
Texts	
Reading/Reference Lists	1. Douglas, B.E. and McDaniel, D.H. *Concepts & Models of Inorganic Chemistry* Oxford, 1970. . 2. Atkin, P. *Shriver & Atkins' Inorganic Chemistry,* 5th Ed., Oxford University Press (2010). 3. Lee, J. D. *Concise Inorganic Chemistry, 5th Ed.,* Wiley India Pvt. Ltd., 2008. 4.Sethi, A. Conceptual Organic Chemistry; New Age International Publisher. 5.Parmar, V. S. A Text Book of Organic Chemistry, S. Chand & Sons. 6.Madan, R. L. Organic Chemistry, S. Chand & Sons. 7.Wade, L. G., Singh, M. S., Organic Chemistry, Pearson. 8.Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
Evaluation	**Theory: 60 marks** CIA: 10 End-Sem: 50 **Practical: 40 marks** *(Continuous Assessment)* Internal Assessment Exams: 30 Viva (End Sem): 8 Attendance: 2
Paper Structure for the End Sem **Theory Exam** (50 marks)	6 (SIX) Questions (each of 10 marks) will be set and the students will have to answer any 5 (FIVE). Each of the Questions (10 marks) will consist of 2 or 3 parts (of 2/ 3/ 4/ 5)

Annexure GE Set 1

GE: 1 (Theory) 52 Lectures

Module 1: INORGANIC (22 Lectures)

Wave mechanics: (8 Lectures)
de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and ψ^2. Quantum numbers and their significance. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of *s*, *p*, *d* and *f* orbitals. Pauli's Exclusion Principle, Hund's rules and multiplicity, Exchange energy, Aufbau principle and its limitations,

Covalent bond: (6 Lectures)
Polarizing power and polarizability, ionic potential, Fazan's rules. Lewis structures, formal charge. Valence Bond Theory. VSEPR theory, shapes of molecules and ions containing lone pairs and bond pairs (examples from main groups chemistry), hybridizations, , Dipole moments.

Molecular orbital concept of bonding (3 Lectures)
(The approximations of the theory, Linear combination of atomic orbitals (LCAO)) (elementary pictorial approach): sigma and pi-bonds. Orbital designations: *gerade*, *ungerade,* HOMO, LUMO. Orbital mixing,. MO diagrams of H2, O2, F2,

Acid-base equilibria in aqueous solution (5 Lectures)
(Proton transfer equilibria in water), pH, hydrolysis of salts, buffer solution. Acid-base neutralisation curves; indicator, choice of indicators.

Module 2: ORGANIC (30 Lectures)

Fundamentals of Organic Chemistry (3 Lectures)

Electronic displacements: inductive effect, resonance and hyperconjugation; cleavage of bonds: homolytic and heterolytic; nucleophiles and electrophiles; reactive intermediates: carbocations, carbanions and free radicals.

Stereochemistry (6 Lectures)

Different types of isomerism; geometrical and optical isomerism; concept of chirality and optical activity (up to two carbon atoms); asymmetric carbon atom; elements of symmetry (plane and centre); interconversion of Fischer and Newman representations; enantiomerism and diastereomerism, meso compounds; threo and erythro, D and L, cis and trans nomenclature; CIP Rules: R/S (upto 2 chiral carbon atoms) and E/Z nomenclature.

Nucleophilic Substitution and Elimination Reactions (4 Lectures)

Nucleophilic substitutions: SN1 and SN2 reactions; eliminations: E1 and E2 reactions (elementary mechanistic aspects); Saytzeff and Hofmann eliminations; elimination vs substitution.

Aliphatic Hydrocarbons (4 Lectures)

Alkenes: Preparation: elimination reactions: dehydration of alcohols and dehydrohalogenation of alkyl halides; cis alkenes (partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alkaline KMnO4) and trans-addition (bromine) with mechanism, addition of HX [Markownikoff's (with mechanism) and anti-Markownikoff's addition], hydration, ozonolysis, oxymercuration-demercuration and hydroboration-oxidation reaction.

Aromatic Electrophilic Substitution Reactions (6 Lectures):

Electrophilic substitution (general mechanism); nitration (with mechanism), halogenations (chlorination and bromination), sulphonation and Friedel-Craft's reaction (alkylation and acylation) (up to 4 carbons on benzene); side chain oxidation of alkyl benzenes (up to 4 carbons on benzene), Reimer -Tiemann reaction, Houben–Hoesch condensation, Schotten–Baumann reaction, Fries rearrangement and Claisen rearrangement.

Carbonyl Compounds (7 Lectures):

Aldehydes and Ketones:
General properties of aldehydes and ketones; Reactions: with HCN, ROH, $NaHSO_3$, NH_2-G derivatives and with Tollens' and Fehling's reagents; iodoform test; aldol condensation (with mechanism); Cannizzaro reaction (with mechanism), Wittig reaction, benzoin condensation; Clemmensen reduction, Wolff-Kishner reduction and Meerwein-Pondorff- Verley (MPV) reduction.

GE: 1 (Practical) 28 Lectures
Qualitative Analysis of Single Solid Organic Compounds

A. Detection of special elements (N, S, Cl, Br) by Lassaigne's test

B. Solubility and classification (solvents: H_2O, 5% HCl, 5% NaOH and 5% $NaHCO_3$)

C. Detection of the following functional groups by systematic chemical tests:

aromatic amino ($-NH_2$), aromatic nitro ($-NO_2$), amido ($-CONH_2$, including imide), phenolic –OH, carboxylic acid (-COOH), carbonyl (-CHO and >C=O); only one test for each functional group is to be reported.

D. Melting point of the given compound