

CLUSTER UNIVERSITY OF JAMMU

SYLLABUS (CBCS) OF GENERIC ELECTIVE COURSE
OFFERED BY CHEMISTRY DEPARTMENT

(EXAMINATION TO BE HELD IN 2017, 2018 AND 2019)

TITLE: ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY & ALIPHATIC HYDROCARBONS

COURSE CODE : 0CHMGENE01

CREDITS : 04

DURATION OF EXAMINATION

TOTAL: 100 Marks

MINOR TEST : 01 Hour

MINOR TEST: 20 Marks

MAJOR TEST : 2.5 Hours

MAJOR TEST: 80 Marks

UNIT-1: Atomic Structure (12 HOURS)

Introduction of Quantum mechanics. Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and ψ^2 , Schrödinger equation for hydrogen atom. Radial and angular parts of the hydrogenic wavefunctions (atomic orbitals) Radial and angular wave function probability distribution curves of $1s$, $2s$, $2p$ and $3d$ orbitals. Quantum numbers and their significance. Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy.

UNIT-2: Chemical Bonding and Molecular Structure (12 HOURS)

Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.

MO Approach: Rules for the LCAO method, bonding and antibonding MO treatment of homonuclear diatomic molecules (H_2 , B_2 , C_2 , N_2 , O_2 , F_2 and their ions) and heteronuclear diatomic molecules such as CO, NO and NO^+ . Comparison of VB and MO approaches.

UNIT-3: Bio-Inorganic Chemistry (12 HOURS)

A brief introduction to bio-inorganic chemistry. Role of metal ions present in biological systems with special reference to Na^+ , K^+ and Mg^{2+} ions: Na/K pump; Role of Mg^{2+} ions in energy production and chlorophyll. Role of Ca^{2+} in blood clotting and structural role (bones). Structure and importance of haemoglobin & myoglobin

UNIT-4: Fundamentals of Organic Chemistry & Stereochemistry (12 HOURS)

Fundamentals of Organic Chemistry: Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Nucleophiles and electrophiles.

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Reactive Intermediates: Carbocations, Carbanions and free radicals.

Stereochemistry: Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Symmetry Elements Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; (Enantiomerism, Diastereomerism and Meso compounds). CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems).

UNIT-5: Aliphatic Hydrocarbons

(12 HOURS)

Functional group approach for the following reactions (nomenclature, preparations & reactions) to be studied in context to their structure.

Alkanes: Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. *Reactions*: Free radical Substitution: Halogenation.

Alkenes: Preparation: Elimination reactions: Dehydration of alcohols and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis-alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). *Reactions*: cis-addition (alk. KMnO_4) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, Hydroboration-oxidation.

Alkynes: Preparation: Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides.

Reactions: formation of metal acetylides, addition of bromine and alkaline KMnO_4 , ozonolysis and oxidation with hot alk. KMnO_4 .

Reference Books:

1. Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. *Basic Inorganic Chemistry*, 3rd ed., Wiley.
3. Douglas, B.E., McDaniel, D.H. & Alexander, J.J. *Concepts and Models in Inorganic Chemistry*, John Wiley & Sons.
4. Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. *Inorganic Chemistry: Principles of Structure and Reactivity*, Pearson Education India, 2006.
5. Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. *Organic Chemistry*, John Wiley & Sons (2014).
6. McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
7. Sykes, P. *A Guidebook to Mechanism in Organic Chemistry*, Orient Longman, New Delhi (1988).
8. Eliel, E.L. *Stereochemistry of Carbon Compounds*, Tata McGraw Hill education, 2000.
9. Kalsi, P.S. *Stereochemistry of Carbon Compounds*, Tata McGraw Hill education, 2000.
10. Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010.
11. Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry*, S. Chand, 2010.

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INSTRUCTIONS FOR PAPER SETTERS AND CANDIDATES:

1. The question paper for Semester End Examination will consist of two parts:

- a) **Part A** will comprise of short answer /objective type questions of 16 marks (five questions of 2 marks and six questions of 1 mark each) covering all five units.
- b) **Part B** will comprise of eight questions of 16 marks each with two questions each from II, III, IV and V units. The students will have to attempt four questions selecting one question from each unit. Each question of 16 marks will have two parts: (i) long answer question of 12 marks (ii) short answer question/numerical problem of 4 marks each. The duration of the examination will be 2.5 hours.

2. The Minor Test will be held for unit I of the syllabus. It will comprise of two parts:

- a) **Part A** consists of three long answer questions of 5 marks each and students will have to attempt any two.
- b) **Part B** consists of seven short answer questions of 2 marks each and students will have to attempt any five.