

# BODOLAND UNIVERSITY

**REDUCED SYLLABUS::2020-2021**  
**(1<sup>st</sup> Semester)**



**SYLLABUS FOR**  
**B.Sc. CHEMISTRY (CBCS)**

*(Regular Course)*

**Bodoland University**

Kokrajhar-783 370, Assam, India

### B.Sc. (Regular Course)

Sem.	CORE COURSE (12)	Ability Enhancement Compulsory Course (AECC) (2)	Skill Enhancement Course (SEC) (4)	Discipline Specific Elective (DSE) (6)
I	DSC-1 A	(English/Hindi/MIL Communication)		
	DSC-2 A (Chemistry-1)			
	DSC-3 A			
II	DSC-1 B	Environmental Science		
	DSC-2 B (Chemistry-2)			
	DSC-3 B			
III	DSC-1 C		SEC-1 (Basic Analytical Chemistry)	
	DSC-2 C (Chemistry-3)			
	DSC-3 C			
IV	DSC-1 D		SEC-2 (Fuel Chemistry)	
	DSC-2 D (Chemistry-4)			
	DSC-3 D			
V			SEC-3 (Chemical Technology & Society)	DSE-1 A
				DSE-2 A (Analytical Methods in Chemistry)
				DSE-3 A
VI			SEC-4 (Chemistry of Cosmetics & Perfumes)	DSE-1 B
				DSE-2 B (Instrumental Methods of Chemical Analysis)
				DSE-3 B

**Curriculum Structures for B.Sc. (Regular Course)**  
**(Physics, Chemistry, Mathematics, Botany and Zoology)**  
**No. of papers =12+12=24, Total Credits= 120**  
**Total Marks=2100**

<b>SEMESTER-I</b>						
<b>Paper Code</b>	<b>Course</b>	<b>L+T+P</b>	<b>Credit</b>	<b>End Sem Marks</b>	<b>Internal Marks</b>	<b>Total Marks</b>
Paper-101R	DSC-1A	4+0+2 5+1+0	6	60(L)+20(P) 60(L)+20(T)	20	100
CHY-102R	DSC-2A: Chemistry-1	4+0+2	6	60(L)+20(P)	20	100
Paper-103R	DSC-3A	4+0+2 5+1+0	6	60(L)+20(P) 60(L)+20(T)	20	100
COMM-104HR	AECC-1: (English /Hindi/MIL Communication)	2	2	50(L)	-	50
<b>Total</b>			<b>20</b>	<b>290</b>	<b>60</b>	<b>350</b>

## SEMESTER-I

### DSC-2A: Chemistry-1

(*ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY & ALIPHATIC HYDROCARBONS*)

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

#### *Section A: Inorganic Chemistry-1*

(30 Periods)

**Atomic Structure:** Review of: Bohr's theory and its limitations, dual behaviour of matter and radiation, de Broglie's relation, Heisenberg Uncertainty principle. Hydrogen atom spectra. Need of a new approach to Atomic structure.

What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of  $\psi$  and  $\psi^2$ , Schrödinger equation for hydrogen atom. Significance of quantum numbers, orbital angular momentum and quantum numbers  $m_l$  and  $m_s$ . Shapes of *s*, *p* and *d* atomic orbitals, nodal planes. Discovery of spin, spin quantum number (*s*) and magnetic spin quantum number ( $m_s$ ).

Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy.

(14 Lectures)

#### **Chemical Bonding and Molecular Structure**

*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. Statement of Born-Landé equation for calculation of lattice energy, 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.

Concept of resonance and resonating structures in various inorganic and organic compounds.

(16 Lectures)

#### *Section B: Organic Chemistry-1 (30 Periods)*

##### **Fundamentals of Organic Chemistry**

Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis.

Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles.

Reactive Intermediates: Carbocations, Carbanions and free radicals.

Aromaticity: Benzenoids and Hückel's rule.

(8 Lectures)

**Stereochemistry**

Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Threo and erythro; D and L; *cis-trans* nomenclature; CIP Rules: R/S (for upto 2 chiral carbon atoms) and E/Z Nomenclature (for upto two C=C systems).

**(10 Lectures)****Aliphatic Hydrocarbons**

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

**Alkanes:** (Upto 5 Carbons). *Preparation:* Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. *Reactions:* Free radical Substitution: Halogenation.

**Alkenes:** (Upto 5 Carbons) *Preparation:* Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); *Reactions:* *cis*-addition (alk. KMnO<sub>4</sub>) and *trans*-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, Hydroboration-oxidation.

**Alkynes:** (Upto 5 Carbons) *Preparation:* Acetylene from CaC<sub>2</sub> and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides.

**(12 Lectures)****Reference Books:**

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

**DSC-2A LAB: Chemistry-1 LAB**  
**60 Lectures**

***Section A: Inorganic Chemistry - Volumetric Analysis***

1. Estimation of oxalic acid by titrating it with  $\text{KMnO}_4$ .
2. Estimation of water of crystallization in Mohr's salt by titrating with  $\text{KMnO}_4$ .
3. Estimation of Fe (II) ions by titrating it with  $\text{K}_2\text{Cr}_2\text{O}_7$  using internal indicator.

***Section B: Organic Chemistry***

1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements)

**Reference Books:**

- Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
- Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.
- Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., *Textbook of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.
- Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960.

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