CURRICULAR FRAME WORK FOR BACHELORS (FYUGP) WITH CHEMISTRY AS MAJOR

SEMESTER	COURSE CODE	COURSE TITLE	CREDITS	
			TH	P/TU
I	CHM123J	Fundamentals of Chemistry and Chemical Analysis-I	4	2
II	CHM223J	Fundamentals of Chemistry and Chemical Analysis-II	4	2
III	CHM322J	Fundamentals of Chemistry and Chemical Analysis-III	4	2
IV	CHM422J1	Concepts in Analytical Chemistry	3	1
	CHM422J2	Selected Topics in Inorganic Chemistry	4	2
	CHM422J3	Stereochemistry and Reaction Mechanism	4	2
V	CHM522J1	Environmental & Green Chemistry	3	1
	CHM522J2	Selected Topics in Physical Chemistry	4	2
	CHM522J3	Advanced Inorganic Chemistry	4	2
VI	CHM622J1	Biological Chemistry	3	1
	CHM622J2	Selected Topics in Organic Chemistry	4	2
	CHM622J3	Advanced concepts in Physical Chemistry	4	2
VII	CHM722J1	Chemistry of Materials	3	1
	CHM722J2	Quantum Mechanics and Spectroscopy	4	2
	CHM722J3	Coordination Chemistry and Inorganic Reaction Mechanism	4	2
VIII	CHM822J1	Applied Chemistry	3	1
	CHM822J2	Spectroscopy of Organic Compounds	4	2
	CHM822J3	Instrumental Methods in Chemistry	4	2

BACHELORS WITH CHEMISTRY AS MAJOR
1st SEMESTER
CHM123J CHEMISTRY _ FUNDAMENTALS OF CHEMISTRY AND CHEMICAL ANALYSIS-I

CREDITS: THEORY-4, LAB-2

Theory (4 credits: 60 Hours) **Max. Marks**: 100, **Min Marks:** 36

Course Objectives:

- *To introduce students to the basic concepts of Inorganic chemistry, chemical bonding, acid base theories and fundamental aspects of s block elements.*
- *To understand the basic concepts of organic chemistry, electron displacements, stereo chemistry and reactive intermediates*
- *To have knowledge about the gaseous, liquid and solid states of matter.*

Learning outcomes:

On completion of the course, the student should be able to:

- *Understand the nature of different theories of chemical bonding, MO treatment of some molecules, bonding in electron deficient molecules, strength of forces between chemical constituents and different acid base concepts.*
- *Understand how periodic trends affect the reaction chemistry, complexing ability of s-block elements.*
- *Applications of s- block elements.*
- *Recognize the key* reactive intermediates *in organic chemistry and understand different aspects of stereochemistry.*
- *Understand the structural and behavioral aspects of states of matter.*

Unit 1- Basic Inorganic Chemistry **(15 Hours)**

Electronegativity, scales and applications. Effective nuclear charge and its calculation by Slater rules. Fajan's rules and its applications, Solvation energy and factors affecting solubility of ionic solids. VSEPR theory of simple molecules (AX_4, AX_4E_2, AX_5, AX_5E, AX_3E_2, AX_6) MO treatment of heteronuclear diatomic molecules (CO and NO). Multicenter bonding in electron deficient molecules.

Acid base theories: Arrhenius, Bronsted-Lowry, Lewis, Lux-Flood and Usanovich. HSAB-principle, concept and applications. Relative strengths of acids and bases. Differentiating and leveling solvents. Non aqueous solvents: classification and comparison with aqueous solvents. NH_3 as representative non aqueous solvent.

Unit II - s-Block Chemistry **(15 Hours)**

Chemical reactivity of s-block elements towards water, oxygen, hydrogen, and halogens. Anomalous behavior and diagonal relationship (Lithium, Beryllium, Magnesium and Aluminum). Chemical characteristics of the compounds of alkali and alkaline earth metals (oxides, hydrides, hydroxides carbonates, nitrates, sulphates). Solutions of alkali metals in liquid ammonia, EDTA complexes of calcium and magnesium. Industrial importance of s blocks elements (Alkali metal ion batteries).

Unit III: Basic concepts in Organic Chemistry-I **(15 Hours)**

Electron displacements: Inductive, electromeric, conjugative and hyperconjugative effects. Tautomerism. Nucleophiles and electrophiles. Arrow formalism.
Reactive intermediates: Introduction, structure, generation, fate and stability of carbocations, carbanions, free- radicals and carbenes
Stereochemistry
Conformations of ethane, butane and cyclohexane. Interconversions: Wedge Formula, Newmann, Sawhorse and Fischer representations. Geometrical and Optical isomerism, concept of chirality, Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro, Absolute Configuration; D and L; R/ S (upto two chiral centers), *cis - trans* and E / Z systems of nomenclature.

UNIT IV: States of matter **(15 Hours)**

Gaseous State: Kinetic molecular theory of gases, Root mean square, average and most probable velocities; qualitative discussion of Maxwell's distribution of molecular velocities. Deviation of gases from ideal behaviour, van der Waal's equation of state. PV isotherms of real gases, continuity of states, van der Waal's equation isotherms. Relationship between critical constants and van der Waal's constants, the law of corresponding states, reduced equation of state.

Liquid State: Viscosity and surface tension of liquids, factors affecting viscosity and surface tension

Solid State: General characteristics of solids, Symmetry elements in crystals, Crystal lattice and unit cell, number of atoms in the unit cell, close-packed structures, packing efficiency, and Characteristic structures of ionic solids (NaCl, CaF_2, ZnS).

Books Recommended:

1. Concise Inorganic Chemistry; J.D. Lee; 5thEdn., OUP/Wiley India Pvt. Limited, 2008
2. Chemistry of the Elements; N. N. Greenwood, A. Earnshaw; 2nd Edn., Elsevier India, 2010.
3. Principles of Inorganic Chemistry; B.R. Puri, L.R. Sharma and K.C. Kalia; 33rdEdn., Milestone Publishers & Distributors/ Vishal Publishing Co., 2017
4. Advanced General Organic Chemistry: A Modern Approach; S.K. Ghosh; 3rd Revised Edn., New Central, 2010.
5. Organic Chemistry; R.T. Morrison, R.N. Boyd, S. K. Bhattacharjee; 7th Edn., Pearson India, 2011.
6. Organic Chemistry; P.Y. Bruice; 8thEdn., Pearson Education, 2017.
7. Advanced Organic Chemistry; Dr. Jagdamba Singh and LDS Yadav; Pragati edition,2017.
8. Principles of Physical Chemistry; B.R. Puri, L.R. Sharma and L.S. Pathania; 47th Edn.,Vishal Pubs & Co, 2017.
9. Physical Chemistry; T. Engel, P. Reid,;3rd Edn., Pearson India, 2013.
10. Elements of Physical Chemistry, Peter Atkins and Julio de Paula, 7th Edition, Oxford University Press, 2016.
11. Physical Chemistry, Concepts and Models, Volume 1, Nabakumar Bera, Subhasree Ghosh, Paulami Ghosh, Technoi world,
12. Atkins' Physical Chemistry, Peter Atkins, Julio de Paula & James Keeler, 11th Edition, Oxford University Press, 2018.

Practical (2 credits: 60 Hours) Max. Marks: 50, Min Marks: 18

Section A: Volumetric Analysis (any two)

1. Preparation of solutions of different concentrations; Standardization of solutions (acids and bases).
2. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
3. Volumetric estimation of oxalic acid by titrating it with KMnO4.

Section B: Quantitative Analysis (any two)

1. Purification of organic compounds by crystallization (from water and alcohol) and sublimation.
2. Detection of N, S and halogens in organic compounds.
3. Separation of mixtures by Chromatography:
   Separation and Identification of the components in a given mixture of amino acids by paper chromatography

Section C: Physico-chemical Analysis (any two)

1. Measurement of density and relative density of various liquids using pyknometer/density bottle.
2. Measurement of viscosity of given liquids using Ostwald Viscometer.
3. Measurement of surface tension of given liquids using stalagmometer.

Books Recommended:

1. Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
2. Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.
3. Comprehensive Practical Organic Chemistry: Qualitative analysis Ahluwalia, V.K. &Sunita Dhingra; Universities Press, India, 2004.
4. Advanced Practical Organic Chemistry; N. K. Vishnoi; 3rdEdn; Vikas Publishing, 2009.
5. Advanced Practical Physical Chemistry; J.B. Yadav; Krishna Prakashan Media (P) Limited, 2015.
6. Advanced Physical Chemistry Experiments; J. N. Gurtu, A. Gurtu, Pragati Prakashan, 2008.