Course Name: CH-104 Chemistry

Credit Hours: 2-1

Contact Hours: 2-3

Pre-requisites: None

Course Introduction:

This course is designed to provide an introduction to the key concepts of chemistry and its applications in bioinformatics. It will cover a wide range of topics including introduction and stoichiometry, gases & energy, acids and bases, atomic theory & quantum mechanics, chemical bonding & Intermolecular forces, coordination chemistry, and biochemistry. The course will also introduce students to the importance of chemistry in the field of bioinformatics and will serve as a foundation for biochemistry, and related courses.

Course Objective:

The objective of this course is to impart the conceptual understanding of fundamental chemical principles including properties of atoms, molecules, states of matter, and chemical reactions. So that the students can relate ideas about physical / chemical principles with other interdisciplinary fields like bioinformatics and data science.

Course Outcomes:

After successfully completion of this course, the students would be able to:

- Identify and utilize the terminology and concepts of chemistry to acquire and communicate scientific information
- Distinguish between the physical and chemical properties of matter
- Describe the role that energy plays in chemical systems and in modern society.
- Perform stoichiometry calculations of any reaction
- Describe the periodicity of any element in the periodic table
- Identify the nature of interaction between molecules
- Calculate enthalpy change for a given process, and explain the relationship between enthalpy change and the tendency for reactions to occur
- Perform calculations associated with acid-base and redox reactions;

CLO No	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Learning the basic principles of chemistry	C2 (Understand)
CLO-2	Understand different type of interactions in molecules	C2 (Understand)

CLO-3	Analyze and evaluate the relationship between structure and the physical and chemical properties in biological systems	C4 (Analyze)

Course Plan:

#	Weekly Distribution of Course Contents
Week-1	Dimensional analysis; Atomic structure; Isotopes, Atomic & Molecular Masses; Nomenclature; The mole; Empirical & Molecular Formulas; chemical reactions; Calculations involving chemical reactions; Limiting reagents; Percentage Yield; Chemical reactions and calculations involving aqueous solutions – precipitation
Week-2	Acid-base, and redox reactions.
Week-3	Properties of gases; Definition of pressure; the Absolute and Centigrade temperature scales; Gas laws; Ideal gas equation; Kinetic Molecular Theory; Effusion; Non-ideal gases; Energy
Week-4	Periodic relationship of electronegativity; Ionic, Polar covalent, and Covalent Bonding etc.
Week-5	Lewis structures; Resonance; Formal Charge
Week-6	Chemical Bonding and its types
Week-7	Hybridization
Week-8	Functional groups
Week-9	Valence Bond-Hybridization Theory; Polarity, Intermolecular Forces/Hydrogen bonding
Week-10	Molecular Orbital Theory; Multiple Bonds; Delocalization; Bond Order; Paramagnetism and Diamagnetism
Week-11-12	Quantum theory, Bohr atom; Schrödinger wave mechanics, Atomic quantum mechanics of hydrogenic and polyelectronic atoms
Week-13	Coordination complexes, Oxidation numbers,
Week-14	Crystal field theory, Optical and Magnetic properties
Week-15	Introduction to Biochemistry, proteins, enzymes,
Week-16	Amino acids, nucleotides and nucleic acids

Lab Outline

Labs	Description
1	Overview of the lab and lab equipment.
2	Knowledge of Glassware, pipette, beaker, conical flasks etc
3	Chemical handling (all type of chemicals)
4	Calibration of equipment
5-6	Boiling point, Melting point
7-8	Solution preparation, molar, normal etc.
	MID SEMESTER EXAMS
10	Acid-Base Titration
11-12	pH measurement using pH meter
13	Computational Lab-1, Introduction to computational chemistry
14	Computational Lab-2, Designing of small molecules
15-16	Computational Lab-3, Visualization of bonds, spectras, HOMO-LUMO etc
	END SEMESTER EXAMS

Reference Materials:

1. General Chemistry: Principles and Modern Applications (10th Edition) by Petrucci, Ralph H., Herring, F. Geoffrey, Madura, Jeffry D., Bissonnette, Carey (2010)
2. Chemistry: The Central Science (14th ed) by Brown, Theodore; LeMay, H.; Bursten, Bruce; Murphy, Catherine; Woodward, Patrick; Stoltzfus, Matthew (2017)
3. Lehninger: Principles of biochemistry. Nelson, D and M Cox. 6th ed. New York: W.H. Freeman and Company, 2012.