FACULTY OF SCIENCES

SYLLABUS

FOR

Interdisciplinary Course
Chemistry (UG & PG)

(Under Credit Based Continuous Evaluation Grading System)

Examinations: 2015-16

GURU NANAK DEV UNIVERSITY

AMRITSAR

Interdisciplinary Courses (Chemistry)

(UG)

CYL-001 General Chemistry

Credit: 4-0-0

1. Introduction

Chemistry in everyday living
Branches of chemistry

2. Nature and Composition of Matter

Matter and energy
Separation of mixtures
Atomic theory of matter
Atoms and molecules
Formulae
Chemicals equations
Avogadro's Hypothesis
Mole concept
Chemical equation

3. Structure of an Atom

Atomic structure
Electrons, Protons and Neutrons
Models of an atom
Atomic number and mass number
Isotopes, Isobars, Isotones, Isodiaphers and Isosteres
Theories of radiation
Quantum numbers
Configuration of atoms

4. Radioactivity

Discovery of Radioactivity
Nuclear Disintegration
Nuclear Reactor
Application of Radioactive Isotopes

5. Periodic Classification of Elements

Modern Periodic table
Gradation of Properties in groups and periods

6. Chemical Bonding

Chemical Bond
Causes of Chemical Combinations
Types of Bonding

7. Chemical Reactions

Introduction
Types of chemical reactions
Speed of reactions and catalysts
Rate of chemical reactions
Energies involved in a reactions
Electrochemicals cells
Metallic corrosion

8. Oxidation and Reduction

Oxidation and reduction
Oxidation Reduction
Reaction / Redox Reaction
Oxidation Number

9. Metals & Non Metals

Occurrence of Metals
Properties of Metals
Properties of Non-Metals

10. Carbon

Introduction
Allotrophy of crabon

11. Solutions

Components of solutions
Concentrations of solutions
Solubility of gases
Solid solutions
Raoult's Law
Osmosis

12. Acids, Bases and Salts

Acid and Base
Salts
The pH scale
The pH of solution
Buffer solutions

13. Chemistry in Service of Man

Polymers
Natural Rubber
Plastics

14. Fertilizers and Pesticides

Fertilizers
Pesticides

15. Cement and Glass

Cement
Glass

Books:

1. General Chemistry by Darrel D. Ebbing and Steven D. Gammon, 9th Edition, Houghton Mifflin company, Boston, New York.
2. Principles of general chemistry by Martin S. Silberberg, Publisher McGraw-Hill
3. Engineering Chemistry by Jain and Jain, Dhanpat Rai Publishing Co.
4. Modern ABC of Textbook Chemistry Vol. I & II For Class 11 and 12 by Dr. S.P.Jauhar Modern Publishers Books, New Delhi.
5. Pradeep New Course Chemistry Vol. I & II For Class 11 and 12 by S. N. Dhawan, S. C. Khterpal & P. N. Kapil, Pradeep Publication, Jalandhar

Interdisciplinary Courses (Chemistry)

(UG)

CYL-002: Physical Chemistry

Credit: 3-0-0 **Course Hrs. 45**

Statistical Thermodynamics: (20 Hrs)

The thermodynamic probability of a system, Types of statistics; Maxwell- Boltzmann distribution law, Fermi- Dirac and Bose- Einstein distribution laws and their comparison.Systems of independent particles. The energy of a system: Ensembles; canonical, microcanonical and grand canonical ensemles. The partition function. Separation of partitionfunctions into translational, rotational, vibrational and electronic partition functions. Relation between partition function thermodynamic functions. Statistical calculation of equilibriumconstants. Relation between entropy and thermodynamic probability.

Chemical Bonding: (25 Hrs)

Hamiltonian for diatomic molecules, Born oppenheimer approximation, understanding chemical bonding through molecular orbital treatment of H2+, Bonding and antibonding molecular orbitals, Molecular orbital configurations of homonuclear diatomic molecular, molecular electronic terms, the Valence bond and molecular orbital treatment of hydrogen molecule. Comparison of molecular orbital and valence bond treatments. The Hartree Fock method for molecules. TheVirial theorem, the Hellman Feynman theorem, the electrostatic theorem. The free electron molecular orbital method, the Huckel m.o method HMO treatment of butadiene, benzene Extended Huckel method**.**

Books Suggested:

1. Quantum Chemistry, Ira N. Levine Prentice Hall.
2. Introduction to Statistical Thermodynamics, T.l. Hill.

Interdisciplinary Courses (Chemistry)

(PG)

CYL-051: Bio-physical Chemistry

Credits: 3-0-0

UNIT-I

(23 Hrs)

Biological Cell and its Constituents: Biological Cell, structure and functions of proteins, enzymes,DNA and RNA in living systems. Helix coil transition.

Bioenergetics: Standard free energy change in biochemical reactions, exergonic, endergonic, Hydrolysis of ATP, synthesis of ATP from ADP, coupled reactions, degree of coupling.

Statistical Mechanics in Biopolymers: Chain configuration of macromolecules, statistical distribution end to end dimensions, calculation of average dimensions for various chain structures. Polypeptide and protein structures, introduction to protein folding problem.

Biopolymer Interactions: Forces involved in biopolymer interactions, Electrostatic charges and molecular expansion, hydrophobic forces, dispersion force interactions. Multiple equilibria and various types of binding processes in biological systems. Hydrogen ion titration curves.

Thermodynamics of Biopolymer Solutions: Thermodynamics of biopolymer solutions, osmoticpressure, membrane equilibrium, muscular contraction and energy generation in mechanochemicalsystem.

Cell Membrane and Transport of Ions: Structure and functions of cell membrane. Active transport across cell membrane, irreversible thermodynamics treatment of membrane transport.

UNIT- II

(22 Hrs)

Bio-polymers and their Molecular Weights: Evaluation of size, shape, molecular weight and extent of hydration of biopolymers by various experimental techniques.

Viscosity: Measurement, relation to geometry and correlation with hydrodynamic properties.

Diffusion: Fick’s Law of diffusion, diffusion coefficient and its interpretation, frictional coefficient.

Ultracentrifugation: Svedberg equation, sedimentation equilibrium, density gradient sedimentation.

Electrophoresis: General principles, Double layer techniques, moving boundary electrophoresis, zonal electrophoresis, isoelectric focusing.

Osmotic Pressure: Second virial coefficient, Donnan effect, molecular mass and geometry from O.P. data.

Optical properties of Biomacromolecules: Light Scattering, fundamental concepts, Rayleigh Scattering, Scattering by Larger particles.

Books Recommended:

1. Principles of Biochemistry, A.L. Lehninger, Worth Publishers.

2. Biochemistry, L. Stryer, W.H. Freeman.

3. Biochemistry, Voet and Voet, John Wiley.

4. Macromolecules: Structure and Function, F.Wold, Prentice Hall.

5. Text Book of Polymer Science, F.W. Billmeyer.

6. Physical Chemistry of Polymers, A. Tager.

Interdisciplinary Courses (Chemistry)

(PG)

Molecular Spectroscopy
Paper: CYL-052

Credit 4-0-0

1. General Features of Spectroscopy: (5 Hrs.)

Units and conversion factors. Introduction to spectroscopy, Nature of radiation. Energies corresponding to various kinds of radiation, Experimental techniques, intensities of spectrallines, Selection rules and transition moments, Line widths, Broadening.

2. Nuclear Magnetic Resonance Spectroscopy: (35 Hrs.)

PMR: Natural abundance of 13C, 19F and 31P nuclei; The spinning nucleus, effect of externalmagnetic field, precessional motion and frequency, Energy transitions, Chemical shift and itsmeasurements. Factors influencing chemical shift, anisotropic effect; Integrals of protons,proton exchange, spin-spin coupling- splitting theory, one, two and three bond coupling,virtual, long range and allylic coupling, magnitude of coupling constant; factors affecting thecoupling constant, Chemical and magnetic equivalence, First and second order spectra, A2,AB, AX, AB2, AX2, A2B2 and A2X2 spin systems, Simplification of complex spectra (solventeffect, field effect, double resonance and lanthanide shiftreagents),CWandFTNMR,Relaxationprocesses,T1andT2measurements, Applications of PMR in structuralelucidation of simple and complex compounds.

$_{13}$C-NMR: Resolution and multiplicity of $_{13}$C NMR, 1H-decoupling, noise decoupling, broadband decoupling; Deuterium, fluorine and phosphorus coupling; NOE and origin of nuclearoverhauser effect. off-resonance, proton decoupling, Structural applications of $_{13}$C-NMR.,pulse sequences, pulse widths, spins and magnetization vectors, DEPT, INEPT,Introduction to 2D-NMR, COSY, NOESY, HSQC spectra.

3. Mass Spectra: (10 Hrs.)

Introduction, methods of ionization EI & CI, Brief description of LD, FAB, SIMS, FD etc.,Ion analysis methods (in brief), isotope abundance, Metastable ions, general rules predictingthe fragmentation patterns. Nitrogen rule, determination of molecular ion peak, index of Hdeficiency, fragmentation patterns for aliphatic compounds, amines, aldehydes, Ketons,esters, amides, nitriles, carboxylic acids ethers, aromatic compounds etc.

4. **UV and Visible Spectroscopy of organic molecules: (10 Hrs.)**

Measurement techniques, Beer – Lambert's Law, molar extinction coefficient, oscillator strength and intensity of the electronic transition, Frank Condon Principle, Ground and firstexcited electronic states of diatomic molecules, relationship of potential energy curves toelectronic spectra, Chromophores, auxochromes, blue shift, red shift, hypo and hyperchromic effect, - *, - *, n- * transitions in organic molecules, Woodward rules for conjugated dienes and , - unsaturated carbonyl groups, extended conjugation and aromatic sterically hindered systems, Quantitative applications.

Books Recommended:

1. Pavia, Lampman & Kriz, Introduction to Spectroscopy.
2. C.N Banwell "Fundamentals of Molecular Spectroscopy".
3. R. M. Silverstein, G.C.Bassler, T.C. Morrill, "Spectrometic Identification of Organic Compounds.
4. W. Kemp, "Organic Spectroscopy".
5. D.H. Williams, I. Fleming, "Spectroscopic Methods in Organic Chemistry".
6. D.H. Williams, I. Fleming, "Spectroscopic Problems in Organic Chemistry", 1967.
7. R.C. Banks, E.R. Matjeka, G. Mercer, "Introductory Problems in Spectroscopy", 1980.
8. G.M. Barrow "Introduction to Molecular Spectroscopy".