

UNIVERSITY OF MADRAS
B.Sc. DEGREE COURSE IN CHEMISTRY
SYLLABUS WITH EFFECT FROM 2020-2021

BCY-DSC01

CORE-I: GENERAL CHEMISTRY-I

Learning outcomes

1. To know the fundamental concepts of atomic structure and basics of quantum mechanics.
2. To know the periodicity of properties of elements.
3. To understand the various types of chemical bonding and basics of solid state.
4. To learn the principles of inorganic qualitative and quantitative analysis. To understand the basic concepts of nanotechnology
5. To understand the basic concepts of organic chemistry.

Semester	Subject	Hours	Credits
I	General Chemistry –I	75	4

Unit - I Atomic Structure and Introduction to Quantum Mechanics (15 hrs)

Rutherford's atomic model, Planck's quantum theory of radiation, Photoelectric effect, Bohr's theory of hydrogen atom - postulates, Bohr's radius, energy of electron, origin of hydrogen spectrum. Particle and wave nature of electron - de Broglie's equation, Heisenberg's uncertainty principle and Compton effect - Schrodinger wave equation (no derivation) - Significance of Ψ and Ψ^2 - Wave mechanical concept of atomic orbitals, - Shapes of orbitals - Quantum numbers - Zeeman effect, Pauli's exclusion principle, Aufbau principle - Effective nuclear charge, screening effect, Slater's rules - applications and limitations. Electronic configuration of first 30 elements - extra stability of half-filled and completely filled orbitals. Hund's rule - its basis and applications.

Unit - II Classification of Elements and Periodicity of Properties (10 hrs)

Classification of elements - noble gases and s, p, d and f - block elements. Modern periodic table. Position of hydrogen in the periodic table - Variation of atomic volume, atomic and ionic radii, ionization potential, electron affinity, electronegativity along periods and groups - variation of metallic characters - factors influencing the above periodic properties.

Unit - III

3.1 Chemical Bonding (15hrs)

Ionic bond - factors influencing the formation of ionic compounds - ionisation energy, electron affinity and lattice energy; inert pair effect, Fajan's rules.

Covalent bond - polarity of covalent bond, percentage ionic character of covalent bond, dipole moment and molecular structures of CO_2 , H_2O , NH_3 and CH_4 , bond characteristics - bond length, bond angle and bond energy.

3.2 Solid State

Classification of solids, isotropic and anisotropic crystals, representation of planes, Miller indices, space lattice, unit cell, crystal systems. X-ray diffraction - derivation of Bragg's equation, discussion of structures of NaCl , CsCl and ZnS , determination of Avogadro's number.

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Unit - IV Principles of Inorganic Qualitative and Quantitative Analysis (10 hrs)

Common ion effect, solubility product, applications of the solubility product principle in qualitative analysis. Principle of elimination of interfering anions. Complexation reactions in qualitative analysis. Spot test reagents and tests with them - Cupferon, DMG, thiourea, magneson, alizarin and Nessler reagent. Volumetric analysis - Definitions - normality, molarity, molality and molefraction,

primary and secondary standards, theories of acid - base, redox, complexometric, iodometric and iodimetric titrations, calculations of equivalent weights, theories of acid - base, redox, metal ion and adsorption indicators and choice of indicators.

Nanotechnology(10Hrs)

Introduction to nano science and nanotechnology – Types of nanoparticles, Techniques to synthesize nanoparticles, Physical methods – Physical vapour deposition (evaporation and sputtering) – chemical methods–reduction methods – sol–gel methods

Unit - V Basic Concepts of Organic Chemistry (15 hrs)

Hybridisation and shapes of molecules - methane, ethane, ethylene, acetylene and benzene. Electron displacement effects - inductive, electromeric, mesomeric (resonance) and hyperconjugation. Steric effect. Cleavage of bonds - homolytic and heterolytic fissions. Reactive intermediates - carbocations, carbanions and free radicals - their formation and stability.

Nomenclature of organic compounds: IUPAC system of nomenclature of compounds containing upto 8 carbon atoms - mono and bifunctional compounds.

Textbooks :

1. Puri B.R., Sharma L.R. and Pathania M.S., Principles of Physical Chemistry, 47th ed., New Delhi, Vishal Publishing Co.,2016.
2. Puri B.R., Sharma L.R. and Kalia K.C., Principles of Inorganic Chemistry, 33th ed., New Delhi, Milestone Publishers and Distributors,2016.
3. Soni P.L., and Chawla H.M., Textbook of Organic Chemistry, 29th ed., New Delhi, Sultan Chand & Sons, 2007.
4. T. Pradeep, Nano: The Essentials, New Delhi, McGraw Hill,2007
5. H.M., Textbook of Organic Chemistry, 29th ed., New Delhi, Sultan Chand & Sons,2007.
6. Fundamentals of Crystal Chemistry, T R N Kutty;J A K Tareen, Universities Press Private Limited, Chennai, 2000
7. Basic Course in Crystallography, A, J A K Tareen;T RN Kutty, Universities Press Private Limited, Chennai, 2000

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Reference Books

1. Jain M.K, Sharma S.C. Modern Organic Chemistry, Vishal Publishing Co.,2017
2. Lee J.D. Concise Inorganic Chemistry, 5th ed., Blackwell Science,2005.
3. Soni, P.L. and Mohan Katyal. Textbook of Inorganic Chemistry, 20th ed., Sultan Chand & Sons, 2006.
4. Glasstone Samuel. Textbook of Physical Chemistry, 2nd ed., Macmillan India Ltd.,1990.
5. Soni P.L., Dharmarha O.P. and Dash U.N Textbook of Physical Chemistry, 23rd ed., New Delhi, Sultan Chand & Sons,2011.
6. Graham Solomons T.W. Organic Chemistry, 3rd ed., John Wiley & Sons.
7. Morrison R.T. and Boyd R.N., Organic Chemistry, 6th ed., Pearson Education, Asia,2002.
8. C. N. R. Rao, Chemistry of Nanomaterials: Synthesis, Properties and Applications, Wiley-VCH Verlag GmbH & Co. KgaA,2004
9. Charles P. Poole Jr., Frank J. Owens, Introduction to Nanotechnology, New Jersey, John Wiley & Sons, 2003