BSc Semester 2 – Chemistry (Hons) with specialization in Analytical Chemistry

Title of the Course: DSC – 2: INORGANIC AND PHYSICAL CHEMISTRY - I

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours/ semesters
4	56	2	56

Content of Theory Course 2	56Hrs
Unit – 1	14
Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and ψ^2. Quantum numbers and their significance. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of s, p, d and f orbitals. Contour boundary and probability diagrams. Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations- Electronic configurations of the elements (Z=1-30), effective nuclear charge, shielding/screening effect, Slater's rules. Variation of effective nuclear charge in Periodic Table.	
Unit - 2	14
s, p, d and f-block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to s and p-block elements: (a) Atomic radii (van der Waals) (b) Ionic and crystal radii. (c) Covalent radii (d) Ionization enthalpy, successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy. (e) Electron gain enthalpy, trends of electron gain enthalpy. (f) Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's/ and Mulliken-Jaffé's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity. Trends in the chemistry of the compounds of groups 13 to 17 (hydrides, carbides, oxides and halides) are to be discussed.	
Unit - 3	14
Gaseous State Elementary aspects of kinetic theory of gases, Ideal and real gases. Boyle temperature (derivation not required), Molecular velocity, collision frequency, collision diameter, Collision cross section, collision number and mean free path and coefficient of viscosity, calculation of σ and η, variation of viscosity with temperature and pressure. Maxwell's Boltzmann distribution law of molecular velocities (Most probable, average and root mean square velocities). Relation between RMS, average and most probable velocity and average kinetic energies. (Mathematical derivation not required), law of equipartition of energy. Behaviour of real gases: Deviation from ideal gas behaviour. Compressibility factor (Z) and its variation with pressure for different gases. Causes of deviation from ideal behaviour, vander Waals equation of stat (No derivation) and application in explaining real gas behaviour. Critical phenomena - Andrews isotherms of CO_2, critical constants and their	

Gulbarga University Department of Chemistry GULBARGA

calculation from van der Waals equation, Continuity of states, Law of corresponding states. Numerical problems. **Liquid State** **Surface Tension**: Definition and its determination using stalagmometer, effect of temperature and solute on surface tension **Viscosity**: Definition, Coefficient of viscosity. Determination of viscosity of a liquid using Oswald viscometer. Effect of temperature, size, weight, shape of molecules and intermolecular forces. **Refraction**: Specific and molar refraction- definition and advantages. Determination of refractive index by Abbes Refractometer. Additive and constitutive properties. **Parachor:** Definition, Atomic and structure parachor, Elucidation of structure of benzene and benzoquinone. Viscosity and molecular structure. Molar refraction and chemical constitution. Numerical Problems.	
Unit - 4	14
Liquid Crystals Explanation, classification with examples- Smetic, nematic, cholesteric, dics shaped and polymeric. Structures of nematic and cholesteric phases-molecular arrangements in nematic and cholesteric liquid crystals. Applications of liquid crystals in LCDs and thermal sensing. **Solids** **Forms of solids:** Unit cell and space lattice, anisotropy of crystals, size and shape of crystals, Laws of Crystallography: Law of constancy of interfacial angles, Law of rational indices, Law of symmetry (Symmetry elements), Crystal systems, Bravais lattice types and identification of lattice planes. Miller indices and its calculation, X–Ray diffraction by crystals: Bragg's law and derivation of Bragg's equation, Single crystal and powder diffraction methods. Defects in crystals, glasses and liquid crystals. Numerical problems. **Distribution Law** Nernst Distribution Law - Statement and its derivation. Distribution constant, factors affecting distribution constant, validity of Distribution Law, Modification of distribution law when molecules undergo a) Association b) Dissociation. Application of Distribution Law in Solvent extraction. Derivation for simple and multiple extraction. Principles of distribution law in Parkes Process of desilverisation of lead. Numerical Problems.	

Text Books

1. Concise Inorganic Chemistry: J D Lee, 4th Edn, Wiley, (2021)
2. Fundamentals Concepts of Inorganic Chemistry, Vol 1 and 2, 2nd Edition, Asim K Das, CBS Publishers and Distributors, (2013)
3. Basic Inorganic Chemistry, F A Cotton, G Wilkinson and P. L. Gaus, 3rd Edition. Wiley. India
4. Inorganic Chemistry, 2nd Edn. Catherine E. Housecroft and A.G. Sharpe, Pearson Prentice Hall (2005)
5. Atkins Physical Chemistry.8th Edition. Peter Atkins & Julio De Paula Oxford University Press.
6. Physical Chemistry by Samuel Glasstone, ELBS (1982).
7. A Text book of Physical Chemistry, A S Negi & S C Anand, New Age International Publishers (2007).
8. Principles of Physical Chemistry, Puri, Sharma & Pathania, Vishal Publishing Co.
9. A Text Book of Physical Chemistry P.L.Soni , O.P. Dharmarhaand and U.N.Dash, Sultan Chand and Sons.
10. Advanced Physical Chemistry, Gurdeep Raj, Goel Publishing House (2018)

Gulbarga University Department of Chemistry GULBARGA

References

Pedagogy

Formative Assessment	
Assessment Occasion/ type	**Weightage in Marks**
Internal Test	30
Sem End Exam	70
Total	100

Date Course Co-ordinator Subject Committee Chairperson

Content of Practical Course 2: List of Experiments to be conducted

PART-A Inorganic Chemistry

TITRIMETRY

1. Determination of carbonate and hydroxide present in a mixture.
2. Determination of oxalic acid and sodium oxalate in a given mixture using standard $KMnO_4$/NaOH solution
3. Standardization of potassium permanganate solution and determination of nitrite in a water sample
4. Standardization of silver nitrate and determination of chloride in a water sample (demonstration)
5. Determination of alkali content in antacids
6. Determination of chlorine in bleaching powder using iodometric method.

GRAVIMETRY

1. Determination of Ba^{2+} as $BaSO_4$
2. Determination of Cu^{2+} as CuSCN

PART-B Physical Chemistry

1. Safety Practices in the Chemistry Laboratory, Knowledge about common toxic chemicals and safety measures in their handling, cleaning and drying of glassware's
2. Determination of density using specific gravity bottle and viscosity of liquids using Ostwald's viscometer (Ethyl acetate, Toluene, Chloroform, Chlorobenzene or any other non-hazardous liquids)
3. Study of the variation of viscosity of sucrose solution with the concentration of a solute
4. Determination of the density using specific gravity bottle and surface tension of liquids using Stalagmometer (Ethyl acetate, Toluene, Chlorobenzene, any other non-hazardous liquids
5. Study of variation of surface tension of detergent solution with concentration.
6. Determination of specific and molar refraction by Abbes Refractometer. (Ethyl acetate, Methyl acetate, Ethylene Chloride)
7. Determination of the composition of liquid mixture by refractometry. (Toluene & Alcohol, Water & Sucrose)
8. Determination of partition/distribution coefficient - i) Acetic acid in water and cyclohexane. ii) Acetic acid in Water and Butanol. iii) Benzoic acid in water and toluene.

Gulbarga University
Department of Chemistry
GULBARGA - 585 106

BSc Semester 2 – Chemistry (Hons) with specialization in Analytical Chemistry

Title of the Course: OE – 2: Molecules of Life

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours/ semesters
3	42	-	42

Content of Theory Course 2	42 Hrs
Unit – 1	14
Carbohydrates Classification of carbohydrates, reducing and non-reducing sugars, General properties of glucose and fructose, their open chain structures. Epimers, mutarotation and anomers. Linkage between monosaccharides, structure of disaccharides (sucrose, maltose, lactose) and polysaccharides (starch and cellulose) excluding their structure elucidation. **Amino Acids, Peptides and Proteins** Classification of amino acids, Zwitterion structure and Isoelectric point. Overview of Primary, Secondary, Tertiary and Quaternary structure of proteins. Determination of primary structure of peptides.	
Unit - 2	14
Enzymes and correlation with drug action Mechanism of enzyme action, factors affecting enzyme action, Co-enzymes and cofactors and their role in biological reactions, Specificity of enzyme action (including stereospecificity), Enzyme inhibitors and their importance, phenomenon of inhibition (Competitive and Non competitive inhibition including allosteric inhibition). **Drug action**-receptor theory. Structure–activity relationships of drug molecules, binding role of –OH group, -NH_2 group, double bond and aromatic ring **Lipids** Introduction to lipids, classification. Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol).	
Unit - 3	14
Nucleic Acids Components of nucleic acids: Adenine, guanine, thymine and cytosine (Structure only), other components of nucleic acids, Nucleosides and nucleotides **(nomenclature)**, Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA (**types of RNA**), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation. **Concept of Energy in Biosystems** Calorific value of food. Standard caloric content of carbohydrates, proteins and fats. Oxidation of foodstuff (organic molecules) as a source of energy for cells. Introduction to Metabolism (catabolism, anabolism), ATP: the universal currency of cellular energy, ATP hydrolysis and free energy change. Conversion of food into energy. Outline of catabolic pathways of Carbohydrate- Glycolysis, Fermentation, Krebs Cycle. Overview of catabolic pathways of Fats and Proteins. Interrelationships in the metabolic pathways of Proteins, Fats and Carbohydrates.	

Gulbarga University Department of Chemistry GULBARGA

Text Books

1. Morrison, R. T. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. *Organic Chemistry* (*Volume 1*), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. *Organic Chemistry* (*Volume 2*), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Nelson, D. L. & Cox, M. M. *Lehninger's Principles of Biochemistry 7th Ed.,*
5. W. H. Freeman. Berg, J.M., Tymoczko, J.L. & Stryer, L. *Biochemistry*, , 2002.

References

Pedagogy

Formative Assessment	
Assessment Occasion/ type	**Weightage in Marks**
Internal Test	30
Sem End Exam	70
Total	100

Date Course Co-ordinator Subject Committee Chairperson

Gulbarga University Department of Chemistry GULBARGA - 585 106