Lecture Plan

Name of the college: Government College of Arts, Science and Commerce, Sanquelim- Goa

Name of Faculty: Ankita M. Vernekar	**Subject:** Chemistry	
Paper code: CHC-108	**Program:** T.Y. B.Sc	**Division:** A
Academic year: 2024 - 2025	**Semester:** VI	**Total Lectures: 60**

Course Objectives: : To equip students with a strong understanding of key concepts in Nuclear Chemistry, Electrochemistry, Molecular Spectroscopy, and Quantum Chemistry, focusing on theoretical principles, experimental techniques, and practical applications.

Expected Course Outcome:

1) Gain a foundational understanding of nuclear composition, radioactivity, spectroscopy principles, and quantum mechanics.
2) Explain nuclear forces, electrochemical processes, molecular spectra, and quantum mechanical frameworks in various contexts.
3) Solve numerical problems related to decay constants, molecular vibrations, and quantum systems; analyse experimental setups in electrochemistry and spectroscopy.
4) Design and interpret theoretical models, molecular properties, and experimental techniques to address complex scientific problems.

Student Learning Outcome:

1. Gain a foundational understanding of nuclear composition, radioactivity, spectroscopy principles, and quantum mechanics.
2. Explain nuclear forces, electrochemical processes, molecular spectra, and quantum mechanical frameworks in various contexts.
3. Solve numerical problems related to decay constants, molecular vibrations, and quantum systems; analyse experimental setups in electrochemistry and spectroscopy.
4. Design and interpret theoretical models, molecular properties, and experimental techniques to address complex scientific problems.

Month	Lecture From	Lecture To	No. of lectures allotted	Topic, Subtopic to be covered	Exercise/ Assignment	ICT Tools	Reference books
December	09/12/2024	014/12/2024	-	FIP			
December	16/12/2024	21/12/2024	4	**ELECTROCHEMISTRY II** Definition of pH, pOH, pKa, and pKb, Determination of pH using glass electrodes by potentiometric method Buffer solution, types, buffer action, buffer capacity, mechanics of buffer action	Definition of pH, pOH, pKa, and pKb Explain mechanism of buffer action	Smart board	1. J.N. Gurtu, Physical Chemistry Vol-III, A pragati edition. 2. N. B. Laxmeshwar, S. M. Malushte, A. S. Mulye, V. N. Kulkarni, Concepts of Physical Chemistry, Chetana Prakashan
January	02/01/2025	04/01/2025	4	Henderson equation for acidic and basic buffer, amphoteric electrolyte	Derive Henderson equation for buffers	Smart board	1. J.N. Gurtu, Physical Chemistry Vol-III, A pragati edition. 2. N. B. Laxmeshwar, S. M. Malushte, A. S. Mulye, V. N. Kulkarni, Concepts of Physical Chemistry, Chetana Prakashan
January	06/01/2025	11/01/2025	4	existence of dipolar ions, isoelectric point, strong electrolytes,	Discus Debye Huckel theory	Smart board	1. J.N. Gurtu, Physical Chemistry Vol-III, A pragati edition. 2. N. B. Laxmeshwar, S. M. Malushte, A. S. Mulye, V. N. Kulkarni, Concepts of Physical Chemistry, Chetana Prakashan
January	13/01/2025	18/01/2025	4	Debye Huckel theory of strong electrolytes.	Explain variation of activity coefficient with concentration	Smart board	1. J.N. Gurtu, Physical Chemistry Vol-III, A pragati edition.

				Variation of activity coefficient with concentration, ionic strength, .			2. N. B. Laxmeshwar, S. M. Malushte, A. S. Mulye, V. N. Kulkarni, Concepts of Physical Chemistry, Chetana Prakashan
January	20/01/2025	25/01/2025	4	Debye Huckel limiting law Energy sources: Primary and Secondary batteries. Acid and Alkaline battery, Ni-Cd cell,olar cells. Construction, working, advantages and CdS solar Cell.	Discuss different types of battery	Power point presentation/ Smart board	1. J.N. Gurtu, Physical Chemistry Vol-III, A pragati edition. 2. N. B. Laxmeshwar, S. M. Malushte, A. S. Mulye, V. N. Kulkarni, Concepts of Physical Chemistry, Chetana Prakashan
January	27/01/2025	01/02/2025	4	**Electronic Spectroscopy: Franck-Condon principle, electronic transitions** singlet and triplet states, fluorescence and phosphorescence, dissociation and pre dissociation,	Derive schrodinger equation for hydrogen atom	Smart board	1)Ira N. Levine, Quantum Chemistry, Seventh Edition, Pearson 2)Chemistry for degree students Semester V and VI by R. L. Madan, S. Chand Publication 11. 3) Chandra, A.K., Introductory Quantum Chemistry, Tata McGraw –Hill (2001)
February	03/02/2025	08/02/2025	4	calculation of electronic transitions of polyenes using free electron model. Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy,	Derive schrodinger equation for harmonic oscillator	Smart board	1)Ira N. Levine, Quantum Chemistry, Seventh Edition, Pearson 2)Chemistry for degree students Semester V and VI by R. L. Madan, S. Chand Publication 11. 3) Chandra, A.K., Introductory Quantum Chemistry, Tata McGraw –Hill (2001)

February	10/02/2025	15/02/2025	4	Armor precession, Chemical shift and low resolution spectra, different scales (Delta and T), Spin –spin coupling and high resolution spectra, interpretation of PMR spectra of organic molecules.	Set up of Schrodinger equation in spherical polar co-ordinates	Smart board	1)Ira N. Levine, Quantum Chemistry, Seventh Edition, Pearson 2)Chemistry for degree students Semester V and VI by R. L. Madan, S. Chand Publication 11. 3) Chandra, A.K., Introductory Quantum Chemistry, Tata McGraw –Hill (2001)
February	17/02/2025	22/02/2025	4	Electron Spin Resonance (ESR) spectroscopy: Principle, hyperfine structure, ESR of simple radicals	Explain quantisation of energy	Smart board	1)Ira N. Levine, Quantum Chemistry, Seventh Edition, Pearson 2)Chemistry for degree students Semester V and VI by R. L. Madan, S. Chand Publication 11. 3) Chandra, A.K., Introductory Quantum Chemistry, Tata McGraw –Hill (2001)
February	24/02/2025	01/03/2025	4	Nuclear Fission, discovery, energy released in fission, fission products, neutron emitted in fission, nuclear reactors, classification of reactors, Breeder reactor, nuclear reactors in India,	Determine Average and most probable distances of electron from nucleus	Smart board	1) U. N. Dash, Nuclear Chemistry, S. Chand & Sons Publications, 2010, New Delhi.
March	03/03/2025	08/03/2025	4	chain Reactions & its control, reprocessing of spent fuels Units of radiation energy, applications	Set up Schrodinger equation for many electron system	Smart board	1) U. N. Dash, Nuclear Chemistry, S. Chand & Sons Publications, 2010, New Delhi.

				of radio-isotopes, radioisotopes as tracers, biological effects of radiation.			
March	10/03/2025	15/03/2025	4	Qualitative treatment of hydrogen atom and hydrogen – like ions; setting up of Schrodinger equation in spherical polar co-ordinates, radial part, quantization of energy (only final energy expression)	Explain need of approximations	Smart board	1) U. N. Dash, Nuclear Chemistry, S. Chand & Sons Publications, 2010, New Delhi.
March	17/03/2025	22/03/2025	4	Average and most probable distances of electron from nucleus. Setting up of Schrodinger equation for many-electron atoms (He, Li) Need for approximation methods.	Explain variation theorem	Smart board	U. N. Dash, Nuclear Chemistry, S. Chand & Sons Publications, 2010, New Delhi.

March	24/03/2025	29/03/2025	4	Statement of variation theorem and application to simple systems (Particle in a box, harmonic oscillator, hydrogen atom)	Explain valence bond and molecular orbital approach	Smart board	U. N. Dash, Nuclear Chemistry, S. Chand & Sons Publications, 2010, New Delhi.
April	31/03/2025	05/04/2025	4	Chemical Bonding: Covalent bonding, valence bond and molecular orbital approaches, LCAO-MO treatment of H_2^+. Bonding and antibonding orbitals qualitative extension to H_2, comparison of LCAO-MO and VB treatments of H_2. (Only wave functions, detailed solution not required) and their limitations.	Differentiate between bonding and antibonding orbitals	Smart board	U. N. Dash, Nuclear Chemistry, S. Chand & Sons Publications, 2010, New Delhi.
April	07/04/2025	11/04/2025	4	Refinements of the two approaches (Configuration Interaction for MO, ionic terms in VB). Qualitative description of LCAO-MO treatment of homo-nuclear and hetero-nuclear diatomic molecules (HF, LiH).	Give extension to hydrogen atom	Smart board	U. N. Dash, Nuclear Chemistry, S. Chand & Sons Publications, 2010, New Delhi.