Department of Chemistry and Chemical Sciences
CENTRAL UNIVERSITY OF JAMMU
Rahya-Suchani (Bagla), District-Samba, Jammu-181143, (J&K) India

Five-year Integrated M.Sc. Chemistry
Teaching Plan (August 2022-Dec 2022)

Semester: V
Course: Physical Chemistry IV (ICHE5C002T)
Course Teacher: Dr. Tapta Kanchan Roy

Week	Lecture No./Day	Topic to be Taught	No of Hours	Suggested Readings
1st Week	I	Basic principles of quantum mechanics	1	1, 2, 3, 4, 5
	II	Contd.	1	1, 2, 3, 4, 5
	III	Inadequacy of classical mechanics	1	1, 2, 3, 4, 5
	IV	Black–body radiation	1	1, 2, 3, 4, 5
2nd Week	I	Planck's radiation law, Photoelectric effect	1	1, 2, 3, 4, 5
	II	Contd.	1	1, 2, 3, 4, 5
	III	Heat capacity of solids, Bohr's model of hydrogen atom and its defects,	1	1, 2, 3, 4, 5
	IV	Contd.	1	1, 2, 3, 4, 5
3rd Week	I	Compton effect, The wave-particle duality	1	1, 2, 3, 4, 5
	II	The wave-particle duality Contd.	1	1, 2, 3, 4, 5
	III	The Heisenberg's uncertainty principle	1	1, 2, 3, 4, 5
	IV	Operator formalism: Linear operator	1	1, 2, 3, 4, 5
4th Week	I	Expectation values and its significance	1	1, 2, 3, 4, 5
	II	Hermitian operator and angular momentum operator	1	1, 2, 3, 4, 5
	III	Numerical	1	1, 2, 3, 4, 5
	IV	Commutator and numerical	1	1, 2, 3, 4, 5
5th Week	I	Eigen functions and eigen values, Expectation values	1	1, 2, 3, 4, 5
	II	Numerical	1	1, 2, 3, 4, 5
	III	Hamiltonian operator	1	1, 2, 3, 4, 5
	IV	Schrödinger wave equation and its importance	1	1, 2, 3, 4, 5
6th Week	I	Physical interpretation of the wave function	1	1, 2, 3, 4, 5
	II	Orthogonal and orthonormal functions, Correspondence principle,	1	1, 2, 3, 4, 5
	III	Postulates of quantum mechanics and their analysis	1	1, 2, 3, 4, 5
	IV	Contd.	1	1, 2, 3, 4, 5
7th Week	I	Particle in a one, two and three-dimensional box	1	1, 2, 3, 4, 5
	II	Particle in a two and three-dimensional box & Degeneracy	1	1, 2, 3, 4, 5
	III	Its applications to conjugated systems, Problem-solving regarding Particle in a box	1	1, 2, 3, 4, 5
	IV	Class Test-I	1	1, 2, 3, 4, 5
8th Week	I	Simple harmonic oscillator	1	1, 2, 3, 4, 5
	II	Contd.	1	1, 2, 3, 4, 5
	III	Contd.	1	1, 2, 3, 4, 5
	IV	Characteristic features of SHO	1	1, 2, 3, 4, 5
9th	I	Schrödinger wave equation for H-atom	1	1, 2, 3, 4, 5

Week				
Week	II	Transformation of coordinates: Cartesian to polar (without derivation)	1	1, 2, 3, 4, 5
	III	Separation into three total differential equations in terms of the variables r, θ, φ	1	1, 2, 3, 4, 5
	IV	r, θ, φ; and their significance for H-atom	1	1, 2, 3, 4, 5
10th Week	I	Solution of φ equation and emergence of magnetic quantum number 'm' and its interpretation	1	1, 2, 3, 4, 5
	II	Concept of orbital	1	1, 2, 3, 4, 5
	III	Numerical	1	1, 2, 3, 4, 5
	IV	Overview of quantum mechanics	1	1, 2, 3, 4, 5
11th Week	I	Class test-II	1	1, 2, 3, 4, 5
	II	Surface chemistry: Ideas	1	1, 2, 3, 4, 5
	III	Structure of solid surfaces: Adsorption and desorption of molecules, physisorption and chemisorption	1	1, 2, 3, 4, 5
	IV	Surface reaction kinetics, Langmuir, adsorption isotherms	1	1, 2, 3, 4, 5
12th Week	I	BET and Freundlich adsorption isotherms	1	1, 2, 3, 4, 5
	II	Contd. & Numerical	1	1, 2, 3, 4, 5
	III	The rates of surface processes, Temperature dependence of adsorption	1	1, 2, 3, 4, 5
	IV	Structure of heterogeneous surfaces: Langmuir-Hinshelwood mechanism	1	1, 2, 3, 4, 5
13th Week	I	Structure of heterogeneous surfaces: Eley-Rideal	1	1, 2, 3, 4, 5
	II	Numerical	1	1, 2, 3, 4, 5
	III	Colloidal state: concept	1	6, 8,9
	IV	The colloidal systems, general properties, Tyndall effect	1	6, 8,9
14th Week	I	Electrical properties (electrical double layer)	1	6, 8,9
	II	electrokinetic properties (electro-osmosis)	1	6, 8,9
	III	Surface active agent, Classification of surface active agent	1	6, 8,9
	IV	Critical micelle concentration (CMC), Factor affecting the CMC of surfactants	1	6, 8,9
15th Week	I	Hydrophobic interaction	1	6, 8,9
	II	Thermodynamics approach to CMC and micellization	1	6, 8,9
	III	Contd.	1	6, 8,9
	IV	Class test-III	1	6, 8,9
16th Week	I	Tutorial	1	
	II	Tutorial	1	
	III		1	
	IV		1	

REFERENCES

1. D. A. McQuarrie and J. D. Simon, *Physical Chemistry: A Molecular Approach*, Viva Student Ed., 2011.
2. D. A. McQuarrie, *Quantum Chemistry,* Viva Student Ed., 2014.
3. R. K. Prasad, *Quantum Chemistry*, New Age International Publishers Ltd., New Delhi, 4th revised Ed., 2014.
4. A. K. Chandra, *Introductory Quantum Chemistry*, Tata McGraw Hill, 4th Ed., 1998.
5. I. N. Levine, *Quantum Chemistry*, Pearson, 7th Ed., 2013.
6. P. W. Atkins and J. de Paula, *The Elements of Physical Chemistry*, Oxford, 10th Ed., 2014.
7. P. W. Atkins and R. Friedman, *Molecular Quantum Mechanics*, Oxford University Press, 5th Ed., 2012.
8. B. R. Puri, L. R. Sharma and M. S. Pathania, *Principles of Physical Chemistry*, Vishal Publishing Co., 47th Ed., 2017.
9. Y. Moroi, *Micelles: Theoretical and Applied Aspects,* Springer, 1992 Ed.