

DEPARTMENT OF CHEMISTRY				CLASS: I B.Sc. Chemistry				
SEM	Course type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
I	Part-III- Core	20U1CMC2	General Chemistry – II	3	3	25	75	100

Course Objectives: The objective of this course is to make the student

1. To explain the theories of various atomic models, shape of orbitals, and importance of different quantum numbers
2. To discuss the basic concepts of quantum theory and importance of operators
3. To classify the elements based on the atomic numbers in the periodic table and study the knowledge on classification of elements based on atomic number study the factors affecting properties of elements across the periodic table
4. To compare the hybridization and shapes of simple inorganic molecules based on VB and MO and VSEPR theories

Unit-I: Atomic Structure

Introduction to Atomic structure-Rutherford, Bohr, Sommerfeld concepts and its drawbacks-Bohr's model of hydrogen atom-Atomic orbitals and shapes of s, p and d orbitals - Quantum numbers-Principal, Azimuthal, Magnetic and Spin quantum numbers and their significance - Pauli's exclusion principle - Hund's rule- Aufbau Principle, (n+1) rule- Stability of half-filled and completely filled orbitals- inert pair effect.

Unit-II: Introduction to quantum mechanics

Planck's quantum theory - Photoelectric effect, Compton effect-Wave particle duality, de Broglie equation-Davisson -Germer Experiment-Heisenberg uncertainty principle - Eigen function and Eigen value.

Unit-III: Quantum Chemistry

Wave functions and its physical properties -Normalization and Orthogonal function- The significance of the wave function ψ - interpretation of ψ^2 - Postulates of Quantum mechanics - Operators-Hamiltonian, Hermitian and Laplacian -Schrodinger's time independent wave equation. (1D box)

Unit-IV: Periodic properties

Periodic properties - classification of elements as s, p, d and f-block elements - variation of atomic volume - atomic and ionic radii - ionization potential - electron affinity and electro negativity along period and groups - variation of metallic characters - Factors affecting the periodic properties. Periodic table anomalies and variations in atomic radius, ionic radius, electronic configuration, electron affinity and electro negativity, ionization energy and metallic character of elements along the group and periods and their influences on stability, colour, coordination number, geometry, physical and chemical properties.

Unit-V: Chemical bonding-II

VSEPR Theory - Principles and hybridization- sp, sp², sp³ sp³d and sp³d²-Shapes of simple inorganic molecules (BeCl₂, BF₃, SiCl₄, PCl₅, SF₆, IF₇, H₂O, NH₃, XeF₆) - MO Theory -Bonding and anti-bonding molecular orbitals - Applications of MO theory H₂, He, N₂, O₂, HF and CO molecules - Comparison of VB and MO Theories.

Books for Study

1. B.R. Puri, L.R. Sharma, K.K. Kalia, Principles of Inorganic Chemistry, 23rdedn, New Delhi, ShobanLalNagin Chand & Co.,1993.
2. R. D. Madan, Modern Inorganic Chemistry, 3rdedn, S. Chand & Company Ltd., Reprint2014.
3. N. Kundu and S.K. Jain, Physical Chemistry, S. Chand & Company Ltd.2000
4. P.L. Soni, Text book of Inorganic Chemistry, 20thedn, Sultan chand& Sons,2000
5. B.R.Puri, L.R.Sharma and M.S.Pathania, Principles of Physical Chemistry.47thedn, Vishal Publishing Co. 2017.

Books for Reference

1. S. P. Banerjee, Advanced Inorganic Chemistry, 2ndedn, Vol- 1 and 2, ArunabhaSen, Books and Allied (P) Ltd., Kolkata,2017.
2. G.M.Barrow, Physical Chemistry, 6thedn, McGraw-Hill Inc., US,1996.

Web Resources

1. <https://www.khanacademy.org/science/chemistry/chemical-bonds#hybridization-and-hybrid-orbitals-chemistry>
2. <https://ocw.mit.edu/courses/chemistry/5-04-principles-of-inorganic-chemistry-ii-fall-2008/syllabus/>

Pedagogy

1. Chalk-Talk class room activities
2. Group Discussion
3. Seminar
4. Quiz through ICT- Mode

Lesson Plan

Unit	Descriptions	Staff Name	Hours	Lecture Mode
Atomic Structure				
I	Introduction to Atomic structure-Rutherford, Bohr, sommerfeld concepts and its drawbacks-Bohr's model of hydrogen atom	-	1	BB
	Atomic orbitals and shapes of s, p and d orbitals	-	1	BB/PPT
	Quantum numbers- Principal, Azimuthal, Magnetic and Spin quantum numbers and their significance	-	2	BB
	Pauli's exclusion principle – Hund's rule- Aufbau Principle, (n+1) rule	-	2	BB/PPT
Quantum Chemistry-I				
II	Planck's quantum theory - Photoelectric effect, Compton effect	-	3	BB/PPT
	Wave particle duality, de Broglie equation-	-	3	BB
	Davison –Germer Experiment-Heisenberg uncertainty principle - Eigen function and Eigen value.	-	3	BB
Quantum Chemistry-II				
III	Wave functions and its physical properties - Normalization and Orthogonal function	-	2	BB/PPT
	The significance of the wave function ψ – interpretation of ψ^2	-	3	BB/PPT
	Postulates of Quantum mechanics - Operators	-	2	BB/PPT
	Hamiltonian, Hermitian and Laplacian - Schrodinger's time independent wave equation.(1D box)	-	3	BB/PPT
Periodic properties				
IV	Periodic properties – classification of elements as s, p, d and f-block elements – variation of atomic volume – atomic and ionic radii – ionization potential	-	2	BB/PPT
	Electron affinity and electro negativity along period and groups – variation of metallic characters - Factors affecting the periodic properties	-	2	BB/PPT
	Periodic table anomalies and variations in atomic radius, ionic radius, electronic configuration, , electron affinity and electro negativity, ionization energy	-	3	BB/PPT
	and metallic character of elements along the group and periods and their influences on stability, colour, coordination number, geometry, physical and chemical properties..	-	2	BB/PPT

Chemical bonding-II				
V	VSEPR Theory – Principles and hybridization- sp , sp^2 and sp^3	-	2	BB/PPT/Animated Video
	Shapes of simple inorganic molecules ($BeCl_2$, BF_3 , $SiCl_4$, PCl_5 , SF_6 , IF_7 , H_2O , NH_3 , XeF_6)	-	2	BB/PPT/Animated Video
	MO Theory –Bonding and anti-bonding molecular orbitals	-	2	BB/PPT/Animated Video
	Applications of MO theory H_2 , He, N_2 , O_2 , HF and CO molecules – Comparison of VB and MO Theories.	-	3	BB/PPT/Animated Video
Total Hours			45	

Course outcome: After successful completion of this course, the student will be able

CLOs	CLO Statement	Knowledge level
CLO1	To interpret atomic models, various quantum numbers and comparing stability of orbitals various orbitals	K2
CLO2	To organize basic concepts of quantum mechanics and the difference between classical and wave mechanics.	K3
CLO3	To apply operators to solve simple eigen values problems and approximation methods used in solving molecular energy.	K3
CLO4	To develop concept of trends in periodic properties and its variation to rationalize the nature of the bonding in substances.	K3
CLO5	To develop the structure and types of bond in inorganic molecules using VB and MO theories.	K4

PO and CLO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5
CLO1	3	2			
CLO2	3	2			
CLO3	3	2			
CLO4	3	2			
CLO5	3	2			

PSO and CLO Mapping:

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CLO1	3	2		3			
CLO2	3	2		3			
CLO3	3	2		3			
CLO4	3	2		3			
CLO5	3	2		3			

3-Advance application; 2-Intermediate level;1-Basic level