University of Kerala

Discipline	CHEMISTRY				
Course Code	**UK1DSCCHE104**				
Course Title	**GENERAL INORGANIC CHEMISTRY**				
Type of Course	**DSC**				
Semester	1				
Academic Level	100 – 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	1. Higher secondary level science knowledge				
Course Summary	The course covers atomic structure, chemical bonding, co-ordination chemistry and secondary bond forces, analytical principles including volumetric analysis and Nuclear Chemistry. Students learn about quantum numbers, orbital concepts, electron configuration, bond energetics, molecular geometry, and fundamentals of analytical chemistry. They also gain a detailed understanding of the radioactivity and nuclear chemistry				

Detailed Syllabus:

Module	Unit	Content GENERAL INORGANIC CHEMISTRY	Hrs 75
1	**ATOMIC STRUCTURE, CHEMICAL BONDING AND SECONDARY BOND FORCES**		**21**
	1	Atomic spectrum of hydrogen - different series, Rydberg equation. Bohr theory – postulates – statement of Bohr energy equation – derivation of spectral frequency from Bohr equation	3
	2	Schrodinger wave equation (mention only, no derivation), concept of orbitals. Quantum numbers and their significances	2
	3	Orbital wise electron configuration, energy sequence rule – Pauli's principle, Hund's rule, Stability of filled and half-filled orbitals.	3
	4	Electronic configuration of lanthanides and actinides	2
	5	Energetics of ionic bond formation – Born-Haber cycle. Fajan's rule.	3
	6	Hybridisation and shape of molecules with examples – sp ($BeCl_2$), sp^2 (BF_3), sp^3 (CH_4), sp^3d (PCl_5), sp^3d^2 (SF_6) and sp^3d^3 (IF_7)	3
	7	VSEPR theory, regular and irregular geometry, H_2O, NH_3, XeF_2, XeF_4. Hydrogen bond – inter and intra molecular – its consequences on boiling point and volatility. Importance of hydrogen bonding in biomolecules – Proteins and nucleic acids.	3
	8	Ionic character of covalent bond – Polar and non-polar covalent compounds.	2

II	**CO-ORDINATION CHEMISTRY**		**6**
	9	Types of ligands, Werner's coordination theory, Valence bond theory of bonding in octahedral and tetrahedral complexes, Drawbacks of valence bond theory.	3
	10	Crystal field theory of octahedral and tetrahedral complexes, examples – high and low spin complexes, magnetic properties, Application in qualitative and quantitative analysis	3
III	**ANALYTICAL PRINCIPLES**		**9**
	11	Principles of volumetric analysis – primary standard – standard solutions normality and molarity	3
	12	Theory of acid-base titrations, permanganometric and dichrometric titrations, iodometry and complexometric titrations. Theory of acid-base indicator – redox indicators	3
	13	Principles of colorimetry – estimation of biomolecules - glucose and chlorophyll.	3
IV	**RADIOACTIVITY AND NUCLEAR CHEMISTRY**		**9**
	14	Radioactive decay series, Radioactive equilibrium, Average life, Half-life. Detection of radio activity-Geiger Muller Counter, Wilson cloud chamber. Units of radioactivity - Curie and Rutherford, Units of radiations.	3
	15	Nuclear Chemistry - stability of nucleus, n/p ratio. Artificial transmutation and radioactivity, mass defect, binding energy.	3
	16	Applications of radio activity- in medicine and agriculture. Biological effects of radiation, pathological and genetic damage.	3
V	**VOLUMETRIC ANALYSIS**		**30**
	18	**Section A: Volumetric Analysis (5 Experiments (double titration) from Section A are compulsory)** 1. Preparation of standard solutions. 2. Neutralization Titrations a. Strong acid – Strong base b. Strong acid – Weak base c. Weak acid – Strong base 3. Redox Titrations - Permanganometry a. Estimation of oxalic acid. b. Estimation of Fe^{2+}/$FeSO_4.7H_2O$/Mohr's salt.	15
	19	**Section B (Open ended: Any 3 experiments are to be conducted - May be selected from the list or the teacher can add related experiments)** 1. Dichrometry 2. Iodometry & Iodimetry 3. Complexometry 4. Colorimetry	15

References

1. *Coordination Chemistry,* Fred Basolo, Ronald C. Johnson, 2nd Edition, Science Reviews, 1986.

2. *Organometallic Chemistry,* R. C. Mehrotra, New Age International, 2007.
3. *J.D. Lee, Concise Inorganic Chemistry, 5th Edn., Wiley India Pvt. Ltd., 2008.*
4. B.R Puri, L R Sharma K C Kalia, Principles of Inorganic Chemistry, Sobhanlal Nagin Chand & Co. New Delhi
5. A.D. Madan, *Modern Inorganic Chemistry*
6. A. I.Vogel, *A text book of Quantitative analysis"*
7. Day & Underwood, *Quantitative analysis: laboratory manual":*

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Analyze the fundamental principles and theories of atomic structure, bonding, molecular geometry, and intermolecular forces to explain spectral characteristics, electronic configurations, hybridization, molecular shapes, and the impact of bonding interactions on physical and chemical properties of elements and compounds.	An	PSO-1
CO-2	Analyze the bonding, geometry, magnetic properties, and analytical applications of coordination complexes using Werner's theory, Valence Bond Theory, and Crystal Field Theory, distinguishing between high and low spin behaviours in octahedral and tetrahedral environments.	An	PSO-1
CO3	Evaluate the principles and applications of volumetric and colorimetric analytical techniques, including standardization procedures, indicator theories, and the estimation of biomolecules such as glucose and chlorophyll.	C	PSO-1,2,3
CO 4	Design applications and interpret concepts related to radioactivity, including detection methods, nuclear stability, decay processes, and biological impacts, with emphasis on real-world uses in medicine and agriculture.	E	PSO-1
CO 5	Design and perform standard volumetric and instrumental analytical experiments to prepare solutions, estimate analytes through acid-base, redox, and complexometric titrations, and apply suitable methods for quantitative chemical analysis with scientific reasoning.	C	PSO-1,2,3,4,5

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: GENERAL INORGANIC CHEMISTRY

Credits: 3:0:1 (Lecture:Tutorial:Practical)

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	CO-1	PO-1,6 PSO-1	An	F, C	L	-
2	CO-2	PO-1,6 PSO-1	An	F, C	L	-
3	CO3	PO-1,6 PSO-1,2,3	C	F, C, P	L	-
4	CO 4	PO-1,6 PSO-1	E	F, C	L	-
5	CO 5	PO-1,2,6 PSO-1,2,3,4,5	C	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO 1	3	-	-	-	-	2	-	-	-	-	2	-	-
CO 2	3	-	-	-	-	2	-	-	-	-	2	-	-
CO 3	3	2	2	-	-	2	-	-	-	-	2	-	-
CO 4	3	-	-	-	-	2	-	-	-	-	2	-	-
CO 5	2	2	2	2	3	2	2	-	-	-	2	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments