University of Kerala

Discipline	CHEMISTRY				
Course Code	**UK1DSCCHE103**				
Course Title	**FOUNDATIONS OF INORGANIC & POLYMER 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 fundamental topics in chemistry, including atomic structure, periodicity, environmental pollution, polymers, and analytical principles. Students will gain a comprehensive understanding of these concepts, along with practical skills in volumetric analysis, preparing them for careers in fields such as chemistry, environmental science, and materials science with an emphasis on theoretical knowledge and hands-on laboratory experience.				

Detailed Syllabus:

Module	Unit	Content FOUNDATIONS OF INORGANIC & POLYMER CHEMISTRY	Hrs 75
I	**ATOMIC STRUCTURE & PERIODICITY**		**18**
	1	Atomic structure – Introduction - Atomic spectrum of Hydrogen – different series, Rydberg equation, Bohr theory –postulates – statement of Bohr energy equation, limitations of Bohr model	4
	2	Dual nature of matter and radiation, Photoelectric effect, de Broglie equation, Heisenberg's uncertainty principle	3
	3	Concept of orbital, Quantum numbers, shapes of orbitals (s, p, d)	2
	4	Electronic configuration of atoms - Aufbau principle, Hund's rule of maximum multiplicity, Pauli's exclusion principle.	3
	5	Modern periodic law – Long form of periodic table	1
	6	Periodicity in properties: Atomic radii, ionic radii, ionization enthalpy, electron affinity (electron gain enthalpy) and electronegativity (Pauling scale).	3
	7	Atomic mass - Molecular mass – Mole concept – Molar volume - Oxidation and reduction – Oxidation number and valency - Equivalent mass.	2
II	**ENVIRONMENT AND POLLUTION**		**9**

	8	Air and soil pollution - Introduction, different types of air and soil pollution, air pollutants SO_2, SO_3, NO, NO_2 and smog.	2
	9	Acid rains, CO_2, CO, Greenhouse effect, O_3, importance of ozone layer, causes and effects of ozone layer depletion.	2
	10	Photochemical oxidants, PAN, hydrocarbons, particulates, dust, smog, asbestos, lead, mercury, cadmium. Control of air pollution	2
	11	Water pollution-Factors affecting the purity of water, sewage water, Industrial waste, agricultural pollution such as pesticides, fertilizers, detergents; treatment of industrial waste water using activated charcoal, synthetic resins, reverse osmosis and electro dialysis (elementary idea only).	3
III	**NATURAL AND SYNTHETIC POLYMERS**		**9**
	12	Introduction. Classification of polymers: Natural, synthetic; linear, cross-linked and network polymers, plastics, elastomers, fibres; homopolymers and copolymers.	2
	13	Mode of formation - Addition, Condensation Polymerization (definition and examples only)	1
	14	Typical examples: Polyethylene, polypropylene, PVC, phenol-formaldehyde and melamine formaldehyde resins, polyamides (nylons) and polyesters.	3
	15	Natural rubber: structure, latex processing methods, vulcanization and uses. Synthetic rubbers: SBR, nitrile rubber and neoprene.	2
	16	Biodegradability of polymers, environmental hazards. Recycling of plastics.	1
IV	**ANALYTICAL PRINCIPLES**		**9**
	18	Reporting of Analytical Data: Units, significant digits, rounding, Precision and accuracy – Types of errors – Ways of expressing precision – Methods to reduce systematic errors.	2
	19	Methods of expressing concentration: Weight percentage, molality, molarity, normality, mole fraction, ppm and millimoles.	2
	20	Methods of Analysis: Volumetric method of analysis - General principles. Primary and secondary standards, criteria for primary standards, preparation of standard solutions, standardization of solutions, end point.	2
	21	Acid base, redox and complexometric titrations and corresponding indicators.	2
	22	Separation Techniques: General principles of distillation and solvent extraction.	1
V	**VOLUMETRIC ANALYSIS**		**30**
	23	**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	15

		3. Redox Titrations - Permanganometry a. Estimation of oxalic acid. b. Estimation of Fe^{2+}/$FeSO_4.7H_2O$/Mohr's salt.	
	24	**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. *Elements of Physical Chemistry,* B. R. Puri, L. R. Sharma, M.S. Pathania, Vishal Pub. Co.
2. *Inorganic Chemistry,* P. L. Soni.
3. *Atomic Structure and Molecular Spectroscopy,* Manas Chanda,
4. *University General Chemistry*, C. N. R. Rao, Macmillan.
5. *Text Book of Environmental Studies for undergraduate Courses,* Bharucha Erach, University Press.
6. *Polymer Science,* V R Gowariker, N V Viswanathan, Jayadev Sreedhar, New Age International Pvt Ltd, Fourth Edition, 2021.
7. *Vogel's Text Book of Quantitative Chemical Analysis,* J. Mendham, R. C. Denney, J.D. Barnes, M. Thomas, Pearson Education.
8. *Analytical Chemistry,* R. Gopalan, S. Chand and Co., New Delhi.
9. *Quantitative Analysis,* R. A. Day Junior, A.L. Underwood, 5th edn. Prentice Hall of India Pvt. Ltd. New Delhi.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Critically analyze the fundamental concepts of atomic structure, quantum theory, electronic configuration, and periodicity, applying principles such as Bohr's model, quantum numbers, and periodic trends to explain atomic and molecular properties, as well as interpret related chemical calculations including mole concept, oxidation-reduction, and equivalent mass.	An	PSO-1,2
CO-2	Analyze the sources, types, chemical nature, environmental impacts, and control methods of air, soil, and water pollutants, including acid rain, greenhouse gases, ozone depletion, and industrial/agricultural contaminants, and critically evaluate treatment technologies for pollution	E	PSO-1,2,3

	mitigation.		
CO-3	Analyze the classification, formation mechanisms, structural characteristics, and environmental impact of natural and synthetic polymers, including key examples, rubber processing techniques, and recycling methods.	An	PSO-1,2,4
CO-4	Analyze and report chemical data with proper units and error analysis, apply various concentration expression methods, perform precise volumetric titrations using appropriate standards and indicators, and effectively utilize separation techniques such as distillation and solvent extraction to solve complex analytical problems.	C	PSO-1,2,3,4
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: FOUNDATIONS OF INORGANIC & POLYMER 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-1,2	An	F, C	L	L
2	CO-2	PO- 1,6 PSO-1,2,3	E	F, C	L	L
3	CO-3	PO- 1,6 PSO-1,2,4	An	F, C	L	L
4	CO-4	PO- 1,6 PSO-1,2,3,4	C	F, C	L	L
5	CO-5	PO- 1,2,6 PSO-1,2,3,4,5	C	F, C, P	-	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	2	2	-	-	-	1	-	-	-	-	2	-	-
CO 2	2	2	3	-	-	1	-	-	-	-	2	-	-
CO 3	1	2	-	3	-	1	-	-	-	-	2	-	-
CO 4	2	2	3	3	-	1	-	-	-	-	2	-	-
CO 5	1	2	3	3	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
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓			✓
CO 3	✓		✓	✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓