

DEPARTMENT OF CHEMISTRY				CLASS: I B.Sc. Chemistry				
SEM	Course type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
II	Part-III-Core	20U2CMC4	General Chemistry – IV	3	3	25	75	100

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

1. to explain the basic knowledge on the physical properties of liquids
2. to classify the thermotropic liquid crystals
3. to discuss the chemistry of s - block elements and its complexes
4. to design the theory behind the volumetric analysis and to develop the knowledge in the principles of concentration, primary and secondary standards
5. to outline the basic metallurgical processes and gain knowledge on the various refining methods

Unit-I: Liquid State

Liquid state: Physical properties – vapour pressure – Trouton’s rule – surface tension – Effect of temperature on surface tension – capillary rise method - viscosity – effect of pressure and temperature – refraction – refractive index – specific and molar refraction. Liquid crystals: Vapour pressure temperature diagram – thermography – classification of thermotropic liquid crystals – nematic, smectic and cholesteric liquid crystals with examples.

Unit-II: s-block elements

Position of hydrogen in the periodic table, General characteristics of s – block elements – Compounds of s-block metals – oxides, hydroxides, peroxides, superoxide’s-preparation and properties – oxo salts – carbonates – bicarbonates – nitrates – halides and polyhalides. Anomalous behavior of Li and Be – physical and chemical properties of Be – Uses – physical and chemical properties of Mg– Uses-biological importance of sodium and potassium.

SLT - Complexes of s-block metals - complexes with crown ethers - Organometallic compounds of Li and Be.

Unit-III: Principles of Volumetric Analysis

General principle: Types of titrations. Requirements for titrimetric analysis. Concentration systems: Molarity, molality formality, normality, wt%, ppm, milliequivalence and millimoles -problems. Primary and secondary standards, criteria for primary standards, preparation of standard solutions, standardization of solutions. Limitations of volumetric analysis, endpoint and equivalence point. Neutralisation-titration curve, theory of indicators, choice of indicators. Use of phenolphthalein and methyl orange. Metal ion indicators. Problems based on titrimetric analysis.

Unit-IV: Metallurgy-I

Occurrence of metals –basic metallurgical operations and metallurgy process – General methods involved in extraction of metals- concentration of ores – froth floatation, magnetic separation, calcination, roasting, smelting, flux, aluminothermic process. Extraction processes– Chemical reduction – electrolytic reduction – metal displacement.

Unit-V: Metallurgy-II

Refining methods - Zone refining – van Arkel de Boer methods – electrolytic refining – ion exchange method – muffle furnace – –Extraction of the following metals: Be, Mg and Al.

Books for Study

1. R. Puri, L.R.Sharma and M.S.Pathania, Principles of Physical Chemistry, 47th edition, Vishal Publishing Co, 2016.
2. R. Puri and L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, ShobanLalNagin Chand and Co, 1990.
3. R. D. Madan, Modern Inorganic Chemistry, 3rdedn, S. Chand & Company Ltd., Reprint, 2014.

Books for Reference

1. N. Kundu and S.K. Jain, Physical Chemistry, S. Chand & Company Ltd.2000.
2. G.M. Barrow, Physical Chemistry, 6th edn, McGraw-Hill Inc., US, 1996.
3. A.I. Vogel, A Textbook of Quantitative Inorganic Analysis, ELBS and Longman London, 1975.
4. S.M. Khopkar, Basic Concepts of Analytical Chemistry New Age International Publisher, 2009.
5. W. U. Malik, G. D. Tuli, and R. D. Madan: Selected Topic in Inorganic Chemistry, S. Chand & Company Ltd, New Delhi, 1998.
6. P. L. Soni, Mohan Katyal, Text book of Inorganic Chemistry, 20th Edition, Sultan Chand & Sons, New Delhi,2007.

Web Resources

1. <https://en.wikipedia.org/wiki/Liquid>
2. <https://www.britannica.com/science/metallurgy>
3. <https://www.coursehero.com/file/p4nk7p5/1-The-basic-principles-of-volumetric-analysis-are-given-as-below-1-The-one/>
4. <https://www.vedantu.com/chemistry/volumetric-analysis>

Pedagogy

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

Lesson Plan

Unit	Descriptions	Staff Name	Hours	Lecture Mode
Liquid State				
I	Liquid state: Physical properties – vapour pressure – Trouton's rule – surface tension – Effect of temperature on surface tension - capillary rise method.	-	3	BB/PPT
	Viscosity – effect of pressure and temperature – refraction – refractive index – specific and molar refraction.	-	3	BB/PPT
	Liquid crystals: Vapour pressure temperature diagram – thermography	-	1	BB
	Classification of thermotropic liquid crystals – nematic, smectic and cholesteric liquid crystals with examples.	-	2	BB/PPT
s-block elements				
II	Position of hydrogen in the periodic table, General characteristics of s – block elements	-	1	BB/PPT
	Compounds of s-block metals – oxides, hydroxides, peroxides, superoxides	-	2	BB
	Preparation and properties – oxo salts – carbonates – bicarbonates – nitrates – halides and polyhalides.	-	2	BB
	Anomalous behavior of Li and Be – physical and chemical properties of Be – Uses	-	2	BB
	Physical and chemical properties of Mg – Uses-biological importance of sodium and - potassium.	-	2	BB
Principles of Volumetric Analysis				
III	General principle: Types of titrations. Requirements for titrimetric analysis.	-	1	BB/PPT
	Concentration systems: Molarity, molality formality, normality, wt%, ppm, milliequivalence and millimoles -problems.	-	2	BB/PPT
	Primary and secondary standards, criteria for primary standards, preparation of standard solutions, standardization of solutions. Limitation of volumetric analysis, endpoint and equivalence point	-	3	BB/PPT
	Neutralisation-titration curve, theory of indicators, choice of indicators. Use of phenolphthalein and methyl orange. Metal ion indicators. Problems based on titrimetric analysis.	-	3	BB/PPT
Metallurgy-I				
IV	Occurrence of metals –basic metallurgical operations and metallurgy process	-	2	BB/PPT
	General methods involved in extraction of metals- concentration of ores – froth floatation, magnetic separation, calcination, roasting, smelting, flux, alumino-thermic process.	-	4	BB/PPT
	Extraction processes– Chemical reduction – electrolytic reduction – metal displacement.	-	3	BB/PPT

Metallurgy-II				
V	Refining methods - Zone refining – van Arkel de Boer methods	-	2	BB/PPT
	Electrolytic refining – ion exchange method – muffle furnace	-	3	BB/PPT
	Extraction of the following metals: Be, Mg and Al.	-	4	BB/PPT
	Total Hours			45

*BB-Black board/Chalk and Talk

PPT-Power point presentation

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

CLOs	CLO statement	Knowledge Level
CLO1	To outline the behavior of liquids and to classify types of liquid crystals	K2
CLO2	To find the applications of Be and Mg	K3
CLO3	To organize knowledge about compounds and biological importance of some s block elements	K4
CLO4	To apply the theory behind the volumetric analysis, which gives the information about the concentration, and primary & secondary standards; To solve problems based on titrimetric analysis	K3
CLO5	To describe the basics of metallurgy and the principles of extraction and refining of metals.	K3

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	1
CLO2	3			3			
CLO3	2			3		1	
CLO4	1	2	1			3	3
CLO5	3			3		2	2

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