

School of Chemistry
Faculty of Science
University of the Punjab, Lahore
Course Outline



BS Chemistry Semester-IV					
Programme	BS (Chemistry)	Course Code	Chem-217	Credit Hours	2
Course Title	Chemistry of f-block Elements		Course type	Major	
Course Introduction					
<p><i>This course will familiarize to students about lanthanides and actinides chemistry. The students will get knowledge about their discovery, extraction, separation, electronic configuration and their applications.</i></p> <p><i>Here is a brief description of course outlines:</i></p> <p>Lanthanides: General characteristics, occurrence, extraction and general principles of separation, electronic structure and position in the periodic table, lanthanides contraction, oxidation states, spectral and magnetic properties and uses.</p> <p>Actinides: General characteristics, electronic structure, oxidation state and position in the periodic table, Extraction and applications of Uranium and Thorium, artificial transmutation, synthesis of tracer elements, their role in nuclear, industrial and chemical reactions.</p>					
Learning Outcomes					
<p>Upon successful completion of the course, the student will:</p> <ol style="list-style-type: none"> 1. Have an in-depth knowledge of electronic configuration f- block elements and its impact on their magnetic, spectral and radioactive properties. 2. Importance of Lanthanides and Actinides in industry. 3. Understand the extraction processes of lanthanides and synthesis of actinides by artificial transmutation. 					
Course Content			Assignments/Readings		
Week 1	Introduction of f-block elements and Lanthanides		Reading from recommended books		
			Examples solving practices		
Week 2	General characteristics		Reading from recommended books		
			Examples solving practices		
Week 3	Occurrence and extraction , Cracking of ores		Reading from recommended books		
			Examples solving practices		
Week 4	Separation of individual Lanthanides		Reading from recommended books		
			Examples solving practices		
Week 5	Electronic structure, oxidation and position in the periodic table		Reading from recommended books		
			Examples solving practices		

Week 6	Lanthanides contraction	Reading from recommended books
		Examples solving practices
Week 7	Spectral and magnetic properties and uses.	Reading from recommended books
		Examples solving practices
Week 8	Revision of all aspects of Lanthanides' chemistry	Reading from recommended books
		Examples solving practices
Week 9	Mid term assessment	
Week 10	General characteristics of Actinides.	Reading from recommended books
		Examples solving practices
Week 11	Electronic structure, oxidation state and position in the periodic table.	Reading from recommended books
		Examples solving practices
Week 12	Extraction and applications of Uranium	Reading from recommended books
		Examples solving practices
Week 13	Extraction and applications of Thorium	Reading from recommended books
		Examples solving practices
Week 14	Artificial transmutation, synthesis of tracer elements	Reading from recommended books
		Examples solving practices
Week 15	Their role in nuclear, industrial and chemical reactions.	Reading from recommended books
		Examples solving practices
Week 16	Revision of all aspects of actinides' chemistry	Reading from recommended books
		Examples solving practices

Textbooks and Reading Material

1. Housecraft, C. and Sharpe, A. G., (2012), "*Inorganic Chemistry*", 4th ed., Prentice Hall.
2. Shriver, D. and Atkins, P.,(2010), "*Inorganic Chemistry*", 5th ed., W. H. Freeman & Company.
3. Ullah, S., (2020) "*Inorganic Chemistry*", Ilmi Kitab Khana, Lahore.
4. Atkins, P. and Jones, L.,(2010), "*Chemicals Principles*", 5th ed., W. H. Freeman & Company.
5. Huheey, J. E., Keiter, E. A. and Keiter, R. L.,(1997), "*Inorganic Chemistry: Principles of Structure and Reactivity*", 4th ed., Prentice Hall.
6. Rehman, R., and Bhatti, H.N., (2015) "*Advanced Inorganic Chemistry*", Volume I, Carvan Book House Lahore.

Teaching Learning Strategies

1. Lecture Based Examination (Objective and Subjective)
2. Assignments
3. Class discussion
4. Quiz
5. Tests

Assignments: Types and Number with Calendar

1. Lanthanides: Extraction and applications
2. Actinides: synthesis and applications / Uranium extraction and applications

Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

BS Chemistry Semester-IV					
Programme	BS Chemistry	Course Code	Chem-218	Credit Hours	1
Course Title	Inorganic Chemistry Lab		Course type	Major	
Course Introduction					
<p>The course is organized to provide an adequate knowledge about chemical nature and general concepts of redox and acid-base titrations along with gravimetric analysis of water samples.</p> <p>Redox Titrations Determine the amount/L of $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ hydrate using potassium dichromate. Determine of %of Iron in ferric Alum using $\text{K}_2\text{Cr}_2\text{O}_7$. Determination of no. of water molecules in $\text{FeSO}_4 \cdot x\text{H}_2\text{O}$ using $\text{K}_2\text{Cr}_2\text{O}_7$.</p> <p>Acid Base Titrations Standardization of NaOH using oxalic as primary standard. Determine the amount/L of Oxalic acid in given sample. Determine the amount/L of HCl in given sample. Determine the amount/L of H_2SO_4 in given sample. Determine the amount/L of HNO_3 in given sample.</p> <p>Gravimetric Analysis Determination of barium ions in a given sample, Determination of chloride ions in a given solution. Determination of Oxalate ions in a given solution. Determination of Sulphate ions in a given solution.</p>					
Learning Outcomes					
<p>On the completion of the course, the students will be able to:</p> <ol style="list-style-type: none"> 1. Understand the types of titrations. 2. Acquire the basic knowledge of acid base and redox titrations. 3. Understand the chemistry behind gravimetry to analyze water samples. 					
Course Content				Assignments/Readings	
Week 1	Introduction about Lab safety and solution preparations, primary and secondary standards substances for solution preparations.	Sample solution practices			
		Analysis and written task			
Week 2	Introduction of Volumetric analysis by different types of titrations.	Sample solution practices			
		Analysis and written task			
Week 3	Determine the amount/L of $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ hydrate using potassium dichromate.	Sample solution practices			
		Analysis and written task			
Week 4	Determine of %of Iron in ferric Alum using $\text{K}_2\text{Cr}_2\text{O}_7$.	Sample solution practices			
		Analysis and written task			
Week 5	Determination of no. of water molecules in $\text{FeSO}_4 \cdot x\text{H}_2\text{O}$ using $\text{K}_2\text{Cr}_2\text{O}_7$.	Sample solution practices			
		Analysis and written task			
Week 6	Standardization of NaOH using oxalic as primary standard.	Sample solution practices			
		Analysis and written task			
Week 7	Determine the amount/L of Oxalic acid in given sample.	Sample solution practices			
		Analysis and written task			
Week 8	Determine the amount/L of HCl in given sample.	Sample solution practices			

		Analysis and written task
Week 9	Mid term assessment	
Week 10	Determine the amount/L of H ₂ SO ₄ in given sample.	Sample solution practices Analysis and written task
Week 11	Determine the amount/L of HNO ₃ in given sample.	Sample solution practices Analysis and written task
Week 12	Determination of barium ions in a given sample	Sample solution practices Analysis and written task
Week 13	Determination of chloride ions in a given solution.	Sample solution practices Analysis and written task
Week 14	Determination of Oxalate ions in a given solution.	Sample solution practices Analysis and written task
Week 15	Determination of Sulphate ions in a given solution.	Sample solution practices Analysis and written task
Week 16	Revision of overall aspects of acid base, redox and gravimetric analysis.	Sample solution practices Analysis and written task

Textbooks and Reading Material

- Hill, R. H. JR and Fister, D. C.,(2010), “*Laboratory Safety for Chemistry Students*”, John-Wiley & Sons, Inc.
- Mendham, J., Denny, R. C., Barnes, J. D., Thomas, M. and Sivasankar, B.,(2000), “*Vogel’s Textbook of Quantitative Chemical Analysis*”, 6th ed., Pearson Education, Ltd.
- Svehla, G.,(2009), “*Vogel’s Qualitative Inorganic Analysis*”, 7th ed., (7th imp.), Pearson Education, Ltd.
- Rehman, R., and Bhatti, H.N., (2013), “*Inorganic Chemistry, Laboratory Manual*”, Carvan Book House Lahore.
- Rehman, R., and Bhatti, H.N.,(2015), “*Experimental Inorganic Chemistry*”, Carvan Book House Lahore.

Teaching Learning Strategies

- Lab based practice
- Examination (Objective and Subjective)
- Assignments
- Class discussion

Assignments: Types and Number with Calendar

- Redox and acid base titrations and their applications.
- Gravimetry and its applications.

Assessment			
Sr. No.	Elements	Weightage	Details
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