



University of Al Ameer



Faculty of Health and Medical Technologies

All Departments

General Chemistry

Course Description

### Course Information

Course Information				
<b>Course Title</b>	General chemistry	<b>Course Delivery</b>		
<b>Course Code</b>		<b>Method</b>	<b>H/Week</b>	<b>Frequency</b>
<b>Credits</b>	2 Credits (1 Theory + 1 Practical)	<b>Theory</b>	2 hours	Weekly
<b>Course Type</b>		<b>Online Lecture</b>	-	-
<b>Course Level</b>	First Year / Level 1	<b>Lab</b>	2 hours	Weekly
<b>Semester of Delivery</b>	Second Semester	<b>Tutorial</b>		
<b>Administering Department</b>	Health and Medical Technologies	<b>Practical</b>	1 hour	Weekly
<b>Instructor</b>	Zainab Ali	<b>Seminar</b>		
<b>Version Number</b>		<b>Faculty</b>	Health and Medical Technologies	
		<b>E-mail</b>	<a href="mailto:E-mail@alameed.edu.iq">E-mail@alameed.edu.iq</a>	
		<b>Scientific Committee Approval Date</b>	Version Number	

## Brief Description

This course introduces the fundamental principles of analytical chemistry, focusing on chemical calculations, methods of expressing concentration, and volumetric analysis including acid-base, precipitation, redox, and complexometric titrations. It also covers basic spectrophotometric concepts to equip healthcare students with foundational laboratory skills.

## Course Objective, Learning Outcomes and Indicative Contents

### Course Objective

To provide students with a foundational understanding of quantitative analytical calculations, solution preparations, and volumetric analyses in the first semester.

### Course Learning Outcomes

1. Express chemical concentrations precisely using Molarity, Normality, and percentage calculations.
2. Prepare standard chemical solutions and perform dilution calculations accurately for laboratory use.
3. Apply principles of chemical stoichiometry to solve quantitative analytical problems and titration data.
4. Differentiate between types of volumetric titrations, including acid-base, redox, and complexometric methods.
5. Perform basic titration experiments safely and calculate unknown sample concentrations from practical measurements.
6. Operate basic spectrophotometric instruments and interpret quantitative data according to the Beer-Lambert Law.

### Indicative Contents

#### Theory Lectures

##### **Lecture 1: Fundamentals of Analytical Chemistry [Skoog]**

- Concept: Introduction to quantitative and qualitative chemical analysis.

##### **Lecture 2: Methods of Expression of Concentration I [Skoog]**

- Concept: Core principles of Molarity and chemical weight calculations.

### **Lecture 3: Methods of Expression of Concentration II [Skoog]**

- Concept: Core principles of Normality, equivalents, and dilution laws.

### **Lecture 4: Titration and its Types [Skoog]**

- Concept: Fundamental concepts of volumetric titration and equivalence points.

### **Lecture 5: Acid-Base Titration I [Skoog]**

- Concept: Neutralization reactions and selection of appropriate pH indicators.

### **Lecture 6: Acid-Base Titration II [Skoog]**

- Concept: Understanding the secondary solutions against primary standard solutions.

### **Lecture 7: Midterm Theory Exam**

### **Lecture 8: Redox Titration [Skoog]**

- Concept: Electron transfer processes and oxidation-reduction indicators

### **Lecture 9: Precipitate Titration I [Skoog]**

- Concept: classification precipitation titrations methods.

### **Lecture 10: Precipitate Titration II [Skoog]**

- Concept: Understanding the principle of precipitation titration (Mohr's method)

### **Lecture 11: Complexometric Titration [Skoog]**

- Concept: Formation of metal-EDTA complexes and their diagnostic uses.

### **Lecture 12: Spectrophotometric Analysis & Beer-Lambert Law I [Skoog]**

- Concept: Basic components and optical instrumentation of a spectrophotometer.

### **Lecture 13: Spectrophotometric Analysis & Beer-Lambert Law II [Skoog]**

- Concept: Relationship between light absorption and solute concentration.

### **Lecture 14: Comprehensive Revision**

- Concept: Reviewing core topics and discussing sample exam questions.

### **Lecture 15: Final Theory Examination**

## **Lab. Lectures**

**Lab 1:** Introduction of Basic Lab Equipment and General Laboratory Safety Rules.

- Safety guidelines and personal protective equipment (PPE) requirements.
- Calibration and proper handling of pipettes, burettes, and volumetric flasks.

**Lab 2:** Preparation and standardization of 0.1M Hydrochloric Acid HCl solution.

- Calculations involving molarity, specific gravity, and dilution factors.
- Titration of secondary acid solutions against primary standard bases

**Lab 3:** Preparation and Standardization of Approximately 0.1N Sodium Hydroxide NaOH.

- Understanding normality vs molarity definitions.
- Using standard reference materials like Potassium Hydrogen Phthalate (KHP).

**Lab 4:** Estimation of Sodium Hydroxide and Sodium Carbonate in a Mixture)

- Determine the concentrations of NaOH and Na<sub>2</sub>CO<sub>3</sub> using phenolphthalein and methyl orange indicators.

**Lab 5:** Quantitative Analysis of Oxidation-Reduction (Redox) Reactions.

- Differentiating oxidizing and reducing agents.
- Finding equivalence points via visual color changes without external indicators.

**Lab 6:** Estimation of Ferrous Iron Using Potassium Dichromate

- Understanding the principle of redox titration for the determination of ferrous iron (Fe<sup>2+</sup>) using standard potassium dichromate (K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>).
- Performing a redox titration and calculating the concentration of ferrous iron from the titration results.

**Lab 7: Mid-term Practical Examination**

**Lab 8:** Precipitation Titration (Determination of Chloride Ions by Mohr's Method).

- Understanding the chemistry of silver chloride precipitation.
- Utilizing potassium chromate indicator behavior under specified pH ranges.

**Lab 9:** Determination of Chloride in Drinking Water by Mohr's Method

- Understanding the principle of precipitation titration (Mohr's method) for the determination of chloride ions in drinking water.
- Determining the chloride concentration using standard silver nitrate ( $\text{AgNO}_3$ ) and potassium chromate as an indicator.

**Lab 10:** Determination of Total Hardness of Water Using EDTA

- Understanding the principle of complexometric titration using EDTA for the determination of total water hardness.
- Determining the concentration of calcium and magnesium ions in a water sample by EDTA titration and expressing the result as mg/L as  $\text{CaCO}_3$ .

**Lab 11:** Spectrophotometric Determination of Potassium Permanganate Concentration Using the Beer–Lambert Law.

- Principles of molecular spectrophotometry and light absorption.
- Building and interpreting concentration vs. absorbance standard curves.

**Lab 12:** Determination of the Maximum Wavelength ( $\lambda_{\text{max}}$ ) of Potassium Permanganate ( $\text{KMnO}_4$ ) Solution

- Understanding the principle of UV–Visible spectrophotometry and the concept of the maximum wavelength ( $\lambda_{\text{max}}$ ).
- Determining the  $\lambda_{\text{max}}$  of potassium permanganate ( $\text{KMnO}_4$ ) solution by measuring its absorbance at different wavelengths.

**Lab 13:** Preparation and pH Measurement of Buffer Solutions

- Understanding the principles of buffer solutions and their role in resisting changes in pH.

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|  | <ul style="list-style-type: none"><li>• Preparing buffer solutions and measuring their pH before and after the addition of small amounts of acid or base.</li></ul> <p><b>Lab 14:</b> Determination of pH by Acid–Base Indicators</p> <ul style="list-style-type: none"><li>• Understanding the principle of pH measurement and the relationship between hydrogen ion concentration and pH.</li><li>• Measuring the pH of different solutions using a pH meter and interpreting the results as acidic, neutral, or alkaline.</li></ul> <p><b>Lab 15:</b> Final Practical Examination</p> |
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## Learning and Teaching Strategies

<b>Strategies</b>	<p><b>Interactive Lectures:</b> Explaining analytical calculations and concentration laws using whiteboards and presentation slides.</p> <p><b>Problem-Based Learning:</b> Solving quantitative chemical problems step-by-step with students during class.</p> <p><b>Practical Laboratory Sessions:</b> Performing volumetric titrations and spectrophotometric measurements inside the lab.</p>
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# Course Evaluation

		Time Number	Weight (Marks)	Week Due															Relevant Learning Outcome																							
				W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8	LO9	LO10														
<b>Formative</b>	Quizzes	-	10%																																							
	Report	-	-																																							
	Lab Report	-	10%																																							
	Project	-	-																																							
	Online Assig.	-	10%																																							
	Onsite Assig.	-	-																																							
	Seminar	-	-																																							
<b>Summative</b>	Mid. Exam T		25%																																							
	Mid. Exam L		15%																																							
	Mid. Exam P		-																																							
	Final Exam T		35%	<b>Week 16</b>																																						
	Final Exam L		25%																																							
	Final Exam P		-																																							
<b>Total assessment</b>			100%																																							

## Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Fundamentals of Analytical Chemistry
Week 2	Methods of Expression of Concentration I
Week3	Methods of Expression of Concentration II
Week 4	Titration and its Types (Introduction and Classifications)
Week 5	Acid-Base Titration Principles
Week6	Acid-Base titration II
Week 7	Midterm Theory Exam
Week 8	Redox Titration
Week 9	Precipitation Titration Methods I
Week10	Precipitation Titration Methods II
Week 11	Complexometric Titration
Week 12	spectrophotometric Analysis
Week13	Beer-Lambert Law and its Quantitative Applications
Week 14	Comprehensive Revision and Discussion
Week15	Final Theory Exam

## Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1	Introduction of Basic Lab Equipment and General Laboratory Safety Rules.
Week 2	Preparation and standardization of 0.1M Hydrochloric Acid HCl solution.
Week 3	Preparation and Standardization of Approximately 0.1N Sodium Hydroxide NaOH.
Week4	Estimation of Sodium Hydroxide and Sodium Carbonate in a Mixture
Week 5	Quantitative Analysis of Oxidation-Reduction (Redox) Reactions.
Week6	Estimation of Ferrous Iron Using Potassium Dichromate
Week 7	Mid-term Practical Examination

Week 8	Precipitation Titration (Determination of Chloride Ions by Mohr's Method).
Week9	Determination of Chloride in Drinking Water by Mohr's Method
Week10	Determination of Total Hardness of Water Using EDTA
Week 11	Spectrophotometric Determination of Potassium Permanganate Concentration Using the Beer–Lambert Law.
Week12	Determination of the Maximum Wavelength ( $\lambda_{max}$ ) of Potassium Permanganate ( $KMnO_4$ ) Solution
Week13	Preparation and pH Measurement of Buffer Solutions
Week14	Determination of pH by Acid–Base Indicators
Week 15	Final Practical Examination

## Learning and Teaching Resources

	Title or Address	Available in the Library?
<b>Required Texts</b>	Skoog, D.A. Fundamentals of Analytical Chemistry. 9th Ed. Cengage Learning, 2014	Choose an item.
		Choose an item.
		Choose an item.
		Choose an item.
<b>Recommended Texts</b>	Christian, G.D. Analytical Chemistry. 7th Ed. Wiley, 2013	Choose an item.
		Choose an item.
		Choose an item.
		Choose an item.
<b>Websites</b>	<a href="http://www.chemguide.co.uk">www.chemguide.co.uk</a>	

## Grade Policy

<b>Class Participation</b>	Evaluation of student engagement during sessions
<b>Quizzes</b>	Short unannounced tests to check understanding
<b>Report</b>	-
<b>Lab Report</b>	Weekly evaluation of laboratory experimental results
<b>Project</b>	-
<b>Online Assig.</b>	-

<b>Onsite Assig.</b>	-
<b>Seminar</b>	-
<b>Mid. Exam Theory</b>	Written exam covering first half of theoretical lectures
<b>Mid. Exam Lab.</b>	Practical and written evaluation of lab skills
<b>Mid. Exam Practical</b>	Included in the Midterm Lab evaluation
<b>Final Exam Theory</b>	Comprehensive written examination at the end of semester
<b>Final Exam Lab.</b>	Final practical exam inside the laboratory
<b>Final Exam Practical</b>	Evaluation of practical performance and final spotting

## Grading Scheme

Group	Grade	التقدير	Marks %
<b>Success Group (50 - 100)</b>	<b>A – Excellent</b>	امتياز	90 – 100
	<b>B - Very Good</b>	جيد جدا	80 – 89
	<b>C – Good</b>	جيد	70 – 79
	<b>D - Satisfactory</b>	متوسط	60 – 69
	<b>P – Pass</b>	مقبول	50 – 59
<b>Fail Group (0 – 49)</b>	<b>Conditional Pass</b>	راسب (قيد القرار)	(45-49)
	<b>F – Fail</b>	راسب	(0-44)

## University Policy

### **Attendance Policy**

Students must attend all theoretical and practical sessions. Unjustified absences of 10% or more will result in a formal warning.

### **Academic Integrity**

Cheating on quizzes or laboratory exams will result in immediate failing grades and strict disciplinary action.

### **Laboratory Safety**

Wearing clean white lab coats and following medical chemical safety guidelines is mandatory and strictly enforced.