



Shatt Al-Arab University

College of Science

Pathological analysis science Dept.

Analytical Chemistry Course Description

This description provides a brief overview of the key characteristics of the Analytical Chemistry course and its expected learning outcomes

1. Educational Institution	Shatt Al-Arab University
2. Department / Center	Department of Pathological Analyses
3. Course Title /Code	Analytical Chemistry
4. Lecturer Name	Lecturer Zainb Kadhum Zebala
5. Type of Teaching	Attendance
6. Academic Year /Term	Term
7. Total No. of Teaching Hours	125
8. Date of Preparing this Course Description	15/11/2024

1. Course Objectives

- Demonstrate a basic understanding of Analytical Chemistry principles, definitions, and the classification of analytical techniques.
 - Illustrate the basic concepts of qualitative and quantitative analysis and their applications in solving chemical problems.
 - Develop practical skills in preparing standard solutions, performing titrations, and using instrumental methods of analysis.
 - Describe the differences between classical and instrumental methods, including accuracy, precision, sensitivity, and selectivity from a practical and theoretical perspective.

2. Course Output, Methodology and Evaluation

(A) Cognitive Objectives

- Achieve a foundational understanding of key concepts in analytical chemistry and the properties of chemical substances.
 - Develop a comprehensive understanding of fundamental analytical techniques and their real-world applications.
 - Enhance problem-solving skills in quantitative and qualitative chemical analysis, including titration, gravimetry, and instrumental methods.
 - Analyze and describe classical and instrumental analytical methods, highlighting their characteristics, limitations, and practical implications.

(B) Skill Objectives Related to the Program:

- **Analytical Skills:** Students will analyze experimental data from chemical analyses to assess the accuracy, precision, and reliability of various analytical techniques, identifying potential sources of error and areas for improvement.
- **Problem-Solving Skills:** Students will address complex chemical analysis challenges, selecting appropriate methods and developing effective procedures for both qualitative and quantitative assessments.
- **Communication Skills:** Students will effectively present laboratory results, data interpretations, and analytical reports, clearly communicating conclusions and recommendations using appropriate scientific terminology.

(C) Methods of Teaching and Learning

- Delivering Pre-Prepared Lectures.
- Assigning Homework.
- Facilitating Group Discussions.

(D) Methods of Evaluation

- **Oral Tests:** Assessing students' understanding through verbal responses.
- **Monthly Tests:** Evaluating students' knowledge and progress on a monthly basis.
- **Daily Quizzes:** Regular quizzes to gauge students' grasp of material covered each day.
- **Regular Attendance:** Monitoring and evaluating students' consistent participation in classes.

(E) Sentimental and Value Objectives

- **Ethical Understanding:** Promoting respect, integrity, and social responsibility.
- **Attitudes and Values:** Fostering positive attitudes towards learning, collaboration, and ethical behavior.

(F) General and Qualitative Skills (other skills related to the ability of employment and personal development)

- Develop students' leadership capabilities to manage laboratory projects and collaborative analytical tasks effectively in scientific and research contexts.
 - Improve proficiency in presenting chemical analysis results, writing scientific reports, and communicating findings clearly to both technical and non-technical audiences.
 - Develop skills in using, calibrating, and maintaining analytical instruments and tools essential for conducting accurate chemical measurements and experiments.
 - Foster the ability to adapt to emerging technologies and modern analytical methodologies in the field of chemistry.

3. Course Structure

Week	No. of hours	Learning Outcome	Topic/Concept	Teaching Method	Assessment Method
1	3	Grasping key analytical chemistry concepts, terms, and variables	Fundamental concepts and terminologies in analytical chemistry	Lectures and discussions	Oral tests and questions
2	3	Categorizing analytical techniques and classifying types of chemical analysis	Classification of qualitative and quantitative methods	Lectures and discussions	Oral tests and questions
3	3	Understanding sampling methods and analytical procedures	Sampling techniques and analytical workflow	Lectures and discussions	Oral tests and questions
4	3	Grasping the concepts of accuracy, precision, error types, and data validation	Analytical accuracy, precision, errors, and calibration	Lectures and discussions	Oral tests and questions
5	3	Understanding the principles of volumetric analysis and titration curves	Volumetric methods and titration theory	Lectures and discussions	Oral tests and questions

6	3	Understanding gravimetric analysis and its practical applications	Gravimetric methods and precipitation techniques	Lectures and discussions	Oral tests and questions
7	3	Statements and applications of instrumental analytical methods	Introduction to instrumental analysis (e.g., UV-Vis, AAS, Chromatography)	Lectures and discussions	Oral tests and questions
8	3	Understanding spectroscopic principles and their chemical applications	Spectroscopy: principles, types, and use in quantitative analysis	Lectures and discussions	Oral tests and questions
9	3	Identifying and applying analytical separation methods (e.g., chromatography)	Chromatographic techniques and applications	Lectures and discussions	Oral tests and questions
10	3	Calculating concentration using standard addition and calibration methods	Calibration curves and standard addition method	Lectures and discussions	Oral tests and questions
11	3	Understanding the role of pH, buffers, and indicators in analysis	Acid-base equilibria and buffer systems in analysis	Lectures and discussions	Oral tests and questions
12	3	Understanding redox reactions and applying redox titrations	Redox principles and titration calculations	Lectures and discussions	Oral tests and questions
13	3	Understanding precipitation titrations and solubility product applications	Precipitation equilibria and titration techniques	Lectures and discussions	Oral tests and questions
14	3	Exploring modern analytical tools and automated techniques	Automation and modern instrumentation in analytical chemistry	Lectures and discussions	Oral tests and questions
15	3	Learning to validate methods and ensure data quality in analytical work	Quality control, method validation, and documentation	Lectures and discussions	Oral tests and questions
16	3	Reviewing key concepts of the analytical chemistry course	Preparatory week before the final exam	Lectures and discussions	Oral tests and questions

4. Lab Structure

Week	No. of Hours	Experiment / Material Covered
1	4	Introduction to laboratory safety and proper use of analytical instruments
2	4	Preparation and standardization of a sodium hydroxide solution
3	4	Acid-base titration (e.g., HCl vs NaOH)
4	4	Determination of acetic acid concentration in vinegar

5	4	Redox titration: Determination of iron using potassium permanganate
6	4	Complexometric titration using EDTA for calcium ion determination
7	4	Gravimetric determination of sulfate as barium sulfate
8	4	Spectrophotometric analysis of iron (colorimetric method)
9	4	Flame photometry for sodium and potassium determination
10	4	Conductometric titration (e.g., strong acid vs strong base)
11	4	Potentiometric titration and electrode calibration
12	4	Paper and thin-layer chromatography for mixture separation
13	4	Determination of buffer capacity and pH measurement
14	4	Validation of analytical method: Accuracy, precision, LOD, LOQ
15	4	Final revision and lab report presentation

5. Learning and Teaching Resources

Textbooks	<p>[1] Skoog, Douglas A., F. James Holler, and Stanley R. Crouch. <i>Principles of Instrumental Analysis</i>. Cengage Learning.</p> <p>[2] Harris, Daniel C. <i>Quantitative Chemical Analysis</i>. W.H. Freeman and Company.</p> <p>[3] Christian, Gary D., and Purnendu K. Dasgupta. <i>Analytical Chemistry</i>. John Wiley & Sons.</p>
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6. Course Improvement Plan

- Update and expand course content to include recent advancements and applications in Analytical Chemistry.
 - Incorporate real-world case studies and examples to bridge theory with practical laboratory analysis.



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