هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission
اعتماد
NCAAA
2024
TP-153

Course Specification
(Bachelor)

Course Title :	**Classical Analytical Chemistry**
Course Code:	**CHM 1230**
Program:	**Bachelor of Science in Chemical Laboratories**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammed Ibn Saud Islamic University**
Version:	**1446-10 v1**
Last Revision Date:	17 September 2024

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A. General information about the course:

-1. Course Identification

1. Credit hours: 4 (3, 3, 0)					
4 (3 Lectures, 3 Lab, 0 Tutorials)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: Level 3/ Second year					
4. Course general Description:					
This course is an introduction to principles, and practices of classical quantitative analytical methods. The course covers the fundamentals of volumetric analysis such as acid – base, complexometric, redox and precipitation titrations. The basic principles and steps of gravimetric analysis will be covered in details.					
5. Pre-requirements for this course (if any)**:**					
Chemical Calculations - CHM 1131					
6. Co-requisites for this course (if any)**:**					
None					
7. Course Main Objective(s):					
By the end of completion this course students will be to: • **Understand the basic concepts and principles of volumetry and gravimetry.** • **Gain the required theoretical and practical concepts and skills to conduct titrimetric analysis.** • **Practice preparing, standardizing solutions for quantitative chemical analysis.** • **Introduce the basic analytical techniques and practical aspects of volumetric analysis.** • **Solve problems related to titrimetric analysis and interpret analytical results.**					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	**90**	**100%**
2	E-learning	**0**	**0**
3	Hybrid • Traditional classroom • E-learning	**0**	**0**
4	Distance learning	**0**	**0**

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**45**
2.	**Laboratory/Studio**	**45**
3.	**Field**	**0**
4.	**Tutorial**	**0**
5.	**Others (specify)**	**0**
Total		73

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**To define the main principles of volumetric analysis**	**K1; K2; K4**	lecturing	Short quizzes
1.2	**To recognize the different types of titrations such as acid-base, redox, complexiметric, and precipitation titration**	**K1; K2; K4**	Lecturing, group discussions, Homework and assignment	Oral test, Homework and assignment marks and written exams
1.3	**To list the principles of gravimetric analysis**	**K1; K4**	Lecturing, group discussions, Homework and assignment	Homework and assignment marks and written exams
2.0	**Skills**			
2.1	**To evaluate the concentration of solutions of different materials by titrations**	**S1; S2**	Lecture, oral discussions, and laboratory	Solved problem marks Lab reports, Short quizzes and homework assignment
2.2	**To estimate the concentration and the percent yield of**	**S1; S2**	Tutorial, Brain storming and self-study and	Work portfolio, , lab reports and homework

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
	metals by gravimetric analysis .		laboratory	
2.3	**To demonstrate skills to participate in class by asking questions and giving answers.**	**S4**	Motivate students to ask questions and to give response.	Participation marks
2.4	**To diagram and explain experimentally obtained data during laboratory classes and field tasks, and to demonstrate oral and network communication and technical writing skills.**	**S2; S2; S4**	• Seminars • Laboratory • Encourage students to use blackboard and electronic mail to submit works and assignments.	• Lab reports • Assignments and homework
3.0	**Values, autonomy, and responsibility**			
3.1	**To appraise teamwork, and create awareness to maintain scientific integrity during different assessments, projects, and mini reports.**	**V1, V2**	• Group discussion and assignments • homework	• Oral tests Assignments • homework marks

C. Course Content

No	List of Topics	Contact Hours
1.	**Introduction to titration:** Volumetric Titrimetry, Standard solutions, Standardization &Titration, Indicators, titration error, Types of titrations, Percent Purity Calculations.	**3**
2.	**Acid/Base Titrations: Titration**: methods of end point determination, acid – base titrations, titration of strong acid with strong base, regions of equivalence	**9**

	point, before, at and after equivalence point, the titration curves, finding the end point with indicators, choosing an indicator.	
3	**Complexometric Titrations**: EDTA titrations, metal chelate complexes, acid-base properties of EDTA, EDTA complexes, EDTA titration curves, regions of equivalence point, before, at and after equivalence point, titration calculations, metal ion indicators, EDTA titrations techniques, direct, indirect, displacement and back titrations, water hardness, masking.	9
4	**Oxidation/Reduction** Titrations: Basic concepts of Redox reactions, Redox titrations. The shape of redox titration curves, regions of equivalence point, before, at and after equivalence point, finding the end, Redox indicators.	9
6	**Precipitation Titrations:** Precipitation titration curve, Methods of Precipitation Titrations: Mohr's method, Volhard's Method, Fajan's method. Calculations.	9
6	**Gravimetric Analysis**: A successful Gravimetric Analysis: Preparation of the solution, The Precipitation, Digest the Precipitate, Washing and Filtering, Drying or Igniting, Gravimetric Calculations.	6
No	**List of Experiments**	**Contact hours**
1	Strong acid- strong base titration	3
2	determiantion of vinegar using sodium hydroxide	3
3	determination of phosphoric acid	3
4	analysis of mixture of carbonate and hydroxide	3
5	Redox titration: Standardization of permanganate using oxalic acid	3
6	Determination of ferrous using standard potassium dichromate	3
7	Iodimetry	3
8	Iodometry	3
9	Precipitation titration: Mohr method	3
10	Volhard method (Indirect method)	3
11	Complexometric titration: standardization of EDTA using ZnO	3
12	Determination of Ca using Murexide in direct titration	3
13	Gravimetric analysis: Determination of Nickel using DMG.	3
14, 15	Review and Lab. Reports overview	6
Total		**90**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Midterm 1**	**6th/ 7th week**	**10 %**
2.	**Midterm 2**	**11th/ 12th week**	**10 %**
3.	**Quizzes, Home Works, class participation, and mini projects**	**During the semester**	**10 %**

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
4.	Laboratory	All the semester	30 %
5.	Final Exam	16thweek	40 %
6.	Total	All weeks	100 %

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	Gary D. Christian, Purnendu K. (Sandy) Dasgupta, Kevin A. Schug. **Analytical Chemistry**, Wiley; 7th edition (October 7, 2013). ISBN-10 : 0470887575, ISBN-13 : 978-0470887578
Supportive References	1. Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch. **Fundamentals of analytical chemistry**, Cengage Learning; 9th edition (January 1, 2013). ISBN-10 : 0495558281, ISBN-13 : 978-0495558286 2. Daniel C. Harris. **Quantitative Chemical Analysis**, W. H. Freeman; Eighth edition (April 30, 2010) , ISBN-10 : 1429218150, ISBN-13 : 978-1429218153
Electronic Materials	Blackboard
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• **Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students.** • **In each laboratory, a list of safety and precautions are provided.** • **In each lab has proper ventilation, and well equipped with instruments.** • **In each lab, containers for solid waste, liquid waste, and crushed glasses.** • **Each lab has a small pharmacy for first aid in case of an accident** • **In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs**

Items	Resources
Technology equipment (projector, smart board, software)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other equipment (depending on the nature of the specialty)	• **Appropriate Glasswares for carrying the requested experiments (conical flasks, beakers, measuring cylinders)** • **Appropriate fine chemicals and solvents (distilled Water ammonium nitrate)** • **Analytical balance (3 digits), Set gas laws with the glass jacket Data acquisition set for gas laws with glass jacket, PC, Windows® 95 or higher, calorimeter, thermometer, Filter papers , clamps, stands**

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**Students**	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of Students assessment	**Program Leaders**	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Quality of learning resources	**Students**	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.
The extent to which CLOs have been achieved		
Lab Performance	**Students**	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**COUNCIL OF DEPARTMENT OF CHEMISTRY**
REFERENCE NO.	**3 (NO. 1/3)**
DATE	**5/3/1446- 8/09/2024**