



Course Specifications

Course Title:	Chemistry of Volumetric and Gravimetric Analysis
Course Code:	2042104-3
Program:	Bachelor in Chemistry
Department:	Department of Chemistry
College:	College of Sciences
Institution:	Taif University

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A. Course Identification

1. Credit hours: 3 (2 Theoretical, 1 Lab)
2. Course type
a. University <input type="checkbox"/> College <input type="checkbox"/> Department <input checked="" type="checkbox"/> Others <input type="checkbox"/>
b. Required <input checked="" type="checkbox"/> Elective <input type="checkbox"/>
3. Level/year at which this course is offered: 5 th Level/ 2 nd Year
4. Pre-requisites for this course (if any): General Chemistry 1 (204101-4)
5. Co-requisites for this course (if any): NA

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	3 Theoretical and 2 Practical hours/ Week	100 %
2	Blended	-	-
3	E-learning	-	-
4	Distance learning	-	-
5	Other	-	-

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	30
2	Laboratory/Studio	20
3	Tutorial	-
4	Others (specify)	-
	Total	50

B. Course Objectives and Learning Outcomes

1. Course Description

The course describes the principles of the qualitative and quantitative analysis, treatment of analytical data and the estimation of experimental error, chemical calculation in volumetric analysis, acid-base titration, precipitate titration, redox titration, complex metric titration, separation methods, gravimetric analysis, introduction to spectroscopic methods of chemical analysis, and introduction to electrochemical analysis.

2. Course Main Objective

The course aims to understand the fundamentals of chemical analysis and volumetric and gravimetric methods associated with lab experiments and chemical problems.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	Knowledge and Understanding:	
1.1	Describe the volumetric and gravimetric methods in chemical analysis	K2
1.2	Use the qualitative and quantitative chemical analysis in industrial applications	K3
2	Skills :	

CLOs		Aligned PLOs
2.1	Distinguish between the qualitative and quantitative analysis.	S1
2.2	Solve a range of chemical problems related to volumetric and gravimetric analysis	S2
3	Values:	
3.1	Justify issues relevant to codes of ethics in chemistry.	V2

C. Course Content

No	List of Topics	Contact Hours
1	Classification of Analytical Chemistry, principles of qualitative analysis.	3
2	The principles of quantitative analysis and Classification of the methods of quantitative analysis.	3
3	The various types of errors in chemical analysis and the estimation of experimental error. The treatment of analytical data and use of statistics for evaluating results	3
4	Methods of the expression of concentration, Molarity, molality, normality, percentage concentration, part per million (ppm), part per billion (ppb) and p-function, Chemical calculations in volumetric analysis.	3
5	Standard and primary standard solutions, preparation of standard solutions, equivalent weight in acid base titration, equivalent weights in oxidation reduction titration.	3
6	Acid base indicators, Acid base titrations, acid base neutralization curve, Calculation of pH during acid-base titrations.	3
7	Precipitation titrations: precipitation titrations curves, precipitation equilibrium, types of equilibrium and factors affecting equilibrium constant, Mohr method, Volhard method and Fajan's method.	3
8	Oxidation reduction titrations, Oxidation reduction indicators, Oxidation using KMnO_4 , Oxidation using $\text{K}_2\text{Cr}_2\text{O}_7$, Oxidation using iodine.	3
9	Complex metric titrations, titration indicators, applications of EDTA titrations, Masking and demasking agents.	3
10	Introduction to separation methods, Gravimetric analysis, solubility product. Calculations in gravimetric analysis, Requirements of the precipitated and weighted forms - Mechanism of precipitate formation.	3
Total		30

Lab Content

No	List of Topics	Contact Hours
1	Preparation of standard solutions from solids [Preparation of a standard solution of anhydrous sodium carbonate (Na_2CO_3)] & from concentrated solutions [Preparation of a standard solution of hydrochloric acid (HCl)].	2
2	Determination of the concentration of a hydrochloric acid (HCl) solution by titrating it with a standard solution of 1.0 N sodium hydroxide (NaOH) (Titration of strong acid strong base)	2

3	Determination of the concentration of sodium carbonate ((Na ₂ CO ₃) by titrating it with a standard solution of hydrochloric acid (HCl) of 1.0 N (Titration of basic salt with strong acid)	2
4	Determination of the concentration of a solution of acetic acid or acetic acid (CH ₃ COOH) by titrating it with a standard solution of sodium hydroxide (NaOH) of 1.0 N (Titration of weak acid with strong base)	2
5	Determination of the concentration of ammonium hydroxide ((NH ₄ OH) by titrating it with a standard solution of 1.0 N HCl (Titration of weak base with strong acid)	2
6	Determination of chloride ion (Cl ⁻) concentration in different units of a sample solution of sodium chloride (NaCl) by direct titration with a standard solution of silver nitrate (AgNO ₃) [Mohr's method]	2
7	Determination of the concentration of potassium permanganate (KMnO ₄) solution as oxidizing agent by titrating it against a 0.1 N standard solution of oxalic acid (H ₂ C ₂ O ₄) (Titration of redox).	2
8	Determination of zinc ions (Zn ²⁺) by EDTA titration.	2
9	Determination of water of crystallization in hydrated barium chloride.	2
10	Determination of calcium (Ca).	2
Total		20

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge and Understanding		
1.1	Describe the volumetric and gravimetric methods in chemical analysis	Lecture	Written exam
1.2	Use the qualitative and quantitative chemical analysis in industrial applications	Lecture	Written exam
2.0	Skills		
2.1	Distinguish between the qualitative and quantitative analysis.	Discussion	Homework Assignments
2.2	Solve a range of chemical problems related to volumetric and gravimetric analysis	Problem-Solving	Practical tasks and Exam
3.0	Values		
3.1	Justify issues relevant to codes of ethics in chemistry.	Collaborative Learning	Individual presentations

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homework Assignments	Throughout Semester	5%
2	Individual presentations	Throughout Semester	5%

#	Assessment task*	Week Due	Percentage of Total Assessment Score
3	Mid Term Exam	6	20%
4	Practical tasks	Throughout Semester	25%
5	Final practical Exam	10/11	5%
6	Final exam	11/12	40%

*Assessment task (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

Commitment to the rules of the Academic Advising Department at the university in accordance with the academic guidance manual approved by the university and the attached forms, there are different arrangements made by teaching staff to support student consultations including;

- Office hours: 8 hours per a week for each academic member.
- Academic guidance: an academic member has a number of students to guide them throughout degree journey.

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	<ul style="list-style-type: none"> • Vogel's Textbook of Quantitative Chemical, G.H. Jeffery, J. Bassett, J. Mendham, R.C. Denney (1989), John Wiley & Sons Inc. , Latest Edition. ISBN-13: 978-0582446939. https://tinyurl.com/5n6b4572
Essential References Materials	<ul style="list-style-type: none"> • Analytical Chemistry, Gary D Christian (2003). Wiley (USA), Latest Edition. ISBN: 978-0-470-88757-8. https://tinyurl.com/5n8tfsj3 • Fundamentals of Analytical Chemistry, Skoog, Douglas A. Donald M. West, F. James Holler and Stanley R. Crouch (2013), Latest Edition. ISBN: 978-0495558286. https://tinyurl.com/497wcbtw
Electronic Materials	<ul style="list-style-type: none"> • Saudi Digital Library (SDL) https://apps.tu.edu.sa/sdl/default.aspx
Other Learning Materials	<ul style="list-style-type: none"> • Learning Management System (Blackboard) https://lms.tu.edu.sa/

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	<ul style="list-style-type: none"> • Lecture hall with 100 seats. • Equipped Lab with essential instrumentations.
Technology Resources (AV, data show, Smart Board, software, etc.)	<ul style="list-style-type: none"> • Laptop and Data show.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	-

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching and assessment	Students	Survey (indirect method)
Extent of achievement of course learning outcomes	Program leader	Reports (Direct method)
Quality of learning resources	Peer referees Students	Reports (Direct method) Survey (indirect method)

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

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

Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Department Council/ Quality assurance committee
Reference No.	2-5-1444
Date	01/11/2022