Course Specification
(Bachelor)

Course Title:	Instrumental chemical analysis
Course Code:	CEM322
Program:	Chemistry
Department:	Chemistry
College:	Science
Institution:	**Majmaah university**
Version:	TP-153
Last Revision Date:	9/12/2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: 5th level)					
4. At the end of this course students should know the different types of instrumental chemical analysis and measurements as spectroscopic measurements and molecular absorption: (IR, visible, UV, phosphorescence, fluorescence, atomic absorption, atomic emission, X-ray diffraction, NMR); electric measurements: electrical potential, potentiometic titrations, voltammetric methods, polarography and amperometric titration, electrical conductance and Coulommetry. Experiments: using some spectroscopic and electrical tools in microanalysis (accurate determination) of some materials with economic importance					
5. Pre-requirements for this course (if any)**:**					
CEM 221					
6. Pre-requirements for this course (if any)**: Nil**					
CEM 221					

7. Course Main Objective(s):

- Provide students with basic principles of spectroscopic and electro analytical methods.
- • Define components and operation procedures of different instrumental methods of chemical analysis.
- • Interpret results acquired and assess the benefits and limitation of different instrumental methods of chemical analysis.
- • Identify appropriate instrumental methods for certain chemical analysis.
- Design experiment implement analysis using the relevant chemical literature, process and analyze the data effectively.

• **Solving different exercises and questions concerning with spectroscopic and electric analysis and writing lab reports**

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30 (lectures) 30 (practical)	100% 100%
2	E-learning	0	0
3	Hybrid • Traditional classroom • E-learning	-	-
4	Distance learning	-	-

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	30
3.	**Field**	-
4.	**Tutorial**	-
5.	**Others (specify)**	-
Total		60

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

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Know the concepts and principles of instrumental analysis and to evaluate and interpret the principles	K1	-Lectures. - Conduct scientific research.	-Theoretical tests (Quarterly and final)

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	of different instruments.		- Seminars. -Discussions -Brainstorming	-Quizzes. - Homework - Class exercises - Evaluation of research
1.2	Recognize laboratory skills, quality control standards, and the concepts of different instrumental chemical analysis.	K2	Lectures. - Conduct scientific research. - Seminars. - Discussions - Brainstorming	
...				
2.0	**Skills**			
2.2	Demonstrate laboratory skills, proper safety procedures, and regulatory compliance in laboratory settings.	S2	Lectures Laboratories -Self-learning -Cooperative Education	Final exam - Midterm exam -Quizzes. - Homework -Practical tests Lab reports
2.3	Demonstrate the ability to use modern technology and statistical applications that are used in different methods of instrumental analysis	S3		
3.0	**Values, autonomy, and responsibility**			
3.1	Apply standards of integrity, transparency and ethical behavior in various academic and professional fields	V1	-Simulation programs - Cooperative work	-Simulation programs - Cooperative work
...				

C. Course Content

No	List of Topics	Contact Hours
1.	General properties of electromagnetic radiation and its interaction with matter, the electromagnetic spectrum as well as the absorption and emission of electromagnetic radiation.	4

2	Instrumentation, radiation sources, monochromators, sample cell (cuvette), detectors, single-beam and double-beam spectrophotometers and photometers	6
3	Introduction to spectrophometric methods:, UV-Visible and IR Molecular Absorption Spectroscopy and their applications	2
4	Atomic absorption and emission spectroscopy.	2
5	Molecular fluorescence spectroscopy, theory of molecular fluorescence, instrumentation and	2
6	Introduction to (NMR) spectroscopy, basic principles and some applications	2
7	Basic principles of electrochemistry. Potentiometric, conductometric and electrogravimetric methods of analysis.	6
8	Polarography, Amperometry and Conductomery.	2
	total	**30**
	Practical part Conductometric titration of hydrochloric acid	2
1	Determination of copper using potentiometric titration	2
2	Determination of phosphoric acid in soft drink using pH titration	2
3	Determination of Wavelength of maximum absorbance (λmax) of Paracetamol	2
4	Determine copper in copper sulphate solution using spectrophotometric methods	2
5	Analysis of $KMnO_4$ and $K_2Cr_2O_7$ in mixture using UV-Vis. spectrophotometer	2
6	Determine iron in its salt solution using spectrophotometric methods	2
7	Experiments using beer lambert law for the determination the concentration of the unknown samples	12
8	Revision	4
Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1	Midterm1	6th	10%
	Midterm2	10th	10%
2	E-exam	15th	10%
3	Group discussion and activities	Every week	10%
4	Practical examination	16th	20%
5	Final written Examination	18th	40 %

*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	Modern Instrumentation methods and Techniques, F. Rouessac and A. Rouessac.2010.
Supportive References	Principles of instrumental analysis , D.A.Skoog,F.J.Holler,SR.Crouch . Brooks Cole,2006
Electronic Materials	http://www.chemistry.ohio-state.edu
Other Learning Materials	Bb, power point

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Class rooms are available with smart boards and internet
Technology equipment (projector, smart board, software)	Computers and internet are available for online study and video tutorials.
Other equipment (depending on the nature of the specialty)	Labs are available with required glassware and chemicals

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	students	questionnaire
Effectiveness of Students assessment	students	Electronic questionnaire
Quality of learning resources	students	questionnaire
The extent to which CLOs have been achieved	Staff members	Internal revision reports
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**CHEMISTRY**
REFERENCE NO.	**17**
DATE	**15/12/2024**