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

Course Specification
(Bachelor)

Course Title:	**Methods of Instrumental Analysis**
Course Code:	**415CHEM4**
Program:	**Bachelor of Science in Chemistry**
Department:	**Physical Sciences**
College:	**College of Science**
Institution:	**Jazan University (JU)**
Version:	**TP153 2024**
Last Revision Date:	5/5/2024

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A. General information about the course:

1. Course Identification

1. Credit hours: (4 hrs)

2. Course type

A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		

3. Level/year at which this course is offered: (Level 6 - Year 3)

4. Course general Description:

4. Course general Description

Course Title	*Course Number*	*Contact Hours (CH)*		*Credit unit (CU)*	*Year*	*Level*	*Pre-requisite*
		Lec.	*Prac.*				
Methods of Instrumental Analysis	***415CHEM4***	***3***	***2***	***4***	***3***	***6***	***212CHEM3***

This course aims to give students the basic principles of methods of instrumental analysis and their applications

Course objectives: They are to identify the following.

- Recognizing the Electromagnetic Radiation.
- Recognizing the Molecular Ultraviolet and Visible Absorption Spectroscopy.
- Recognizing the Infra-Red Spectroscopy, Spectrum of IR and IR Instrumentation.
- Recognizing the Atomic and emission Spectrometry as well as NMR, MS and X-Ray Spectroscopy

Syllabus: A-Theoretical contents
Spectroscopic methods: Introduction to electromagnetic radiation and molecular transitions, UV- and visible radiations and spectrophotometer, Laws of spectral absorption, Fluorimetry, Infra-red spectrometer, atomic absorption and atomic emission spectrometers, NMR spectrometer, Mass spectrometry, X-ray absorption and fluorescence.

Syllabus: B-Practical contents

- Selected experiments related to instrumental analysis (See attachment)

5. Pre-requirements for this course (if any)**:**

212 CHEM4

6. Co-requisites for this course (if any)**:**

None

7. Course Main Objective(s):

This course aims to give students the basic principles of methods of instrumental analysis and their applications

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1.	Traditional classroom	3x15 =45	100
2.	E-learning		
3.	Hybrid • Traditional classroom • E-learning		
4.	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	45
2.	Laboratory/Studio	30
3.	Field	
4.	Tutorial	
5.	Others (specify)	
	Total	75

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**; (Upon completion of the course, student will be able to)			
1.1	**Demonstrate a broad understanding and knowledge in different topics of the course as, electromagnetic radiation, molecular transitions after absorption of light, electronic transitions, dual nature of light radiations and use of analytical instruments for qualitative and quantitative chemical analysis and in**	K(1.1)	***lecture / discussion Seminars /presentation***	***Objective questions***

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	addition the necessary background in Physics and Mathematics.			
1.2	Describe correctly Chemical phenomena using instrumental analysis principles and scientific reasoning	K(1.2)	*lecture / discussion / Seminars /Individual presentation*	*Objective questions*
2.0	**Skills**; (Upon completion of the course, student will be able to)			
2.1	Demonstrate an ability in critical thinking, analytical reasoning and solving problems concerning with instrumental analysis (in measurement and modeling of chemical systems)	S(2.1)	*lecture / discussion / Seminars /Individual presentation*	Solving Problems & chart analysis & Essay questions
2.2	Apply their experimental basics and skills to use laboratory equipment, modern instrumentation, and classical techniques for carrying out experiments in the field of instrumental analysis and to write a report representing the scientific data.	S(2.2)	*Lab work, group work*	*Lab final exam / lab report rubric/ Objective questions*
2.3	Examine his material and lab safety background to Follow proper procedures and regulations for safe handling and use of chemicals.	S(2.3)	*lab demonstrations / hands-on student learning activities*	*Safety exam*
3.0	**Values, autonomy, and responsibility**; (Upon completion of the course, student will be able to)			
3.1	*Working as a group leader in cooperation with other colleagues. (P)*	V(3.1)	*lab demonstrations / whole group and small group discussion*	*Practical group work Rubric*

C. Course Content

No	List of Topics	Contact Hours
1.	Types of Instrumental Analysis Methods and Applications of Instrumental Methods of analysis and Advantage of instrumental analysis	3
2.	Electromagnetic field, Elementary theoretical basis of spectroscopy, Electronic Excitations, Electronic absorption	4

3.	**Spectroscopy, UV-Vis spectroscopy, Absorption laws, Lambert-Beer Law, Instrumentation, Sample Preparation and applications**	6
4.	**Mass spectroscopy for qualitative and quantitative analysis and nuclear magnetic resonance for identification of the organic compounds (qualitative analysis)**	6
5.	**Infrared spectroscopy, IR-Radiation, Modes of Vibration, Typical Infrared Absorption Regions, Frequencies of common structural units, Sample Application, Measurement process, Infrared Absorption, Calibration and Background Spectrum, Advantages of IR analysis, Detection and Quantitation, FT-IR Qualitative and Quantitative**	4
6.	**Atomic spectroscopy, Atomic Absorption Spectroscopy (AAS), Atomic Emission Spectroscopy (AES), Steps of Atomic Absorption measurement, Vaporization and Atomization**	7
7.	**Atomic Emission Spectroscopy, Recording and Analysis, Inductively coupled plasma (ICP) and advantages of ICP**	3
8.	**X-Ray Analysis, What is X-Ray? , Generation of X-Rays, Sampling, Identifying and Quantization of Compounds**	6
9.	**Fluorescence Spectroscopy**	6
10.	**Selected experiments related to instrumental analysis**	**30**
Total		75

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Homework**	**3-8**	**2 %**
2.	**Quiz**	**4-6**	**3 %**
3.	**Midterm Exam**	**6-8**	**15 %**
4.	**LAB Sheet**	***10-11***	**5 %**
5.	**Quiz in Safety**	***10-11***	**4%**
6.	**Final practical exam**	***11***	**10 %**
7.	**Lab report**	***2-10***	**5%**
8.	**Group work evaluation**	***2-10***	**6 %**
9.	**Final Exam**	**16-17**	**50 %**
	Total		**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	د. إبراهيم الزامل (التحليل الآلي) – دار الخريجي- الطبعة الثالثة 1998 - Douglas A. Skoog, F James Holler and Stanley R. Crouch, Principles of instrumental analysis, (2016) 7th edition Thomson Brooks/Cole

Supportive References	د. سلامة أحمد خميس محمد (المطيافيات بين النظرية و التطبيق) جامعة المجمعة- الطبعة الأولى– (143)2010
Electronic Materials	Some course contents and materials are posted on Black board sites
Other Learning Materials	Websites on the internet that are relevant to the topics of the course https://learnchemistry12.com/2018/02/modern-chemical-analysis-book.html https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Supplemental_Modules_(Analytical_Chemistry)/Instrumental_Analysis https://chem.libretexts.org/Courses

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	***1 Lecture room(s) for groups of 50 students*** 1 Lab room for 25 students
Technology equipment (projector, smart board, software)	***Smart board, Data show, Black board, internet***
Other equipment (depending on the nature of the specialty)	**none**

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	***Student***	***Likert-type Survey (CES)*** ***Indirect***
Effectiveness of students assessment	***Instructor &*** ***Course coordinator***	***Classroom evaluation (direct & indirect)***
Quality of learning resources	***Program coordinator***	***Indirect***
The extent to which CLOs have been achieved	***Assessment committee***	***Indirect***
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Physical Sciences Department Council
REFERENCE NO.	Psci2415
DATE	28/03/1446 Corresponding to 1 / 10 /2024

H. Attachments

1- Practical Work

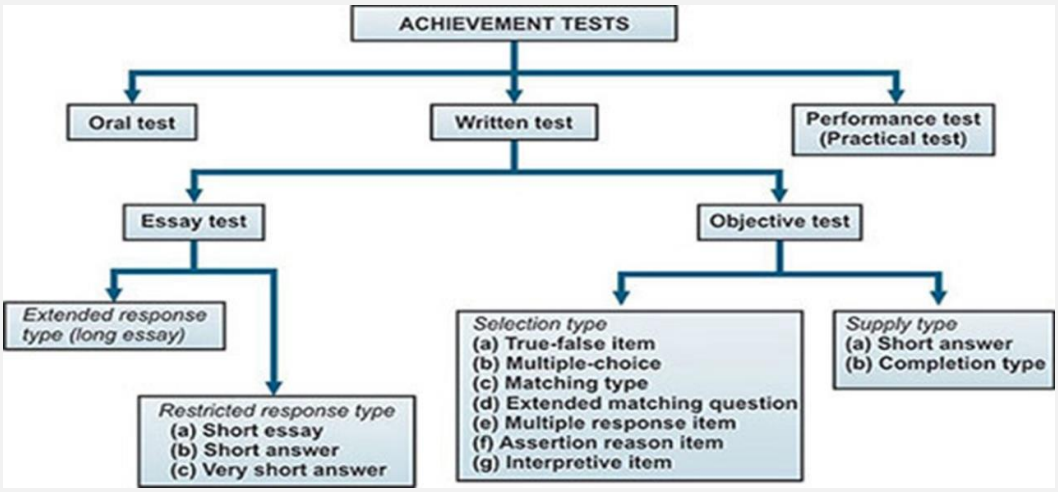
No	*Title of Experiment*	*Tools, Chemicals, and equipment Needed in Experiments*	*Week no.*
1.	Safety measures	-	1
2.	Introduction to spectroscopic analysis and related calculations	-	2
3.	Determination of potassium permanganate concentration using UV-Vis. Spectrophotometer	Conical flasks, $KMnO_4$, distilled water, UV-Vis. Spectrophotometer	3
4.	Determination of chromium chloride (colored compound) concentration using UV-Vis. Spectrophotometer	Conical flasks, chromium chloride, distilled water UV-Vis. Spectrophotometer	4
5.	Determination of potassium nitrate (colorless compound) concentration using UV-Vis. Spectrophotometer	Conical flasks, potassium nitrate, distilled water UV-Vis. Spectrophotometer	5
6.	Spectrophotometric determination of paracetamol in tablets	Conical flasks, paracetamol bulk powder, Panadol tablets, distilled water, methanol, UV-Vis. Spectrophotometer	6
7.	Spectrophotometric determination of paracetamol in tablets	Conical flasks, paracetamol bulk powder, Panadol tablets, distilled water, methanol, UV-Vis. Spectrophotometer	7
8.	Spectrofluorimetric determination of eosin yellow dye	Conical flasks, eosin yellow dye, distilled water Spectrofluorimeter	8
9.	IR- identification of benzoic acid	Benzoic acid, potassium bromide, acetone, IR- spectrometer	9
10.	Determination of Zinc in aqueous medium using atomic absorption spectrometer	Zinc standard solutions, water samples containing Zinc, nitric acid, distilled water, atomic absorption spectrometer	10
11.	Determination of Copper in tea samples using atomic absorption spectrometer (sample preparation)	Cu standard solutions, tea samples, nitric acid, distilled water, flame spectrometer	11
12.	Determination of Copper in tea samples using atomic absorption spectrometer (Analysis)	Cu standard solutions, tea samples, nitric acid, distilled water, flame spectrometer	12
13.	Determination of Calcium in tape water using atomic absorption spectrometer (Analysis)	Calcium standard solutions, water samples containing Ca, nitric acid, distilled water, atomic absorption spectrometer	13
14.	Revision	-	14
15.	Final exam	-	15

2- Blue Print

Course Name	Methods of instrumental analysis
Course Code	415CHEM4

PLOs	K1	K2	S1	S2	S3	S4	V1	V2
CLOs	1.1	1.2	2.1	2.2	2.3	2.4	3.1	--
Marks	10	18	42	20	4	---	6	--

Learning Domain	PLOs	CLOs	Assessment Type	Assessment Tool	No of Questions	Marks of the Assessment	Weight of the Assessment
Knowledge & understanding	K1	1.1 (10M)	Quiz	Objective questions	2	1	1
			Mid term	Objective questions	3	2	2
			Final Exam	Objective questions	3	7	7
	K2	1.2 (18M)	Quiz	Objective questions	2	1	1
			Mid term	Objective questions	4	5	5
			Final Exam	Objective questions	6	12	12
Skills	S1	2.1 (42M)	H.W	Solving Problems & chart analysis & Essay questions	4	2	2
			Quiz	Solving Problems & chart analysis & Essay questions	2	1	1
			Mid term	Solving Problems & chart analysis & Essay questions	6	8	8
			Final Exam	Solving Problems & chart analysis & Essay questions	12	31	31
	S2	2.2 (20M)	Practical Sheet	Objective questions	2	8	5
			Lab Report	Lab report rubric	5	5	5
			Final Lab Exam	I Task experiment	1	7	10
	S3	2.3 (4M)	Safety Quiz	Objective questions	1	8	4
Value	V1	3.1 (6M)	Continuous assessment	Group evaluation rubric	-	6	6
TOTAL		100					100


ACHIEVEMENT TESTS
Oral test
Written test
Performance test (Practical test)
Essay test
Objective test
Extended response type (long essay)
Restricted response type
(a) Short essay
(b) Short answer
(c) Very short answer
Selection type
(a) True-false item
(b) Multiple-choice
(c) Matching type
(d) Extended matching question
(e) Multiple response item
(f) Assertion reason item
(g) Interpretive item
Supply type
(a) Short answer
(b) Completion type