هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Instrumental Analysis
Course Code:	CHEM311-4
Program:	Bachelor of Science in Chemistry
Department:	Department of Physical Sciences
College:	College of Science
Institution:	Jazan University
Version:	TP-153 (2024)
Last Revision Date:	31 January 2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (4)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (5th /3rd)					
4. Course general Description:					

Course title	Course code	Contact Hours			Credit Hours	Year	Level	Prerequisite	Corequisite
		Lec	Tut	Lab					
Instrumental Analysis	CHEM311-4	2	-	4	4	3rd	5th	CHEM213-3 + CHEM214-2	-

This course aims to give students theoretical and practical principles of spectroscopic and electroanalytical methods of analysis

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

CHEM213-3 + CHEM214-2

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

None

7. Course Main Objective(s):

1- Recognize the fundamentals, principles, and concepts of instrumental method analysis.
2- The ability to select the appropriate analytical method
3- The ability to think critically to develop the analytical methods
4- The ability to use a variety of analytical instruments to conduct different chemical analyses
5- The ability to analyze and interpret the obtained results

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	(2x15)=30	100%
2	E-learning		
3	Hybrid • Traditional classroom		

No	Mode of Instruction	Contact Hours	Percentage
	• E-learning		
4	Traditional lab		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	$2 \times 15 = 30$
2.	**Laboratory/Studio**	$4 \times 15 = 60$
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
Total		90

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, students are able to:			
1.1	**Demonstrate a broad understanding and knowledge of different topics of the course such 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 (p)**	**K1**	**lecture/discussion Seminars /presentation**	**oral and written examinations/ laboratory reports**
1.2	**Describe correctly concepts, theories, principles, and scientific reasoning in different topics of spectroscopic and electro-analytical methods of analysis (p)**	**K2**	**lecture/discussion / Seminars /Individual presentation**	**oral and written examinations/ laboratory reports**
2.0	**Skills;** Upon completion of the course, students are able to:			
2.1	**Demonstrate ability in critical thinking, analytical reasoning, and solving problems, interpreting and analyzing data concerning spectroscopic and electro-analytical methods of analysis (p)**	**S1**	**lecture / discussion / Seminars /Individual presentation**	**oral and written examinations/ laboratory reports**

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
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. (p)	S2	Lab work, group work	Lab report/ Lab notebook.
2.3	Use a variety of instruments to analyze different samples.	S3	Lab work, group work	Lab report/ Lab notebook.
2.4	Examine material and lab safety background to Follow proper procedures and regulations for safe handling and use of chemicals. (p)	S4	lab demonstrations / hands-on student learning activities	Safety exam
3.0	**Values, autonomy, and responsibility;** Upon completion of the course, students are able to:			
3.1	Working as a group leader in cooperation with other colleagues. (P)	V1	lab demonstrations / whole group and small group discussion	Practical group work Rubric

C. Course Content

1- Theoretical Part

No	List of Topics	Contact Hours
1.	Types of Instrumental Analysis Methods, Applications of Instrumental Methods of analysis and Advantage of instrumental analysis	2
2.	Electromagnetic field, Elementary theoretical basis of spectroscopy, Electronic Excitations, Electronic absorption	2
3.	Spectroscopy, UV-Vis spectroscopy, Absorption laws, Lambert-Beer Law, Instrumentation Sample Preparation Sample Cleanup	6
4.	Mass spectroscopy for qualitative and quantitative analysis and nuclear magnetic resonance for identification of the organic compounds (qualitative analysis)	3

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	3
6.	Atomic spectroscopy,Atomic Absorption Spectroscopy (AAS), Atomic Emission Spectroscopy (AES), Steps of Atomic Absorption measurement, Vaporization and Atomization	5
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	3
9.	Fluorescence Spectroscopy, What is Fluorescence Spectroscopy? Introduction to Fluorescence Spectroscopy, Sampling	3
Total		$2 \times 15 = 30$

2- Lab work

No	List of Topics	Contact Hours
1.	Laboratory safety	2
2.	Solution preparation	4
3.	Introduction to different instrumental methods of analysis and analytical tools	4
4.	UV-vis determination of Potassium Permanganate	4
5.	UV-vis determination of potassium dichromate	4
6.	Assay of Paracetamol tablet by UV spectrophotometer	4
7.	AAS determination of copper in tea samples	4
8.	Spectroscopic and Fluorometric Determination of eosin y dye	4
9.	AAS determination of calcium in plant samples	4
10.	IR analysis of benzoic acid	4
11.	AAS determination of sodium in water	4
12.	pH meter calibration	2
13.	The potentiometric titration of hydrochloric acid with sodium hydroxide	4
14.	The potentiometric titration of sodium hydroxide with acetic acid	4
15.	The conductometric titration of hydrochloric acid with sodium hydroxide	4
16.	Revision	4
Total		$4 \times 15 = 60$

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	*Periodic Exams*	*During Semester*	*15%*
2.	*Assignments & Classroom Activities*	*During Semester*	*5%*
3.	*Lab Work*	*During Semester*	*30%*
4.	*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
Supportive References	- Douglas A. Skoog, F James Holler and Stanley R. Crouch, Principles of instrumental analysis, (2016) 7th edition Thomson Brooks/Cole
Electronic Materials	Some course contents and materials are posted on Blackboard sites
Other Learning Materials	None

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)	**Chemicals and standards used in lab experiments - Related analytical equipment and instruments such as atomic absorption,uv-vis spectrophotometer, spectrofluorometer and accessories, pH meter, analytical balance, …etc**

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Student	Likert-type Survey CES) Indirect

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of Students' assessment	Instructor & Course coordinator	Class room 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.	Meeting (3)
DATE	12/03/2024 -02/09/1445