The Hashemite University

الجامعـــــة الهاشميـــــة

Faculty of Pharmaceutical Sciences

كلية العلوم الصيدلانية

Syllabus: Pharmaceutical Instrumental Analysis (1917031315)
First Semester 2024 /2025

COURSE INFORMATION	
Course Name: Pharmaceutical Instrumental Analysis (face-to-face education) **Semester:** First **Department:** Pharmaceutical Chemistry **Faculty:** Pharmaceutical Sciences	Course Code: **1917031315** Sections: 1 - 4 Core Curriculum: 2020 study plan
Day(s) and Time(s): Sunday/ Tuesday: 8:30-15:00 **Laboratory:** Classroom B207	**Credit Hours:** 3 **Prerequisites**: **110103211 and 131703211**

COURSE DESCRIPTION

The course is designed to give pharmacy students an overview of the various modern instrumental analytical techniques used in pharmaceutical analysis. It will discuss the requirements for instrumentation, including precision, accuracy, sensitivity, selectivity, detection limit, and dynamic range. Students will be taught how to identify the chemical structure from the complementary information afforded by four types of spectra: UV-visible, IR, NMR, and MS. Additionally, the introduction to the chromatographic theory, separation techniques, and applications concerned HPLC and GC.

DELIVERY METHODS

The course will be delivered through a combination of active learning strategies. These will include:

- PowerPoint lectures and active classroom based discussion.
- Collaborative learning through small groups acting in an interdisciplinary context.
- Relevant films and documentaries
- Video lectures.
- E-learning resources: e-reading assignments and practice quizzes through Model and Microsoft Team.

FACULTY INFORMATION

Name	**Nabil N. AL-Hashimi**
Academic Title:	**Associate Professor**
Office Location:	**3425, third floor, the Faculty of Pharmaceutical Sciences**
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Office Hours:	**Monday** 9.20-10.20 **Wednesday** 9.20-10.20 *Please send an e-mail (nabil@hu.edu.jo) to meet at any other time.*

REFERENCES AND LEARNING RESOURCES

Required Textbook(s):

1- Douglas A. Skoog, F. James Holler, Stanley R. Crouch, Principles of instrumental analysis (Cengage Learning: 2017) ISBN: 978-1-305-57721-3.

2- Watson D., Pharmaceutical Analysis, (Elsevier: 2015) ISBN: 978-0-7020-4621-6.

Suggested Additional Resources:

1- James W. Robinson, Eileen M. Skelly Frame, George M. Frame, Undergraduate Instrumental analysis, (CRC Press Taylor & Francis Group: 2014) ISBN:978-1-420-061352.

2- Müllertz A., Perrie Y., Rades T., Analytical Technique in the Pharmaceutical Sciences (Springer: 2016) ISBN: 978-1-4939-4027-1.

3- Rasmussen K., Pedersen-Bjergaard S., Hansen S., Introduction to Pharmaceutical Chemical Analysis (Wiley: 2011) ISBN: 978-1-119-95433-0.

Course Objectives

1. To grasp the instrumental principles that are universally applicable in analytical chemistry, pharmacy, agriculture, and other scientific disciplines.

2. To recognize the significance of instrumental methods in pharmaceutical analysis.

3. To learn about UV-visible spectroscopy and how to apply Beer 's-Lambert's law to solve related problems.

4. To understand the importance of instrumental analysis in identifying chemical structures using IR, NMR, and MS.

5. Teach the students the instrumental techniques used to separate more than one component, such as HPLC and GC.

Intended Learning Outcomes

A. Knowledge

A.1 Explain the basic principles of spectroscopic and electrochemical analytical methods.

A.2 Determine quantitative & qualitative analysis of drugs using various analytical instruments.

A.3 Give reasons for applications of spectroscopic and electrochemical methods for pharmaceutical analysis.

B. Skills

B.1 Choose appropriate spectroscopic methods for analyzing a material of pharmaceutical relevance.

B.2 Evaluate the validity of the electrochemical and spectrometric methods for analyzing target compounds in complex matrices.

C. Competencies

C.1 Compare the techniques suitable for specific analytical problems and choose the appropriate method for quantitative or qualitative analysis of a particular drug in a specific medium.

C.2 Interpret basic IR and NMR spectra and chromatograms for simple compounds.

C.3 Validate the acquired knowledge of various analytical drug identification and assay methods.

ACADEMIC SUPPORT

It is The Hashemite University policy to provide educational opportunities that ensure fair, appropriate, and reasonable accommodation to students who have disabilities that may affect their ability to participate in course activities or meet course requirements. Students with disabilities are encouraged to contact their instructor to ensure that their individual needs are met. The University, through its Special Needs section, will exert all efforts to accommodate individual needs.

Special Needs Section:
Tel: 00962-5-3903333 Extension: 4209 **Location: Students Affairs**
Deanship/ Department of Student Welfare Services **Email**: **amalomoush@hu.edu.jo**
amalomoush@staff.hu.edu.jo

COURSE REGULATIONS

Participation

Class participation and attendance are important elements of every student's learning experience at The Hashemite University, and the student is expected to attend all classes. A student should not miss more than 15% of the classes during a semester. *Those exceeding this limit of 15% will receive a failing grade regardless of their performance*. It is a student's responsibility to monitor the frequency of their own absences. **Attendance record begins on the first day of class irrespective of the period allotted to drop/add and late registration. It is a student's responsibility to sign-in; failure to do so will result in a non-attendance being recorded.**

In exceptional cases, the student, with the instructor's prior permission, could be exempted from attending a class provided that the number of such occasions does not exceed the limit allowed by the University. The instructor will determine the acceptability of an absence for being absent. A student who misses more than 25% of classes and has a valid excuse for being absent will be allowed to withdraw from the course.

On average, students must spend 15 hrs of study and preparation weekly. At the beginning of the lectures, be on time and don't leave before the end of the lecture without an accepted excuse. **If you missed a class, you must find out about any missed announcements or assignments.** For any clarification, please communicate with your instructor during her office hours by appointment. Listen well to the lecture; ask your instructor if you have a question. You will find the course material at the course team after the lecture.

Sharing of course materials is forbidden. No course material, including, but not limited to, course outlines, lecture hand-outs, videos, exams, and assignments, may be shared online or with anyone outside the class. Any suspected unauthorized sharing of materials will be reported to the university's Legal Affairs Office. If a student violates this restriction, it could lead to student misconduct procedures.

Plagiarism

Plagiarism is considered a serious academic offense and can result in your work losing marks or failing. HU expects its students to adopt and abide by the highest standards of conduct when interacting with their professors, peers, and the broader university community. As such, a student is expected not to engage in behaviours that compromise his/her integrity as well as that of The Hashemite University.

Plagiarism includes the following examples, and it applies to all student assignments or submitted work:

- **Use of someone else's work, ideas, images, or words without his/her permission or reference to them.**
- **Use someone else's wording, name, phrase, sentence, paragraph, or essay without quotation marks.**
- **Misrepresentation of the sources that were used.**

The instructor has the right to fail the coursework or deduct marks where plagiarism is detected

Late or Missed Assignments
In all cases of assessment, students who fail to attend an exam, class project, or deliver a presentation on the scheduled date without prior permission and/or are unable to provide a medical note will automatically receive a fail grade for this part of the assessment.

- Submitting a term paper on time is a key part of the assessment process. Students who fail to submit their work by the deadline specified will automatically receive a 10% penalty. Assignments over 24 hours late will receive a further 10% penalty. Each subsequent 24 hours will result in a further 10% penalty.

- In cases where a student misses an assessment on account of a medical reason or with prior permission; in line with University regulations an incomplete grade for the specific assessment will be awarded and an alternative assessment or extension can be arranged.

Missed Assessments
In all cases of assessment, students who fails to attend an exam on the scheduled date without prior permission, and/or are unable to provide a medical note, will automatically receive a failure grade for this part of the assessment

• In cases where a student misses an assessment on account of a medical reason or with prior permission; in line with university regulations an incomplete grade for the specific assessment will be awarded and an alternative assessment or extension can be arranged.

Cheating
Cheating, academic disconduct, fabrication and plagiarism will not be tolerated, and the university policy will be applied. Cheating policy: The participation, the commitment of cheating will lead to applying all following penalties together:
- Failing the subject, he/she cheated at
- Failing the other subjects taken in the same course.
- Not allowed to register for the next semester
- The summer semester is not considered as a semester

Student Complaints Policy
Students at Hashemite University have the right to pursue complaints related to faculty, staff, and other students. The nature of the complaints may be either academic or non-academic. For more information about the policy and processes related to this policy, you may refer to the students' handbook.

COURSE ASSESSMENT

Students will be graded through the following means of assessment, and their final grade will be calculated from the evaluation forms listed below, with their grade weighting taken into account. The criteria for grading are listed at the end of the syllabus.

Students will be graded through the following means of assessment:

Course Assessment Plan						
Assessment	**Grade Weighting**	**Deadline Assessment**	**CILOs**			
			A	**B**	**C**	**D**
First Exam	30%	3rd-14th Nov.2024	A			
Second Exam	30%	15-26th Dec. 2024	A	B		
Final Exam	40%	12-23th Jan.2025	A	B	C	D

Description of Exams
Test questions will predominately come from the material presented in the lectures. Semester exams will be conducted during the regularly scheduled lecture period. The exam will consist of a combination of multiple choice, short answer, match, true and false, and/or descriptive questions.
Homework: This will be given for each chapter; while the chapter is in progress, you are supposed to work on it continuously and submit it in the next lecture when I finish the chapter. You are also expected to work on in-chapter examples, self-tests, and a representative number of end-of-chapter problems. The answers to self-tests and end-of-chapter exercises are given at the end of the book.

Quizzes: Unannounced quizzes will be given during or/and at the end of each chapter based upon the previous lectures. It will ensure that you come prepared for the class.

No make-up exams, homework, or quizzes will be given. Only documented absences will be considered as per HU guidelines.

Letter Grade	Description	Grade Points
A+	Excellent	4.00
A		3.75
A-		3.50
B+	Very Good	3.25
B		3.00
B-		2.75
C+	Good	2.50
C		2.25
C-		2.00
D+	Pass	1.75
D	Pass	1.50
F	Fail	0.00
I	Incomplete	-

WEEKLY LECTURE SCHEDULE AND CONTENT DISTRIBUTION

"Lecture hours and weeks are approximate and may change as needed."

Note: For Chem 101 sections with 2 lecture periods per week (S/T, M/W, or T/R), one lecture period covers

1. lecture hours (60 minutes). The course content specifies the sections in chapters 1-10 of the textbook that will be included in quizzes, homework, and exams.

"Lecture hours and weeks are approximate and may change as needed."

Note: For the 2 lecture periods per week (S/T, M/W), one lecture period covers 1 lecture hour (60 minutes). The course content specifies textbook chapters that will be included in exams.

Week Number	No. of Hours	CILOs	Subject	Delivery Methods	Assessment Methods
1.	3	A, B, D	**Introduction to instrumental methods** - Figures of Merit	Lecturing	Exam First and Final
2.	3	A, B, D	- Methods of calibration	Lecturing	Exam First and Final
3.	3	A, B, D	**Karl Fisher Titration** - Basic concept - Types of methods Determination of Water - Advantages of Analysis	Lecturing	Exam First and Final
4.	3	A, B, D	**Fundamentals of Spectrophotometry** - Introduction - What happens when molecules absorb light? - Beer's Law - Limitations and Deviations from Beer's Law	Lecturing	Exam First and Final
5.	3	A, B, D	**Application of Ultraviolet/Visible Molecular Absorption Spectrometry** - Absorptivity - Electronic Transitions	Lecturing	Exam First and Final
6.	3	A, B, D	- Absorption of Energy - Absorption by Organic Compounds - Solvent Effects, Effect of Conjugation of Chromophores - Empirical Rules for Calculating Uv-Vis Absorptions (Woodward-Fieser Rules)	Lecturing	Exam First and Final
7.	3	A, B, D	**Atomic Spectroscopy** - Type of Methods - Atomic Spectroscopy	Lecturing	Exam Second and Final

			- Atomic Emission Spectroscopy (Flame Photometry) - Atomic Absorption Spectroscopy		
8.	3	A, B, D	**Infrared Spectrometry** - Theory of Infrared Absorption Spectrometry - Molecular Vibration, Rotation and Translation motion	Lecturing	Exam Second and Final
9.	3	A, B, D	- Quantum Treatment of Vibrations - Vibrational Modes - Fundamental Peaks and Overtones - Infrared Light Sources	Lecturing	Exam Second and Final
10.	3	A, B, D	**Nuclear Magnetic Resonance Spectroscopy** - Theory of Nuclear Magnetic Resonance Spectroscopy - Energy of spinning nuclei	Lecturing	Exam Second and Final
11.	3	A, B, D	- Magnetic Shielding - Nuclear Magnetic Resonance Signals - The NMR Spectrometer - Chemical Shift - Splitting	Lecturing	Exam Second and Final
12.	3	A, B, D	**Chromatographic Separations** - Introduction to Chromatography - Types of Chromatography - Response obtained by chromatography	Lecturing	Exam Final
13.	3	A, B, D	- High-Performance Liquid Chromatography - Separation - Detectors - Applications	Lecturing	Exam Final

14.	3	A, B, D	**Mass Spectrometry** - Theory of Mass Spectrometry - Determining the molecular formula - Application to Organic Compounds	Lecturing	Exam Final
15.			**University Final Exam**		