



Syllabus*: Pharmaceutical Instrumental Analysis (1917031315) First Semester 2021 /2022

COURSE INFORMATION	
Course Name: Pharmaceutical Instrumental Analysis (face-to-face education) Semester: First Department: Pharmaceutical Chemistry Faculty: Pharmaceutical Sciences	Course Code: 1917031315 Section: 1 and 2 Core Curriculum: 2020 study plan
Day(s) and Time(s): Sunday/ Tuesday: 11:30-13:00 Monday/ Wednesday:11:30-13:00 Classroom: A105	Credit Hours: 3 Prerequisites: 110103211 and 131703211
COURSE DESCRIPTION	
<p>The course is designed to give the pharmacy student an overview of the various modern instrumental analytical technique used in pharmaceutical analysis. The requirements for instrumentation including the precision, accuracy, sensitivity, selectivity, detection limit, and dynamic range will be discussed during this course. Students will be taught how to identify the chemical structure from the complementary information afforded by four types of spectra: UV, IR, NMR, and MS. Additionally, the introduction to the chromatographic theory, separation techniques, and applications concerned HPLC and GC.</p>	
DELIVERY METHODS	
<p>The course will be delivered through a combination of active learning strategies. These will include:</p> <ul style="list-style-type: none"> • 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

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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

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

STUDENT LEARNING OUTCOMES MATRIX*

Field according to (JNQF)	Required to achieve (according to (JNQF)	Core curriculum learning outcomes	B.Sc. Pharmacy Program ILOs	Course Objectives	Assessment Method
Knowledge	A systematic understanding of the theories, concepts, principles and circulations related to the field of learning, some of which are within the limits of the latest scientific findings	Foundational Knowledge	Learner	1. Demonstrate and understanding the basic principles spectroscopic and electrochemical analytical methods. 1.2 Explain different spectroscopic and electrochemical methods and the need for their use in pharmaceutical analysis. 1.3 Give knowledge about applications of spectroscopic and electrochemical methods for pharmaceutical analysis.	<ul style="list-style-type: none"> • Exams • Quizzes • “On-line’ reading assignments • homework assignments
Skills	Mastering the skills and tools required to solve complex problems in a specialized field of study Demonstrate specialized and conceptual skills in the field of study Practice evaluation in planning, design, technical and/or supervisory functions related to products, services or processes	Essentials for Practice and Care Approach to Practice and Care	Caregiver Manager Promoter Provider Creative Thinker & Problem-Solver Educator Advocate Collaborator Includer Communicator	1. Choose appropriate spectroscopic methods for the analysis of a material of pharmaceutical relevance 2. Evaluate the validity of the electrochemical and spectrometric methods in the analysis of target compound in complex matrices. 3. Interpret spectra, identification and quantitation of pharmaceutical compounds. 4. Use spectrophotometer, spectrofluorometric and flame photometer in the identification and quantitation of pharmaceutical compounds. 5. Students will be encouraged to read widely and to research the various topics using the assigned texts, libraries and relevant web sites 6. The use of other information resources is essential if students are to gain maximum benefit from their studies. 7. This approach to the subject is in part designed to encourage students to be more responsible for their own learning and to become lifelong learners.	<ul style="list-style-type: none"> • Exams • Quizzes • “On-line’ reading assignments • homework assignments

Competencies	Management of activities and projects	Personal & Professional Development	Self-aware	<ol style="list-style-type: none"> 1. Develop of problem solving and critical thinking skills. 2. Use of videos and animation to effectively understand the concepts. 3. The ability to use simple word and IT skills (i.e., data processing, software, internet, and multimedia) and the library to find information. 4. The ability to be self-motivated learners and responsive to feedback. 5. Working in team (i.e., sharing presentations and discussions and solving problem) 	<ul style="list-style-type: none"> • Exams • Quizzes • “On-line’ reading assignments • homework assignments
	Take responsibility for decision-making in work or study contexts	Pharmaceutical Product Expert	Leader		
	Take responsibility for group work and work effectively with peer guidance		Innovator		
	Transfer and apply diagnostic and creative skills in a range of contexts		Professional Manufacturer		

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 Need section will exert all efforts to accommodate for individual’s needs.

Special Needs Section:

Tel:

Location:

Email:

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.

Plagiarism

Plagiarism is considered a serious academic offence and can result in your work losing marks or being failed. HU expects its students to adopt and abide by the highest standards of conduct in their interaction with their professors, peers, and the wider University community. As such, a student is expected not to engage in behaviours that compromise his/her own 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 the work, ideas, images or words of someone else without his/her permission or reference to them.**
- **Use of someone else's wording, name, phrase, sentence, paragraph or essay without using 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 fails 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 handed in more than 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.

Student Complaints Policy

Students at The 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

Course Calendar and Assessment

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

Assessment	Grade Weighting	Deadline Assessment
Exam 1	25%	Add date/time
Exam 2	25%	Add date/time
Quizzes	5%	
Homework	5%	
Final Exam (3)	40%	Add date/time

Description of Exams

Test questions will predominately come from material presented in the lectures. Semester exams will be conducted during the regularly scheduled lecture period. Exam will consist of a combination of multiple choice, short answer, match, true and false and/or descriptive questions.

Homework: Will be given for each chapter, while the chapter in progress you are supposed to work on them continuously and submit in next lecture when I finish the chapter.

You are also expected to work on in-chapter examples, self-tests and representative number of end of chapter problems. The answers of 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 enforce that you come prepared to the class.

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

Grades are not negotiable and are awarded according to the following criteria*:

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 Pharmaceutical Instrumental Analysis sections with 3 lecture periods per week (S/T/T, M/W), one lecture period covers 1.5 lecture hours (80 minutes). The course content specifies the sections in chapters 1-9 that will be included in quizzes, homework and exams.

<u>Chapter 1 Introduction</u>		<u>Week 1/2</u>	<u>6 lecture hours</u>
1.1	Introduction to instrumental methods		
1.2	Figures of Merit		
1.3	Methods of calibration		
<u>Chapter 2 Electroanalytical chemistry (Karl Fisher Titration)</u>		<u>Week 2/3</u>	<u>3 lecture hours</u>
2.1	Basic concept		
2.2	Types of methods		
2.3	Determination of Water		
2.4	Advantages of Analysis		
<u>Chapter 3 Fundamentals of Spectrophotometry</u>		<u>Week 3-4</u>	<u>3 lecture hours</u>
3.1	Fundamentals of Spectrophotometry		
3.2	What happens when molecules absorb light?		
3.3	Beer's Law		
3.4	Limitations and Deviations from Beer's Law		
<u>Chapter 4 Application of Ultraviolet/Visible Molecular Absorption Spectrometry</u>		<u>Week 4-6</u>	<u>6 lecture hours</u>
4.1	Absorptivity		
4.2	Electronic Transitions		
4.3	Absorption of Energy		
4.4	Absorption by Organic Compounds		
4.5	Solvent Effects, Effect of Conjugation of Chromophores		
4.6	Empirical Rules for Calculating Uv/Vis Absorptions (Woodward-Fieser Rules)		
<u>Chapter 5 Atomic Spectroscopy</u>		<u>Week 7</u>	<u>3 lecture hours</u>
5.1	Atomic Spectroscopy Methods		
5.2	Atomic Spectroscopy		
5.3	Atomic Emission Spectroscopy (Flame Photometry)		
5.4	Atomic Absorption Spectroscopy		
<u>Chapter 6 Infrared Spectrometry</u>		<u>Week 8-9</u>	<u>6 lecture hours</u>
6.1	Theory of Infrared Absorption Spectrometry		
6.2	Molecular Vibration, Rotation and Translation motion		
6.3	Interpretation of an Infrared Spectra		
6.4	Quantum Treatment of Vibrations		
6.5	Vibrational Modes		
6.6	Fundamental Peaks and Overtones		
6.7	Infrared Light Sources		
<u>Chapter 7 Nuclear Magnetic Resonance Spectroscopy</u>		<u>Week 10-12</u>	<u>7 lecture hours</u>
7.1	Theory of Nuclear Magnetic Resonance Spectroscopy		
7.3	Energy of spinning nuclei		
7.6	Magnetic Shielding		
7.7	Nuclear Magnetic Resonance Signals		
7.8	The NMR Spectrometer		
7.9	Chemical Shift		
7.10	Splitting		
<u>Chapter 8 Chromatographic Separations</u>		<u>Week 13</u>	<u>3 lecture hours</u>

8.1	Introduction to Chromatography		
8.2	Types of Chromatography		
8.3	Response obtained by chromatography		
8.4	High Performance Liquid Chromatography, Separation, Detectors, Applications		
<u>Chapter 9</u>	<u>Mass Spectrometry</u>	<u>Week 14</u>	<u>3 lecture hours</u>
9.1	Theory of Mass Spectrometry		
9.2	Determining the molecular formula		
9.4	Application to Organic Compounds		
<u>Review</u>		<u>Week 15</u>	
University Exams		<u>Week 16</u>	

Classroom Participation: Assessment Criteria					S c o r e
Criteria	Quality				
	Excellent (4 points)	Good (3 points)	Satisfactory (2 points)	Needs Improvement (1 points)	
Degree to which student integrates course readings into classroom participation	<ul style="list-style-type: none"> - often cites from readings; - uses readings to support points; - often articulates "fit" of readings with topic at hand. 	<ul style="list-style-type: none"> -occasionally cites from readings; - sometimes uses readings to support points; -occasionally articulates "fit" of readings with topic at hand . 	<ul style="list-style-type: none"> -rarely able to cite from readings; - rarely uses readings to support points; - rarely articulates "fit" of readings with topic at hand 	<ul style="list-style-type: none"> -unable to cite from readings; -cannot use readings to support points; cannot articulates "fit" of readings with topic at hand . 	
Interaction/ participation in classroom discussions	<ul style="list-style-type: none"> -always a willing participant, responds frequently to questions; - routinely volunteers point of view . 	<ul style="list-style-type: none"> -often a willing participant, - responds occasionally to questions; - occasionally volunteers point of view . 	<ul style="list-style-type: none"> -rarely a willing participant, - rarely able to respond to questions; - rarely volunteers point of view . 	<ul style="list-style-type: none"> -never a willing participant., - never able to respond to questions; - never volunteers point of view . 	
Interaction/ participation in classroom learning activities	<ul style="list-style-type: none"> -always a willing participant; -acts appropriately during all role plays; - responds frequently to questions; - routinely volunteers point of view. 	<ul style="list-style-type: none"> -often a willing participant; -acts appropriately during role plays; - responds occasionally to questions; -occasionally volunteers point of view. 	<ul style="list-style-type: none"> -rarely a willing participant. -occasionally acts inappropriately during role plays; - rarely able to respond to direct questions; -rarely volunteers point of view . 	<ul style="list-style-type: none"> -never a willing participant - often acts inappropriately during role plays,; - never able to respond to direct questions; - never volunteers point of view. 	
Demonstration of professional attitude and demeanor	<ul style="list-style-type: none"> -always demonstrates commitment through thorough preparation; - always arrives on time; - often solicits instructors' perspective outside class. 	<ul style="list-style-type: none"> - rarely unprepared; rarely arrives late; - occasionally solicits instructors' perspective outside class . 	<ul style="list-style-type: none"> -often unprepared; occasionally arrives late; - rarely solicits instructors' perspective outside class . 	<ul style="list-style-type: none"> -rarely prepared; - often arrives late; -never solicits instructors' perspective outside class 	

ASSESSMENT RUBRICS

Classroom Participation: Oral Presentation

Element	Excellent			Satisfactory			Needs Improvement			Points
	8	7	6	5	4	3	2	1	0	
Organization	<ul style="list-style-type: none"> There is a logical sequence of information. Title slide and closing slide are included appropriately. 			<ul style="list-style-type: none"> There is some logical sequence of information. Title slide and closing slides are included. 			<ul style="list-style-type: none"> There is little or no logical sequence of information. Title slide and/ or closing slides are not included. 			
Slide Design (text, colors, background, illustrations, size, titles, subtitles)	<ul style="list-style-type: none"> Presentation is attractive and appealing to viewers. 			<ul style="list-style-type: none"> Presentation is somewhat appealing to viewers. 			<ul style="list-style-type: none"> Little to no attempt has been made to make presentation appealing to viewers. 			
Content	<ul style="list-style-type: none"> Presentation covers topic completely and in depth. Information is clear, appropriate, and accurate. 			<ul style="list-style-type: none"> Presentation includes some essential information. Some information is somewhat confusing, incorrect, or flawed. 			<ul style="list-style-type: none"> Presentation includes little essential information. Information is confusing, inaccurate, or flawed. 			
Language	<ul style="list-style-type: none"> Spelling, grammar, usage, and punctuation are accurate Fluent and effective 			<ul style="list-style-type: none"> There are minor problems in spelling, grammar, usage, and/or punctuation. 			<ul style="list-style-type: none"> There are persistent errors in spelling, grammar, usage, and/or punctuation. Less or not fluent and effective. 			
Delivery	<ul style="list-style-type: none"> Ideas were communicated with enthusiasm, proper voice projection and clear delivery. There was sufficient eye contact with audience. There were sufficient use of other non-verbal communication skills. Appropriate delivery pace was used. 			<ul style="list-style-type: none"> There was some difficulty communicating ideas due to voice projection, lack of preparation, incomplete work, and/or insufficient eye contact. Insufficient use of non-verbal communication skills. Delivery pace is somewhat appropriate. 			<ul style="list-style-type: none"> There was great difficulty communicating ideas due to poor voice projection, lack of preparation, incomplete work, and/or little or no eye contact. No use of non verbal communication skills. Inappropriate delivery pace was used. 			

Interaction with Audience	<ul style="list-style-type: none"> ▪ Answers to questions are coherent and complete. ▪ Answers demonstrate confidence and extensive knowledge. 	<ul style="list-style-type: none"> ▪ Most answers to questions are coherent and complete. ▪ Answers somehow demonstrate confidence and extensive knowledge. 	<ul style="list-style-type: none"> ▪ Answers to questions are neither coherent nor complete. ▪ Is tentative or unclear in responses. 	
	Total Score (Y x 5/16) =			