Philadelphia University	PHILADELPHIA UNIVERSITY THE WAY TO THE FUTURE	**Approved Date: 12/10/2021**
Faculty: Pharmacy		**Issue: 1**
Department: -		**Credit Hours: 3**
Academic Year: 21/22	**Course Syllabus**	**Bachler: 2nd year**

Course Information

Course No.	Course Title	Prerequisite
051020600	Pharmaceutical Instrumental Analysis	051012200

Course Type	Class Time	Room No.
☐ Univirsity Requirement ☐ Fuclty Requirement ☐ Major Requirement ☐ Elective ■ Compulsory	**Sec.1** S, T: 9:45-11:15 **Sec.2** M, W: 8:15-9:45 **Sec.3** M, W: 11:15-12:45 **Sec.4** S, T: 12:45-14:15	 9314 5507 9414 5613

Instructure Information

Name	Office No.	Phone No.	Office Hours	E-mail
Dr. Ahmad Najjar	P 516	2609	S, T, 11:15-12:00 M, W 9:45-11:10	a.najjar@philadelphia.edu.jo

Course Delivery Method

☐ Blended	☐ Online	■ Physical
Learning Model		
Percentage	**Synchronous**	**Asynchronous**	**Physical**
		100%

Course Description

This course is devoted to the exploration of the instrumental methods of analysis used to check the purity of pharmaceutical products and raw materials while validating these methods according to the quality control requirements. These methods include chromatography (liquid and gas) and electrophoresis, molecular and atomic spectroscopy (UV-Visible, IR, NMR, mass spectrometry, atomic absorption and emission), and electrochemical methods of analysis.

Course Learning Outcomes

CLO	Outcome	PLO	Corresponding Competencies
Knowledge			
K1	Describe the basic principles, the instrumental design and advantages and limitations of a variety of analytical techniques, including: electrochemical, spectrophotometric (molecular and atomic), and chromatographic methods of analysis critically used in pharmaceutical analysis.	KP1	C1
K2	Distinguish the qualitative and quantitative methods for the analysis of raw materials, and pharmaceutical finished products.	KP1, KP6	C1, C6
K3	Demonstrate the differences between various types of instruments used in chemical analysis in terms of basic principles, parts, functions and applications.	KP1, KP6	C1, C6
K4	Demonstrate the knowledge of data acquisition and analysis for various techniques.	KP6	C6
Skills			
S1	Demonstrate capability of choosing the appropriate instrumental method for a particular investigation pertinent to a certain drug or pharmaceutical product.	SP2	C8
S2	Interpret the various types of spectra driven from spectroscopic techniques under study and identify simple organic and pharmaceutical molecules.	SP2, SP9	C8, C15
S3	Work on different instruments critical for pharmaceutical analysis.	SP9	C15
S4	Read, evaluate, and interpret numerical, chemical and general scientific information related to instrumental methods of chemical analysis.	SP2, SP9	C8, C15
S5	Search, use and evaluate the chemical literature in both printed and electronic formats.	SP9	C15

CLOs: Course learning outcomes
PLOs: Programme learning outcomes
C1: Learner; C6: Manufacturer; C8: Problem Solver; C9: Innovator

Learning Resources

Course Textbook	Chemical Analysis: Modern Instrumentation Methods and Techniques; F. Rouessac and A. Rouessac, John Wiley; 2nd edition (2007).
Supporting References	• Undergraduate Instrumental Analysis", J., W. Robinson, Marcel Dekker, 7th edition; (2019). • Handouts when needed
Supporting Websites	
Teaching Environment	■ **Classroom** ■ **laboratory** □ **Learning Platform** □ **Other**

Meetings and Subjects Time Table

Week	Topic	Learning Method*	Task	Learning Material
1	شرح رؤية ورسالة الكلية، واهداف ومخرجات تعلم المادة			الخطة الدراسية
2	**Ultraviolet and visible spectroscopy.** Basic principles of molecular spectroscopy, Beer-Lambert law, spectra of some representative drug molecules, applications to pharmaceutical quantitative analysis.	lecture, problem solving based learning, collaboration learning.	Quiz 1 Assign. 1	Chapter 9 & Handout
3				
4	**Infrared spectroscopy.** Basic principles of IR spectroscopy, instrumentation, application of IR in structure elucidation, near IR analysis and its pharmaceutical applications.	lecture, problem solving based learning, collaboration learning.	Quiz 2 Project 1	Chapter 10 & Handout
5				
6	**Atomic spectrophotometry** Basic principles of atomic emission, inductively coupled plasma and atomic absorption spectrophotometric techniques, some applications, standard addition technique	lecture		Chapter 13, Chapter 14 & Handout
7	**Nuclear magnetic resonance spectroscopy** Basic principles of NMR technique and instrumentation, proton-NMR and carbon-13 NMR. Applications of NMR to structure confirmation in some drug molecules and to quantitative analysis	lecture, problem solving based learning, collaboration learning.	Quiz 3 Assign. 2	Chapter 15 & Handout
8				
9	**Mass spectrometry** Basic principles of mass spectrometry and instrumentation, mass spectra, molecular fragmentation. Applications in pharmaceutical applications and characterization of degradation products	lecture, problem solving based learning, collaboration learning.	Quiz 4	Chapter 16 & Handout
10	**Theory of Chromatography** Column efficiency, band broadening, van Deemter equation, parameters used in evaluating column performance	lecture, problem solving based learning.	Quiz 5	Chapter 1 & Handout
11				
12	**Gas chromatography** Instrumentation, types of columns, detectors, analytical applications.	lecture, project based learning	Project 2	Chapter 2 & Handout
13	**High performance liquid chromatography, HPLC** Instrumentation, columns, detectors, applications to the quantitative analysis to the quantitative analysis of drugs in formulations	lecture, project based learning		Chapter 3 & Handout
14	**Electroanalytical methods of chemical analysis** Various types of electrodes ad ion-selective electrodes, Potentiometry and potentiometric titration, Karl Fischer titration, Automation of wet chemical methods, Applications of flow injection analysis technique in pharmaceutical analysis.	lecture		Chapter 19.
15				
16	**Final Exam**			

*Includes: lecture, flipped Class, project based learning, problem solving based learning, collaboration learning.

Course Contributing to Learner Skill Development

Using Technology
- Use Excel in numerical problems solving and calibration curve calculations. - Use Powepoint to prepare presentations. - Use varity of electronic databases in searching for published data.
Communication Skills
- Apply critical thinking and hypothesis-driven methods of scientific inquiry - Demonstrate effective written and oral communication skills
Application of Concept Learnt
Pharmaceutical analysis in deferent matrecies for varity fields (industrial, clinical, regulatory,…etc.)

Assessment Methods and Grade Distribution

Assessment Methods	Grade	Assessment Time (Week No.)	Course Outcomes to be Assessed
Mid Term Exam	**30%**	**10**	**K1, K2, K3, S1, S2**
Term Works*	**30%**	**Continuous**	**K1, K4, S2, S3, S4, S5**
Final Exam	**40%**	**16**	**K1, K2, K3, S1, S2**
Total	**100%**		

* Include: quizzes, in-class and out of class assignment, presentations, reports, videotaped assignment, group or individual project.

Alignment of Course Outcomes with Learning and Assessment Methods

CLO	Learning Outcomes	Corresponding Compatencies	Learning Method*	Assessment Method**
Knowledge				
K1	Describe the basic principles, the instrumental design and advantages and limitations of a variety of analytical techniques, including: electrochemical, spectrophotometric (molecular and atomic), and chromatographic methods of analysis critically used in pharmaceutical analysis.	C1	lecture	exam, quizzes
K2	Distinguish the qualitative and quantitative methods for the analysis of raw materials, and pharmaceutical finished products.	C1, C6	collaboration learning	exam
K3	Demonstrate the differences between various types of instruments used in chemical analysis in terms of basic principles, parts, functions and applications.	C1, C6	collaboration learning	exam
K4	Demonstrate the knowledge of data acquisition and analysis for various techniques.	C6	collaboration learning	assignments, quizzes

Skills				
S1	Demonstrate capability of choosing the appropriate instrumental method for a particular investigation pertinent to a certain drug or pharmaceutical product.	C8	collaboration learning	exam
S2	Interpret the various types of spectra driven from spectroscopic techniques under study and identify simple organic and pharmaceutical molecules.	C8, C15	problem solving based learning, collaboration learning	exam, quizzes, assignments
S3	Work on different instruments critical for pharmaceutical analysis.	C15	lecture, Lab.	reports
S4	Read, evaluate, and interpret numerical, chemical and general scientific information related to instrumental methods of chemical analysis.	C8, C15	project based learning, problem solving based learning	individual projects, reports
S5	Search, use and evaluate the chemical literature in both printed and electronic formats.	C15	project based learning	individual projects, presentations

*Include: lecture, flipped class, project based learning, problem solving based learning, collaboration learning.
** Include: quizzes, in-class and out of class assignments, presentations, reports, videotaped assignments, group or individual projects.

Course Polices

Policy	Policy Requirements
Passing Grade	The minimum pass for the course is (50%) and the minimum final mark is (35%).
Missing Exams	• Anyone absent from a declared semester exam without a sick or compulsive excuse accepted by the dean of the college that proposes the course, a zero mark shall be placed on that exam and calculated in his final mark. • Anyone absent from a declared semester exam with a sick or compulsive excuse accepted by the dean of the college that proposes the course must submit proof of his excuse within a week from the date of the excuse's disappearance, and in this case, the subject teacher must hold a compensation exam for the student. • Anyone absent from a final exam with a sick excuse or a compulsive excuse accepted by the dean of the college that proposes the material must submit proof of his excuse within three days from the date of holding that exam.
Attendance	The student is not allowed to be absent more than (15%) of the total hours prescribed for the course, which equates to six lecture days (n t) and seven lectures (days). If the student misses more than (15%) of the total hours prescribed for the course without a satisfactory or compulsive excuse accepted by the dean of the faculty, he is prohibited from taking the final exam and his result in that subject is considered (zero), but if the absence is due to illness or a compulsive excuse accepted by the dean of the college that The article is introduced, it is considered withdrawn from that article, and the provisions of withdrawal shall apply to it.
Academic Integrity	Philadelphia University pays special attention to the issue of academic integrity, and the penalties stipulated in the university's instructions are applied to those who are proven to have committed an act that violates academic integrity, such as cheating, plagiarism (academic theft), collusion, intellectual property rights.

Program Learning Outcomes to be Assessed in this Course

Number	Learning Outcome	Course Title	Assessment Method	Targeted Performance level

Description of Program learning Outcomes Assessment Method

Number	Detailed Description of Assessment

Assessment Rubric of the Program Learning Outcomes
