Course Plan for Bachelor Program - Study Plan Development and Updating Procedures/ Pharmacy Department	QF02/0408-4.0E

Study Plan No.	**2021/2022**		**University Specialization**		**Bachelor of Pharmacy**	
Course No.	**0201456**		**Course Name**		**Selected Topics in Pharmaceutical Analysis**	
Credit Hours	**3**		**Prerequisite *Co-requisite**		**Instrumental Analysis**	
Course Type	☐ Mandatory University Requirement	☐ University Elective Requirement	☐ Faculty Mandatory Requirement	☐ Support course family requirements	☐ Mandatory Requirement	☑ **Elective Requirement**
Teaching Style	☐ Full Online Learning		☑ **Blended Learning**		☐ Traditional Learning	
Teaching Model	☐ 1 Synchronous: 1 Asynchronous		☑ **1 Face to Face: 1 Asynchronous**		☐ 2 Traditional	

Faculty Member and Study Divisions Information *(to be filled in each semester by the subject instructor)*

Name	Academic rank	Office No.	Phone No.	E-mail	
Office Hours (Days/Time)	**Sunday, Tuesday, Thursday ()**		**Monday, Wednesday ()**		
Division number	**Time**	**Place**	**Number of Students**	**Teaching Style**	**Approved Model**
				Blended Learning	**1 Face to Face: 1 Asynchronous**

Brief Description

This course is designed to provide students with required knowledge and skills about the most important techniques used in pharmaceutical analysis including separation techniques such as chromatography (HPLC, GC) and capillary electrophoresis (CE) and their application and employments in different fields of pharmaceutical sciences. In addition to hyphenated spectroscopic techniques (UV-Vis, Fluorescence, Mass, and Conductivity) used in combination with HPLC, GC, and CE.

Learning Resources

Course Book Information (Title, author, date of issue, publisher ... etc)	Pharmaceutical Analysis: A Textbook for Pharmacy Students and Pharmaceutical Chemists, 5th edition, David Watson, Elsevier/ Churchill Livingstone, 2020. (Available at Al-Zaytoonah University of Jordan library)			
Supportive Learning Resources (Books, databases, periodicals, software, applications, others)	1. Principles of instrumental analysis, 7th edition, Douglas Skoog, James Holler, and Stanley Crouch, Cengage learning, 2018. 2. Spectrometric Identification of Organic Compounds, 8th edition, Robert Silverstein, Francis Webster, David Kiemle, and David Bryce, Wiley, 2014. 3. Fundamentals of Analytical Chemistry, 9th edition, Donald West, F. James Holler, Douglas A. Skoog & Stanley R. Crouch. Brooks/Cole – Thomson Learning, 2014.			
Supporting Websites				
The Physical Environment for Teaching	☑ **Classroom**	☐ Labs	☑ **Virtual Educational Platform**	☐ Others

Necessary Equipment and Software	Moodle
Supporting People with Special Needs	
For Technical Support	E-Learning & Open Educational Resources Center. Email: elearning@zuj.edu.jo; Phone: +962 6 429 1511 ext. 425/362.

Course learning outcomes *(K= Knowledge, S= Skills, C= Competencies)*

No.	Course Learning Outcomes	The Associated Program Learning Output Code
Knowledge **The student should be able to:**		
K1	Differentiate classifications of separation techniques including chromatographic and electrophoretic methods used in pharmaceutical analysis.	**MK2**
K2	Distinguish the theories, principles, instrumentations, and applications of separation techniques (UV-Vis, fluorescence, atomic, IR, mass and NMR) employed in pharmaceutical analysis.	**MK2**
K3	Describe applications of separation techniques (HPLC, GC, and CE) utilized in pharmaceutical analysis.	**MK2**
Skills **The student should be able to:**		
S1	Predict approaches addressed by separation techniques.	**MS4**
S2	Perform qualitative and quantitative analysis through the interpretations of chromatograms and electropherograms.	**MS4**
S3	Define the suitable separation technique for analysis of various samples, matrices and dosage forms.	**MS4**
Competencies **The student should be able to:**		
C1	Critically evaluate analytical methods used in pharmaceutical analysis for their validity and reliability.	**MC3**

Mechanisms for Direct Evaluation of Learning Outcomes

Type of Assessment / Learning Style	Fully Electronic Learning	Blended Learning	Traditional Learning (Theory Learning)	Traditional Learning (Practical Learning)
Midterm Exam	30%	**30%**	30%	0%
Participation / Practical Applications	0%	**0%**	30%	60%
Asynchronous Interactive Activities	30%	**30%**	0%	0%
Final Exam	40%	**40%**	40%	40%

Note 1: *Asynchronous interactive activities are activities, tasks, projects, assignments, research, studies, projects, and work within student groups ... etc, which the student carries out on his own, through the virtual platform without a direct encounter with the subject teacher.*

Note 2: *According to the Regulations of granting Master's degree at Al-Zaytoonah University of Jordan, 40% of final evaluation goes for the final exam, and 60% for the semester work (examinations, reports, research or any scientific activity assigned to the student).*

Schedule of Simultaneous / Face-to-Face Encounters and their Topics

Week	Subject	Learning Style*	Reference **
1	**Introduction**: Review of the concept of pharmaceutical analysis	Lecture	Textbook: Ch. 1, pp. (1-24)
2	**Introduction**: Review of the concept of analytical methods.	Lecture	Textbook: Ch. 1, pp. (1-24)
3	**Chromatographic Theory**: - Introduction to chromatographic separations. - Classification of chromatographic methods. - Elution chromatography. - Chromatogram.	Lecture	Textbook: Ch. 10, pp. (247-259)
4	**Chromatographic Theory**: - Distribution constants. - Retention time, Column efficiency, retention factor, selectivity factor.	Lecture	Textbook: Ch. 10, pp. (247-259)
5	**Gas Chromatography (GC):** - Principles, applications, strengths and limitations. - GC Instrumentation. - GC type of columns.	Lecture	Textbook: Ch. 11, pp. (260-293)
6	**Gas Chromatography (GC):** - Selectivity of liquid stationary phases. - Use of derivatization in GC. - GC detectors	Lecture	Textbook: Ch. 11, pp. (260-293)
7	**High-performance liquid chromatography (HPLC):** - Principles, applications, strengths and limitations. - HPLC Instrumentation. - Stationary phases and Mobile phases.	Lecture	Textbook: Ch. 12, pp. (295-348)
8	**High-performance liquid chromatography (HPLC):** - HPLC elution of neutral compounds. - HPLC elution rate of ionizable compounds by adjustment of pH of mobile phase.	Lecture	Textbook: Ch. 12, pp. (295-348)
9	**High-performance liquid chromatography (HPLC):** - HPLC solvent selectivity. - HPLC effect of temperature. - HPLC vs UPLC.	Lecture	Textbook: Ch. 12, pp. (295-348)

	Midterm Exam		
10	**High-performance capillary electrophoresis (CE):** - Principles, applications, strengths and limitations. - CE Instrumentation.	Lecture	Textbook: Ch. 14, pp. (366-385)
11	**High-performance capillary electrophoresis (CE):** - Electroosmotic Flow (EOF). - Electropherograms.	Lecture	Textbook: Ch. 14, pp. (366-385)
12	**High-performance capillary electrophoresis (CE):** - Variables controlling electrophoretic separation. - Applications of CE in pharmaceutical analysis.	Lecture	Textbook: Ch. 14, pp. (366-385)
13	**Selected applications of chromatography:** - Employment of HPLC-PDA, HPLC-fluorescence in pharmaceutical analysis	Lecture	Research articles and published methods
14	**Selected applications of chromatography:** - Employment of HPLC-MS, HPLC-MS/MS in pharmaceutical analysis	Lecture	Research articles and published methods
15	**Selected applications of Capillary Electrophoresis:** - Employment of CE-UV and CE-C^4D in pharmaceutical analysis	Lecture	Research articles and published methods
16	**Final Exam**		

** Learning styles: Lecture, flipped learning, learning through projects, learning through problem solving, participatory learning ... etc.*
*** Reference: Pages in a book, database, recorded lecture, content on the e-learning platform, video, website ... etc.*

Schedule of Asynchronous Interactive Activities *(in the case of e-learning and blended learning)*

Week	Task / Activity	Reference	Expected Results
1	**Introduction**: Review of the concept of pharmaceutical analysis Watch a recorded lecture	Video on the E-learning platform	Answer questions embedded in the video / Assignment
2	**Introduction**: Review of the concept of analytical methods. Watch a recorded lecture	Video on the E-learning platform	Answer questions embedded in the video / Assignment
3	**Chromatographic Theory**: Watch a recorded lecture	Video on the E-learning platform	Answer questions embedded in the video / Assignment
4	**Chromatographic Theory**: Watch a recorded lecture	Video on the E-learning platform	Answer questions embedded in the video / Assignment
5	**Gas Chromatography (GC):**	A selected topic	Assignment

	Watch a recorded lecture		
6	**Gas Chromatography (GC):** Watch a recorded lecture	Video on the E-learning platform	Answer questions embedded in the video / Assignment
7	**High-performance liquid chromatography (HPLC):** Watch a recorded lecture	Video on the E-learning platform	Answer questions embedded in the video / Assignment
8	**High-performance liquid chromatography (HPLC):** Watch a recorded lecture	A selected topic	Assignment
9	**Midterm Exam**	**-**	**-**
10	**High-performance liquid chromatography (HPLC):** Watch a recorded lecture	Video on the E-learning platform	Answer questions embedded in the video / Assignment
11	**High-performance capillary electrophoresis (CE):** Watch a recorded lecture	Video on the E-learning platform	Answer questions embedded in the video / Assignment
12	**High-performance capillary electrophoresis (CE):** Watch a recorded lecture	Video on the E-learning platform	Answer questions embedded in the video / Assignment
13	**Selected applications of chromatography:** Watch a recorded lecture	A selected topic	Assignment
14	**Selected applications of chromatography:** Watch a recorded lecture	Video on the E-learning platform	Answer questions embedded in the video / Assignment
15	**Selected applications of Capillary Electrophoresis:** Watch a recorded lecture	Video on the E-learning platform	Answer questions embedded in the video / Assignment
16	**Final Exam**	**-**	**-**