

Course Plan for Bachelor Program - Study Plan Development and Updating Procedures/ Pharmacy Department	QF02/0408-4.0E
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Study Plan No.	2021/2022	University Specialization	Bachelor of Pharmacy
Course No.	0201361	Course Name	Pharmaceutical Analysis Lab
Credit Hours	1	Prerequisite *Co-requisite	Pharmaceutical Organic Chemistry Lab + *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	☐ 2 Synchronous: 1 Asynchronous	☐ 2 Face to Face: 1 Asynchronous	☒ 1 Traditional

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

Faculty Member and Study Division Information (to be given 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
1		-	-	Traditional Learning	1 Traditional

Brief Description

The course focuses on the practical application of various instrumental techniques for pharmaceutical analysis and most commonly used in spectroscopic techniques such as UV-Vis, IR, and NMR spectroscopy analysis. In addition, the students will apply titration methods using electrochemical techniques.

Learning Resources

Course Book Information (Title, author, date of issue, publisher ... etc)	- European Pharmacopeia, 7th edition - Accompanying laboratory manual.
Supportive Learning Resources (Books, databases, periodicals, software, applications, others)	- Fundamentals of Analytical Chemistry (Brooks/Cole – Thomson Learning), 9th edition. Author: Donald West, F. James Holler, Douglas A. Skoog & Stanley R. Crouch, 2014. - Quantitative Chemical Analysis, 7th edition (2007), (W. H. Freeman and Company). Author: Daniel C. Harris - Analytical Chemistry: An Introduction, 7th edition (2000), (Saunders Golden Sunburst series). Author: Douglas A. Skoog, Donald M. West, F. James Holler and Stanley R. Crouch. - Pharmaceutical Analysis: A Textbook for Pharmacy Students and Pharmaceutical Chemists, 3rd edition, David Watson, Elsevier/ Churchill Livingstone, 2012. - Spectroscopic Methods in Organic Chemistry, 6th edition, Dudley Williams, Ian Fleming, McGraw-Hill book company, 1995 3- Organic Structures from Spectra, 3rd edition, L. D. Field, S. Sternhell and J. R. Kalman, John Wiley & Sons, 2002. M. Silverstein, Francis X. Webster and David Kiemle, John Wiley & Sons, 2005.

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	7. Principles of Instrumental Analysis, 6 th edition, Skoog, D. A., Brooks/ Cole Thomson Learning, 2007.			
Supporting Websites	https://elearning.zuj.edu.jo/login/index.php			
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: elarning@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		
K1	Identify the principles, theories, and techniques of instrumental analysis that are used in pharmaceutical industry.	MK2
K2	Differentiate different types of volumetric, electrochemical and spectroscopic technique used in pharmaceutical analysis	MK2
Skills		
S1	Interpret data obtained from instrumental analytical techniques, including sample preparation steps and analytical results.	MS4
S2	Interpret the instrumental data and results of the different pharmaceutical methods to quantify pharmaceutical samples accurately and precisely	MS4
Competencies		
C1	Demonstrate effective problem-solving, critical thinking, and the ability to develop and validate pharmaceutical analysis procedures.	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: Asynchronous interactive activities are activities, tasks, projects, assignments, research, studies, projects, 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.

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

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Week	Subject	Learning Style*	Reference **
1	Check in : Introduction to laboratory and safety rules.	Lecture	Lab manual content on the e-learning platform,
2	Preparation of solutions: - Handling of balances and - volumetric glassware (preparation of 0.1 M NaCl and 0.1 M HCl)	Lecture participatory learning Work within student groups. Reports, quizzes	Lab manual content on the e-learning platform,
3	Direct titration: Part 1: Standardization of 0.1N HCl Part 2: Determination of carbonate and bicarbonate in a mixture	Lecture participatory learning Work within student groups. Reports, quizzes	Lab manual content on the e-learning platform,
4	Back titration: Determination of aspirin purity.	Lecture participatory learning Work within student groups. Reports, quizzes	Lab manual content on the e-learning platform,
5	Potentiometry: Part 1: pH calibration (Demonstration) Part 2: Assay of acetyl salicylic acid using potentiometric titration	Lecture participatory learning Work within student groups. Reports, quizzes	Lab manual content on the e-learning platform,
6	Conductometry: Part 1: Conductimetric determination of aqueous HCL sample using aqueous solution of standardized NaOH Part 2: Conductimetric determination of aqueous Formic acid sample using aqueous solution of standardized NaOH Part 3: Conductimetric determination of a mixture of formic acid and HCl using aqueous solution of standardized NaOH	Lecture participatory learning Work within student groups. Reports, quizzes	Lab manual content on the e-learning platform,
7	Polarimetry: Determination of unknown concentration of glucose using polarimetry	Lecture participatory learning Work within student groups. Reports, quizzes	Lab manual content on the e-learning platform,
8	UV-Vis Spectroscopy: Part 1: Assay of paracetamol raw material using U.V. spectroscopy Part2: Assay of paracetamol tablets using U.V. spectroscopy Part 3: Solvent Effect (Demonstration)	Lecture participatory learning Work within student groups. Reports, quizzes	Lab manual content on the e-learning platform,
9	Molecular and atomic emission Part 1: Spectrofluorometric determination of quinine bisulfate Part 2: Determination of potassium iodide using fluorescence quenching of quinine bisulfate	Lecture participatory learning Work within student groups. Reports, quizzes	Lab manual content on the e-learning platform,

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	Part 3: Assay of sodium and potassium ions in an I.V. infusion using flame photometry		
10	Infrared (IR) spectroscopy Part 1: Using IR spectroscopy to analyze samples (Demonstration) Part 2: IR spectra interpretation	Lecture participatory learning Work within student groups. Reports, quizzes	Lab manual content on the e-learning platform,
11	Nuclear Magnetic Resonance (NMR) spectroscopy: (¹ H – NMR and ¹³ C - NMR) spectra interpretation	Lecture participatory learning Work within student groups. Reports, quizzes	Lab manual content on the e-learning platform,
12	Chromatography: Chromatographic analysis techniques (HPLC and GC)	Lecture participatory learning Work within student groups. Reports, quizzes	Lab manual content on the e-learning platform,
13	Practical lab exam	-	
14	Check out	-	-
15	Final exam		
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* 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