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.	**0201210**		**Course Name**		**Analytical Chemistry**	
Credit Hours	**2**		**Prerequisite *Co-requisite**		**Physical Pharmacy**	
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**
				Traditional Learning	**2 Traditional**

Brief Description

This course aims to cover different types of titrimetric methods (acid and bases, precipitation, complexometric, and oxidation and reduction titrations) that are employed in quantitative pharmaceutical analysis.

Learning Resources

Course Book Information (Title, author, date of issue, publisher ... etc)	Fundamentals of Analytical Chemistry (Brooks/Cole – Thomson Learning), 9th edition (2014). Author: Donald West, F. James Holler, Douglas A. Skoog & Stanley R. Crouch.			
Supportive Learning Resources (Books, databases, periodicals, software, applications, others)	1- Quantitative Chemical Analysis, 7th edition (2007), (W. H. Freeman and Company). Author: Daniel C. Harris. 2- 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. 3- Modern Analytical Chemistry, 1st edition (2000). McGraw –Hill Higher Education. Author: David Harvey 4- A Textbook of Pharmaceutical Analysis, 3rd edition (1982). John Wiley & Sons, New York. Author: Connors, K.A.			
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: 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	Identify the different qualitative and quantitative analytical procedures applied in the pharmaceutical sciences.	**MK1**
K2	Recall the fundamentals of preparations, properties, reactions, and stoichiometric calculations involving solutions.	**MK1**
K3	Recognize the terms, abbreviations, and symbols encountered in the pharmaceutical sciences.	**MK1**
K4	Describe the concepts of statistical analysis and data handling.	**MK1**
Skills **The student should be able to:**		
S1	Perform basic calculations involving stoichiometry and titrimetric methods of analysis.	**MS4**
S2	Apply statistical analysis concepts in analytical procedures.	**MS4**
Competencies **The student should be able to:**		
C1	Demonstrate problem solving and critical thinking skills related to analytical work.	**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%	**20%**	50%
Asynchronous Interactive Activities	20%	20%	**0%**	0%
Final Exam	50%	50%	**50%**	50%

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: Classification of analysis (Quantitative & Qualitative) and the typical quantitative method.	Lecture Problem-based learning	1-2 And 62-75 content on the e-learning platform, website
2	- Calculations used in analytical chemistry : Concentration units a. based on moles (molarity and normality) b. relative concentration units (percentage)	Lecture Problem-based learning	62-75 content on the e-learning platform
3	-Calculations used in analytical chemistry : Concentration units c. dilute concentration (ppm, ppb) - Calculations used in analytical chemistry: stoichiometry.	Lecture Problem-based learning	62-75 content on the e-learning platform
4	- Statistical handling of data (mean, median, accuracy, precision). - Statistical handling of data (relative and absolute error, standard deviation, coefficient of variation, examples).	Lecture Problem-based learning Homework	82-87, 93-98 and 123 Recorded lecture content on the e-learning platform
5	Titrimetric methods: - Volumetric analysis (requirements, terms, definitions, titration, primary standards, standard solutions, standardization). - Volumetric analysis (equivalence point, end point, titration error, type of reactions, indicators and methodologies: direct and back titration examples)	Lecture Problem-based learning	302-317 content on the e-learning platform
6	- Neutralization titrations; Acids and Bases definitions - pH calculation. - Neutralization titrations: titration curves for strong acids and strong bases. - Indicators and applications	Lecture Problem-based learning	179-202 and 322-331 content on the e-learning platform
7	- Buffer solutions: definition, buffer capacity, Henderson-Hasselbalch equation - Strong-weak neutralization titration curves.	Lecture Problem-based learning	221-227 and 332-337 content on the e-learning platform
8	- Solubility products and applications - Precipitation titrations : Volhard's method, Fajan's method and Mohr's	Lecture Problem-based learning	280-294 and 400-404 content on the e-learning platform

	method.		
9	- Precipitation titrations (titration curves). **Midterm Exam**	Lecture Problem-based learning	280-294 and 400-404 content on the e-learning platform
10	-Complexometric titrations: the concept of complexation reaction and stability constant. -Ligands' definition and characterization, examples (EDTA as a ligand)	Lecture Problem-based learning	400-414 content on the e-learning platform
11	- Titration curves -Indicators in complexometric titrations. - Titration methodologies	Lecture Problem-based learning	415-436 content on the e-learning platform
12	- Oxidation Reduction titrations: Oxidation- reduction half-cell reactions. -Calculating oxidation number.	Lecture Problem-based learning	442-444 content on the e-learning platform
13	-Electrochemical cells: schematic representation of cells -Standard electrode potential and cell potential	Lecture Problem-based learning	450-466 content on the e-learning platform
14	- Nernst equation. - Applications: pH-determination, concentration cells and determination of equilibrium constant.	Lecture Problem-based learning	450-466 content on the e-learning platform
15	- Some common reducing agents. - Some common oxidizing agents. - Oxidation reduction titration problems	Lecture Problem-based learning	509-515 content on the e-learning platform
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
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