

**The University of Jordan**

**Accreditation & Quality Assurance Center**

**COURSE Syllabus**

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| 1 | Course title | Applied Chromatography |
| 2 | Course number | 1201524 |
| 3 | Credit hours (theory, practical) | 2 credits  |
| Contact hours (theory, practical) |  |
| 4 | Prerequisites/corequisites | 1201315 |
| 5 | Program title | B.sc in Pharmacy/Pharm D |
| 6 | Program code | ---- |
| 7 | Awarding institution  | The University of Jordan |
| 8 | Faculty | Pharmacy |
| 9 | Department | Pharmaceutical Sciences |
| 10 | Level of course  | 5th year students |
| 11 | Year of study and semester (s) | 2021/2022 – first semester |
| 12 | Final Qualification | B.sc in Pharmacy |
| 13 | Other department (s) involved in teaching the course | ----- |
| 14 | Language of Instruction | English  |
| 15 | Date of production/revision | September 12, 2021  |

16. Course Coordinator:

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| Prof. Muhammed AlzweiriOffice No.: 365Phone No.: + 962 65355000 (23365)Email: m.alzweiri@ju.edu.joOffice hours: To be determined |

17. Other instructors:

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| *Office numbers, office hours, phone numbers, and email addresses should be listed.**------* |

**18. Course Description:**

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| *As stated in the approved study plan.*The course will cover advanced study of the modern methods of chromatography used in separation & purification including TLC, CC, GC, HPLC and other hyphenated techniques. Aspects of different extraction and purification methods and analytical method validation will also be covered. At the end of the course the student is expected to acquire basic and applied knowledge regarding chromatography and separation science. The student will realize the importance of chromatography in different pharmaceutical fields including drug discovery, drug identification and characterization, and will recognize its wide application in quantitative and qualitative pharmacopoeial analysis including its application in the limit test of impurities and in the assay of different drugs. The proper selection of the best chromatographic technique and conditions to resolve certain separation problems will be covered and discussed. The course is designed to be integrated. There is an online video/lecture/presentation after a couple of face-to-face lectures. |

1. 19. Course aims and outcomes:

 A- Aims

1. Understanding the definition, basics and types of separation and chromatographic techniques.
2. Understanding the importance and various application of chromatography in pharmacy.
3. Recognizing the variables of chromatographic process and the best conditions to achieve the best results.
4. To get familiar with some common and specialized chromatographic techniques (e.g. hyphenated systems), pharmacopoeial drug analysis (assay related substances), bioanalysis, and method development and validation.

**B- Course Intended Learning Outcomes (ILOs):**

Upon successful completion of this course students will be able to:

**Develop, integrate, and apply knowledge from the foundational pharmaceutical sciences in separation techniques (learner)**

1. Define information regarding separation and chromatographic techniques such as stationary phase, mobile phase and retention time

2. Recall basic concepts in analytical and organic pharmaceutical chemistry fields used in the science of separation.

3. Explain and outline the principles, basics and variables of extraction processes.

4. Explain and outline the principles, basics, variables and types of chromatography and its various techniques.

5. Recognize the context of method validation and its importance; official requirements, methodology and conduction.

6. Identify chromatographic parameters and conditions that affects the performance and intended outputs

7. Apply the gained knowledge of different analytical methods for purpose of drug identification and assay

8. Examine and inspect the output of the chromatographic separation.

**Proactively investigates new knowledge and approaches or behaviour and takes steps to evaluate and improve performance (Self-learner)**

9. Investigate proactively different extraction techniques for analytical and preparative pharmaceutical applications.

10. Interpret proactively different chromatographic techniques for analytical - qualitative and quantitative - pharmaceutical applications

**Solve problems and think critically (Problem Solver)**

11.Identify separation problems (problem in the chromatogram)

12. List the potential strategies and solutions to the chromatographic problem

13. Prioritize the potential strategies

**Exhibit behaviors and values that are consistent with the trust given to the profession by patients, other healthcare providers, and society (Professional)**

14. Demonstrate integrity by not cheating and not committing plagiarism

15. Demonstrate respect to professors and classmates by observing active listening inside the classroom

20. Topic Outline and Schedule:

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| **Topic** | **Week** | **Instructor** | **Achieved ILOs** | **Evaluation Methods** | **Reference** |
| **Basics of Chromatography**  | 1 | M.alzweiri | 2, 14, 15 | Exam | 3 and 5 |
| **Mechanisms of separation** | 1 | M.alzweiri | 3,7, 9, 14, 15 | Exam, Quiz | 1 and 2  |
| **Videos on separation concept:**[**https://www.youtube.com/watch?v=0m8bWKHmRMM**](https://www.youtube.com/watch?v=0m8bWKHmRMM)[**https://www.youtube.com/watch?v=23W5Z\_redfs**](https://www.youtube.com/watch?v=23W5Z_redfs)[**https://youtu.be/UkIFBCuyHdc**](https://youtu.be/UkIFBCuyHdc) | 2 |  |  |  | online |
| **Chromatographic techniques** | 2 | M.alzweiri | 1,4,6,7,14,15 | Exam, Quiz | 1, 2, 4 and 5 |
| **Thin Layer Chromatography** (Principles and Applications) | 3 | M.alzweiri | 1,4,6,7,10, 14,15 | Exam, Assignment, Quiz | 1 and 2 |
| **https://youtu.be/8Bpecy9Lkuk** | 3 |  |  |  | online |
| **Gas Chromatography** (Principles and Applications) | 4 | M.alzweiri | 1,4,6,7,14,15 | Exam | 1, 2 and 4 |
| **HPLC** (Principle and instrumentation) | 4,5 | M.alzweiri | 1,4,6,14,15 | Exam | 1, 2 and 4 |
| [**https://www.youtube.com/watch?v=IgdcyAQDKro**](https://www.youtube.com/watch?v=IgdcyAQDKro)[**https://www.youtube.com/watch?v=Ia8yrBL2Xwc**](https://www.youtube.com/watch?v=Ia8yrBL2Xwc) | 5 |  |  |  | online |
| **HPLC: Efficiency of Separation** (Factors affecting resolutionand peak broadening,Van Deemter Equation) | 5 | M.alzweiri | 1,4,6,7,14,15 | Exam, Assignment | 1, 2 and 4 |
| [**https://www.youtube.com/watch?v=wG5nDzKuGDU**](https://www.youtube.com/watch?v=wG5nDzKuGDU)[**https://www.youtube.com/watch?v=u7EPAPQDLlY**](https://www.youtube.com/watch?v=u7EPAPQDLlY)[**https://www.youtube.com/watch?v=p2KvzK81s2g**](https://www.youtube.com/watch?v=p2KvzK81s2g)[**https://youtu.be/OmMWMGM-P-0**](https://youtu.be/OmMWMGM-P-0)[**https://youtu.be/zE\_tjBHrrIA**](https://youtu.be/zE_tjBHrrIA) | 6 |  |  |  | online |
| **Mid exam**  |  |  |  |  |  |
| **HPLC Detectors and Hyphenated Techniques** | 6,7 | M.alzweiri | 1,4,6,7,14,15 | Exam,  |  1, 2, 4 |
| [**https://youtu.be/fegoVj7YwPM**](https://youtu.be/fegoVj7YwPM)[**https://youtu.be/rcixvHJkHp0**](https://youtu.be/rcixvHJkHp0) | 7 |  |  |  | online |
| **Mass ionisers** | 8 | M.alzweiri | 3,7, 9, 14, 15 | Exam, Quiz | 1 and 2  |
| **Mass analysers** | 8 | M.alzweiri | 3,7, 9, 14, 15 | Exam, Quiz | 1 and 2  |
| **Mass interpretation** | 9 | M.alzweiri | 3,7, 9, 14, 15 | Exam, Quiz | 1 and 2  |
| Student presentations:Types of spraying reagents and detection systems of TLC/Common detectors of GC./HPLC solvents and their specifications/Stationary phase types in HPLC/Photodiode array applications/Common Mass ionizers/Common mass analysers/Column bed physical characteristics | 9-11 | M.alzweiri |  |  | Online presentation for students and face-to-face discussion for the concepts |
| ***Final Exam*** |  |  |  |

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21. Teaching Methods and Assignments:

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| Development of ILOs is promoted through the following teaching and learning methods:

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| ILOs | Teaching and Learning Method |
| ILO1 | Live Lectures through Microsoft teams |
| ILO2 | Live Lectures through Microsoft teams |
| ILO3 | Live Lectures through Microsoft teams |
| ILO4 | Live Lectures through Microsoft teams |
| ILO5 | Live Lectures through Microsoft teams |
| ILO6 | Live Lectures through Microsoft teams |
| ILO7 | Lectures, Assignment, live broadcast visits to CROs and industry |
| ILO8 | Lectures, Case Discussion |
| ILO9 | Lectures, Case Discussion |
| ILO10 | Lectures, Assignment |
| ILO11 | live broadcast visits to CROs |
| ILO12 | Presentations, Oral discussion |
| ILO13 | Presentations , Oral discussion |
| ILO14 | Presentations , Oral discussion |
| ILO15 | Presentations , Oral discussion |

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22. Evaluation Methods and Course Requirements:

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| Opportunities to demonstrate achievement of the ILOs are provided through the following assessment methods and requirements:

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| ILOs | Assessment Method |
| ILO1 | Exams, Quizzes |
| ILO2 | Exams |
| ILO3 | Exams, Quiz |
| ILO4 | Exams, Oral discussion |
| ILO5 | Exams , Oral discussion |
| ILO6 | Exams , Oral discussion |
| ILO7 | Exams, Assignment |
| ILO8 | Exams |
| ILO9 | Exams, Quiz |
| ILO10 | Assignment/evaluation |
| ILO11 | Assignment/evaluation |
| ILO12 | Assignment/evaluation |
| ILO13 | Assignment/evaluation |
| ILO14 | Assignment/evaluation |
| ILO15 | Assignment/evaluation |

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23. Course Policies:

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| A- Attendance policies:According to the University RegulationsAttendance: Mandatory.First warning – with 4 absencesLast warning – with 5 absencesFailing in the subject – with 6 absencesB- Absences from exams and handing in assignments on time:Will result in zero achievement unless health report or other significant excuse is documented.C- Health and safety procedures: NAD- Honesty policy regarding cheating, plagiarism, misbehavior:The participation, the commitment of cheating will lead to applying all following penalties together1) Failing the subject he/she cheated at2) Failing the other subjects taken in the same course3) Not allowed to register for the next semester. The summer semester is not considered as a semesterE- Grading policy:Semester Works 20 Marks (Oral exam (10), Evaluation during the live lectures (10))Midterm Exam 30 MarksFinal Exam 50 MarksTotal 100 MarksF- Available university services that support achievement in the course:Classrooms, , library, internet classes, E-Learning, HPLC, GC, |

24. Required equipment:

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| Data Show, Teaching Board and internet connection  |

**25. References:**

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| 1. Required book (s), assigned reading and audio-visuals:
2. Pharmaceutical Analysis; A Textbook for Pharmacy Students and Pharmaceutical Chemists by David Watson.
3. Recommended books, materials, and media:
4. Undergraduate instrumental analysis by James W.Robinson.
5. Introduction to spectroscopy: A guide for students of organic chemistry by Donald L.Pp, Gary M.L., and George S.K.
6. Principles of Instrumental analysis. D. Skoog, F.J. Holler and T.A Nieman
7. Analytical Chemistry: An introduction for D.A. Skoog, D.M. West and F.J.Holler
8. Bp, USP
9. ICH Guidelines (Validation of Analytical Procedures), Q2(R1). ICH: 2005.

URL: (<http://www.ich.org/products/guidelines/quality/quality-single/article/validation-of-analytical-procedures-text-and-methodology.html>) |

26. Additional information:

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| **Course Material and Announcements:** Students need to use the e-learning page at the JU website in order to get all lecture handouts and guidelines which will be uploaded there. In addition, course related announcements and exam results will be posted on the e-learning page and **it is the responsibility of each student to check the site regularly**.Username and password to access the course on the e-learning page will be provided to students in the beginning of the semester.**Grievance Policy**According to the general policies applied at the University of Jordan for grievance, when there is a complaint or conflict between a student and an academic/staff member or another student, the following procedures must be followed:1. The student writes a formal complaint describing the situation of conflict to the Dean of the School or the President of the University.
2. Dean or President will first try to resolve the controversy by meeting/listening to both parties.
3. If agreement was not possible, Dean or president forms an investigation committee which will follow, within a specified timeline, the general policies for relevant circumstances. The following points are considered:

a.       The committee will meet/talk to both parties and witnesses (if applicable) within two weeks of conflict.b.      All meetings and discussions are documented according to the university policies. c.       Results/ recommendations will be sent to the Dean or President who is responsible for their  implementation |

Name of Course Coordinator: Prof. Muhammed Alzweiri Signature: M.Alzweiri- Date: September 12, 2021

Head of curriculum committee/Department: ------------------------- Signature: ---------------------------------

Head of Department: Dr. Sana Bardaweel Signature: ---------------------------------

Head of curriculum committee/Faculty: ------------------------- Signature: ---------------------------------

Dean: ------------------------------------------- -Signature: ---------------------------------

Copy to:

 Head of Department

 Assistant Dean for Quality Assurance

 Course File