



**Jordan University of Science and Technology**  
**Faculty of Pharmacy**  
**Pharmacy Department**

PHAR735 Chromatography

First Semester 2024-2025

**Course Catalog**

3 Credit Hours. The objective of this course is to familiarise the student with the theory and practice of the state of the art of analytical and preparative chromatographic separation processes. Topics include: Theory of chromatography, chromatographic techniques and LC method selection and development (e.g. choice of sample preparation, columns, mobile phase and detector). An emphasis on development and optimising chromatographic methods coupled to MS will be made. Tutorials, critical reviews of the current literature and laboratory demonstrations in the lab will be employed throughout the course to illustrate important concepts and familiarise students with instrumentation.

**Teaching Method:** Blended

**Text Book**

|                          |   |
|--------------------------|---|
| <b>Title</b>             | Principles in Instrumental Analysis         |
| <b>Author(s)</b>         | Douglas Skoog, James Holler, Stanley Grouch |
| <b>Edition</b>           | 7th Edition                                 |
| <b>Short Name</b>        | Ref #1                                      |
| <b>Other Information</b> |   |

**Course References**

| Short name | Book name   | Author(s)   | Edition     | Other Information |
|------------|---|---|-------------|-------------------|
| Ref #2     | Pharmaceutical Analysis: A Textbook for Pharmacy Students and Pharmaceutical Chemists | David G. Watson   | 5th Edition |                   |
| Ref #3     | Chromacademy  | <a href="https://www.chromacademy.com">https://www.chromacademy.com</a> | 1st Edition |                   |
| Ref #4     | Word/ PDF files   | Miscellaneous   | 1st Edition |                   |
| Ref #5     | HPLC Simulator  | Multidimensional Separations  | 1st Edition |                   |
| Ref #6     | ACD / Method Selection Suite  | ACD / Labs  | 1st Edition |                   |
| Ref #7     | Principles of Instrumental Analysis   | Holler Scoog  | 6th Edition |                   |
| Ref #8     | Quantitative Chemical Analysis  | Daniel Harris   | 6th Edition |                   |

**Instructor**

|                        |                      |
|------------------------|----------------------|
| <b>Name</b>            | Prof. Adnan Massadeh |
| <b>Office Location</b> | P1 L1                |
| <b>Office Hours</b>    |                      |
| <b>Email</b>           | massadeh@just.edu.jo |

**Class Schedule & Room**

Section 1:  
Lecture Time: Sun, Tue : 11:30 - 12:30  
Room: قاعة الندوات/ميدلة

**Tentative List of Topics Covered**

| Weeks  | Topic  | References                                  |
|--------|--|---|
| Week 1 | Introduction: a. What is Chromatography? b. Mobile phase/ Stationery phase c. Liquid Chromatography: Column Chromatography vs Planar Chromatography d. Gas Chromatography e. Chromatogram f. Application of Chromatography: Qualitative Analysis and Quantitative Analysis | From Ref #1                                 |
| Week 1 | Separation Methods   | From Ref #1,<br>From Ref #7                 |
| Week 2 | HPLC Instrumentation   | From Ref #1,<br>From Ref #2                 |
| Week 2 | HPLC Columns   | From Ref #1,<br>From Ref #7                 |
| Week 3 | HPLC Detectors: UV-Vis Absorbance Detector, Fluorescence Detector, Refractive Index Detector, Electrochemical Detector, Mass evaporative Detector, Coupled Detectors, Calibration Methods : Internal, External and Standard Addition Calibrations                          | From Ref #1,<br>From Ref #2,<br>From Ref #7 |

|         |   |   |
|---------|---|---|
| Week 4  | LC Theory: a. Peak Retention b. Peak Efficiency c. Resolution d. Van Deemter Equation   | From Ref #1,<br>From Ref #7                 |
| Week 5  | LC Method Selection: a. Macromolecular Separation b. Hydrophobic Interaction Chromatography c. Normal Phase Liquid Chromatography d. Reversed Phase Liquid Chromatography | From Ref #1,<br>From Ref #7                 |
| Week 6  | Strategies for Ionizable Compounds: a. Ion Suppression b. Ion Pair Chromatography c. Ion exchange Chromatography d. Derivatisation  | From Ref #1,<br>From Ref #7                 |
| Week 7  | Sample Preparation: Liquid extraction Solid phase extraction Supercritical fluid extraction Protein precipitation Salting out Liquid-Liquid Extraction (SALLE)            | From Ref #1,<br>From Ref #7                 |
| Week 8  | Size Exclusion Chromatography   | From Ref #1,<br>From Ref #7                 |
| Week 8  | Chiral Separation   | From Ref #1,<br>From Ref #3,<br>From Ref #7 |
| Week 8  | Preparative Chromatography: Scaling Up from analytical to preparative LC, Flash Chromatography  | From Ref #1,<br>From Ref #3,<br>From Ref #7 |
| Week 9  | Quantitative Analysis of Small Molecules by LC-MS/MS: Compound dependent parameters Source dependent parameters Chromatography Ionization parameters                      | From Ref #1,<br>From Ref #8                 |
| Week 9  | Method Validation and Regulatory Acceptance Criteria  | From Ref #1,<br>From Ref #8                 |
| Week 10 | Medicinal Chemistry Lab Visit   |   |
| Week 10 | Analytical Lab Visit  |   |
| Week 10 | Beginner's Guide to HPLC- Self Study  | From Ref #3,<br>From Ref #4                 |
| Week 11 | HPLC Introduction- Guided Module  | From Ref #3                                 |
| Week 11 | Reversed Phase Chromatography- Guided Module  | From Ref #3                                 |
| Week 12 | Band Broadening- Guided Module  | ChromAcademy Website From Ref #3            |
| Week 12 | Chromatography Parameters- Guided Module  | ChromAcademy From Ref #3                    |
| Week 13 | Method Development - Guide to Basic   | From Ref #4                                 |
| Week 13 | The Role of Mobile Phase in HPLC  | PDF Slides - Phenomenex From Ref #4         |
| Week 14 | An Efficient Approach to Column Selection- HPLC Method Development  | PowerPoint Slides From Ref #4               |
| Week 14 | Biopharmaceutical Analysis- Guided Module   | ChromAcademy Website From Ref #3            |
| Week 15 | Fundamentals of MS Proteomics - Guided Module   | ChromAcademy Website From Ref #3            |
| Week 15 | Lab Case Study- Quantification of Unknown Drug in Plasma  | From Ref #4                                 |
| Week 16 | HPLC Simulator- Webpage   | From Ref #5                                 |

| Mapping of Course Outcomes to Program Outcomes                           | Course Outcome Weight (Out of 100%) | Assessment method |
|--|-------------------------------------|-------------------|
| Examine the Principles of Liquid Chromatography (LC) [1PLO-MP1]          | 30%                                 |                   |
| Describe Chromatographic Techniques and Instrumentation [1PLO-MP4]       | 20%                                 |                   |
| Recommend Analytical Methodologies for Different Applications [1PLO-MP1] | 25%                                 |                   |
| Interpret Chromatographic Data and Troubleshoot Analyses [1PLO-MP2]      | 25%                                 |                   |

| PLO1.1 | PLO2.1 | PLO3.2 | PLO3.3 | PLO2.2 | PLO2.3 | PLO2.4 | PLO3.1 | PLO3.4 | PLO3.5 | PLO3.6 | PLO4.1 | PLO4.2 | PLO4.3 | PLO4.4 | PLO5.1 | PLO-PT1.1 | PLO-PT2.1 | PLO-PT2.2 | PLO-PT3.1 |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------|-----------|-----------|-----------|
|        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |           |           |           |           |

| Evaluation      |        |
|-----------------|--------|
| Assessment Tool | Weight |
|                 |        |

|   |     |
|---|-----|
| Midterm Exam Includes: Short Exam                                 | 10% |
| Midterm Exam Includes: Seminar by Students                        | 20% |
| Midterm Exam Includes: Scientific Report on Instrumental Analysis | 20% |
| Final Exam  | 50% |

| <b>Policy</b> |  |
|---------------|--|
| Course Policy | <p>Exams: All exams are closed book and notes. The final exam is comprehensive (covers all the material). Incomplete exams need approval from the Dean of Faculty</p> <p>Cheating: Prohibited; and in case of cheating the student will be subject to punishment according to the regulations.</p> <p>Attendance: According to the policy: Absence more than 20% of the lectures, the system is dropped the course electronically.</p> <p>Participation: Participation, answering questions will be taken in consideration.</p> <p>Withdraw: There is a dead time for withdrawing the course through the student services. The student must follow up that dead time with the registration unit based on the academic year calendar.</p> |

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