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**Department of Chemistry**

**College of Science**

**Salahaddin University**

# Subject: Chromatography

**Theoretical Part**

**Course Book –3rd Year -2st semester**

**Lecturer's name: Dr. Rebwar Omar Hassan**

**Academic Year: 2023-2024**

**Course Book (Theory)**

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| **1. Course name** | **Chromatography** |
| **2. Lecturer in charge** | **Dr. Rebwar Omar Hassan** |
| **3. Department/ College** | **Chemistry - College of Science** |
| **4. Contact** | **e-mail:** **Rebwar.hassan@su.edu.krd** |
| **5. Time (in hours) per week**  | **Theory: 2**  |
| **6. Office hours** |  |
| **7. Course code** |  |
| **8. Teacher's academic profile** Academic achievements and Qualifications: (starting from the most recent degree)

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| From- To | Degree | College-University | Country |
| 2009 to date | PhD in Analytical Chemistry, Department of Chemistry | College of Science- University of Salahaddin | Iraq |
| 2001-2002 | M. Sc. in Analytical Chemistry, Department of Chemistry | College of Science- University of Salahaddin | Iraq |
| 1993-1997 | B.Sc. Chemistry, Department of Chemistry,  | College of Science- University of Salahaddin | Iraq |

1. ***Teaching Activities***

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| From- To | Subject | Stage-College | University |
| 20012- to date | I introduction to Analytical Chemistry-Volumetric Analysis | 1st- year students / Chemistry Department-College of Science | Salahaddin University |
| 2012 to date | Advance Separation Techniques | M.Sc student –Chemistry Department –College of Science | Salahaddin University |
| 2013- to date | Organic Functional Group Analysis | M.Sc student –Chemistry Department –College of Science | Salahaddin University |
| 2009-2011 | Analytical Chemistry- Separation Methods | 3rd- year students / Chemistry Department-College of Science | Salahaddin University |
| 2009 to date | Environmental Application of Analytical Chemistry  | 1st- year students / Environmental-Department-College of Science | Salahaddin University |
| 2003-2005 | Analytical Chemistry- Separation Methods-Practical Fiel | College of Science, University of Salahaddin | Salahaddin University |

**Published articles, papers and researches:*** + - 1. Separation and determination of Sulfamerazine and Sulfathiazole in Veterinary Drugs by Ion-Pair HPLC. (Tikrit Journal for Pure Science Vol.(9) No.(2) 2003).
			2. Spectrophotometric Determination of Vitamin B1 (Thiamin Hydrochloride) In Pharmaceutical Preparation by Coupling Reaction with Diazotized Sulfanilic acid.) Tikrit Journal of Pharmaceutical Science, Vol. (1), No (2), 2005).
			3. Separation and Determination of Five Water-Soluble Vitamins in Pharmaceutical Preparation by IP RP-HPLC.) Tikrit Journal of Pharmaceutical Science, Vol. (1), No (1), 2005 (.
			4. Determination of Contents Levels of Nitrogen Species (Nitrite, Nitrate and Nitrosamine) In Processed Meat Consumed In Erbil City. (Der Pharma Chemica, Vol. 2,No. 6, 2010, 31).
			5. Reverse-flow-injection analysis (FIA) for the determination of vitamin C in pharmaceutical formulation with chemiluminescence detection. (African Journal of Pure and Applied Chemistry Vol. 5, No. (11), 2011, 373).
			6. Reverse-FIA with Spectrophotometric Detection Method for Determination of Vitamin C. (J. Iran. Chem. Soc., Vol. (8), No.(3), 2011, 662).
			7. Indirect Spectrophotometric determination of Cephalexin in pharmaceutical formulations. (Chemical Science Transection, Vol.(2), No (4), 2013, 1110).
			8. Determination of Nicotinamide by Stopped-Flow Injection method in Pharmaceutical Formulations. (Arabian Journal of Chemistry, Vol. (6), 2013, 393).
			9. Reversed Flow injection method for the Spectrophotometric Determination of Cephalexin in Pharmaceutical Products. (Zanco Journal of pure and Applied Chemistry,Vol.(25), No. (3), 2013).
			10. Spectrophotometric determination of chlorthalidone in pharmaceutical formulations using different order derivative methods. (Arabian Journal of Chemistry, Under press)
			11. Reverse-FIA Technique for the Determination of Omeprazole Using Chemiluminescence Detection. (Zanco Journal of pure and Applied Chemistry, Under press)
			12. Simultaneous spectrophotometric determination of thiamine and pyridoxine in multivitamin dosage forms using H-point standard addition and Vierodt᾿s methods. (Journal of the Iranian Chemical Society, 15(7)(2018), 1603–1612)

***Conferences and Scientific activities:*** 1. Training courses about application international quality according to (*ISO/ IEC 17025:1999*) in analytical laboratory and quality control laboratory.
2. 1st International Conference of Chemical, Environment and Energy; ICCEE-2012, Malaysia.
3. Chemical Safety and Security Officer Training, 18th -20th June, 2013, University of Salahaddin, Iraq (Sponsored by the United State Department of State).
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| **9. Keywords** | Separation techniques, Extraction, Solid phase extraction, Distillation, Precipitation, Volatilization |
| **10. Course Overview:**Separation Science is a senior-level undergraduate course within the analytical chemistry lecture series. It focuses on the chemical and physical separation of substances, emphasizing separation as a chemical identification and measurement tool.This course will illustrate lecture topics with examples from biological, pharmaceutical, food & drink, and environmental sample analysis. This approach will highlight the scope and impact of separation science on society and provide concrete examples of identifying appropriate separation and analysis strategies depending on the target analyte(s) and sample matrix. |
| **11. Course Objective:**This course provides an introduction to the fundamental principles of separation techniques. It aims to teach you how to correctly handle and interpret experimental measurements and perform analytical procedures effectively. Through this course, you will understand the methodologies used in separation science and develop practical skills essential for conducting precise and accurate chemical analyses. |
| **12.** Student's Obligation:Each student must prepare a report on a separation method not covered or discussed during the course. This report should include the theory, principles, and a discussion of the selected technique, explaining how it helps improve the understanding of the principles of separation science. |
| **13. Forms of teaching**Data show and whiteboard  |
| **14. Assessment scheme**The students are required to take two closed exams during the course period. The assessment components and their respective weightings are as follows:Exams (closed and optional): 8%Quiz tests and homework: 5%Classroom participation and assignments: 2%Final Exam: 60%The final grade will be based on the cumulative performance in these areas. |
| **15. Student learning outcome:**Students will understand the basic principles and gain practical experience with various analytical methods. Additionally, they will become familiar with numerous other separation techniques that may be useful in their future professional endeavors. |
| **16. Course Reading List and References‌:**The student can find additional information and examples in the following references1. Modern Analytical Chemistry; by David Harvey.2. Fundamentals of Analytical Chemistry; Eighth Edition, by Douglas A. Skoog, DonaldM. West, F. James Holler and Stanley R. Crouch.3. Principles and Practice of Analytical Chemistry, Fifth Edition, by F.W. Fifield and D.Kealey.4. Vogels, Textbook of Quantitative Chemical Analysis, Fifth Edition, G.H. Jeffery, J.Bassett, J. Mendham and R.C. Denney.5. Quantitative Chemical analysis, Seventh Edition, -Daniel C. Harris. |
| **17. The Topics:** | **Lecturer's name** |
| Course Program (Chromatography)**-**General Introduction to Separation Science1- Introduction* 1. Chromatography

-Definition -Chromatographic Theories1- Plate Theory1. Rate Theory
* Chromatographic Resolutions
* Classification of Different Chromatographic Methods
1. Classification according to the types of mobile phase
2. Geometry of the System
3. Classification according to the mode of operation
4. Principle of Separation.
* Adsorption Chromatography

Types of adsorbents* **Partition Chromatography**
* Mobile phase Operations in Chromatography
1. Elution
2. Frontal
3. Displacement
* **Paper Chromatography (PC)**
* **Type of paper**
* **Choice of solvent in PC**
* **Techniques of Paper Chromatography**

**I-Ascending Paper Chromatography**.**II-Descending Paper Chromatography.****III-Two-dimensional Separations on Paper****IV-Horizontal or Circular Paper Chromatography*** **Preparative paper chromatography**
* **Quantitative application of PC**
* **Thin Layer Chromatography (TLC)**
* ***Additive to the Stationary layer in TLC***
* **Ion Exchange Chromatography (IEC)**
* Classification of Ion-Exchanger
* **Resin Capacity**
* **Liquid Chromatography (LC)**
* **High performance Liquid Chromatography (HPLC)**
* **Elution System in HPLC**

**1- Isocratic Elution****2- Gradient Elution*** **Ion-Pair Chromatography**
* **Ion Chromatography**
* **Gas Chromatography**
 | Lecturer's name: Dr Rebwar Omar Hassan. |
| **20. Peer review پێداچوونه‌وه‌ی هاوه‌ڵ**   |