Course Specification
(Bachelor)

Course Title:	**Chemical Separation Methods**
Course Code:	**CHM 1231**
Program:	**Bachelor of Science in Chemical Laboratories**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammed Ibn Saud Islamic University**
Version:	2024- **1**
Last Revision Date:	**15 September 2024**

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A. General information about the course:

-1. Course Identification

1. Credit hours: 4 (3, 3, 0)					
4 (3 Lectures, 3 Lab, 0 Tutorials)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: Level 3/ Year 2					
4. Course general Description:					
The course offers an extensive study about Chemical separation methods and various approaches to chemical analysis. The topics include Liquid- Liquid extraction, Solid Phase Extraction. Ion exchange and types of ion exchangers, size exclusion, adsorption and partition.					
5. Pre-requirements for this course (if any)**:**					
Chemical Calculations CHM 1131					
6. Co-requisites for this course (if any)**:**					
None					
7. Course Main Objective(s):					

The main objective of this course is to help students to gain a wide knowledge about the fundamentals of different chemical separation processes used in analytical chemistry.

By the end of this course, students will have the ability to:

- Recognize the basic kinds of classical chemical separation methods.
- Apply the simple extraction methods including solvent extraction, paper and thin layer extraction.
- Recognize the suitable separation method for certain compounds and mixtures.
- Distinguish the main factors affecting the separation process.
- Learn how to deal with the resulted experimental data

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	**90**	**100%**
2	E-learning	**0**	**0**
3	Hybrid • Traditional classroom • E-learning	**0**	**0**
4	Distance learning	**0**	**0**

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**45**
2.	**Laboratory/Studio**	**45**
3.	**Field**	**0**
4.	**Tutorial**	**0**
5.	**Others (specify)**	**0**
Total		90

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**To outline principles of chemical separations and construction of relevant instrumentation.**	**K1, K2, K3**	lecturing	Short quizzes
1.2	**To name factors that affect performance of chemical separation methods**	**K2, K3**	Lecturing, group discussions, Homework and assignment	Oral test, Homework and assignment marks and written exams

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
	especially GC and HPLC and optimize respective operating conditions.			
1.3	**To describe experimental methods to separate plant extract components**	**K1, K2**	Tutorials and laboratory experiments.	Participation, Quizzes and MCQs, laboratory reports
2.0	**Skills**			
2.1	To identify the scientific separation methods employed in multidisciplinary fields such as environmental and pharmaceutical analysis.	**S1, S3**	Lectures and laboratory sessions	Quizzes, Exams, Homework assignment and laboratory reports
2.2	To design experimental setup for separation of compounds with different properties such as polarity and solubility.	**S1**	Lecturing and oral discussion supported by laboratory experiments	Homework assignment, Examination and laboratory report
2.3	To demonstrate oral communication skills by presenting seminars before his class mates and teaching staff, to write reports about real pollution cases in his community and operate electronic mail and Network skills in	**S2, S3**	• Oral participation • Group discussions and lab experiment and reports • Encourage students to use electronic mail to submit homework and assignments.	• Oral tests and lab performance, reports and sheets Marks • Assignments and homework marks

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
	communicating with others.			
3.0	**Values, autonomy, and responsibility**			
3.1	**To appraise teamwork and create awareness to maintain scientific integrity during different assessments, projects, and mini-reports.**	**V1, V2**	• Group discussion and assignments • Lab. Reports • Virtual labs and demonstration • homework	• Oral tests Assignments • Lab performance, • Lab-reports and sheets marks • homework marks

C. Course Content

No	List of Topics	Contact Hours
1.	**Introduction to separation: Pre-concentration, quantification, purity and role of separation. Simple separation methods depending on sieving, sublimation, masking, precipitation, distillation, re-crystallization, filtration, decantation, ion-exchange and centrifugation, Introduction to the developed method of separation, requirements and specifications**	**12**
2.	**liquid-liquid extraction and its application**	**9**
3.	**liquid–solid extraction**	**6**
4.	**soild-pahse micro and solid-phase nano extractions**	**6**
5.	**stir-bar sorptive extraction**	**6**
6.	**Applications**	**6**
	Sub-Total	**45**

No	List of Topics Practical	Contact Hours
1	Sieving: Separation based on the Particle size of solid samples.	**3**
2	Separation of a Solid Mixture: by Sublimation,	**3**
3	Separation of a Solid Mixture: Dissolution and Filtration.	**3**
4	Separations Based on Mass or Density: Centrifugation	**3**
5	Separations Based on Complexation Reactions: Masking	**3**

6	Re-crystallization and Vacuum Filtration: Purification of Medical ingredients from analgesic tablets,	3
7	Fractional Distillation of organic liquids mixture	3
8	Fractional distillation under reduced pressure	3
9	Fractional precipitation	3
10	Liquid - Liquid Extraction: Determination of distribution coefficient K_D.	3
11	Liquid-Liquid Extraction: Comparison between Single and Multiple extractions	3
12	Applications to Liquid-Liquid Extraction: Determination of copper as the Diethyldithiocarbamate complex	3
13	Applications to Liquid-Liquid Extraction: Determination of iron as the 8-Hydroxyquinolate complex.	3
14	Acid-Base Extraction: Separation of organic mixture by acid-base extraction	3
15	Revision and Lab Reports overview	3
	Sub-total	**45**
Total		**90**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes, Attendance, Participation, Homework	All the semester	10%
2.	Laboratory	All the semester	30%
3.	Midterm Exam 1	Around 6th -7th week	10%
4.	Midterm Exam 2	Around 11th -12th week	10%
5.	Final Exam	Around 15th – 16th week	40%
6.	Total		100%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	• **Quantitative Chemical Analysis**, Daniel C. Harris, 8th Ed., 2010, W. H. Freeman & Co., New York, ISBN: 9781429218153.

Supportive References	• David Harvey, **Modern Analytical Chemistry**, McGraw-Hill Education (ISE Editions); International Ed edition (November 1, 1999), ISBN-10 : 0071169539, ISBN-13 : 978-0071169530 • **Chemical Analysis: Modern Instrumentation Methods and Techniques**, Francis Rouessac, Annick Rouessac, John Wiley & Sons, 2nd, 2007.ISBN: 0470859040, 9780470859049. • **Principles of Instrumental Analysis**, D. A. Skoog, F. J. Holler, S.R. Crouch, Brooks Cole; sixth edition (2006), ISBN: 0495012017, 978-0495012016. • **Chromatography: Fundamentals and applications of chromatography and related differential migration methods**, Heftmann ،E , 6th Ed, Elsevier Science, 2004., ISBN: 0444511067, 978-0444511065. • Pradyot Patnaik, **Dean's Analytical Chemistry Handbook**, McGraw Hill; 2nd edition (May 28, 2004), ISBN-10 : 0071410600, ISBN-13 : 978-0071410601
Electronic Materials	• Blackboard • http://highered.mcgrawhill.com/classware/ala.do?isbn=0073048518&alaid=ala_1136810&protected=true&showSelfStudyTree=true • http://www.chem1.com/acad/webtext/virtualtextbook.html • http://www.shodor.org/UNChem/index.html
Other Learning Materials	Journal of chromatography. Encyclopedia of chemistry

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• **Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students.** • **In each laboratory, a list of safety and precautions are provided.** • **In each lab has proper ventilation, and well equipped with instruments.** • **In each lab, containers for solid waste, liquid waste, and crushed glasses.** • **Each lab has a small pharmacy for first aid in case of an accident** • **In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs**
Technology equipment (projector, smart board, software)	**The rooms are equipped with data show, Smart Board, WI-FI access.**

Items	Resources
Other equipment (depending on the nature of the specialty)	• **Appropriate Glasswares for carrying the requested experiments (conical flasks, beakers, measuring cylinders)** • **Appropriate fine chemicals and solvents (distilled Water ammonium nitrate)** • **Analytical balance (3 digits), Set gas laws with the glass jacket Data acquisition set for gas laws with glass jacket, PC, Windows® 95 or higher, calorimeter, thermometer, Filter papers , clamps, stands**

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**Students**	**Direct**: Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. Indirect: External assessor report.
Effectiveness of Students assessment	**Program Leaders**	**Direct:** Course e-Portfolio. **Indirect:** Course report
Quality of learning resources	**Students**	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct**: Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.
The extent to which CLOs have been achieved	**Course Responsible**	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.

Assessment Areas/Issues	Assessor	Assessment Methods
Other	**Students**	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.
	Course Responsible	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**COUNCIL OF DEPARTMENT OF CHEMISTRY**
REFERENCE NO.	**3 (NO. 1/3)**
DATE	**5/3/1446- 8/09/2024**