School of Chemistry Faculty of Science University of the Punjab, Lahore Course Outline



separation of complex mixture. The students will be able to understam The students will also learn about the basic concepts of chromatograph Chromatographic techniques: Basic principle of chromatography, classifications of chromatograph column, paper and thin layer chromatographic techniques; their instrand limitations Ion exchange chromatography: Cation exchange resin, anion exchange resin, cross-linkage, effect separation of metal ions by anions/cations exchange columns, applichromatography. Learning Outcomes On the completion of the course, the students will: 1. Explain the basic principles and classifications of chromatography. Sexplain the principles and applications of ion exchange chromatography. 5. Perform separations of metal ions using anion and cation exchange and applications in analytical chemistry reachromatography. 6. Course Content A Week 1 Introduction to Chromatography Co Overview of different types of chromatography Re Re Overview of different types of chromatography Re Re Week 3 Principles of column Chromatography Re Applications and Limitations of Column Re Applications and Limitations of Column	BS Chemistry Semester-V							
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Learning Outcomes On the completion of the course, the students will: 1. Explain the basic principles and classifications of chromat 2. Implement practical applications of column, paper, and thi 3. Explain the principles and applications of ion exchange ch 4. Understand the effect of pH on amino acids and its signic chromatography. 5. Perform separations of metal ions using anion and cation et course Content Metek 1 Introduction to Chromatography Classifications of Chromatography Co Week 1 Introduction to Chromatography Re Overview of different types of chromatography Comparison between various chromatography Re Week 3 Theory of Column Chromatography Re Week 4 Theory of Column chromatography Re Instrumentation and setup quadratic Applications and Limitations of Column	This course will help the students in understanding chromatographic techniques, involving separation of complex mixture. The students will be able to understand ion exchange methods. The students will also learn about the basic concepts of chromatography. Chromatographic techniques: Basic principle of chromatography, classifications of chromatographic techniques, theory of column, paper and thin layer chromatographic techniques; their instrumentation, applications and limitations Ion exchange chromatography: Cation exchange resin, anion exchange resin, cross-linkage, effect of pH on amino acids,							
On the completion of the course, the students will: 1. Explain the basic principles and classifications of chromat 2. Implement practical applications of column, paper, and thi 3. Explain the principles and applications of ion exchange ch 4. Understand the effect of pH on amino acids and its signic chromatography. 5. Perform separations of metal ions using anion and cation e Course Content Meek 1 Introduction to Chromatography Re Overview of different types of chromatography Comparison between various chromatography Re discussion Week 3 Theory of Column Chromatography Re Output for column chromatography Re Output for column chromatography Re Overview of different types of chromatography Comparison between various chromatography Class Discussion Theory of Column Chromatography Instrumentation and setup Applications and Limitations of Column Chromatography Re <	chromatog	raphy						
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Chromatography	Week 3	Principles of column chromatography lecture and make possible				ossible		
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	Theory of Paper Chromatography	Read and understand the
Week 5	Principles of paper chromatography	lecture and make possible
	Instrumentation and setup	question for discussion
	Class discussion	1
	Applications and Limitations of Paper	Read and understand the
Week 6	Chromatography	lecture and make possible
WEEK U	Practical applications of paper chromatography	question for discussion
	Limitations and troubleshooting	
	Theory of Thin Layer Chromatography (TLC)	
	Principles of TLC	Read and understand the
Week 7	Instrumentation and setup	lecture and make possible
	Practical applications of TLC	question for discussion
	Limitations and troubleshooting	
Week 8	Mid-term assessment	
	Introduction to Ion Exchange Chromatography	Read and understand the
Week 9	Basic principles of ion exchange chromatography	lecture and make possible
-	Importance and applications in analytical chemistry	question for discussion
	Principles of Chromatography	Read and understand the
Week 10	Basic principles of separation techniques	lecture and make possible
WEEK IU	Understanding retention, selectivity, and resolution	question for discussion
	Class discussion	
	Cation Exchange Resin	Read and understand the
Week 11	Properties and functions of cation exchange resins	lecture and make possible
	Practical applications	question for discussion
	Anion Exchange Resin	Read and understand the
Week 12	Properties and functions of anion exchange resins	lecture and make possible
	Practical applications	question for discussion
	Quiz	
Week 13	Cross-Linkage in Ion Exchange Resins	Read and understand the
	Understanding cross-linkage and its significance	lecture and make possible
	Practical applications	question for discussion
Week 14	Effect of pH on Amino Acids	Read and understand the
	How pH affects amino acids in ion exchange	lecture and make possible
	chromatography	question for discussion
	Practical examples and experiments	1
Week 15	Separation of Metal Ions by Anion/Cation Exchange Columns	Read and understand the
	Techniques for separating metal ions	lecture and make possible
	Practical applications and examples	question for discussion
Weels 16	Final assessment	
Week 16		

Textbooks and Reading Material

- 1. Chromatography by R.K Sharma, Gogel publishing home meerret
- 2. Introduction to chromatography by Nasir-ud-din, Published by author
- 3. Modern analytical chemistry by David Harvey, Roohani-art press, Islamabad
- 4. Principle and Practice of analytical chemistry by Fillfield, Blackwell Science Ltd
- 5. Fundamentals of Chromatography by H.G. Cassidy, Inter Science Publisher, London, N.Y.
- 6. Fundamentals of Analytical Chemistry by Doughlas Skoog and Donals M. W. West, Holt Reinchart and Inc, London.
- 7. Analytical Chemistry by G. D. Christian

Teaching Learning Strategies

- 1. Lecturing using white/black board/Multimedia
- 2. Written Assignments
- 3. Class activities and discussion
- 4. Quiz about last lecture
- 5. Presentations

Assignments: Types and Number with Calendar

Assignments, quiz, Tasks, Presentation, etc.

	Assessment						
Sr. No.	Elements	Weightage	Details				
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.				
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.				
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.				

	BS Chemistry Semester V								
Program	ProgrammeBS ChemistryCourse CodeChem- 347Credit Hour		edit Hour	1					
Course	Title	Basic Chromatographic Techniques (Lab-I)		С	ourse Titl	e	Major (Ele	ective)	
		Course	Introduction	n					
chromato separatio	ography ns.	ourse covers basic analytical v. It also finds its applications k components by paper chron	s in various fi		-	-	•	-	
Separation Separation Determinn Separation Separation	on of va on of lea ation o on of m on of ca	ves using thin layer chromato arious amino acids by thin lay af pigments using column ch of the capacity of an ion exch etal ions using cation exchan dmium and zinc using an ani- ions using anion exchange c	ver chromato romatograph ange resin ge chromatog on exchange	grap y grap col	bhy				
Recovery chromato Separatio Separatio	of the graphy on of dy on of m	separated bromophenol blue	, congo red a 1y circular pape	ind j er ch	iromatogra	phy	g TLC/colu	mn	
		Learnii	ng Outcomes	5					
1.	 On the completion of the course, the students will: 1. Analyze and interpret the results of paper, TLC, and column chromatography experiments. 2. Separate metal ions and anions using ion exchange chromatography. 3. Analyze and interpret the results of ion exchange chromatography experiments. 								
		Course Content		•	As	sign	nents/Read	lings	
Week 1	Week 1 Overview of chromatography principles				reco	Collect the material from recommended books and perform experiments			
Week 2	Separation of ink components by paper Collect the ma			nded book	and and				
Week 3	Collect the material free				l from and				
Week 4	Week 4Separation of various amino acids by thin layer chromatographyCollect the material from recommended books a perform experiments				as and				
Week 5	Week 5Separation of leaf pigments using column chromatographyCollect the material from recommended books and perform experiments				as and				
Week 6	Week 6 Separation of dyes by column chromatography				reco	mme	he materia nded book xperiments	and and	

Week 7red and phenol red using TLC/Column chromatographyrecommended books and perform experimentsWeek 8Mid-term assessmentCollect the material from recommended books and perform experimentsWeek 9Introduction to ion exchange chromatographyCollect the material from recommended books and perform experimentsWeek 10Determination of the capacity of an ion exchange resin the separation of metal ions using cation exchange chromatographyCollect the material from recommended books and perform experimentsWeek 11Separation of metal ions using cation exchange chromatographyCollect the material from recommended books and perform experimentsWeekSeparation of cadmium and zinc using an anionCollect the material from recommended books and perform experiments		Recovery of the separated Bromophenol blue, congo	Collect the material from				
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Week 16 Final assessment Textbooks and Reading Material 1. Vogel's text book of quantitative inorganic analysis by J. Bassett. The English language book Society and Longman 2. Introduction to chromatography by Nasir-ud-din, Published by author 3. Paper chromatography by Dr. Friedrich Cramer, London Macmilian and Co. Ltd 4. Thin-layer chromatography by Marini, Elservier publisher Teaching Learning Strategies 1. Lecturing using white/black board/Multimedia 2. Written Assignments 3. Class activities and discussion 4. Quiz about last lecture 5. Presentations	15	15 chromatography					
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	Assessment					
Sr. No.	Elements	Weightage	Details			
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.			
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.			
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.			