BS Chemistry Semester-V					
Programme	**BS Chemistry**	**Course Code**	**CHEM-346**	**Credit Hours**	**2**
Course Title	**Chromatographic Techniques-I**		**Course Type**	**Major (Elective)**	

Course Introduction

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, separation of metal ions by anions/cations exchange columns, applications of ion exchange chromatography.

Learning Outcomes

On the completion of the course, the students will:

1. Explain the basic principles and classifications of chromatography.
2. Implement practical applications of column, paper, and thin layer chromatography.
3. Explain the principles and applications of ion exchange chromatography.
4. Understand the effect of pH on amino acids and its significance in ion exchange chromatography.
5. Perform separations of metal ions using anion and cation exchange columns.

	Course Content	**Assignments/Readings**
Week 1	Introduction to Chromatography Basic principles of chromatography Importance and applications in analytical chemistry	Collect the material from recommended books and read as per lecture
Week 2	Classifications of Chromatographic Techniques Overview of different types of chromatography Comparison between various chromatographic techniques	Read and understand the lecture and make possible question for discussion
	Class Discussion	
Week 3	Theory of Column Chromatography Principles of column chromatography Instrumentation and setup	Read and understand the lecture and make possible question for discussion
Week 4	Applications and Limitations of Column Chromatography Practical applications of column chromatography Limitations and troubleshooting	Read and understand the lecture and make possible question for discussion
	Quiz	
Week 5	Theory of Paper Chromatography Principles of paper chromatography Instrumentation and setup	Read and understand the lecture and make possible question for discussion
	Class discussion	
Week 6	Applications and Limitations of Paper Chromatography Practical applications of paper chromatography Limitations and troubleshooting	Read and understand the lecture and make possible question for discussion

Week 7	Theory of Thin Layer Chromatography (TLC) Principles of TLC Instrumentation and setup Practical applications of TLC Limitations and troubleshooting	Read and understand the lecture and make possible question for discussion
Week 8	Mid-term assessment	
Week 9	Introduction to Ion Exchange Chromatography Basic principles of ion exchange chromatography Importance and applications in analytical chemistry	Read and understand the lecture and make possible question for discussion
Week 10	Principles of Chromatography Basic principles of separation techniques Understanding retention, selectivity, and resolution	Read and understand the lecture and make possible question for discussion
	Class discussion	
Week 11	Cation Exchange Resin Properties and functions of cation exchange resins Practical applications	Read and understand the lecture and make possible question for discussion
Week 12	Anion Exchange Resin Properties and functions of anion exchange resins Practical applications	Read and understand the lecture and make possible question for discussion
Week 13	Quiz	
	Cross-Linkage in Ion Exchange Resins Understanding cross-linkage and its significance Practical applications	Read and understand the lecture and make possible question for discussion
Week 14	Effect of pH on Amino Acids How pH affects amino acids in ion exchange chromatography Practical examples and experiments	Read and understand the lecture and make possible question for discussion
Week 15	Separation of Metal Ions by Anion/Cation Exchange Columns Techniques for separating metal ions Practical applications and examples	Read and understand the lecture and make possible question for discussion
Week 16	Final assessment	

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.