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M. Sc. Chemistry, I Semester
End-term Examination 2023

Paper Name: Analytical Chemistry

Time: 3 hours 2.5 hrs.

Paper Code: MCHCC104

Maximum Marks: 60

Note: This paper has 3 sections A, B, and C, Attempt all three sections

Section A: Answer *all* the questions; **Section B:** Answer *any 2* out of 4; **Section C:** Answer *all* the questions, each question has an *internal choice*.

Abbreviations Used

CLO- Course Learning Outcome, PLO- Program learning Outcome, BTL- Bloom Taxonomy Level: BT level 1-Remember; BT level 2-Understand; BT level 3-Apply; BT level 4-Analyse; BT level 5-Evaluate, BT level 6-Create.

Q.No		BTL	CLO	PLO
<u>SECTION A</u>				
Attempt <u>all</u> questions		(10x1.5= 15 Marks)		
A 1.	Compare isocratic and gradient elution techniques in column chromatography.	2	3	1
A 2.	What are the basic principles of thermogravimetric analysis (TGA), differential thermal analysis (DTA), and differential scanning calorimetry (DSC)?	2	2	2
A3	Outline the operating parameters and theoretical aspects of column chromatography.	4	3	1
A 4.	What are the functions of the carrier gas, column, detector, and recorder in a GC system?	3	4	1
A 5.	What type of species can be separated by GC but not by HPLC?	4	4	2
A 6.	Discuss the theory and experimental design of size exclusion chromatography.	6	5	1
A 7.	Explain the principles and characteristics of adsorption/partition chromatography.	3	1	3
A 8.	Describe the physical differences between capillary and packed columns. What are the advantages and disadvantages of each?	4	3	2
A 9.	What are the operating parameters in HPLC?	4	4	2
A 10.	Evaluate the role of acid and base resins in ion exchange chromatography. Explain with examples.	6	5	1

SECTION B

Attempt <u>any two</u> out of four		(2x10=20 Marks)		
B 1.	What are the key differences between gas-liquid and gas-solid chromatography? Why is gas-solid chromatography not as widely used as gas-liquid chromatography?	4	4	1
B 2.	What are the different applications of size exclusion chromatography? How is it used to determine the molecular weight of a polymer?	4	3	3
B 3.	Explore the working principles and applications of ion exchange chromatography.	4	5	2
B 4.	Investigate the working principles of scintillation counters in the detection of nuclear radiation. How does scintillation technology enhance the accuracy and sensitivity of measurements?	3	2	3

SECTION C

Attempt *all* questions, each question has an Internal choice

(5x5=25 Marks)

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| C 1. Label the instrumental components of the HPLC system and explain their functions. | 2 | 4 | 1 |
| OR | | | |
| Differentiate between analytical and preparative thin-layer chromatography. | 1 | 1 | 1 |
| C 2. What is retention time in GC? How is it measured? What factors affect it? | 4 | 4 | 2 |
| OR | | | |
| Explain the differences between normal and reverse-phase column chromatography. | 1 | 3 | 2 |
| C 3. Explain the principles behind radioactive decay measurements. Discuss how these measurements contribute to the determination of the half-life of a radioactive substance. | 3 | 2 | 2 |
| OR | | | |
| Discuss the instrumentation of GC. | 1 | 2 | 2 |
| C 4. Describe the fundamental difference between ion exchange and size exclusion chromatography. | 2 | 5 | 2 |
| OR | | | |
| Analyze the principles and applications of semi-conductor detectors in nuclear radiation methods. | 5 | 2 | 2 |
| C 5. Discuss the interpretation of TGA curves for calcium oxalate monohydrate and its significance in thermal analysis. | 6 | 2 | 1 |
| OR | | | |
| Describe the different types of gels used in size exclusion chromatography, emphasizing their characteristics. | 1 | 5 | 1 |
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