No. of Printed Pages : 6

MCH–022

M. SC. IN CHEMISTRY

(MSCCHEM)

Term-End Examination

December, 2025

MCH-022 : SEPARATION AND SPECTROSCOPIC METHODS

Time : 2 Hours *Maximum Marks : 50*

Note : *This question paper has two Parts–Part A and Part B. Attempt number of questions as instructed in each Part.*

Part—A

Note : *Answer any* ***one*** *of the following questions.*

1. Briefly explain distribution law. Also give its limitations. 5

2. List any *five* characteristics of support material used in liquid-liquid partition chromatography. 5

Note : *Answer any* ***five*** *of the following questions.*

3. Briefly discuss various interaction forces which can aid in Gas Chromatography (GC) separations. 4

4. List any *four* materials which are used for column tubing in HPLC. Also, give reasons for choice of each of these materials. 4

5. What are the requirements of an ion exchanger ? 4

6. List the essential requirements of gels used in size exclusion chromatography. 4

7. Give a brief account of reverse osmosis as a membrane process. 4

8. What is electroosmotic flow ? Illustrate using a suitable diagram. 4

Part—B

Note : *Answer any* ***five*** *of the following questions.*

9. (a) What are monochromators ? Draw a schematic diagram of any *one* type of monochromator. 2.5

   (b) List any *two* factors responsible for the deviations from Beer-Lambert's law. Give explanation of any *one* of these factors. 2.5

10. (a) Explain the selection rule for the vibrational spectroscopy. 2.5

    (b) List the components of an IR spectrometer and write any *one* radiation source used. 2.5

11. (a) Name the sampling techniques for the preparation of solid samples in IR spectrometry and explain any *one* of them. 2.5

    (b) Differentiate between photo-luminesence and chemiluminesence giving an example for each. 2.5

12. (a) Name the non-radiative deactivation processes in phosphorescence methods and explain any *one* of them. 2.5

    (b) Name the radiation source that is widely used in AAS. Describe in brief with illustration. 2.5

13. (a) What are the ways of achieving resonance in NMR ? Illustrate your answer for any *one* way. 2.5

(b) With the help of an example, explain the anisotropy of chemical bonds in NMR. 2.5

14. (a) Write any *two* points of similarities and *three* points of differences between ^{13}C-NMR and ^{1}H-NMR. 2.5

(b) Name the factors responsible for the intensity of ^{13}C peaks. Explain in brief. 2.5

15. (a) Name the time periods of a 2D NMR sequence and represent these graphically. 2.5

(b) Name the gas phase ion sources of a mass spectrometer. Write the type of samples where these ion sources are used. 2.5

16. (a) What is meant by interfaces in hyphenated techniques ? Write any *two* roles of interfaces. 2.5

(b) Why the X-ray tube has a provision of continuous flow of water for cooling during the generation of X-rays ? Illustrate graphically a typical X-ray spectrum with labelling. 2.5

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