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MCH-003

**POST GRADUATE DIPLOMA IN
ANALYTICAL CHEMISTRY (PGDAC)**

Term-End Examination

December, 2022

MCH-003 : SPECTROSCOPIC METHODS

Time : 3 Hours

Maximum Marks : 75

Note : (i) *Answer any **five** questions.*

(ii) *All questions carry equal marks.*

1. Answer any *three* of the following :

- (a) Explain the difference between atomic absorption and molecular absorption. Draw simplified energy level diagram showing the reason for observing band spectrum in molecules.

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- (b) What are charge transfer complexes ?
Draw the spectrum of $\text{Fe}(\text{SCN})^{2+}$ along with schematic diagram showing the disposition of the molecular orbitals of donor, acceptor and charge transfer species. 5
- (c) Write the applications of phosphorescence spectroscopy for various metal ions. 5
- (d) Draw the low and high resolution NMR spectrum of ethanol and explain its splitting pattern. 5
- (e) Describe any *one* application each of AAS and AES. 5
2. (a) Explain refraction and reflection diagrammatically and mathematically. 5

- (b) List the sources of IR radiations. Describe sampling of solid for IR spectroscopy. 5
- (c) Write the steps involved in the quantitative determination by UV-spectrophotometry and explain any *one* step. 5
3. (a) What do you understand by depolarisation ratio ? Define degree of depolarisation. How does it help in the assignment of signals ? 5
- (b) Explain the term chemiluminescence with a suitable example. Schematically show possible electronic states of the molecule. 5
- (c) What is fluorescence spectrum ? Draw excitation and emission fluorescence spectra of 9-methyl anthracene. 5

4. (a) List the factors affecting fluorescence.
Explain the effect of any *two* factors. 5
- (b) Write any *five* advantages of FT-IR. 5
- (c) Explain how fluorescence spectroscopy can be used in quantitative analysis. Explain the expression between concentration and fluorescence intensity. 5
5. (a) Write the steps encountered by a sample in the flame. Explain these diagrammatically. 5
- (b) Write the advantages and disadvantages of total consumption burner used in flame photometry. 5
- (c) Describe the quantitative analysis in flame photometry using calibration plot and standard addition method. 5

6. (a) Draw a schematic diagram of hollow cathode lamp illustrating different components. What is electrodeless discharge lamp ? 5
- (b) Explain the function of graphite furnace with the help of a schematic diagram. 5
- (c) List the types of interferences in AAS and explain any *one*. 5
7. (a) Explain hydride generation technique with the help of schematic diagram. Write the elements for which this technique is better suited and give reason. 5
- (b) What is Inductively Coupled Plasma (ICP) ? Explain the mechanism of plasma formation. 5

- (c) Discuss the use of ICP-AES in quantitative analysis. 5
8. (a) Define chemical shift in NMR and mention its units. Name the standard used for measuring chemical shift and write its characteristics. 5
- (b) Describe the method of sample preparation for determination by AAS and AES. 5
- (c) Draw and explain the mass spectrum of butanal. 5