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MCH-003

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

Term-End Examination

June, 2023

MCH-003 : SPECTROSCOPIC METHODS

Time : 3 Hours

Maximum Marks : 75

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

(ii) *All questions carry equal marks.*

1. (a) Explain fluorescence. Name any *three* minerals that start emitting fluorescence on exposure to UV radiation. 5
- (b) Draw transitions for fundamental vibration and the overtones with selection rule for vibrational spectroscopy. 5
- (c) Why organic solvents of low molar mass are preferred in AAs sample handling ? Explain its advantages. 5

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2. (a) Name the *three* components in molecular energy level and draw all these transitions in a simplified energy level diagram. 5
- (b) Draw generalized molecular energy level diagram showing various possible transitions in organic compounds. What transitions do you expect in ethylene? 5
- (c) A substance has molar absorptivity of $15000 \text{ cm}^{-1} \text{ mol}^{-1} \text{ dm}^3$ at 520 nm. Calculate the concentration of substance whose solution in a cuvette of 2 cm has an absorbance of 0.90. 5
3. (a) Name any *two* IR radiation sources. Describe the *two* sampling techniques of solids. 5
- (b) Schematically represent the energy changes associated with excitation, Rayleigh scattering and Raman scattering. 5
- (c) Define luminescence, fluorescence and phosphorescence. Draw Jablonski diagram showing the phenomenon of fluorescence. 5

4. (a) Explain the relationship between structure and characteristics of fluorescence of a molecule with suitable examples of any *three* molecules. 5
- (b) List the factors affecting fluorescence. Explain any *two* of these briefly. 5
- (c) Write the essential components of fluorescence spectrometer and draw a schematic diagram of a fluorimeter. 5
5. (a) Write any *five* advantages of FT-IR. 5
- (b) Explain the term bioluminescence. Write the reactions involved in case of the chemical luciferin. Write *one* application of bioluminescence in medical field. 5
- (c) Give schematic representation of atomic absorption (AAs), atomic emission (AEs) and atomic fluorescence (AFs). 5
6. (a) Name any *two* fuel oxidant mixtures. What are the zones of a laminar flow flame ? 5
- (b) Name *two* types of atomizer burners. Draw a schematic labelled diagram of any *one* burner. 5

- (c) List the components of an atomic fluorescence spectrometer. Draw a schematic diagram of an atomic fluorescence spectrometer. 5
7. (a) How is a double beam atomic absorption spectrophotometer better than a single beam spectrophotometer ? Write any *three* features of a modern AAs. 5
- (b) Explain the principle of atomic emission spectrometry. Write any *three* characteristics of an ideal atomisation excitation source. 5
- (c) Give the application of AEC in the elemental analysis of environmental samples. 5
8. (a) Which of the following nuclei have magnetic moment and will be NMR active ? 5
 ${}^2\text{D}$, ${}^{11}\text{B}$, ${}^{19}\text{F}$, ${}^{12}\text{C}$, ${}^{27}\text{Al}$, ${}^{31}\text{P}$
Write the expression of magnetic moment.
- (b) Draw the nature of low resolution NMR spectrum of ethanol and NMR spectrum of benzyl alcohol. 5
- (c) Write the theory of mass spectrometry and draw the mass spectrum of methanol. 5