

**P.G. DIPLOMA IN ANALYTICAL CHEMISTRY
(PGDAC)**

Term-End Examination

June, 2018

01375

MCH-003 : SPECTROSCOPIC METHODS

Time : 3 hours

Maximum Marks : 75

*Note : Attempt any **five** questions. All questions carry equal marks.*

1. Answer any **three** of the following : $3 \times 5 = 15$
- (a) Explain the terms reflection, refraction and diffraction.
 - (b) Define and differentiate between phosphorescence and fluorescence.
 - (c) List and briefly describe various sources of IR radiation.
 - (d) Draw a labelled diagram of a hollow cathode lamp and describe its working.
 - (e) Discuss the role of tetramethylsilane for chemical shift measurement in NMR.

2. (a) Derive the Beer-Lambert law and discuss its importance in quantitative analysis using UV-Vis spectrometry. 5
- (b) Calculate the number of vibrational modes for the molecules CO_2 and SO_2 and explain how these will be different. 5
- (c) Explain Coherent Anti-stokes Raman Spectroscopy (CARS) and represent energy changes during CARS experiment. 5
3. (a) Draw the Jablonski diagram and explain the various processes by which the excited state of a molecule undergoes deactivation. 5
- (b) Draw a schematic layout of a fluorimeter and discuss the different sources used. 5
- (c) Explain the term bioluminescence. How is this phenomenon being used in the medical field? 5
4. (a) Draw a typical atomic spectrum and a typical molecular spectrum. Comment on spectral line width in the two cases. 5
- (b) Define the term nebulisation. Discuss the various processes that occur in the flame. 5

- (c) What are the different types of interferences encountered in quantitative determination by flame photometry ? Explain any one of these briefly. 5
5. (a) Explain the origin of atomic fluorescence and list the different types of atomic fluorescence transitions. 5
- (b) State the principle of Atomic Absorption Spectrophotometry (AAS) and derive an expression relating absorbance and concentration. 5
- (c) List the different methods used for quantitative determination using AAS. Explain any one of these. 5
6. (a) Draw the diagram for the cross-section of a graphite furnace. Give any two advantages and any two disadvantages of GFAAS over Flame AAS. 5
- (b) Explain hydride generation technique with the help of schematic diagram. For which type of elements is it more useful ? 5
- (c) Enlist the characteristics of an ideal atomization-excitation source. What are the various types of plasma sources used in AAS ? 5

7. (a) What are the different types of instruments used for ICP-AES ? Which of these is better and why ? 5
- (b) Compare the characteristics of AAS and AES. 5
- (c) Describe the determination of trace elements in air particulate matter using AES. 5
8. (a) Which of the following nuclei will be NMR active and why ? Explain. 3
 ^1H and ^2H , ^{12}C and ^{13}C , ^{31}P , ^{18}O
- (b) Unit of chemical shift δ is in ppm even though it is not a concentration. Explain δ and τ scales. 4
- (c) What is McLafferty rearrangement ? Explain with the example of butanal ($\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$) and predict its mass spectral features. 8
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