

[This question paper contains 6 printed pages.]

1949

Your Roll No.

B.Sc. (Prog.)/III

D

AC-302 – Instrumental Methods of Analysis

(Admissions of 2005 and onwards)

Time : 3 Hours

Maximum Marks : 75

*(Write your Roll No. on the top immediately
on receipt of this question paper.)*

Attempt six questions in all.

Question No. 1 is compulsory.

*Use of Scientific Calculator and log table is
permitted.*

1. Answer any **five** of the following:

- (i) No $n \rightarrow \sigma^*$ transition is not observed in protonated trimethylamine. Explain.
- (ii) Why half-shadow devices are required for polarimeters. Differentiate between plane polarized radiations and electromagnetic radiations.

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- (iii) What are the gross selection rules for IR spectroscopy? Explain with the help of suitable examples.
- (iv) What is anemia? What are the causes of pernicious anemia.
- (v) What is spin-spin coupling? Explain.
- (vi) Why is it necessary to add NaF at the time of collection of blood, used for the estimation of blood glucose?
- (vii) Which of the following are NMR active and why?
 C^{12} , O^{16} , N^{14} , H^2 , F^{19} , C^{13} , P^{31} (5×3)
2. (i) Explain how the presence of two conjugated chromophores in a molecule shifts both the λ_{max} and ϵ_{max} to higher values.
- (ii) Benzene is colourless and p-benzoquinone is yellow in colour; Which of these will undergo easy excitation.
- (iii) A substance when dissolved in water at $10^{-3}M$ concentration absorbs 10 percent of an incident radiation in a path of 1cm length. What would be

the concentration of the solution in order to absorb 90% of the same radiation?

- (iv) What is chemical shift? (3,3,4,2)
3. (i) Concentrated solutions of alcohols in CCl_4 have an IR absorption band at about 3300cm^{-1} but this band is shifted to a higher frequency on dilution. Explain.
- (ii) Explain the various types of molecular vibrations associated with IR absorption.
- (iii) How will you distinguish *o*-hydroxybenzaldehyde (salicylaldehyde) and *m*-hydroxybenzaldehyde on the basis of IR spectroscopy?
- (iv) How many bands due to fundamental vibrations do you expect in the following molecules:
- (a) Ammonia
- (b) Ethylene
- (c) water (3,3,3,3)
4. (i) Why is TMS selected as a reference compound in NMR spectroscopy?

- (ii) Identify the number of signals and their splitting (with relative intensities) in NMR spectra of following compounds:
- (a) $\text{CH}_3\text{-CH}_2\text{-Br}$
- (b) $\text{CH}_3\text{-CHCl-CH}_3$
- (iii) Calculate the NMR frequency of a bare proton in the magnetic field of 114093 Gauss. Given $g = 5.505$, and $\beta = 5.05 \times 10^{-27} \text{ JT}^{-1}$.
- (iv) If the observed chemical shift of a proton is 315 Hz from TMS at a 90MHz NMR spectrometer, what is the chemical shift in terms of δ ? (3,4,3,2)
5. (i) What is atomization and explain the various processes involve in it?
- (ii) Define specific rotation. On factors does it depend?
- (iii) What is thermogravimetry? What is the importance of a themogram in the thermogravimetry?
- (iv) What is the basic principle of flame Photometry?
(4,3,3,2)

6. Write short note on the following:
- (i) Fluorescence and Phosphorescence
 - (ii) Jablonski Diagram
 - (iii) Coagulation of blood
 - (iv) Limitations of Lambert-Beers law. (3;3,3,3)
7. (i) What is invert sugar? Explain.
- (ii) Define the following terms and explain their biochemical significance:
- (a) Erythrocyte sedimentation rate
 - (b) Iodine value of fats
 - (c) Denaturation of proteins
- (iii) Give the structure of cellulose and explain why cellulose cannot be utilized as a metabolic fuel by human beings. (3,6,3)
8. (i) What are the precautions that must be taken when collecting a blood sample?

- (ii) What changes take place in a urine sample if a preservative is not added to it when it is collected?
- (iii) Name any ONE component of urine which can be tested only in a freshly voided sample.
- (iv) Give the test used to identify ketone bodies in urine. (3,3,3,3)