

Exam. Code : 107405  
Subject Code : 2294

B.Sc. (Biotechnology) 5<sup>th</sup> Semester  
PHYSICAL, ORGANIC & INORGANIC ASPECTS  
OF SPECTROSCOPY—A

Paper—BT-7

Time Allowed—3 Hours] [Maximum Marks—40

SECTION—A

**Note** :— ALL questions in this section are compulsory and each question is of 1 mark.

1. Arrange the following radiations in increasing order of wavelengths : UV, X-rays, Radiowaves, Microwaves  
Visible rays.
2. Convert the following wavelengths to their wave numbers ( $\text{cm}^{-1}$ ) :  
90 MHz, 2.5 microns.
3. For the detection of aldehydes and ketones, which transition is more authentic  $\pi$  to  $\pi^*$  or  $n$  to  $\pi^*$  ?
4. Which spin state is observed at the instant of excitation ?
5. Write the expected infrared peaks for the following compounds :  
Acetic anhydride, Benzamide.
6. How many fundamental vibrational frequencies can be observed in the infrared absorption spectrum of water ?

7. Why do carbon-carbon double bonds and carbonyl bonds absorb at different frequencies ?
8. Describe hypso-chromic effect with an example.

### SECTION—B

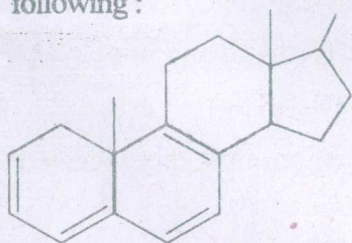
**Note** :— Attempt any **FIVE** questions from this Section. Each question is of **4** marks.

9. What is fluorescence ? How it is different from phosphorescence ?
10. State Born-Oppenheimer approximation.
11. The ultraviolet spectrum of benzonitrile shows a primary absorption band at 224 nm and a secondary band at 271 nm.

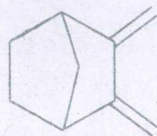
If a solution of benzonitrile in water, with a concentration of  $1 \times 10^{-4}$  molar, is examined at a wavelength of 224 nm, the absorbance determined is 1.30. The cell length is 1 cm, what is the molar absorptivity of this absorption band ?

12. The UV spectrum of acetone shows absorption maximum at 166, 189 and 279 nm. What type of transition is responsible for each of these bands ?
13. Methyl alcohol is a good solvent for the determination of UV spectrum; however it is not a good solvent for infra-red spectroscopy, why ?
14. How many fundamental vibrational frequencies would you expect to observe in the IR spectrum of  $\text{CO}_2$  ?

15. Using Woodward Fieser rules to calculate the  $\lambda_{\max}$  for the following :



(i)



(ii)

16. Describe the following :
- Bathochromic shift
  - Hypsochromic shift.

### SECTION—C

**Note** :— Attempt any **TWO** questions from this Section. Each question is of **6** marks.

- What is Frank Condon principle ? What are its applications and limitations ?
- What is Beer Lambert's Law ? What are its applications and limitations ? Can this law be applied to a concentrated solution ?
- Define Infra-red spectroscopy. Describe various types of fundamental vibrational frequencies. Explain the factors that influence vibrational frequencies.
- What is a Chromophore ? Also explain the term auxochrome. How will you explain the effect of conjugation on the absorption maximum of polyenes ?