

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2024  
B.Tech-I Semester (BT/BI)

COURSE CODE(CREDITS): 18B11PH212(04)

COURSE NAME: Bioinstrumentation Techniques

MAX. MARKS: 35

COURSE INSTRUCTORS: Dr. Ragini Raj Singh

MAX. TIME: 2 Hours

Note: (a) All questions are compulsory.

(b) Marks are indicated against each question in square brackets.

(c) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

Q.1. (a)

While the reduced mass changes upon isotopic substitution (for example, substitution of D for H in DCl vs. HCl), the vibrational force constant does not change; therefore,  $k_{HCl} = k_{DCl}$ .

[CO:1; Marks:3]

a.) Using the values from the handout on vibrational spectroscopy, calculate the ratio of the experimental harmonic frequencies for HCl and DCl,  $\nu_0(\text{HCl})/\nu_0(\text{DCl})$ .

b.) Using the definition of the harmonic frequency in terms of the force constant and reduced mass predict the theoretical value of the frequency ratio. Does it agree with the experimental result?

Q.1. (b) In a sample with an absorbance of 1 at a specific wavelength. What is the relative amount of light that has been absorbed by the sample.

[CO:1; Marks:2]

Q.1. (c) At 580 nm, which is the wavelength of its maximum absorption. The complex  $\text{Fe}(\text{SCN})^{2+}$  has a molar absorptivity of  $7.00 \times 10^3 \text{ L cm}^{-1} \text{ mol}^{-1}$ . Calculate

[CO:2; Marks:2]

(a) the absorbance of a  $2.50 \times 10^{-5} \text{ M}$  solution of the complex at 580 nm in a 1.00 cm cell

(b) the absorbance of a solution in a 2.00 cm cell in which the concentration of the complex is one half that in (a).

(c) the percent transmittance of the solutions described in (a) and (b).

(d) the absorbance of a solution that has half the transmittance of that described in (a).

Q.2. What can we study in SEM? Differentiate between SE and BE in SEM and discuss their impact on image formation.

[CO:2; Marks:2]

Q.3. (a) What is the principle of mass spectrometry explain with the general diagram? For what mass spectrometry used for?

(b) What are the main components of mass spectrometer and what are their functions?

[CO:3; Marks:3]

[CO:3; Marks:2]

Q.4. Discuss the following:

(a) MALDI

(b) ESI

(c) TOF analyzer

(d) FTICR

[CO:4; Marks:2 X 4=8]

Q.5. What is FACS and what are its applications? What are the main parts of the FACS? Explain the whole process of FACS using proper schematic diagram.

[CO:5; Marks:4]

Q.6. WHAT is FISH, discuss its two applications in detail.

[CO:5; Marks:3]

Q.7. (a) What is DLS? Explain the physics behind DLS.

[CO:5; Marks:3]

(b) What is Stokes's Einstein equation? What is correlation function for monodisperse and polydisperse particles?

[CO:5; Marks:3]