JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- MAY-2023

COURSE CODE(CREDITS): 15B11 PH212

COURSE NAME: Bioinstrumentation Techniques

COURSE INSTRUCTORS: Dr. Ragini Raj Singh

MAX. MARKS: 25

MAX. TIME: 1 Hour 30 Minutes

Note: All questions are compulsory. Marks are indicated against each question in square brackets.

Q.1. Which forces are being considered in AFM? Discuss different types of constant force modes with force distance curve. Also discuss the advantages and disadvantages of all. Which mode is best suitable for biological sample analysis? *[CO: 1; Marks: 3]*

Q.2. Where does the signal come from the materials in SEM? Differentiate between SE1 and SE2 types of signals. What is the new technology in ESEM in comparison to conventional SEM?

[CO: 2; Marks: 3]

Q.3. Which mode can be opted to perform analysis of biological samples? Discuss all the necessary steps to prepare biological sample for TEM analysis? *[CO: 3; Marks: 3]*

Q.4. Draw and discus Jablonski diagram for absorption and emission pathways. What are the rules which can impart constraints on possible spectroscopic transitions? Draw the schematic diagram for UV-VIS spectroscopy instrumentattion? *[CO: 4; Marks: 3]*

Q.5. How to measure quantum yield of unknown fluorophore samples? What do you understand by fluorescence lifetime? Also differentiate between ideal and practical fluorescence measurement. *[CO: 4; Marks: 3]*

Q.6. (a) Convert the following transmittance data to absorbance: *[CO: 2; Marks: 2]*

S. No.	T%
a	27.5
b	60.7
c	35.8
d	5
e	9.5

(b) A solution containing the complex formed between Bi(III) and thiourea has a molar absorptivity of 9.32×10^3 L mol^{-1} cm^{-1} at 470 nm. *[CO: 3; Marks: 2]*

(i) What is the absorbance of a 6.24×10^{-5} M solution of the complex at 470 nm in a 1.00 cm cell?

(ii) What is the percent transmittance of the solution described in (i)?

(iii) What is the molar concentration of the complex in a solution that has the absorbance described in (i) when measured at 470 nm in a 5.00 cm cell

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

[CO: 3; Marks: 2]

Calculate

(i) the absorbance of a 2.50×10^{-5} M solution of the complex at 580 nm in a 1.00 cm cell

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

(iii) the percent transmittance of the solutions described in (i) and (ii).

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

Q.7. (a) A molecule phosphoresces with a single peak wavelength of 530 nm. The single fluorescence peak is at 480 nm. The absorption peak is at 410 nm. Sketch a rough Jablonski diagram based on this information, labeling transitions and calculating differences in each energy state in nm and cm⁻¹.

[CO: 4; Marks: 2]

(b) The absorption and emission spectra for quinine are shown in Figure. Does quinine obey the mirror image rule? Based on your response, what can you conclude about whether there is absorption to states above S1?

[CO: 4; Marks: 2]