

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2025

B.Tech-II Semester (BT/BI)

COURSE CODE (CREDITS):18B11PH212 (04)

MAX. MARKS: 25

COURSE NAME: Bioinstrumentation Techniques

COURSE INSTRUCTORS: Ragini Raj Singh

MAX. TIME: 1 Hour 30 minutes

Note: (a) All questions are compulsory.

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

(c) Candidate is allowed to use calculator.

Q. No	Question	CO	Marks
Q1	Define circular dichroism. Discuss that what kind of samples can be analyzed using CD spectroscopy and what information about molecules can be inferred.	2	3
Q2	Compare between ORD, CD and absorbance spectroscopies with the help of appropriate diagrams.	2	3
Q3	a.) How absolute stereochemistry of chromophores can be studies using CD spectroscopy, draw respective diagrams. b.) What is PEM in CD spectrometer?	3	2 1
Q4	Some conditions must be fulfilled for an IR absorbance to occur, what are these conditions, discuss.	3	2
Q5	Write short notes on FTIR advantages: 1. Multiplex 2. Frequency accuracy 3. Throughput	3	3
Q6	The harmonic vibrational frequency of CdS in wavenumbers is 2120 cm^{-1} . (Given mass of Cd=112.414 amu, S= 32.065) a.) Calculate the energies of the first two vibrational levels in Joules. b.) Determine the wavelength for a transition from the $v=0$ to the $v=1$ level. Is this transition in the infrared region of the electromagnetic spectrum?		3
Q7	Using the spectroscopic constants for NaF, $\omega_e = 536.1\text{ cm}^{-1}$ and $x_e = 0.007144$ on vibrational spectroscopy and determine for NaF: a.) the ground state energy in cm^{-1} assuming a harmonic oscillator and then assuming an anharmonic oscillator. b.) the $v=5$ energy in cm^{-1} assuming a harmonic oscillator and then assuming an anharmonic oscillator. c.) Compare and contrast the harmonic and anharmonic oscillator results from parts (a) and (b).	3	5
Q8	a.) A molecule phosphoresces with a single peak wavelength of 650 nm. The single fluorescence peak is at 575 nm. The absorbance is at 450 nm. Sketch a Jablonski diagram based on the information given, label all the transitions and calculate difference in each energy state in nm and cm^{-1} . b.) A report presenting the data as fluorescence at 625 nm, phosphoresce peak at 420 nm and absorption peak at 540 nm. Give remarks on the data.	4	2 1