

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2024

M.Sc-III Semester (BT)

COURSE CODE (CREDITS): 20MS1BT312 (2)

MAX. MARKS: 35

COURSE NAME: Emerging Technology

COURSE INSTRUCTORS: Dr. Abhishek

MAX. TIME: 2 Hour

Note: (a) All questions are compulsory.

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

Q.No	Question	Marks
Q1	Mass spectrometry is an analytical technique used for characterization of chemical compounds and biological molecules. Compound X, Y and Z have mass of 15, 31, 29 respectively, determine by mass spectrometry, and contain C, H. what are the molecular formula of all these compounds	3
Q2	Nuclear magnetic resonance (NMR) is a dominant technique for determining the molecular structure, content, and purity of a sample. ¹ H-NMR spectra of most organic molecules contain proton signals that are 'split' into two or more sub-peaks. Rather than being a complication, however, this splitting behavior actually provides us with more information about our sample molecule. explain the spin-spin splitting pattern observed in the ¹ H NMR spectrum of following organic compound a. 1,3 dichloropropane b. Acetone c. 1Chloro 2 Bromo ethane d. Ethyl Chloride e. 1,1 Dichloroethane f. 1,1,2-trichloroethane	6
Q3	Solvent polarity and the local environment have profound effects on the emission spectra of polar fluorophores. These effects are the origin of the Stokes' shift, which is one of the earliest observations in fluorescence. Mechanistically explain the effect of polar and non-polar solvent on fluorophore molecule using water and n-hexane as an examples. Also elaborate the effect of temperature and viscosity on emission spectra of fluorophore	5
Q4	Nanobodies (Nbs) are camelid-derived single-domain antibodies and have powerful binding and inhibitory capacity with great therapeutic potential. Nbs are used in cancer, infections, inflammation and neurodegeneration. How these nanobodies differ from conventional antibody, draw a neat and clean sketch diagram of Nbs and its applications in cancer treatment	5
Q5	The NMR spectrum 1,2-dimethoxyethane recorded on a 300 MHz NMR spectrometer consists of signals at 1017 Hz and 1065 Hz downfield from TMS. (a) Calculate the chemical shift of each absorption. (b) At what frequency would each absorption occur if the spectrum were recorded on a 500 MHz NMR spectrometer?	6

Q6	A sample of a fluorescent molecule (concentration of 1.0×10^{-5} M) with no quenching agent has an emission intensity resulting in a 4.6 reading on the detector. An unknown amount of quenching agent is added to the solution and the fluorescence intensity is found to be 2.5. Use the value of $K_{sv} = 15.0$ liter/mole to determine the concentration of quenching agent. Also write down the possible difference between static and dynamic quenching.	5
Q7	The pattern of peak intensities in a nuclear magnetic resonance (NMR) signal follows Pascal's triangle due to the combinatorial nature of spin states in systems with multiple equivalent nuclei. The integration ratio of doublets is 1:1, and of triplets is 1:2:1. What is the integration ratio of the proton (H _x) at C1 and C2 in the following compounds a. CH ₃ CH ₂ Br b. C ₂ H ₆ c. CH ₃ CHClCH ₂ Br d. CH ₃ CH ₂ CH ₂ Cl e. ClCH ₂ CH ₂ Br	5