JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
TEST -3 EXAMINATION-2023
M.Sc-III Semester (Biotechnology)

Course Code (Credits): 20MS1BT312 (2) Max. Marks: 35
Course Name: Emerging Technology
Course Instructors: Dr. Abhishek Max. Time: 2 Hours

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

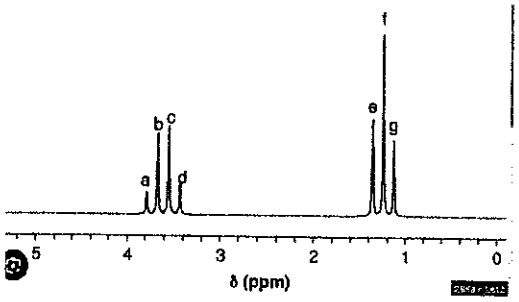
1. The cy3-dornor and cy5-acceptor pair is attached onto the terminals of a DNA sequence. If ignoring the orientations of transition dipoles of donor and acceptor. If the average energy transfers efficiency is 50% and foster radius (R0) of this system is 6.5 nm, what is the average distance between donor and acceptor in a DNA sequence? [3]

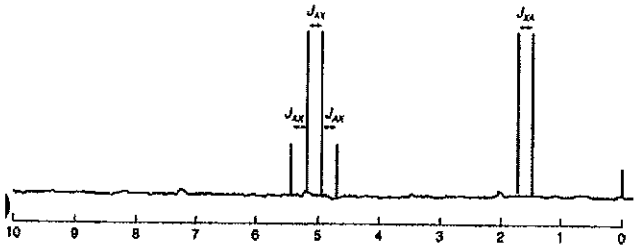
2. You perform a fluorescence resonant energy transfer (FRET) experiment to determine the distance between two groups in a protein molecule. You labeled these groups with fluorophores. The fluorophore group that you excite is called the Donor, and the one from which you read the signal is called the Acceptor. What is the requirement for the absorption and emission wavelengths (or frequencies) of the Donor and Acceptor in order for FRET to occur? [2]

3. Fluorescence intensity of a compound X is 0.2 and 0.8 unit in the presence and absence of quencher. Calculate the concentration of quencher if the value of stern volmer constant is 2.0 LMol-1. Also calculate the quantum yield of the compound if the number of photon absorbed and emitted is 1.0×10^{22} and 0.5×10^{21}. [3]

4. To investigate the properties of cell membranes, a scientist used the Fluorescence Recovery After Photobleaching (FRAP) technique. Based on this method, all the membrane proteins on the cell surface are to be uniformly labeled with a green fluorescent dye. After 10 minutes, a small area on the cell membrane will be photo-bleached by shining a powerful laser at it. Explain why scientist labelled all the membrane protein and later on photobleach the same. Also explain the mechanism and significance of FRAP technique and its limitations.[6]

5. The proton NMR of two compound X and Y is shown below. Propose the structure for both the compound using the concept of NMR. Also write down the intensity distribution ratio of both the peak for compound X and compound Y. [2+2+1.5+1.5]





6. An NMR spectrum is acquired by varying or sweeping the magnetic field over a small range while observing the radiofrequency (Rf) signal from the sample. NMR signals may have different number of peaks (the number of lines). This is called the splitting of the signal or the multiplicity. Signal splitting is arguably the most unique and important feature that makes NMR spectroscopy a comprehensive tool in structure determination. Determine the splitting pattern and intensity distribution of the following compound using the concept of NMR spectroscopy. [1.5 x 6]

   a. n-Pentane
   b. 2-Bromo-3-chlorobutane
   c. 1,1-Dichloropropane
   d. Dimethyl ether
   e. Propanone
   f. 3-Methyl-Butane

7. Calculate the chemical shift of a compound X showing a spectral peak at 555.2 Hz corresponding to TMS. if the spectrum id recorded on a 300 MHz spectrometer and 80 MHz spectrometer respectively. In which spectrometer, you will get better resolution of spectral peak and why? Also explain why TMS is used as internal standard in NMR spectroscopy [5]

For Examination Purpose Only