Name :	
Roll No. :	A American (V Consider Ind Conference)
Invigilator's Signature :	

## CS/M.Tech (BT-BACK LOG)/SEM-2/MBT-202/2010 2010

## SPECTROSCOPY, CRYSTALLOGRAPHY, INSTRUMENTATION & MICROSCOPY

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.* 

Candidates are required to give their answers in their own words as far as practicable.

## **GROUP – A**

1. Answer any *five* of the following :  $5 \times 1 = 5$ 

- - a) Electrons b) Protons
  - c) Neutrons d) The nucleus.
- ii) Name one water soluble compound that can be used as an 'internal NMR reference'.
- iii) What will happen in  $\lambda_{max}$  when the pH of a Tyr solution is changed from 7.0 to 9.1 ?
- iv) The Fourier transform of the electron density function is the
  - a) Spherical wave function
  - b) Plane wave function
  - c) Structure factor
  - d) Cell volume

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v) Consider space group P222 with four equivalent positions (*x*, *y*, *z*), (*-x*, *y*, *-z*), (*-x*, *-y*, *z*), (*x*, *-y*, *-z*). If V is the volume of the cell, then the volume of the asymmetric unit is

c) 
$$4V$$
 d)  $V/2$ .

vi) To improve signal to noise ratio one can measure the same spectra several times and obtain an average spectrum. If one signal averages 100 spectra, the signal to noise ratio will increase by

a) 100 times	b)	10 times
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- c) 64 times d) 4 times.
- vii) Fill in the blanks :

Fluorescence always occurs with ..... shift.

Answer any *three* of the following.

 $3 \times 10 = 30$ 

- 2. a) <sup>13</sup>C NMR is less sensitive in comparison to <sup>1</sup>H NMR. Justify the comment with proper reason. How do you overcome from this ?
  - b) Which pulse gives the maximum signal intensity in NMR spectroscopy ?
  - c) 'To get the UV spectrum usually ~ mM (micromolar) range is necessary'. Justify the statement from the aspect of population density concept.
  - d) What is 'spin-spin coupling' ? How the  ${}^{3}J_{N\alpha}$  coupling helps in determining peptide secondary structures ?

4 + 1 + 2 + 3

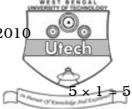
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- 3. What do you understand the term resolution in the context of an experiment in x-ray crystallography ? Write down the steps in typical x-ray crystallography experiment from data collection in obtaining the coordinates of the molecule. 10
- a) What is fluorescence quantum yield ? Arrange in increasing order of fluorescence quantum yield for Phe, Trp, His and Tyr with proper reason.
  - b) A short helical peptide is treated with varying concentration of GnCl to study the unfolding process.
    Using CD, NMR and fluorescence spectroscopy how do you monitor this 'helix-coil transition' ? 3 + 7
- 5. a) What is Cotton effect ? How do you obtain positive Cotton effect ?
  - b) Explain with mechanism the phenomenon of 'FRET'.Give an example of FRET in living biological system.
  - c) On excitation at 285 nm, under ordinary condition BSA sows fluorescence at 347 nm. When tagged with ANS, excitation at same wavelength shows fluorescence at 467 nm, which is characteristic for ANS itself, with little reduced intensity. Characterize the statement with proper reason. 3 + 4 + 3

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## **GROUP – B**

Answer any *five* of the following.

- 6. Who invented electron microscope ?
- 7. What is the illumination source in an Electron Microscope ?
- 8. What is the resolving power of an Electron Microscope ?
- 9. What is the meant by resolving power ?
- 10. What kind of lenses are used in an Electronic Microscope ?
- 11. Which instrument is used to analyze microbial cell surface ?
- 12. Which instrument is commonly used for measurement of bacterial growth curve ?

Answer any *two* of the following :  $2 \times 15 = 30$ 

- 13 Differentiate between an electron microscope and an optical microscope.
- 14. Mention the working principle of any three commonly used instruments in a microbiology laboratory.
- 15. What are the similarities and differences between scanning electron microscope and a transmission electron microscope ?