

SEAT No. _____

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[42 & A-29]

SARDAR PATEL UNIVERSITY

M.Sc. (Physics)(IVth Semester) Examination

Date : 13/04/2018, Day : Friday , Time :10:00 am to 1:00 p.m.

Subject : Applied Crystallography and Biophysics, Paper No. PS04EPHY01

CBCS(choice based credit system)

Important Note : Q.1 : Multiple choice questions (MCQ) carries one mark each.

Q.2 : Short questions carries two marks each (attempt any seven out of nine)

Q.3 to Q.6 : Long questions carries 12 marks .

Total Marks : 70

Choose the appropriate options from the following in Q.1

Q.1 (8)

- i) During double strand formation of DNA, the guanine of the first chain pairs with ----- of the second chain
(a) cytosine (b) thymine (c) adenine (d) guanine
- ii) For crystallising proteins in aqueous solution which of the following can be used as additives
(a) alcohol (b) polyethylene glycol (c) ammonium sulphate (d) salts
- iii) In the application of Raman spectroscopy to proteins which amide bands are used to probe the structure
(a) I & VI (b) I & II (c) I & III (d) I & V
- iv) Which of the following parameter cannot be determined by tight binding model applied to a biomolecule specifically benzene
(a) resonance energy (b) electron affinity (c) Bond order
(d) Lande's splitting factor
- v) In Weissenberg method which type of sample is used
(a) polycrystalline (b) amorphous (c) single crystal (d) thin film
- vi) In Debye Scherrer powder method each line represents
(a) set of directions (b) zone axis (c) set of planes (d) none of these
- vii) Which equation is used to determine the size of particles
(a) Debye (b) Scherrer (c) Roentgen (d) Laue
- viii) Which factor is neglected to measure exact relative integrated intensity of powder diffraction lines ?
(a) multiplicity (b) absorption (c) structure factor (d) Lorentz-polarization

Q.2 Answer any seven questions out of nine in Q.2 (14)

- i) State and explain Pullman's criterion for carcinogenic activity .
- ii) Differentiate between myoglobin and haemoglobin molecule. Why myoglobin molecule shows ESR absorption spectra. ?
- iii) How does temperature factor affects the intensity of diffracted beam?
- iv) How α helix and β sheet secondary structure of proteins differ from each other ?
- v) The monomers of proteins are different aminoacids each of which has a central carbon atom linked to which of the four chemical groups ? What are hydrophilic and hydrophobic amino acids ?
- vi) Explain the difference between rotation and oscillation photograph.
- vii) What is Wilson plot ?
- viii) When X-ray beam is incident on a NaCl crystal with lattice spacing 2.82×10^{-10} m, the first order Bragg reflection is observed at a glancing angle of $8^{\circ}35'$ What is the wavelength of X-rays ? At what angle would the second order Bragg reflection occur?
- ix) Explain in short how indexing can be done of cubic structure.

Q.3(a) Discuss the method in which only single crystal is rotated and (not the film) monochromatic X-rays are used to determine lattice parameter. (6)

Q.3(b) Describe the X-ray method by which we can determine the space group of single crystal from the X-ray photograph obtained. (6)

OR

Q.3(b) "If a polycrystalline sample and monochromatic X-ray source is provided to you then which technique you will prefer to determine lattice parameter" Explain that technique in detail. (6)

Q.4(a) Discuss the non-ideal condition of X-ray diffraction and derive the expression for estimating the particle size of very small crystals from the measurement of width of the diffraction curves. (6)

Q.4(b) Explain in detail how multiplicity and Lorentz factor influence the intensity of reflected beam ? (6)

OR

Q.4(b) If the relation between lattice parameters is $a = b \neq c$ and three axes at right angles then explain with the help of analytical method how we can do the indexing of such crystal system. (6)

Q.5(a) Explain primary, secondary, and tertiary structures of DNA. (6)

Q.5(b) Can proteins crystallize? If yes, then name the techniques known to you and describe them. (6)

OR

Q.5(b) What is phase problem in crystallography? Explain the indirect methods by which phases can be determined. (6)

Q.6(a) Discuss delocalization in biomolecules taking example of benzene molecule and explain various parameters which can be obtained applying tight binding model to it. (6)

Q.6(b) How ESR helpful in studying myoglobin and haemoglobin molecule? Explain it in detail. (6)

OR

Q.6(b) Explain fluorescence spectroscopy to study proteins and nucleic acids. (6)

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