SARDAR PATEL UNIVERSITY
M.Sc. (Physics)(IVth Semester) Examination
Date :23/03/2019, Day :Saturday, Time : 10:00a.m. to 1:00p.m.
Subject : Applied Crystallography and BioPhysics, Paper No. PS04EPHY21
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

Q.1 *Choose the appropriate options from the following in Q.1*   (8)

1   Poles P_1 and P_2, representing two crystal planes on a reference sphere, lie opposite to each other on a great circle in a stereographic projection. The angle between P_1 and P_2 will be
   (a) 90°   (b) 0°   (c) 180°   (d) 270°

2   In single crystal X-ray diffractometer(four circle) for a particular reflection the counter is set at a position corresponding to the Bragg's angle , the rotation axis corresponding to this motion is called the
   (a) 2θ axis   (b) Φ axis   (c) ω axis   (d) Ω axis

3   Which of the following diffraction method gives undistorted representation of the reciprocal lattice of a crystal?
   (a) Laue method   (b) Weissenberg method   (c) Oscillation method   (d) Precession method

4   Which condition is to be satisfied if a spot corresponding to a given (*hkl*) in a single crystal diffraction pattern from a BCC crystal will be non-extinct (n is an integer).
   (a) $h + k + l = 2n$ (b) $h + k + l = 2n + 1$ (c) $h + k = 2n$ (d) $h + k = 2n + 1$

5   ESR technique helps to study myoglobin molecule due to the presence of
   (a) Nitrogen atoms   (b) carbon atoms   (c) iron atoms   (d) oxygen atoms

6   Immunoglobulins are referred to
   (a) antigens   (b) antibodies   (c) nucleic   (d) none of these.

7   The UV absorption of nuclei acids is almost entirely due to
   (a) bases   (b) sugar   (c) phosphate   (d) none of these

8   The technique which involves the interaction of electromagnetic radiation with the change in dipole moment of the molecules is called
   (a)IR   (b) Raman   (c) UV-VIS   (d) Mass spectrometry.

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

1   State the basic difference between various crystallographic projections .

2   In an X-ray diffraction characterization of a crystal with tetragonal structure, the lattice parameter a is found to be equal to 3 Å. Find the angle of diffraction (θ) for (110) plane. Take $\lambda = 1.54$ Å.

3   How single crystal diffractometer differs from powder diffractometer ?

4   Write Friedel's law and explain its physical significance.

5   What is MALDI-TOF ? Explain its basic principle.

6   How circular dichroism(CD) and optical rotatory dispersion(ORD) differs from each other ? Also explain what is positive cotton effect and negative cotton effect by plotting CD and ORD curves.

7   What are proteins ? Discuss the various bonds involved in the formation of tertiary structure of proteins.

8   Which criteria do you know which may be responsible for carcinogenic activity ? Discuss it in short.

9   What are antigens and antibodies ?

Q.3(a) Explain Debye Scherrer method used to determine the crystal structure of a powder specimen . (6)

Q.3(b) Explain the difference between Weissenberg and precession methods in terms of the working of the cameras and the images recorded. (6)

OR

Q.3(b) Describe the analytical methods for indexing an XRD pattern of tetragonal and hexagonal crystal systems. (6)

Q.4(a) Write only the definition of the normalized structure factor and explain each term involved. Explain the Wilson plot and its importance. (6)

Q.4(b) What is the use of proportional counter and scintillation counter in single crystal diffractometry? Discuss principle and advantages of these counters. (6)

OR

Q.4(b) Explain the importance of systematic absences of X-ray reflections recorded in diffractometry. How can one determine the space group symmetry from the intensity data of crystal planes in terms of (hkl) indices ? (6)

(6)

Q.5(a) With proper diagrams explain primary, secondary and tertiary structure of DNA. (6)

Q.5(b) Discuss vapour diffusion and microdialysis methods used for synthesizing biological macromolecules. (6)

OR

Q.5(b) Differentiate between NMR and ESR. Explain how NMR is useful in medicine and state the three different parameters used for imaging. (6)

Q.6(a) Describe light scattering technique used to determine the molecular weight of macromolecules in solution. (6)

Q.6(b) How Raman spectroscopy can be useful to study proteins and nucleic acids.? Explain it in detail along with its basic principle. (6)

OR

Q.6(b) Discuss the technique known to you which can be used to determine the shape of protein molecules. (6)

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