M. Sc. Biotechnology Examination, 2025

(2nd Year, 1st Semester)

BIOTECHNOLOGY

Paper : BT/PG/331T

(Bioanalytical Techniques)

Time : 2 *Hours* *Full Marks* : 40

GROUP—A

Answer *any* **four** questions : 2×4=8

1. *(a)* Why is TLC still relevant in a modern chemistry laboratory?

(b) Why proteins are unstable/denatured in organic solvents?

(c) In a gel filtration chromatography, your protein of choice is eluted in the void volume. Is there any rational in accepting this chromatographic step?

(d) Why is it repeatedly mentioned to label properly all swollen gel filtration matrixes by water insoluble marker inks?

(e) Gel filtration beads are fragile. What precautions are taken to ensure their stabilities?

(f) There are two proteins of very similar Mol. wts. in the order of 100 kDa. However, they were separated in a suitable Sephadex G-200 (fractionation range 20-200 kDa) gel filtration column. Is this possible?

(g) The length of an ion-exchange chromatography column should be as long as possible. Is this correct?

(h) How could you distinguish between a dead enzyme from a functional enzyme?

(i) The homogeneity of an enzyme has been properly ensured by a number of experiments. Which added information, expect the price, would you search for before accepting the preparation for research purpose?

(j) Do you normally expect that a protein may be purified to homogeneity using a single affinity chromatographic step?

GROUP—B

Answer *any* **one** question : 8×1=8

2. Explain fluorescence with the help of Jablonski diagram. What determines whether a molecule is CD active? What is ellipticity in CD? 4+1+3=8

3. Explain the term chemical shift in NMR which is denoted by ppm. Calculate ν where

$\nu_H = 267{\cdot}512 \times 10^6$ rad $T^{-1}sec^{-1}$, $B_0 = 5{\cdot}87$ T and $\pi = 3{\cdot}14$ rad

State the three basic events that characterize the phenomenon of NMR. 3+2+3=8

GROUP—C

Answer *any* **four** questions : 2×4=8

4. *(a)* On which factors numerical aperture of a microscope depend?

(e) Which nucleotide is typically used to specifically label RNA?

(f) Which of these radioisotopes, either ^{14}C or ^{32}P emits β particles of higher energy? **[CO2, CO3]**

7. Write short notes on (*any* **two**) : 1½×2=3

(a) α Radiation

(b) Half-life of Radioactive Decay

(c) Internal Labelling method of DNA

(d) Geiger-Muller Counter **[CO1, CO3]**

8. *(a)* Name a technique which is used to detect radioactivity in a quantitative fashion.

(b) If you use ^{32}P (emits β-particles) in a DNA-labelling experiment, what kind of protection you would exercise – a lead shield or a perspex shield? 1+2=3 **[CO1, CO2]**

9. *(a)* If you want to label a piece of DNA, which one of the following isotopes you will use ^{14}C or ^{32}P? Justify your answer.

(b) Are the energy level of β-particles emitted from various radioisotopes (such as ^{3}H, ^{14}C and ^{32}P etc.) same?

(c) What is the half-life of the following isotopes? ^{3}H, ^{14}C and ^{32}P. 1+1+1=3 **[CO1, CO2]**

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(b) What is 'shade-off effect' of a phase contrast microscope?

(c) What are the disadvantages of differential interference contrast (DIC) microscopy?

(d) Mention the advantage of Spinning disk confocal microscopy (SDCM) over Laser scan confocal microscopy (LSCM).

(e) To observe the localization and dynamics of molecules near the plasma membrane (usually around 100 nm), which kind of microscopy is preferred? Give reasons.

(f) Mention the purposes of using heavy metals for staining samples for transmission electron microscope.

(g) Why should non-conductive samples be coated with a conductive layer in traditional SEM?

(h) Mention the principle of tapping mode operation of Atomic forced microscope.

GROUP—D

Attempt *any* **five** questions : 2×5=10

5. *(a)* Explain the terms 510 LP and 620 SP in flow cytometer. **[CO2]**

(b) What are the functions of sheath fluid and PMT in flow cytometer? **[CO2]**

(c) What is the difference between hydrodynamic and acoustic focusing? **[CO2]**

(d) What is the purpose of BLOCKING in immunoblotting? **[CO1, CO2, CO3]**

(e) Why do we use Ig isotypes of flow cytometry? **[CO1, CO2, CO3]**

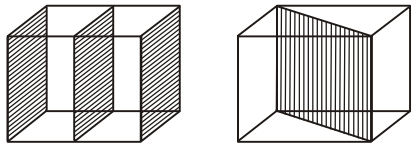
(f) Why do we use different pH for stacking and resolving gels? **[CO2, CO3]**

(g) What is the function of TEMED and APS in SDS-PAGE gel casting? **[CO2, CO3]**

(h) What will be the cell length and cell angles in orthorhombic and tetragonal crystal system? **[CO2]**

(i) Explain Bragg's law with equation. **[CO2]**

(j) State the Miller indices of the diagram given below : **[CO2]**



a. b.

GROUP—E

Answer *any* **two** questions :

6. Answer *any* **three** questions : 1×3=3

(a) Possibly how many kinds of different radiations are coming off from radioisotope?

(b) Among different types of radiations which one has the highest energy?

(c) Which radioisotopes are most frequently used in the biological experiments?

(d) Name the technique by which the 5′-end of a DNA molecule can be labelled.