

SC/BT/PG/331T/2024

MASTER OF SCIENCE EXAMINATION, 2024

(2nd Year, 1st Semester)

BIOTECHNOLOGY

PAPER : BT/PG/331T

(Bioanalytical Techniques)

Time : Two Hours

Full Marks : 40

GROUP—A

1. Answer *any four* : 1×4

- (a) Name a very high resolving chromatographic technique that can purify small organic molecules in an analytical scale.
- (b) Name any one chromatographic method that may be used along with other techniques to purify a protein molecule in a laboratory scale.
- (c) What type of chromatographic matrix is CM-Sephadex G-50?
- (d) Name one precondition of a gel filtration chromatography experiment.
- (e) Name one precondition of an ion-exchange chromatography experiment.

BIOTECH-265

[Turn Over]

(2)

- (f) Can dialysis separate two protein molecules of Mws 20 kDa and 800 kDa?
- (g) What is the easiest way to distinguish between a live and a dead enzyme?
- (h) A cofactor is bound to a protein. Can it be separated from the protein by a gel filtration chromatography?

2. Answer *any three* :

2×3

- (a) What is the difference between absorption and adsorption?
- (b) Does a single peak of a protein in mass spectroscopy indicate that it is pure?
- (c) The protein of your choice is eluted in the unabsorbed fraction of an ion-exchange chromatography. Would you continue the step or reject it?
- (d) Two compounds *A* and *B* are being eluted as overlapping peaks in a chromatography. Is it possible to calculate their relative abundances, – at least semi-quantitatively? How?
- (e) What is meant by C₁₈- RP HPLC system?
- (f) Somebody has purified an enzyme whose assay system is yet to be established. Do you support the claim?

(7)

- (iii) Liquid Scintillation Counter is used to detect gamma rays.
- (iv) ¹⁵N is a radioactive isotope of ¹⁴N.
- (v) Gamma rays have the highest penetrating capacity among all kinds of radiations.

★ ★ ★

(6)

- (c) Possibly how many kinds of different radiations are coming off from radioisotope?
- (d) Among different types of radiations which one has the highest energy?
- (e) Which radioisotopes are most frequently used in the biological experiments?
- (f) Name the technique by which the 5'-end of a DNA molecule can be labelled.
- (g) Which nucleotide is typically used to specifically label RNA?
- (h) Which of these radioisotopes, either ^{14}C or ^{32}P emits β particles of higher energy?
10. (a) Name a technique which is used to detect radioactivity in a quantitative fashion.
- (b) What is the 'half-life' (in days) of the following isotopes? ^3H , ^{32}P , ^{35}S and ^{14}C .
- (c) If you use ^{32}P (emits β -particles) in a DNA-labelling experiment, what kind of protection would you exercise – a lead shield or a perspex shield? 1+2+2=5
11. Mention if following statements are true or false: 1×5=5
- (i) Alpha particles are hydrogen nucleus.
- (ii) Beta particles are equivalent to electrons.

BIOTECH-265

[Continued]

(3)

GROUP—B

Answer *any one* :

3. (a) State the basic difference between ORD and CD. What is circular dichroism? How does a quarter wave plate function in generating a beam of circularly polarized light? 2+2+2
- (b) Write the characteristic events which occur in the NMR process. 4
4. (a) What is the mathematical relationship between anisotropy(r) and Polarization (p)? Explain mathematically why the maximum value of r cannot exceed 0.4. 2+4
- (b) Derive with a proper equation how the mass of a species is related to the radius traversed by it on a mass spectrometry detector. 4

GROUP—C

5. (a) On which factors does the resolving power of a microscope depend? 1
- (b) Why oil immersion lens are used in microscopy? 1

BIOTECH-265

[Turn Over]

(4)

- (c) What type of microscope uses an annular stop and why?
1+1
- (d) In phase contrast microscopy, how much phase shift is created by the phase ring in the condenser? 1
- (e) Which type of specimen is suitable for differential interference contrast microscope? 1
- (f) Mention the characteristics of Nomarski prism. Draw the ray diagram for Differential Interference Contrast microscopy. 1+2
- (g) Mention one advantage of darkfield microscope over bright field. 1

(OR)

6. (a) Which light source is mostly used in fluorescence microscope? 1
- (b) Why is a laser used in confocal microscopy? 1
- (c) What is the function of pinhole in confocal microscope? 1
- (d) Why is two-photon microscopy important? 1
- (e) What is the importance of Scanning Electron Microscopy with energy dispersive X-ray spectroscopy (SEM-EDX)? 2
- (f) What are the advantages of AFM? 1

BIOTECH-265

[Continued]

(5)

- (g) How can non-conducting materials be seen in Scanning Electron Microscopy (SEM)? 1
- (h) Why are osmium tetroxide and glutaraldehyde used as fixative agent in Sample preparation for (Transmission Electron Microscopy) TEM? 1
- (i) Name the parameters on which degree of scattering in Transmission Electron Microscope depends. 1

GROUP—D

7. Why do we do color compensation in flow cytometer data analysis? State the differences between Stacking Gel and Separating Gel. What is the purpose of BLOCKING in immunoblotting? 2+2+1=5

(OR)

8. When do we do competitive ELISA? What is Ig isotype? What is the 'input' in the co-immunoprecipitation assay? What is the function of A/G-coupled agarose beads on Co-IP? 2+1+1+1=5

GROUP—E

Answer *any one* question :

9. Answer *any five* questions : 1×5=5
- (a) What is Radioactive Decay?
- (b) Define Isotope. Give an example of isotope.

BIOTECH-265

[Turn Over]