

M. Sc. (BIOTECHNOLOGY) EXAMINATION, 2023

(1st Year, 2nd Semester)

BIO-ANALYTICAL TECHNIQUES

PAPER – 236

Time : Two hours

Full Marks : 50 (Written 40 + Internal Assessment 10)

Group – A

Answer *any two* questions.

1. Answer *any five* questions : 5×1=5
 - a) What is Radioactive Decay?
 - b) Define Isotope? Give an example of isotope.
 - 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?
2. Write Short Notes on : 2×2.5=5
 - a) Decay of β particle.
 - b) Geiger-Muller Counter
 - c) Different Methods of Labelling DNA
 - d) Southern Blotting Technique
3.
 - 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 you would exercise – a lead shield or a perspex shield? 1+2+2=5
4.
 - 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 ^3H , ^{14}C and ^{32}P etc.) same?
 - c) Mention three applications of radio isotopic methods in various fields of biology, medicine and agriculture. 1+1+3=5

[Turn over

5. Mention if following statements are true or false: 1×5=5
- i) Alpha particles are hydrogen nucleus.
 - ii) Beta particles are equivalent to electrons.
 - iii) Liquid Scintillation Counter is used to detect gamma rays.
 - iv) ^{15}N is radioactive isotope.
 - v) Gamma rays have the highest penetrating capacity among all kinds of radiations.

Group – B

Answer *any two* questions.

6. What is the main use of confocal microscope? Why pinhole is used in confocal microscopy? Why are lasers used in confocal? 1+2+2
7. What is the principle of FACS? Outline briefly the method to get a cell cycle profile for normal cell? Draw a cell cycle graph for normal cells and G1 arrested cells? 1+2+2
8. Draw a schematic diagram of TEM indicating different components. Are same microscopy techniques are employed in SEM and TEM? Why Glutaraldehyde and osmium tetroxide are used in TEM? 2+1+2
9. Mention the basic principle of Atomic force microscopy (AFM)? What are the advantages of AFM? What is the principle of phase contrast microscope? 2+1+2

Group – C

10. Answer *any two* questions. 3 marks each
 - a) Quartz cuvettes are much more expensive than glass cuvettes. Then why do spectrometer users use quartz cuvettes?
 - b) What are the ranges of wavelength of UV and visible lights?
 - c) Among UV and visible lights, which one has a higher level of energy?
 - d) Why is an extremely low value of absorbance in the order of 0.001 not acceptable?
 - e) A solution shows an O.D. of 0.455 at 280 nm in a certain spectrometer. If other spectrometers are used, do you expect the same O.D. of the same solution at the same wavelength? (Within limits of error)
11. Answer *any two* questions. 2 marks each
 - a) In SDS - PAGE, globular proteins are separated based on which property? In non-denaturing PAGE, proteins are separated based on which properties? [No explanation is needed.]
 - b) Holding all experimental conditions constant, if the degree of cross linking is increased in SDS-PAGE, the rate of migration of proteins will be faster or slower?

- c) How will you calibrate a 1000 microlitter pipetman?
- d) Among a spectrometer and a spectrofluorimeter, which one is more sensitive?
- e) In a laboratory, where will you store inflammable organic solvents – near a window or near the exit or away from the exit, etc? In a laboratory, how many exit doors are recommended?

Group – D

12. Answer *all* the questions.

- a) In which frequency range NMR and ESR are observed? 1
- b) Define the term Luminescence. 2
- c) Phosphorescence is the emission of light from singlet excited states. Is this statement true or false. Justify your answer accordingly. 1
- d) Define Circular Dichroism. 2
- e) What is the principal use of CD? 1
- f) What is meant by Larmor Precession? 1
- g) Explain the phenomenon of NMR in one sentence. 2