



WEST BENGAL STATE UNIVERSITY

B.Sc. Honours 6th Semester Examination, 2022

MCBADSE06T-MICROBIOLOGY (DSE3/4)

INSTRUMENTATION AND BIOTECHNIQUES

Time Allotted: 2 Hours

Full Marks: 40

*The figures in the margin indicate full marks.
Candidates should answer in their own words and adhere to the word limit as practicable.*

Answer Question No. 1 and any *four* questions from the rest

1. Answer any *four* questions from the following: 2×4 = 8
 - (a) What is an absorption spectrum? Explain with a diagram.
 - (b) What is meant by the term *phase* in phase contrast microscopy?
 - (c) What is the major limitation of bright field microscopy?
 - (d) Which is the most effective use of dark field microscopy?
 - (e) Why is gel filtration called so?
 - (f) What is the difference between ascending and descending paper chromatography?
 - (g) Why is acetic acid used in thin Layer chromatography?
 - (h) How would you select the pH of a native PAGE?

2. (a) Among the following amino acids which one would have the highest R_f value on a paper chromatography experiment: valine, serine, glutamic acid? Why? $\frac{1}{2} + 2\frac{1}{2} = 3$
 - (b) Mention one application of HPLC in drug industries. 3
 - (c) Can the R_f value be *zero* in a chromatography experiment? Explain your answer. $\frac{1}{2} + 1\frac{1}{2} = 2$

3. (a) Images in an electron microscope cannot be observed through human eye. Then how are images seen? 2
 - (b) What kind of compounds are used to stain electron microscopy samples? 1
 - (c) Both dark field microscopy and negative staining produces dark backgrounds. Why is it so and how? 4
 - (d) Name a dye used to stain bacterial flagella. 1

4. (a) A homodimeric protein of molecular weight 100 kD shows a single band at 50 kD position in SDS-PAGE gel. Explain this observation. 2
 - (b) Mention one use of native-PAGE. 1
 - (c) How can you separate two proteins, having the same molecular weight, using polyacrylamide gel electrophoresis? Discuss the importance of pH in this technique. $\frac{1}{2} + 2\frac{1}{2} = 3$

- (d) What is agarose? How is it used to separate nucleic acids according to their molecular weights? $\frac{1}{2} + 1 \frac{1}{2} = 2$
5. (a) The extinction coefficient of a substance is $1.4 \text{ L.mol}^{-1}.\text{cm}^{-1}$. How will you calculate its concentration using a spectrophotometer? What will be the unit of the concentration value? 2
- (b) What is the unit of optical density? 1
- (c) Derive a relationship between absorbance and transmittance? 2
- (d) What is the purpose of a diffraction grating in a spectrophotometer? 3
6. (a) Which of the following chromatography techniques will you prefer to use to separate a mixture of proteins of varying molecular weights — gel filtration, ion exchange, affinity? Justify your answer. 4
- (b) What kinds of biomolecules can be separated using paper chromatography? Explain how. 1+2=3
- (c) What kind of support is used in thin layer chromatography? 1
7. (a) What is the principle of column chromatography? 1
- (b) Which is the factor responsible for the separation in column chromatography? 1
- (c) “The greater the polarity of solute, more strongly it will adsorb on a polar surface” — Justify the statement. 2
- (d) Why activation of TLC plate is necessary? 2
- (e) What is the mobile phase in affinity chromatography? 2
8. (a) What do you mean by resolution of a light microscope? 2
- (b) How is resolving power of a microscope related to the numerical aperture? 2
- (c) What controls the resolution of TEM and SEM? 2
- (d) Why are SEM images black and white? 2
9. (a) Why do we use ultracentrifugation? 2
- (b) What is the difference between centrifugation and ultracentrifugation? 2
- (c) What is relative centrifugal force (RCF)? Explain its importance. 2
- (d) Why is vacuum needed inside an ultracentrifuge? 2

N.B.: Students have to complete submission of their Answer Scripts through E-mail / Whatsapp to their own respective colleges on the same day / date of examination within 1 hour after end of exam. University / College authorities will not be held responsible for wrong submission (at in proper address). Students are strongly advised not to submit multiple copies of the same answer script.

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