Total No. of Questions: 20

Enrollment No : _____

MEDICAPS UNIVERSITY

Faculty of Science

End Semester Examination May 2025

BT3CO11 Bioanalytical Tools

Programme	:	B. Sc.	**Branch/Specialisation**	:	BT
Duration	:	3 hours	**Maximum Marks**	:	60

Note: *All questions are compulsory. Internal choices, if any, are indicated. Assume suitable data if necessary. Notations and symbols have their usual meaning.*

Section 1 (Answer all question(s))

Marks CO BL

Q1. Resolving power of a microscope depends on which of the following factors? **1 1 1**

- (•) Numerical aperture and wavelength of light used
- ( ) Size of the specimen
- ( ) Type of stain used
- ( ) Intensity of light

Q2. Phase contrast microscopy is particularly useful for: **1 1 1**

- ( ) Observing fluorescent-tagged structures
- ( ) Viewing ultrastructure of cells
- (•) Examining live, unstained cells
- ( ) Imaging metal surfaces

Q3. Which of the following techniques is commonly used for isolating and studying membrane-bound organelles, such as the endoplasmic reticulum or Golgi apparatus, during cell fractionation? **1 1 1**

- ( ) Fluorescence microscopy
- ( ) Differential centrifugation
- ( ) Electrophoretic mobility shift assay (EMSA)
- (•) Isopycnic centrifugation

Q4. In colorimetry, the Beer-Lambert law relates the absorption of light to: **1 1 1**

- ( ) The wavelength of light reflected by the sample
- (•) The concentration of the sample and the molar absorption coefficient
- ( ) The intensity of light scattered by the sample
- ( ) The refractive index of the sample

Q5. Gel filtration chromatography typically separates compounds based on: **1 1 1**

- ( ) Their ability to bind to the column material
- (•) Their size
- ( ) Their pH
- ( ) Their boiling points

Q6. In affinity chromatography, the stationary phase is specially designed to: **1 1 1**

- ( ) Bind non-specifically to all molecules
- ( ) Allow molecules to pass without interaction
- (•) Bind specifically to the target molecule
- ( ) Act like a filter for larger molecules

Q7. What is the main purpose of adding SDS in SDS-PAGE? **1 1 1**

- ( ) To preserve protein structure
- (•) To give proteins a uniform negative charge
- ( ) To separate proteins by their isoelectric point
- ( ) To stain proteins

Q8. Immunoelectrophoresis is a technique that involves: **1 1 1**

- ( ) Only size separation
- (•) Antigen-antibody interaction
- ( ) Only pH gradient separation
- ( ) Only electric field strength measurement

Q9. The main difference between PCR and Real-Time PCR (qPCR) is: **1 1 1**

- ( ) qPCR does not require primers
- ( ) PCR can detect RNA directly
- (•) qPCR monitors DNA amplification as it happens
- ( ) PCR uses fluorescent probes

Q10. In Sanger DNA sequencing, chain termination is caused by: **1 1 1**

- ○ Normal deoxynucleotides (dNTPs)
- ◉ Dideoxynucleotides (ddNTPs)
- ○ Radioactive labels
- ○ Fluorescent dyes

Section 2 (Answer all question(s))

Marks CO BL

Q11. Define resolving power of a microscope. What is the role of refractive index in microscopy? **2 2 1**

Rubric	Marks
Resolving Power-1mk; refractive index 1 mk.	2

Q12. (a) Describe the body structure and working of a compound microscope. **8 2 1**

Rubric	Marks
body structure:4 and working of a compound microscope: 4	8

(OR)

(b) What is fluorescence microscopy? Explain its principle and uses in biology.

Rubric	Marks
What is fluorescence microscopy: 1 Explain its principle: 5 and uses in biology:2	8

Section 3 (Answer all question(s))

Marks CO BL

Q13. Mention two applications of centrifugation in biological research. Name any two sub-cellular organelles that can be isolated using differential centrifugation. **2 1 1**

Rubric	Marks
Mention two applications of centrifugation in biological research: 1 Name any two sub-cellular organelles that can be isolated using differential centrifugation:1	2

Q14. (a) Differentiate between infrared, UV, and visible spectrophotometry with suitable applications. **8 2 1**

Rubric	Marks
Differentiate between infrared, UV, and visible spectrophotometry: 6 with suitable applications: 2	8

(OR)

(b) How are sub-cellular organelles isolated using differential and density gradient centrifugation? Explain.

Rubric	Marks
differential: 4 density gradient centrifugation:4	8

Section 4 (Answer all question(s))

Marks CO BL

Q15. Define retention time in HPLC. Give two applications of HPLC. **2 2 1**

Rubric	Marks
Define retention time in HPLC.: 1 Give 2 applications of HPLC.: 1	2

Q16. (a) Compare gel filtration and ion exchange chromatography with their principles and applications. **8 3 1**

Rubric	Marks
principles: 5.5 and applications: 2.5	8

(OR)

(b) Discuss the principle, instrumentation, and applications of gas chromatography.

Rubric	Marks
Discuss the principle: 2 instrumentation: 4 applications of gas chromatography:2	8

Section 5 (Answer all question(s))

Marks CO BL

Q17. How does SDS-PAGE differ from native PAGE? Give one application of each. **2 2 1**

Rubric	Marks
How does SDS-PAGE differ from native PAGE:1 Give one application of each:1	2

Q18. (a) What is 2D electrophoresis? Discuss its working and significance in proteomics. **8 2 1**

Rubric	Marks
What is 2D electrophoresis?:1 Discuss its working and :5 significance in proteomics.:2	8

(OR)

(b) Explain the principle and steps involved in immuno-electrophoresis.

Rubric	Marks
Explain the principle:4 steps involved in immuno-electrophoresis:4	8

Section 6 (Answer all question(s))

Marks CO BL

Q19. Describe the role of primers in a PCR reaction. **2 2 1**

Rubric	Marks
Describe the role of primers in a PCR reaction:2	2

Q20. (a) Describe the technique of Southern blotting and its applications. **8 2 1**

Rubric	Marks
Describe the technique of Southern blotting: 6 its applications: 2	8

(OR)

(b) Write a detailed note on DNA sequencing methods and their significance.

Rubric	Marks
Write a detailed note on DNA sequencing methods:6 their significance.: 2	8

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