

BINDURA UNIVERSITY OF SCIENCE EDUCATION
BIOLOGICAL SCIENCES DEPARTMENT

HBScBioTec
ANALYTICAL BIOTECHNOLOGY (BTEC133) (1)

EXAMINATION
2 HOURS (100 MARKS)

JUN 2024

INSTRUCTIONS TO CANDIDATES

Answer **FOUR** questions. You **MUST** answer QUESTION 1 (Section A) and any **THREE** questions from section B. Each question carries **25 MARKS**. Where a question contains sub-divisions, the mark value of each sub-division is given in brackets. Illustrate your answer where appropriate with large clearly labelled diagrams. You should not spend more than thirty minutes on each question.

SECTION A (COMPULSORY)

1. DNA was extracted from plant tissue using the Cetyltrimethylammonium bromide (CTAB) method and absorbances at 260nm, 280nm and 320nm wavelength of the 5 DNA samples were measured using a UV Spectrophotometer and recorded in table 1 below.

Table 1: Absorbances of the DNA samples

Sample ID	A ₂₆₀	A ₂₈₀	A ₃₂₀	A ₂₆₀ /A ₂₃₀
W001	0.203	0.112	0.029	1.90
W002	0.233	0.125	0.036	1.85
W003	0.299	0.161	0.056	1.63
W004	0.339	0.203	0.027	1.89
W005	0.275	0.126	0.018	2.01

- Using the absorbances measured in table 1, calculate the concentration of DNA for each sample. (5 marks)
- Determine the purity of each DNA sample. (5 marks)
- The DNA was eluted in 200 µl of TE buffer. Calculate the DNA yield for each of the samples. (5 marks)
- Describe the function of the CTAB buffer. (5 marks)
- List the advantages of the kit based method over organic solvent based methods of DNA extraction. (5 marks)

SECTION B

2. Write short notes on any FIVE of the following:
- (a) Nested polymerase chain reaction (PCR). (5 marks)
 - (b) Southern blotting. (5 marks)
 - (c) Disadvantages of enzyme immunoassays. (5 marks)
 - (d) Applications of immunoprecipitation. (5 marks)
 - (e) Preparative centrifugation. (5 marks)
 - (f) Safe use of radioisotopes. (5 marks)
3. (a) Compare and contrast scanning electron microscopy (SEM) and transmission electron microscopy (TEM). (15 marks)
- (b) Outline sample preparation procedure for SEM. (10 marks)
4. Give a detailed account of high performance liquid chromatography tandem mass spectrometry (HPLCMSMS) method development and validation for quantification of a drug of your choice in plasma samples.
5. (a) Describe estimation of DNA fragment size using gel electrophoresis. (10 marks)
- (b) Discuss the factors affecting migration of DNA in agarose gels. (15 marks)
6. (a) Copy and complete the table 2 below with comparison of main features of RFLPs, RAPDs, AFLPs, SSRs and SNPs. (10 marks)

Table 2: Main features of RFLPs, RAPDs, AFLPs, SSRs and SNPs.

Feature	RFLPs	RAPDs	AFLPs	SSRs	SNPs
DNA required (μg)					
DNA quality					
PCR based					
Number of polymorphic loci analysed					
Amenable to automation					
Reproducibility					
Development cost					
Cost per analysis					
Ease of use					

- (b) Describe the applications of the molecular markers in (a) above in plant genetic studies. (15 marks)

END OF EXAMINATION QUESTION PAPER