

THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY DEPARTMENT OF AGRICULTURE FIRST SEMESTER EXAMINATION

AG 407 AGRICULTURAL BIOTECHNOLOGY

4th YEAR BSc.AG

4th June, 2021 **TIME ALLOWED: 3 HOURS**

INFORMATION FOR CANDIDATES:

- 1. You have 10 minutes to read the paper. You must not begin writing during this time.
- 2. The examination paper has three parts:

Part A: Short Answer Questions I......50 MarksPart B: Short Answer Questions II50 MarksTotal......100 Marks

- 3. Answers must be written in the book provided. No other written materials will be required.
- 4. Rules, calculators and correction fluids are required in the examination room. Notes and text books are not allowed.
- 5. Write your name and student number clearly on the front page of your answer book and examination attendance slip. **DO IT NOW**.

Answer all questions set in this Section.

Question One (10 Marks)

When conducting a polymerase chain reaction (PCR), the temperature in the thermocycler is initially raised to 95°C then lowered to about 60°C and then raised to about 72°C. Explain what happens in the reaction mixture at these different temperatures

Question Two (10 Marks)

During cloning of a gene, bacterial colonies, which have vectors or inserts, have to be separated from colonies which have no vectors. Briefly describe how these colonies are identified and separated from each other.

Question Three (5 + 5 + 5 + 5 + 5 + 5 = 30 Marks)

Describe the process of artificial insemination in cattle under the following subtitles:

- a) Definition and purpose
- b) Equipment
- c) Sperm collection and storage
- d) Heat detection
- e) How AI is done physically
- f) Limitations of AI in developing countries

Answer ANY 5 of the 6 questions set in this Section.

Question Four (3 + 7 = 10 Marks)

Biotechnological techniques can be used to efficiently improve agricultural crop production such as through the use of "Double haploid Production.

- a) What are *dihaploid* or *double haploid* plants?
- b) How are *dihaploid* plants produced?

<u>Question Five</u> (4 + 6 = 10 Marks)

- a) Why is it necessary to eradicate diseases that are transmitted in planting materials?
- b) Briefly describe the process of "pathogen-testing" that is used in eradicating diseases that are transmitted in planting materials.

Question Six (10 Marks)

Define the following terminologies:

- a) Primer
- b) Primer dimer
- c) Hairpin
- d) GC content
- e) Melting temperature

<u>Question Seven</u> (4 + 6 = 10 Marks)

Tissue culture is fundamentally built on an intrinsic nature of plants known as "Totipotency".

- a) Explain why "Totipotency" is considered the basis for *in vitro* cell and tissue cultures.
- b) Briefly describe in your own words the basic procedure of tissue culture.

<u>Question Eight</u> (5 + 5 = 10 Marks)

Using your knowledge of the Central dogma, compare and contrast (1) the PCR-based disease diagnosis and (2) Enzyme-linked immunosorbant assay (ELISA) based on:

- a) the level of accuracy of their diagnoses of plant disease; and
- b) Give a reason for your answer.

Question Nine (10 Marks)

Briefly discuss how <u>any one (1)</u> of the following techniques of biotechnology can be applied to improve agricultural crop production in PNG:

- a) Callus culture
- b) DNA fingerprinting

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END OF EXAM