THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF AGRICULTURE

SECOND SEMESTER EXAMINATION

AG 407 AGRICULTURAL BIOTECHNOLOGY

4th YEAR BSc.AG

June, 2020

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 two parts:

   Part A: Short Answer Questions I……..…60 Marks

   Part B: Short Answer Questions II ……. 40 Marks

   Total……..…....100 Marks
3. Answers must be written in the book provided. No other written materials will be required.
4. Rulers, calculators and correction fluids are required in the examination room. Notes, text books and other recording devices 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**.

Part A. Short answer questions I

Answer all questions in this Section.

Question One (2 + 2 + 2 + 2 + 2 = 10 Marks)

Define the following terms:

a) Exons
b) Genome
c) Reverse transcription
d) Standard amino acids
e) DNA sequencing

Question Two (4 + 8 = 12 Marks)

a) Describe the structure of nucleotides
b) Given the following template DNA sequence
CGTACGCGCGAAGACTGGTGACTGGT
   i. What is the nucleotide sequence of an mRNA that can be transcribed from it?
   ii. What is the amino acid sequence of the corresponding polypeptide using the correct reading frame? (Hint: use the genetic code chart below).

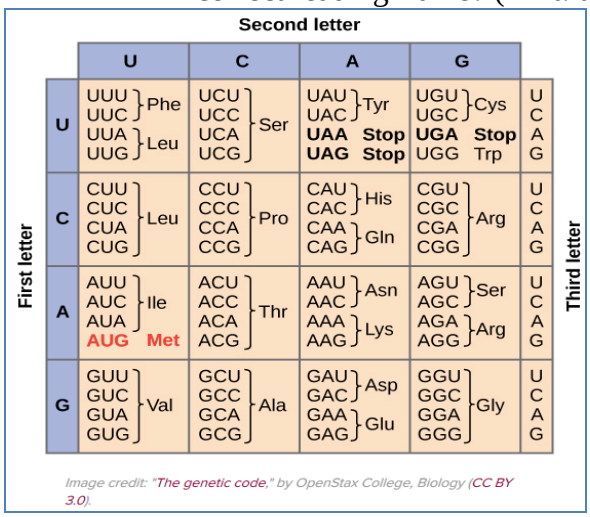

Image credit: "The genetic code," by OpenStax College, Biology (CC BY 3.0).

Question Three (3+3+3+3=12 Marks)

List any four essential materials which you will need to do a PCR in the laboratory and explain how each material is used.

Question Four (8 Marks)

Explain how DNA molecules are separated by gel electrophoresis?

Question Five (6 + 12 = 18 Marks)

Describe the purpose and procedure of only one of the following techniques of biotechnology

a) Southern blot hybridization
b) Multiple ovulation and embryo transfer in cattle.

Part B. Short answer questions II

Answer all questions in this Section.

Question Six (2 + 8 + 5 + 1 = 16 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.

c) Briefly outline the scientific rationale that supports the effectiveness of the pathogen-testing procedure to eradicate such pathogens from the planting materials.

d) What is the reason why “pathogen-testing” is also used interchangeably with the term “virus-indexing”?

Question Seven (2 + 8 = 10 Marks)

Biotechnological techniques can be used in agriculture to make more efficient genetic improvement efforts through the use of "Double haploid Production.

a) Define double haploidy?

b) Discuss how double haploid production can speed up genetic improvement of a crop.

Question Eight (2 + 8 =10 Marks)

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

a) Define totipotency.

b) Briefly describe a tissue culture technique used in propagating plants.

Question Nine (2 + 2 = 4 Marks)

c) Briefly discuss two (2) areas where biotechnology can contribute towards crop breeding in PNG.

END OF EXAM