



Index Number:

UNIVERSITY OF COLOMBO, SRI LANKA

FACULTY OF TECHNOLOGY

LEVEL I EXAMINATION IN TECHNOLOGY – Semester II – 2019/2020

AG 1007 – Introduction to Bio-Systems Technology

Answer all 4 questions

Time: Two (02) hours

No. of Pages: 08

Total 100 marks

Important Instructions to Candidates

- If a page or a part of this question paper is not printed, please inform the supervisor immediately.
- Enter your Index Number on all pages in the answers script.
- **STRUCTURED ESSAY TYPE:** Write the answers to these questions in the space provided in the question paper.
- **ESSAY TYPE:** Write the answers to the questions on booklets provided.
- **MCQ TYPE:** Underline the correct answer in paper.
- Electronic devices capable of storing and retrieving text, including electronic dictionaries and mobile phones are not allowed.

Question	Marks
1	
2	
3	
4	
Total	

Question 1

a) What do you understand as a '**biological system**'? (8 marks)

b) The biosphere is made up of the parts of Earth where life exists. The biosphere extends from the deepest root systems of trees to the dark environment of ocean trenches, to lush rain forests and high mountain tops.

Explain briefly why you can consider the biosphere as a biological system? (9 marks)

c) Explain briefly, why the study of biosystems is important for agriculture? (8 marks)

Question 2

When living organisms are arranged based on their complexity, organisms can be grouped to several levels (from atoms to the biosphere) forming Hierarchy of Biological Organization. A close study reveals that in each level of this hierarchy, characteristic features of biological systems could be identified. In addition, important emergent properties specific to each level of the biological system also can be clearly identified.

a) Briefly describe **five (05)** characteristic features of a biological system. (11 marks)

b) Explain, what are the emergent properties that are specific to each level of the hierarchy of biological organization by considering **two (02)** biological systems such as a cell and organelles. (9 marks)

C) What is a genome of a cell? (5 marks)

Question 3

A cell is the basic unit of life in the biosphere. All cells are surrounded by a plasma membrane and all the organelles within the cell are surrounded by a cell membrane which is structurally similar to plasma membrane.

a) Sketch and label to illustrate the basic structure of a plasma membrane. (8 marks)

b) Briefly describe **two (02)** important functions carried out by plasma membrane (10 marks)

c) What causes specific functions of cell membranes. (7 marks)

Question 4

Salt stress is a major abiotic stress in agriculture worldwide. It is estimated that about 20% of the earth's land mass and nearly half of all irrigated land are affected by salinity. Increased salinization of arable land is expected to have devastated global effects, with predictions of 30% land loss within the next 25 years, and up to 50% by the year 2050.

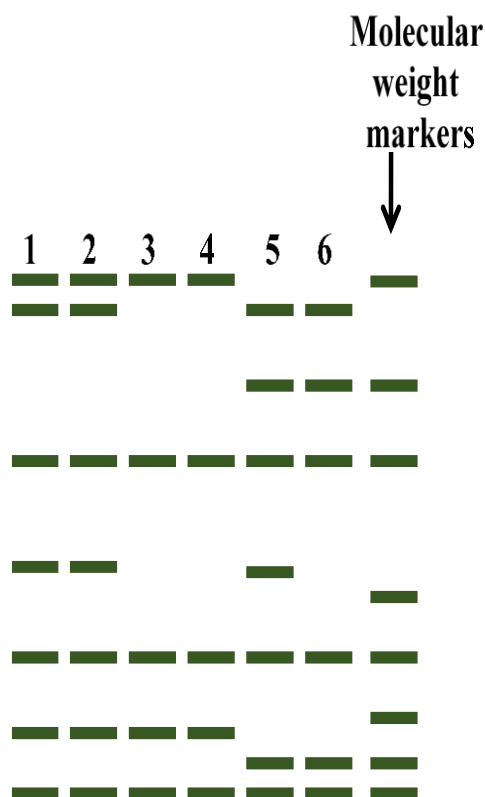
Identifying novel genes, determining their expression patterns in response to salt stress, and understanding their functions in stress

adaptation will provide us with the basis for effective engineering strategies to improve crop stress tolerance.

As a young scientist working for a leading Agricultural Biotechnology company in Sri Lanka, you want to analyse the proteins in roots of rice plants that your company had developed by genetic engineering and few traditional rice varieties.

Before engaging in complex research methods, you decided to analyse the root proteins in rice plants grown under high salinity conditions and perform SDS PAGE to identify novel proteins induced under high salinity conditions. Proteins were extracted from the roots of rice plants that showed sensitivity to salt and resistance to salinity.

Following diagram shows a picture of a gel with protein bands after SDS PAGE and silver staining. Lanes 1 to 4 were loaded with protein extracted from salt-sensitive plants and lanes 5 and 6 were loaded with protein extracted from salt-resistant rice plants.



- a) What are proteins? Give **two (02)** proteins involved in photosynthesis. (7 marks)
- b) Label **two (02)** proteins common to both salt-resistant and salt-sensitive rice plants, on the gel picture given above. (6 marks)
- c) Label **two (02)** proteins found only in salt-resistant rice plants, on the gel picture given above. (6 marks)
- d) Name **two (02)** proteins found in humans and state their functions. (6 marks)