

UNIVERSITY OF RUHUNA

Second Examination in B.Sc. ARMT/AB (Part I) - May 2017

SS 2101 Soil Plant Relations & Nutrient Management (Theory)

Instructions:

Time: Three (3) Hours

- Paper consists of 6 questions.
 - Answer **five (05)** questions.
 - All questions carry equal marks.
 - Only non-programmable calculators are permitted.
 - Mobile phones are **NOT** permitted.
-

- 1) (a) Name **five (05)** structure related properties of water. (10 Marks)
(b) Define the force responsible for the "Surface Tension". (10 Marks)
(c) Explain briefly the **three (03)** types of soil water including their availability to plants. (30 Marks)
(d) What do you mean by Soil-Plant-Atmosphere Continuum? Indicate the forces (soil water potential components) responsible for the water movement through the main steps of the Soil-Plant-Atmosphere-Continuum (10 Marks)
(e) How does the plant-available water content vary with the soil texture? (20 Marks)
(f) "Uniqueness of the characteristics of water is a result of water molecules being polar". Do you agree with this statement?
Justify your answer. (20 Marks)
- 2) (a) Name the **critical levels** of water in soils (10 Marks)
(b) What is meant by soil water potential? (10 Marks)
(c) Explain briefly **three (03)** factors affecting soil water infiltration (30 Marks)
(d) Name **five (05)** growth requirements of plants. (10 marks)
(e) Explain briefly the law of minimum. (20 marks)
(f) List **five (05)** advantages and **five (05)** disadvantages of inorganic fertilizers. (20 marks)
- 3) (a) i. What is the simplest visual indication of the presence of organic matter in the soil? (5 marks)
ii. What are the **two (02)** major processes by which the organic matter content of the soil is balanced? (10 marks)
(b) i. State **two (02)** pools (stocks) of carbon that exist in the earth other than soil? (10 marks)

- ii. Explain how the soil carbon pool manipulates the global temperature? (25 marks)
 - (c) i. Name the factors which drive the organic matter decomposition process? (10 marks)
 - ii. Explain briefly how each factor you mentioned under question (c) i. can affect the decomposition process. (20 marks)
 - iii. The ideal C:N ratio of organic matter that is applied to the soil is considered as 24:1. Explain how this value was obtained. (20 marks)
- 4) (a) i. What are the usable ionic forms of nitrogen, phosphorous and potassium? (05 marks)
- ii. What do you mean by the terms mineralization and immobilization? (10 marks)
 - iii. Trace the pathway by which nitrogen is released from dead organic matter and converted to the form in which it is assimilated by plants. Name organisms involved in this process. (15 marks)
- (b) i. You have learned that N (nitrogen), P (phosphorus) and K (potassium) are all 'fixed' in the soil. Compare the process of these fixations. (15 marks)
- ii. List **four (04)** nitrogen fixing methods and explain briefly one method (10 marks)
 - iii. Explain why the regulation of O₂ concentration is important in a root nodule? State how this is regulation achieved? (10 marks)
- (c) i. What do you mean by 'P (phosphorus) problem'? (05 marks)
- ii. Assume you add a soluble phosphate fertilizer (TSP –Triple Super Phosphate) to an acidic soil and an alkaline soil separately. In each case, within a few months most of the P would be changed to insoluble forms.
 - A. What are these insoluble forms? (05 marks)
 - B. Give **one** example for each form. (05 marks)
 - iii. Indicate the following two statements using appropriate figures.
 - A. The effect of pH on the relative concentrations of the three species of phosphate ions. (10 marks)
 - B. Inorganic fixation of added P at various soil pH values. (10 marks)
- 5) (a) State **three (03)** goals of nutrient management in soil. (6 marks)
- (b) What do you mean by Integrated plant nutrient management (IPNM)? (10 marks)
 - (c) Define the soil fertility. (10 marks)
 - (d) Write **five (05)** steps, in correct order, of preparation of plant leaf samples before laboratory analysis. (15 marks)
 - (e) Differentiate the deficiency symptoms of nitrogen (N) and potassium (K) in plants. (15 marks)

- (f) List **three (03)** immobile nutrients in plants? (9 marks)
- (g) What is an inorganic fertilizer? (15 marks)
- (h) Define the fertilizer ratio. (10 marks)
- (i) Determine fertilizer ratios for the following fertilizer grades. (10 marks)
 - i.) N24-P8-K4
 - ii) N18-P5-K9

6) Explain briefly the following statements.

- a) Capillary water movement depends on the size of the soil pores. (25 Marks)
- b) Soil organic matter and the sustainability of agriculture are linked together. (25 Marks)
- c) Application of inorganic fertilizers will affect the soil properties and cause environmental problems. (25 Marks)
- d) Availability of potassium in soils. (25 marks)