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UNIVERSITY OF RUHUNA

SECOND EXAMINATION IN B.Sc. ARMT/ AB (PART II) – October 2019

SS 2101 Soil Plant Relations and Nutrient Management Time: 03 hours

Answer **05 (FIVE)** questions including all parts of Question number 01

Each question carries a total of 100 marks.

Write your answers only in the space given for question number 1.

This question paper must be attached to your answer sheets.

1). A). I. List down **four (4)** methods used for measurement of soil water content. (04 Marks)

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II. Name **three (3)** important components of soil water potential. (3 Marks)

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III. Write down the equation used for calculation of capillary rise. (06 Marks)

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IV. Calculate the capillary height in a tube with a diameter of 0.5 mm, using following information. (12 Marks)

The coefficient of surface tension = 0.0728 J/m²

The water-glass contact angle = 60°

The density = 1000 kg/m³

The acceleration due to gravity = 9.8 m/s²

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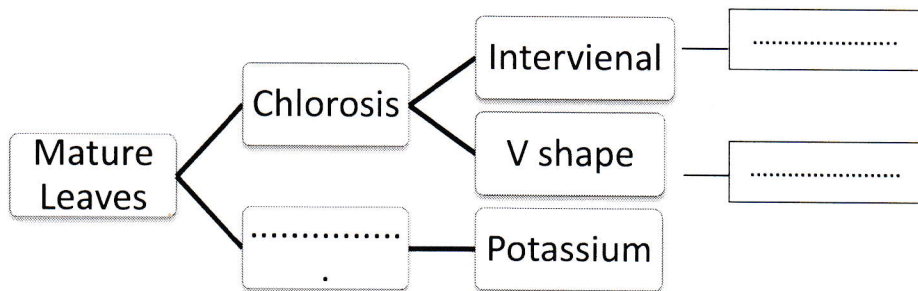
B). I. Give one example for a renewable resource in plant nutrient management. (4 marks)

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II. What is meant by a qualitative method in evaluating soil fertility? (6 marks)

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III. Fill the plant nutrient deficiency key appropriately. (6 marks)



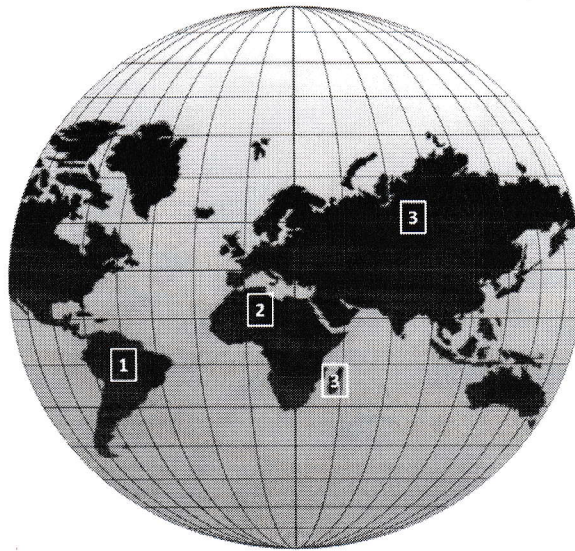
IV. What is the plant nutrient which the plant symptoms may appear initially on the middle leaves? (5 marks)

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V. Determine fertilizer ratio of the given fertilizer grade: N 15% P₂O₅ 5% and K₂O 8%. (6 marks)

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C). Use the below shown diagram of globe to answer the questions. Please write your answers in the table given.



- Q1. Indicate the relative rate of decomposition as “high” or “low” in the locations marked by the numbers in the preceding figure. **Strike off the inappropriate word/term**
- Q2. What is/are the decisive factor/s that regulates the rate of decomposition in each location?
- Q3. Indicate the level of accumulation of organic matter as “high” or “low” in each location marked on the globe.

Table for answers

Question	Q 1		Q2	Q3	
Location	Rate of decomposition		Decisive factor	OM accumulation	
1	High	Low		High	Low
2	High	Low		High	low
3	High	Low		High	low
4	High	Low		High	low
	4 x 10 = 40 marks		5 x 4 = 20 marks	4 x 10 = 40 marks	

D). Name the correct processes in soil nitrogen cycle using the given description. (25 marks)

Description	Process
1. Loss of nitrogen to the atmosphere as ammonia gas	
2. Biochemical reduction of nitrate or nitrite to nitrogen gas	
3. Conversion of organically bound nitrogen in to inorganic mineral forms	
4. Conversion of molecular nitrogen to ammonia and subsequently in to organic forms	
5. Biological oxidation of ammonia or ammonium to nitrite followed by the oxidation of the nitrite to nitrate	

2). A). I. List down **five (05)** factors affecting the amount of water in the soil. (05 Marks)

II. What are the important roles of soil water? (10 Marks)

III. State the **properties of water** which are responsible for the each condition given below. (10 Marks)

(a) Water can absorb/release large amounts of heat without temperature fluctuations:

(b) Water flows easily:

(c) Water allows ions and polar molecules to be evenly spread out:

(d) Water surface acts like an elastic film that resists deformation:

(e) Solid state of water floats on the liquid state:

B). I. Briefly explain the relationship between capillary water movement and the size of soil pores. (15 Marks)

II. Using a schematic diagram, indicate the types and critical levels of soil water. (10 Marks)

III. What is meant by “available water content”? (05 Marks)

IV. Briefly explain the variation of available water content with the soil texture using an appropriate graph. (15 Marks)

C). I. List down the factors affecting infiltration. (05 Marks)

II. Explain briefly how water is moving through the Soil Plant Atmospheric Continuum (SPAC). (15 Marks)

D). "In a salty soil, water passing into the plant is restricted." Explain the statement briefly (10 Marks)

3). A). I. What is meant by immobile nutrients? (5 marks)

II. Give five (05) examples for immobile nutrients. (5 marks)

III. Visual symptoms are difficult to identify and confusing to predict nutrient deficiencies in plants. Explain Briefly a method you can practice to avoid such difficulties. (15 marks)

B). I. Write five (05) growth requirements of plants. (10 marks)

II. Explain briefly the concept of limiting factor using the barrel theory. (15 marks)

C). I. What is an organic amendment? (5 marks)

II. State the important factors that should consider in the process of composting. (5 marks)

III. State the four (04) basic stages of anaerobic digestion process in composting. (8 marks)

iv. A farmer complained that when he practised aerobic digestion by heap method to produce compost, the time taken for decomposition of materials was too long.

a. What would be the possible reasons for the digestion of materials he used to take a long period of time? (12 marks)

b. What are the instructions that you would give the farmer to make the digestion process a rapid one? (Write in point form) (20 marks)

- 4). A). I. Differentiate essential nutrients and beneficial nutrients (5 marks)
- II. What are the two major groups of essential nutrients (10 marks)
- III. If one group of essential nutrients are needed in small quantities for normal plant growth, would it be wise to add large quantities of these nutrients now to supply future plant needs? Explain your answer. (10 marks)
- IV. State usable ionic forms in each essential nutrient (10 marks)
- B). I. What are the two inorganic forms of phosphorous (P) in soil? (5 marks)
- II. Give two examples for each form of P. (5 marks)
- III Explain briefly the factors controlling inorganic phosphorous availability in soil. (10 marks)
- III. Indicate the effect of pH on the relative concentrations of the three species of phosphate ions using an appropriate figure. (10 marks)
- C). I. Assume you added a total of 300 kg/ha of nitrogen for a crop through animal manure and chemical fertilizer, but only 200 kg/ha nitrogen was found in the harvested crop (total biomass of plants was taken for the measurement). What was the fate of the 100 kg/ha nitrogen that are not present in the crop biomass? Explain your answer. (10 marks)
- II. Differentiate symbiotic and non symbiotic nitrogen fixation. (10 marks)
- III. What is meant by 'K fixation' in soil. (10 marks)
- IV. State the various forms of potassium in soils (5 marks)
- 5). A). I. Arrange the given types of organic substances in the order of their tendency to leave the soil or convert into other materials in the soil system in a short period of time (arrange from high tendency to low tendency). (10 marks)
- i. Cellulose
 - ii. Hemicellulose
 - iii. Lignin
 - iv. Starch

- II. In a rainforest ecosystem, what would be the major way of removal of organic matter from the soil? (10 marks)
- III. Using **only a flow diagram**, indicate what happens to the organic matter freshly added to the soil. Indicate only the major processes or end-products and, **chemical formula are not necessary** (25 marks)
- B).I. Agriculture depends heavily on the soil organic matter. Adding **good quality organic** matter is very important in increasing the organic matter content in the soil. **Indicate** what is meant by the term “good quality organic matter” and **list down** the factors that help you to recognize the good quality organic matter in the field. (15 marks)
- II. If a farmer could maintain a sufficient level of organic matter in his farm soil, what are the benefits he receives? (20 marks)
- III. Although agriculture depends heavily on the soil organic matter, conventional agriculture is one of the major causes of soil organic matter depletion. Describe briefly how the agricultural practices may cause the depletion the soil organic matter. (20 marks)
- 6). Write Short Notes on **any four** of the following. (25 marks for each)
- Phosphate solubilizing microorganisms
 - Inorganic phosphorous availability in acid and alkaline soils
 - ‘Composting: A promising technique to reduce waste problem in Sri Lanka’
 - Impacts of continuous usage of inorganic fertilizers in Sri Lanka
 - Adding organic matter to the soil helps increasing the plant vigor
 - If disturbed, soil could be one of the biggest contributors of greenhouse gas emissions