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UNIVERSITY OF RUHUNA

SECOND EXAMINATION IN B.Sc. ARMT/ AB (PART II) – August 2018

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

Answer All parts of Question number 1 and **04 (FOUR)** other questions only

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.

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1). a). I. List down **five (5)** unique features/properties of water (05 Marks)

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II. Write down the equation that is used for the calculation of capillary height (Name all the symbols in the equation) (12 Marks)

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III. What do you mean by **soil water potential**? (05 Marks)

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IV. Name **three (3)** important components of soil water potential (03 Marks)

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b). I. What is the difference between a macronutrient and a micronutrient (5 marks)

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II. State the major five (05) processes involved in the soil nitrogen cycle. (15 marks)

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III. State the importance of phosphate solubilizing microorganisms on phosphorus availability? (5 marks)

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c). I. Draw a graph showing the relationship between plant growth/health and the amount of nutrient availability. (10 marks)

II. State the quantitative methods of soil fertility evaluation? (5 marks)

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III. Name five (5) visual symptoms of plant nutrient deficiencies. (10 marks)

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d) I. Match A and B (7. 5 marks)

A	B
1. C:N 8:1.	a. Gliricidia leaves
2. C:N 600:1	b. Home garden leaf litter
3. C:N 14:1	c. Sawdust
4. C:N 20:1	d. Soil micro organisms
5. C:N 40:1	e. Poultry litter

II. State the main difference between the terms "decomposition" and "humification". (7.5 marks)

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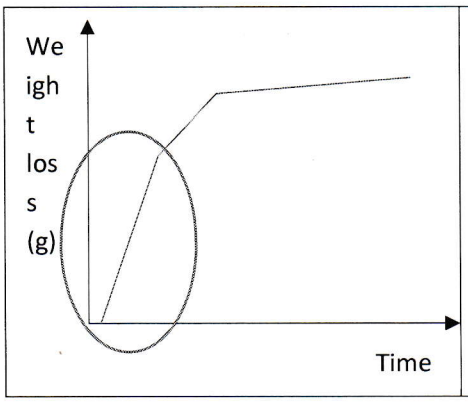
III. The graph below shows the decomposition pattern of mixed forest litter. Write down the components of organic matter that decompose during the stage marked by the circled area. (10 marks)



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2). a). I. List down **five (5)** important roles of soil water. (05 Marks)

II. Give the definitions of the following terms. (10 Marks)

Adhesion:

Cohesion:

b). I. Name the **critical levels** of water in soils. (05 Marks)

II. Explain briefly the **three (3)** types of soil water according to their **availability** to the plants. (15 Marks)

III. What do you mean by **"available water content"**? (05 Marks)

IV. How does the available water content vary with the soil texture? (15 Marks)

c). I. Indicate **three (3)** factors affecting **infiltration** of soil water. (05 Marks)

II. What do you mean by the term "Soil-Plant-Atmosphere Continuum"? (10 Marks)

III. Name the major stages and forces (soil water potential components) responsible for the water movement through the Soil-Plant-Atmosphere Continuum. (10 Marks)

d). "Capillary water movement depends on the sizes of the soil pores," Do you agree with this statement? Justify your answer. (20 Marks)

3). a). I. Explain the importance and the functions of Nitrogenase enzyme in symbiotic nitrogen fixation (15 marks)

II. Why is it important to regulate the O_2 concentration in a root nodule? How is this regulation achieved? (10 marks)

III. The relationship between root nodule and rhizobium is mutual. Why? (10 marks)

IV. Nitrogen is "fixed" (a) from the atmosphere and (b) by vermiculite clays and humus. Differentiate between these two processes. (10 marks)

b). I. What are the problems associated with soil phosphorous? (5 marks)

II. Indicate the following two relations 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)

c). I. What are the main conditions necessary for significant denitrification in soil? (10 marks)

II. What is meant by 'luxury consumption' of potassium? (10 marks)

III. Assume you add a soluble phosphate fertilizer (TSP –Triple Super Phosphate) to an acidic soil and to an alkaline soil separately. In each case,

most of the P has been changed into insoluble forms within a few months.

a) What are these insoluble forms of P? (05 marks)

b) Give one example for each form of P. (05 marks)

c)

4). a). I. What is an inorganic fertilizer? (5 marks)

II. Write **one** example each for N, P, K inorganic fertilizers. (6 marks)

III. State five (5) advantages of using organic fertilizers. (10 marks)

IV. Explain briefly the concept of limiting factor using the Barrel theory. (9 marks)

V. Explain the difference between the soil fertility and productivity. (15 marks)

b). I. Define immobile nutrients. (5 marks)

II. Assume that you are advised to collect a soil sample for your practical class to conduct a laboratory analysis. State the appropriate way you should follow to fulfill the task of collecting the sample) (10 marks)

III. A farmer has complained that the growth of crop in his field has reduced and some symptoms have appeared in the later stage of the plants. You visited his field and observed the following symptoms.

- Yellow color discoloration in older leaves
- discoloration has started from the leaf tip
- midrib alive and green

a) What would be the possible deficient nutrient in this field? (5 marks)

b) Give two (2) reasons that made you to select the above particular nutrient apart from other nutrients, which shows similar deficiency symptoms such as yellow color discolorations. (6 marks)

c) Write three (3) disadvantages in observation based conclusions in soil fertility evaluation. (9 marks)

IV. "Zn has intermediate mobility in the plant and deficiency symptoms will appear in later stages due to hidden hunger". According to your knowledge, state whether this statement is correct or wrong. (5 marks)

Justify your answer giving possible plant deficiency symptoms related to Zn. (15 marks)

5).a). I. Indicate three (3) negative consequences of the soil organic matter depletion. (10 marks)

II. State why the organic matter removal rate from a tropical soil is high compared with that of the temperate soils. (10 marks)

III. The organic matter content of an undisturbed forest soil remains constant, whereas in a conventional farm land, it often depletes over the time. State the reason for this difference. (10 marks)

b).I. Name two plant species (generic or scientific name) which produce high quality organic matter in terms of decomposability. (10 marks)

II. State the reason for your selection for the above question. (15 marks)

III. Using **only a flow chart** with adequate information, show the fate of plant and animal matter when added to the soil. (20 marks)

c). A farmer says that his farm has clayey soil and it is hard for him to use machinery for soil preparation. An agriculture instructor advises him to add organic matter to the soil.

I. Can this solution give a positive answer to the farmer's problem? (10 marks)

II. What would have been the theory the agriculture instructor could have thought of when giving his recommendation? (15 marks)

6). Write Short Notes on **any four** of the following. (25 marks for each)

a. Unique characteristics of water are due to the polarity of water molecules
b. Availability of inorganic phosphorous in soils
c. Possible causes and impacts of Chronic Kidney Disease of unknown etiology (CKDu) in Sri Lanka.
d. Degraded tea lands could be rehabilitated by adding organic matter to the soil
e. Various forms of K (potassium) in soils