



UNIVERSITY OF RUHUNA
FACULTY OF AGRICULTURE

First Examination in BSc Agricultural Resource Management and Technology/ BSc
Agribusiness Management / BSc Green Technology (Part II)

December 2022

SS 12301 Fundamentals of Soil Science (Compulsory)

Theory

INSTRUCTIONS

Answer five (05) questions ONLY.
Only non-programmable calculators are permitted.
Mobile phones are NOT permitted.
Each question carries a total mark of 100.

TIME: 3 (three) Hours

INDEX NUMBER

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1)

A)

- i) State the three dimensions of color used in the determination of soil color. (5 marks)
- ii) Name four factors that affect soil color. (10 marks)
- iii) State reasons for the following colors in soils. (20 marks)
 - a. Dark blackish color
 - b. Red color
 - c. Yellow color
 - d. Grey color
 - e. Greyish and reddish mottles (color patches)

B)

- i) What is meant by soil texture? (10 marks)
- ii) Name three methods that can be used to determine soil texture. (10 marks)
- iii) State one advantage and disadvantage of each of the three methods you mentioned in section B (ii). (15 marks)
- iv) Briefly explain/define the principle used in the Stokes' law. (10 marks)
- v) State five assumptions of the Stokes' Law with the limitations for the particular assumptions. (20 marks)

2)

A)

- i) Write five factors of soil genesis/forming factors and categorize them as active and passive factors. (15 marks)
- ii) Draw a sketch of a typical soil profile and name the soil horizons. (20 marks)
- iii) Briefly explain the formation of "O" horizon. (15 marks)

B)

- i) State three types of primary soil particles. (5 marks)
- ii) State four major constituents of soil. (10 marks)
- iii) State four roles of soil in ecosystems. (10 marks)

C)

- i) What is meant by "organic soil"? Give two examples. (10 marks)
- ii) Explain briefly why soil is considered a renewable resource and a non-renewable resource. (15 marks)

3)

A)

- i) Define soil colloids. (10 marks)
- ii) Name four general types of soil colloids with examples. (15 marks)

B)

- i) Illustrate two basic building blocks of silicate clay minerals. How do you classify clay minerals based on this? (15 marks)
- ii) Give one example each for expanding, limited-expanding and non-expanding minerals. (15 marks)
- iii) 'All clay particles are not necessarily colloids' comment on this statement. (15 marks)

C)

- i) Define isomorphous substitution (10 marks)
- ii) Give an example for isomorphous substitution using a framework silicate mineral. (10 marks)
- iv) What are the functional groups involved with pH dependent charges? (10 marks)

4) A)

- i) What is Cation Exchange Capacity (CEC) of soils? (10 marks)
- ii) List five chemical properties of soil which are important in agriculture. (15 marks)
- iii) Copy the following table to your answer book and fill the table by comparing four common clay minerals; kaolinite, smectite, vermiculite and clay mica. (25 marks)

Property	Kaolinite	smectite	vermiculite	Clay mica
Type (1:1 or 2:1)				
Swelling (None/low/medium/high)				
Interlayer expansion (None/low/medium/high)				
Cation Exchange Capacity (None/low/medium/high)				
Layer bonding type				

B)

- i) Explain briefly the formation processes of three major types of rocks. (20 marks)
- ii) What is weathering of rocks and minerals? (10 marks)
- iii) State the types of rocks and mineral weathering along with an example for each type of weathering. (20 marks)

5) A)

- i) State five functions of humus in soils. (15 marks)
- ii) Explain briefly the factors affecting the soil organism activity. (15 marks)
- iii) Explain the beneficial functions of soil organisms in agriculture and other industries. (20 marks)
- iv) Describe the impacts of human activities on soil organism diversity and population. (20 marks)

B)

- i) Why biodiversity is important for the soil to function properly? (15 marks)
- ii) Explain how a soil rich in biota and organic matter support sustainable agricultural production (15 marks)

6) A)

- i) List the soil orders of the USDA classification. (12 marks)
- i) Among the soil orders you mentioned in part i) above, what are the soil orders found in Sri Lanka? (8 marks)
- ii) Write the soil orders corresponding to the descriptions given below. (20 marks)

Description	Soil order (USDA)
Soils located in arid climates	
Little or no horizon development	
Soil formed in volcanic material	
Soils containing permafrost	
Shrinking and swelling clay soils	

- iii) Giving an example, explain subordinate distinctions. (10 marks)

B)

- i) Name the soil classification levels in descending order under USDA classification. (10 marks)
- ii) What is the most abundant great soil group of Sri Lanka? (10 marks)
- ii) Explain briefly Bog and Half bog soils. (30 marks)