



“Investing in Africa’s future”

COLLEGE OF HEALTH, AGRICULTURE AND NATURAL SCIENCES

NACP 111 INTRODUCTION TO SOIL SCIENCE

END OF FIRST SEMESTER FINAL EXAMINATIONS

NOVEMBER/DECEMBER 2023

LECTURER: MRS S MBIZI

DURATION: 3 HOURS

INSTRUCTIONS

1. Read and understand all questions before you answer.
2. **Do not** write your name on the answer sheets.
3. All working for numerical answers must be shown.
4. The intended number of marks is given in brackets at the end of each question or part of the question.
5. Begin your answer for each question on a new page.

SECTION A (60 MARKS)

Answer all questions in this section

1. Explain the difference between primary and secondary minerals and give an example of each. [4]
2. Describe the sequence of soils along a catena [6]
3. (a) Briefly explain how soil temperature may be detrimental to plant growth [3]
(b) State any three factors that influence the colour of a soil. [3]
4. (a) Differentiate the following soil science terms: Structure and Texture [4]
(b) Briefly discuss the factors that are likely to cause poor soil aeration. [5]
5. Sandy soils derived from granite in Zimbabwe are often acidic and of low fertility.
Discuss six factors that are likely to acidify soils. [6]
6. The following chemical data was obtained from a vertisol in the Darfour region of Sudan.

Exchangeable Cation	mmoles ckg^{-1}
Calcium (Ca)	30
Magnesium (Mg)	40
Potassium (K)	2
Sodium (Na)	1
Hydrogen (H)	10
Aluminium (Al)	50

Use the above data to calculate:

- (i) The Total Exchangeable Bases (TEB) [2]
- (ii) The percentage Base Saturation (% BS) [2]
- (iii) The Percentage Acid Saturation (% AS) [2]

- (iv) What are the typical characteristics of soils with a high C.E.C value [3]
- (v) What is the major implication of isomorphous substitution in a clay lattice [2]
- 7. List the five soil forming factors [5]
- 8. (a) Differentiate between the pedological and edaphological approaches to soils. [4]
- (b) The word soil comes from the latin word solum which means land. What makes up:
 - (i) The solum and the regolith [2]
 - (ii) Which of the two above do you think would give us more Information for soil management and why? [3]
- (c) Explain how organic matter content of soil influences:
 - (i) Temperature [2]
 - (ii) Bulk density [2]

SECTION B (40 MARKS)

Answer any two question two questions from this section.

9. (a) What is bulk density (Db). [4]

(b) Outline the factors that affect Bulk Density, [16]

10. Discuss the processes involved in soil formation [20]

11. An applied soil scientist carrying out a study on soil water measurements generated the data below for a soil profile from a field that has been under plough-based cultivation for over a decade.

Horizon	Depth	Bulk density (gcm^{-1})	Field capacity (mm)	Wilting point(mm)	Available water capacity (mm/100mm)	Cumulative Available water capacity(mm/100mm)
A1	0-25	1.62	42	11		
A2	25-35	1.75	18	5		
A3	35-45	1.70	16	6		
B1	45-75	1.66	87	45		
B2	75-150	1.51	99	113		

(a)(i) Copy the column for horizon, available water capacity and cumulative available water capacity and fill in the missing values [10]

(ii) What may have caused an increase in bulk density within the A2 and A3 horizon [2]

(b) A wheat crop growing under irrigation in the above field has a root depth of 0,08m and a crop factor Kc of 0,9

- (i) What is the total Plant Available Water (PAW in $mm/100mm^{-1}$) in the wheat root zone? [2]
- (ii) List the four factors that affect the free energy of water. [4]
- (iii) Define the term Available Water Capacity (AWC) [2]

The end