

DEPARTMENT OF SOIL SCIENCE & TECH.

2005/2006 RAIN SEMESTER EXAMINATIONS

SST 202: INTRODUCTION TO TROPICAL SOILS.

ANSWER ANY 4 QUESTIONS, ENSURING THAT YOU PICK AT LEAST 2 QUESTIONS FROM EACH SECTION, USE YOUR ANSWER BOOKLETS.

TIME ALLOWED: 2½ HRS

SECTION A:

- 2(a) Define the term soil profile.
- (b) Draw and label a hypothetical soil profile.
- (c) Given that the common symbols used for designating horizons of soil profiles are A,B,C, where C stands for parent material,
- (i) what symbol do we use for parent rock?
- (ii) State the precise meaning of A(B)C profile and (A)B C profile.
- (d) Why is the A horizon of Soils usually dark in colour?
- 3(a) Define cation exchange capacity
- (b) State 4 factors that affect the CEC of a soil and discuss any 3 of them,
- (c) A soil contains the following:-
- | | | | |
|----|---|------|----------|
| Ca | : | 3.35 | meq/100g |
| Mg | : | 2.25 | " " |
| K | : | 1.75 | " " |
| Na | : | 0.82 | " " |
- Exchangeable Hydrogen: 0.35 meq/100g
- Exchangeable acidity: 0.43 " "
- Calculate (a) the ECEC of the soil
- (b) the % Aluminium saturation of the soil.

- (c) The percentage base saturation of the soil
- (d) Comment on the fertility status of the soil, giving appropriate reasons.
- 4(a) Describe, with suitable diagrams, and examples, the structure of a 1:1 and 2:1 lattice clay materials.
- (b) List 3 properties associated with each of the 2 classes of silicate clay minerals above.
- (c) Name the 3 sub-divisions of 2:1 lattice clay minerals, with appropriate examples.
- 5(a) Define the term pH
- (b) State 4 sources of acidity in tropical soils
- (c) What is the optimum pH to which tropical soils should be limed and why?

SECTION B

- 6(a) Define the terms Soil structure and Soil texture and state 2 basic differences between them.
- (b) How does soil texture affect the following:-
- Bulk density
 - Particle density
 - Porosity
 - Nutrient retention.
- (c) The settling time from 0.75m Water column for 3 different soil separates named X, y and z are 30 mins, 60 mins and 180 mins, respectively. If $k = \frac{9 + 10^2}{5m}$

7) Write short notes on four of the following:

- i. Textural triangle
- ii. Prismatic soil structure
- iii. Flocculation
- iv. Soil consistency
- v. Surface tension

(b) Define coefficient of linear expansion.

Suppose the change in length from moistened to air-dried and shranked condition is 30cm and 20cm, respectively, determine the CLE and state the relevance of Cole in Soil or engineering purposes.

8(a) The sides of a clay cube is 3^3 9cm. If each side is broken into 6 subunits of $1.5 \times 15 \text{cm}$, what is the specific area of the clay fraction and the biological processes that affect it?

(b) If 20g and 12g are the respective weights of Wet and air-dried Soil samples. Given that the height and diameter of the cylindrical core containing the samples are 5cm and 3cm, respectively, calculate:

- i. The bulk density
- ii. The particle density
- iii. The % pore space
- iv. The volume of solids if 25% of the total volume is air-filled.

9(a) Explain the relevance of soil colour and factors that affect it.

(b) Calculate the weight of clay and silt particles if 80% and 8% of 21g soil sample is made up of sand and silt respectively.