

SIR ARTHUR LEWIS COMMUNITY COLLEGE
Division of Agriculture

END OF SEMESTER TWO EXAMINATION – APRIL/MAY 2018/2019

PROGRAMME TITLE : General Agriculture – Associate Degree Year One
COURSE TITLE : **Fundamentals of Soil Science**
COURSE CODE : SSC108
DATE : 6th May, 2019
TIME : 9:00 a.m.
DURATION : 2 hours
ROOM : OTW – Room 4
INVIGILATOR(S) :



INSTRUCTIONS:

SECTION A – MULTIPLE CHOICE

Answer All of Question 1

Q1. Answer all questions by shading the circle next to the correct response. There is only **one** correct answer to each question. Where more than one circle is shaded, no marks will be given: **25 marks**

SECTION B

Answer **ANY THREE (3) QUESTIONS FROM THIS SECTION.** (Write the answer to **question 5** on the question paper.)

NB: submit the entire exam paper with other additional writing paper

SECTION A

Name: _____ Student No. _____

Answer All of Question 1 And Any Other Three (3) Questions

Q1. Answer all questions by shading the circle next to the correct response. There is only **one** correct answer to each question. Where more than one circle is shaded, no marks will be given: **25 marks**

1. Chemical weathering processes involves:
 - a. Spheroidal weathering, hydration, CEC, pH
 - b. Flooding, precipitation, substitution, leaching
 - c. Solution, hydrolysis, oxidation, carbonation
 - d. Bonding, Exchange, cations, ionization

2. The inter-relationship between parent materials is illustrated in the:
 - a. Earth's Crust
 - b. Pedogenesis process
 - c. Rock cycle
 - d. Textural Triangle

3. A vertical cross-section of the soil from surface into the underlying unweathered material is the:
 - a. Soil Profile
 - b. Soil Horizon
 - c. Soil Topography
 - d. Soil Pit

4. Given a textural composition of 33% sand, 34% silt and 33% clay where on the textural triangle would this soil lie?
 - a. Silty Clay loam
 - b. Loam
 - c. Silt
 - d. Silty clay

5. The principle behind Stokes Law is that;
 - a. Bigger particles settle more quickly
 - b. The velocity of settling (V) is proportional to the square of particle diameter (d)
 - c. Clay particles moves faster that sand particles
 - d. Both a and b above

6. The following are examples of igneous rocks:
- a. Pumice, Gabbro, Basalt, Gypsum
 - b. Diorite, Sandstone, Obsidian, Chert
 - c. Marble, Gypsum, Pumice, Schist
 - d. Granite, Andesite, Rhyolite, Pumice
7. Which of the following group of terms refer to soil structure sub-types
- a. Glassy, clusters, separates, pedons
 - b. Macropores, micropores, void space, tubular
 - c. Granular, Prismatic, Blocky, Platy
 - d. Profiles, layers, pans, matric
8. Salinization is:
- a. Salt build-up in irrigation water
 - b. Evaporation of sea water
 - c. Salts occurring in the soil
 - d. Soil infertility
9. In terms of nutrient supplying capacity, how would you describe manure in comparison to synthetic fertilizers?
- a. Same as
 - b. Stronger
 - c. Depends on the source of manure
 - d. Low
10. The transportation and accumulation of dissolved or suspended materials within the soil is described as:
- a. Settling and mass flow
 - b. Adsorption and Precipitation
 - c. Diffusion and root interception
 - d. Eluviation and Illuviation
11. Which is the most important group of processes responsible for making specific nutrients available for plant uptake?
- a. Single cycle, Phosphorus cycle, production cycle
 - b. Rock Cycle, Hydraulic cycle, Life cycle
 - c. carbon cycle, nitrogen cycle, sulphur cycle
 - d. Water cycle, Krebs Cycle, Nutrient Cycle,

12. Soil Taxonomy:

- a. A system of soil classification
- b. An arrangement of soil orders
- c. A listing of the products of soil formation
- d. Textural classification of soils

13. The process of $\text{NH}_4^+ \rightarrow \text{NO}_2^- \rightarrow \text{NO}_3^-$ involves the following organisms

- a. Azotobacter and Clostridium
- b. Earth worms and fungi
- c. Rhizobium and Thiobacillus
- d. Nitrobacter and Nitrosomonas

14. 16-8-24 +2MgO 0.1B is a grade/analysis of fertilizer commonly used in the banana industry. This represents, respectively, the amounts of the following nutrients

- a. Nitrogen, Phosphorus, Potassium, Magnesium and Boron
- b. Nitrogen, Phosphorus, Potassium, Manganese and Boron
- c. Urea, Triple superphosphate, Muriate of Potash, Sulpomag, Borax
- d. Major, Minor, Trace and Micro

15. Laterization, Podzolization, Calcification, Salinization and Glaciation are:

- a. Physical and Chemical processes
- b. Principal pedogenic processes acting on soils
- c. Systems of soil classification
- d. Types of soil

16. Examples of igneous rocks

- a. Silicates, ferro-magnesium, peat and schist
- b. Gabbro, dacite, andesite and basalt
- c. Mica, Amphiboles, lava, Magma
- d. Quartz, feldspars, biotite and pyroxenes

17. Which soil parameter that you measure is affected by the amount of pore space, type of minerals present, texture, and amount of organic matter:

- a. Water holding capacity
- b. Compaction
- c. Soil fertility
- d. Bulk density

18. The following are secondary minerals:

- a. Gypsum, calcite, clay minerals, dolomite
- b. Gibbsite, Quartz, Augite, Limestone
- c. Muscovite, Biotite, Hematite, Gypsum
- d. Sand, Silt, Clay, Humus

19. The biological component of soil comprise of:

- a. Flora and fauna
- b. Live and dead (organic matter)
- c. Macroscopic and microscopic organisms
- d. All of the above

20. Soil formation is:

- a. The buildup of horizons
- b. A constructive as well as a destructive process
- c. Climate, parent material, time, biota
- d. An accumulation of debris resulting from decay of rock and organic Materials

21. In symbiotic nitrogen fixation, which of the following is true?

- a. The plant gives fixed carbon to the bacteria which in turn give fixed nitrogen to the plant.
- b. The bacteria find its own energy to provide fixed nitrogen to the plant
- c. Nitrogen fixing bacteria must operate in an oxygen rich environment.
- d. Nitrogen fixing bacteria are most active in systems with crop residues rich in available nitrogen.

22. The following are the results of a chemical analysis of a sample taken from Balembouche Gritty clay loam soil: Calculate the CEC of the soil

Meq/100g					ppm		
H ⁺	Ca ²⁺	Mg ²⁺	K ⁺	Na ⁺	N	P	S
2	9.7	7.12	0.05	1	4	1	26

- a. 19.87
- b. 50.87
- c. 17.87
- d. 31

23. Using the data in question 22, calculate the Percent Base Saturation of the soil

a. 89.93

b. 35.13

c. 39.06

d. 100

24. Soil pedogenic processes can be considered in the following four groups:

a. Soil biota, parent materials, topography, time

b. Additions, losses, transformations and translocation

c. Leaching, accumulation, evaporation, precipitation

d. Substitution, diffusion, mass flow, interception

25. Organisms add humus to the soil through the processes of:

a. Decomposition

b. Nitrification

c. Fixation

d. Catabolism

SECTION B

Answer Any Three (3) Questions

Q1. Discuss the effect of soil organic matter (SOM) on soil productivity and fertilizer use and efficiency, making particular reference to types and forms of SOM, benefits of SOM, how SOM it is maintained in the soil, how levels can be improved, other relevant factors **25 marks**

Q2. Plants require adequate amounts of 17 essential nutrients for optimum growth.

- i. List the possible sources of these nutrients; **5 marks**
- ii. List the main types of fertilizer used to supply nutrients; **2 marks**
- iii. List two fertilizer products, in each instance, that supply Nitrogen, Phosphorus and Potassium for crop production; **6 marks**
- iv. List six (6) fertilizer application methods used in commercial farming operations; **6 marks**
- v. Given a 50 kg bag of an NPK blend with a guaranteed analysis of 16-8-24.2MgO.0.1B. Calculate the amount (kg) of elemental N, P, K, Mg and B and filler present in the bag. **6 marks**

(Conversion factor for P_2O_5 to P, K_2O to K and MgO to Mg is 0.44, 0.83 and 0.60 respectively).

Q3. Soil acidity and conditions which produce acid soils are important considerations in managing soils for good crop production. With that in mind, answer the following.

- a. What is meant by an acid soil? **2 marks**
- b. What activities tend to increase soil acidity? **3 marks**
- c. Do plants get sufficient calcium in soils of low pH? Explain why. **5 marks**
- d. Soil acidity influences the activity of microorganism. Explain **5 marks**
- e. How does the application of lime to an acid soil influence its productivity and the efficiency of applied fertilizer and manure? **10 marks**

Q4. Write some brief notes on any five (5) of the following:

- i. Nitrogen Cycle (**5 marks**)
- ii. Isomorphous Substitution (**5 marks**)
- iii. Ion Exchange (**5 marks**)
- iv. Soil pH (**5 marks**)
- v. The Rock Cycle (**5 marks**)
- vi. Soil pedogenesis (**5 marks**)
- vii. Physical properties of soil (**5 marks**)
- viii. The Textural Triangle (**5 marks**)

Q5. Given the following data collected from the field trip.

Bulk Density & Soil Moisture Data Worksheet					
Sample ID	Core Dimension (cm)		Weight (gm)		
	Length	Diameter	Empty core	Core + Wet Soil	Core + Dry Soil
A	76.09	54.60	99.35	413.75	333.05
B	77.00	54.88	100.32	357.72	276.24
C	77.50	54.83	100.02	389.96	308.35
D	78.11	54.93	98.98	415.84	342.26
E	77.04	54.77	98.79	356.74	314.52

a. Fill the blanks in the table below

Sample ID	Bulk Density (gm/cc)	Porosity (%)	Volume of water in core (cc)	Pore Space Volume of core (cc)	Gravimetric Moisture content of soil (%)	Volumetric Moisture content of soil (%)	Pore space occupied by water (%)
A							
B							
C							
D							
E							

16 marks

b. Which sample has the least compact soil? _____

Explain: _____

3 marks

c. Which sample has the wettest soil? _____

Explain: _____

3 marks

d. Which sample has the driest soil? _____

Explain: _____

3 marks

