

EGERTON



UNIVERSITY

UNIVERSITY EXAMINATIONS

SECOND SEMESTER 2008/2009

FIRST YEAR EXAMINATIONS FOR THE DEGREE OF BACHELOR OF
SCIENCE IN AGRICULTURAL ENGINEERING

AGEN 200: PHYSICS OF THE PLANT ENVIRONMENT

STREAM: 2008 B. Sc. AGENTIME: 2 HoursDAY/TIME: Wednesday, 8.30 – 11.30 a.m.DATE: 6/05/09INSTRUCTIONS:

1. This paper contains FIVE questions
2. Attempt any FOUR questions
3. All questions carry equal marks
4. Marks for each question are shown in parenthesis ()
5. Show all your work on the answer sheet and indicate any assumptions made on calculations.

QUESTION 1

- (a) Using the general soil phase diagram, show the major soil constituents and their proportions. (5 marks)
- (b) Applying the appropriate equations, define the following terms related to soils:
- i) Void ratio (e) (2 marks)
 - ii) Porosity (n) (2 marks)
 - iii) Specific gravity of solid particles (G_s) (2 marks)
 - iv) Soil water (moisture) content (w) (2 marks)
 - v) Bulk density of soil (p) (2 marks)
- (c) A saturated sample of soil was found to have a water content of 27% and a bulk density of 1.97 Mg/m^3 . Determine the dry density and the void ratio of the soil, and the specific gravity of soil particles. (10 marks)

QUESTION 2

- (a) A moist sample of soil in a bottle had a mass of 25.24 g and the bottle when empty had a mass of 14.2 g. After drying in an oven for 48 hours at 105°C, the bottle and soil sample had a mass of 21.62 g. Determine the water content of the soil. (5 marks)
- (b) With the aid of a diagram, show the major horizons that may be present in a theoretical mineral soil profile. (10 marks)
- (c) i) A grain size analysis of a soil sample reveals that 100% of the particles by mass are less than 2 mm in diameter, 60% are less than 0.06 mm and 30% finer than 0.002 mm. Using the textural triangle provided with the question paper, determine the textural classification of this soil. (5 marks)
- ii) Define the following terms
- (i) Soil structure (2½ marks)
 - (ii) Soil texture (2 ½ marks)

QUESTION 3

- (a) Explain THREE major functions of soil in relation to plant growth and development. (9 marks)
- (b) Briefly describe the following types of soil water: -
- i) Hygroscopic water (4 marks)
 - ii) Capillary water (4 marks)
 - iii) Gravitational water (4 marks)
- (c) Explain the meaning of the following terms:
- i) Soil tilth (2 marks)
 - ii) Soil consistency (2 marks)

QUESTION 4

- (a) Explain FIVE major factors that affect the organic matter content of soils. (10 marks)
- (b) Discuss the importance of soil organic matter. (9 marks)
- (c) Briefly explain THREE factors that affect the bulk density of soil. (6 marks)

QUESTION 5

- (a) A soil had a particle density of 2.65 g/cm^3 and a bulk density of 1.34 g/cm^3 . Calculate the percent total pore space in this soil. (5 marks)
- (b) Discuss FIVE soil factors that affect the moisture holding capacity of soil. (10 marks)
- (c) i) Describe THREE types of movement of soil water. (6 marks)
 ii) Define the term aeration in soils. (1 mark)
 iii) Discuss the importance of soil air. (3 marks)
