UNIVERSITY OF SWAZILAND

FINAL EXAMINATION PAPER

PROGRAMMES: BSC AGRICULTURAL AND BIOSYSTEMS ENGINEERING YEAR III

BSC AGRICULTURAL EDUCATION YEAR III

COURSE CODE: ABE 301

TITLE OF PAPER: SOIL AND WATER CONSERVATION

TIME ALLOWED: TWO (2) HOURS

INSTRUCTIONS: ANSWER QUESTIONS ONE AND ANY TWO OTHER QUESTIONS.

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SOIL AND WATER CONSERVATION

Question 1: Compulsory

(a) Discuss three factors that affect water erosion [15 marks]

(b) A sample of soil taken three days after irrigation has a mass of 950g and volume of 600cm^3. The particle density is 3.25g/cm^3 and dry mass of 750g. Determine

(i) void ratio [2.5 marks]

(ii) Porosity [2.5 marks]

(iii) Percentage water content [2.5 marks]

(iv) Degree of saturation [2.5 marks]

(c) List the three main objectives of mechanical soil conservation works [7.5 marks]

(d) Mulching is one technique used to conserve water (moisture), explain the science behind this technique i.e. how it achieves this purpose. [7.5 marks]

Question 2

(a) With the aid of a diagram, describe the different stages during the formation of a donga. [15 marks]

(b) Discuss the effects of soil erosion on water quality. [15 marks]

Question 3

(a) Briefly outline and discuss the use and relevance of the revised universal soil loss equation (RUSSLE) in erosion studies. [15 marks]

(b) The average velocity in a grass waterway is 1.83m/s with a slope of 9%. Assuming no change in roughness (n), and in the hydraulic radius (R);

(i) What is the velocity, if the slope is reduced to 4%? [7.5 marks]

(ii) What is the velocity if the roughness coefficient is reduced from 0.04 to 0.03? [7.5 marks]

Question 4

(a) Briefly explain in less than half a page, what is meant by the term THREE – PHASE SOIL SYSTEM. [5 marks]

(b) Design a parabolic grass waterway to convey peak flow of $6.0m^3/s$ on a 1.0% slope over an erodible sandy soil with Bermuda grass vegetation, which is a good stand cut to height of 5 cm. Allow an 18% freeboard. The roughness coefficient is 0.035 and the velocity is 2.0 m/s [15 marks]

(c) Give four reasons why do we bother about soil and water conservation. [10 marks]