



**UNIVERSITY OF SWAZILAND
FINAL EXAMINATION PAPER**

PROGRAMME: BSc AGRICULTURAL AND BIOSYSTEMS ENGINEERING 1

COURSE CODE: ABE101

TITLE OF PAPER: AGRICULTURAL ENGINEERING PRINCIPLES

TIME ALLOWED: TWO (2) HOURS

SPECIAL MATERIAL REQUIRED: NONE

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS

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CHIEF INVIGILATOR

SECTION 1: COMPULSORY QUESTION**QUESTION 1**

- a. Explain why these factors should be considered when choosing an irrigation system.
- Quality of water [4 marks]
 - Cost of energy [4 marks]
 - Topography [4 marks]
 - Availability of expertise [4 marks]
 - Value of crop being irrigated [4 marks]
- b.
- What are the two categories of mechanics that are used in agricultural engineering? [1 mark]
 - Which of these categories is used in agricultural structures to resolve forces and the ultimate design of buildings and structures? [1 mark]
 - What are the three (3) equations of static equilibrium? [2 marks]
 - Calculate the magnitude of the forces **R**, and **L** in Figure 1. [2 marks]

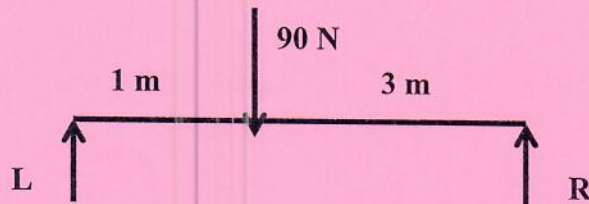


Figure 1. Concrete ring beam loading.

- c. Discuss the three (3) functions of an agricultural tractor [14 marks]

SECTION II: ANSWER ANY TWO (2) QUESTIONS**QUESTION 2**

- a. Discuss three human activities that contribute to global warming, that eventually leads to climate change. [6 marks]

- b. List four climate livestock practices that can be used to offset effects of climate change. **[4 marks]**
- c. Distinguish between hazardous and non-hazardous agricultural waste and suggest safe disposal means for the hazardous waste. **[10 marks]**
- d. What is meant by primary pests and secondary pests? Give one example for each case. **[4marks]**
- e. Name three enemies of grain (maize) in storage. **[6marks]**

QUESTION 3

- a.
- i. Describe with the aid of a diagram how the electromagnetic distance measurement (EDM) instruments operate. **[5 marks]**
- ii. The dimensions of the maize field could have been measured accurately and faster with an electromagnetic distance measurement (EDM). The EDM utilizes equation 1 to determine the distance in question.

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} \quad (1)$$

Given that the speed was 100 m/s and it took 9.7 seconds for the signal to be returned to the emitter, calculate the distance that was measured by the EDM.

- [3 marks]**
- b. Discuss in detail how the surveyor's level was developed from a basic physics liquid principle to be what it is today. **[6 marks]**
- c. Name the types of traffic signs a tractor driver is expected to find on a public road. **[6 marks]**
- d. What is the difference between stress and strain of engineering materials? **[4 marks]**
- e. A metal wire that has a diameter of 3 mm is used in a workshop for hanging engine parts. If the wire is 1.2 m long and is observed to extend by 3 mm when a part of 50 kg is hang, Calculate
- a. The stress created in the rod. **[3 marks]**
- b. The strain. **[3 marks]**

QUESTION 4

- a. What are the conditions necessary to propagate a fire? **[3 marks]**
- b. Figure 1 shows the stress-strain curves of three materials that can be used in an agricultural workshop.

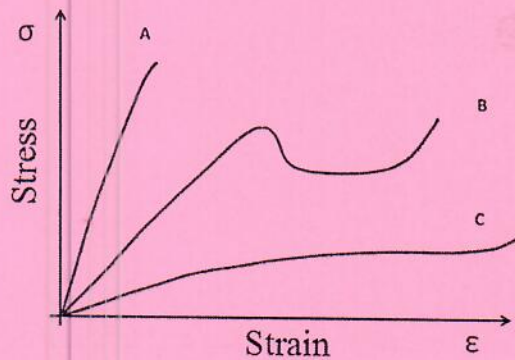


Figure 1 Stress strain diagrams of three engineering materials

- i. Which material shows the highest strength suitable for lifting heavy loads? **[1 marks]**
Give a reason for your choice **[2 marks]**
- ii. Which material is ductile? **[1 marks]**
Give a reason for your choice **[2 marks]**
- c. Name the types of traffic signs a tractor driver is expected to find on a public road. **[6 marks]**
- d. What are the three ways of classifying tractors? **[5 marks]**
- e. Write the four principles used as a guide to develop a waste management system. **[8 marks]**
- f. Briefly explain what is meant by sustainable waste management. **[2 marks]**