



UNIVERSITY OF SWAZILAND  
RESIT/ SUPPLEMENTARY EXAMINATION PAPER

COURSE CODE:                    ABE206/ ABE 209

PROGRAMMES:            BSC. ABE II  
                                  BSC. ANIMAL SCIENCE II  
                                  BSC. ANIMAL SCIENCE (DAIRY) II  
                                  BSC. ANIMAL SCIENCE (DAIRY) IV

TITLE OF PAPER: FARM BUILDINGS AND STRUCTURES

TIME ALLOWED: TWO (2) HOURS

SPECIAL MATERIAL REQUIRED: NONE

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO OTHER  
QUESTIONS

DO NOT OPEN THIS PAPER UNTIL PERMISSION HAS BEEN GRANTED BY THE  
CHIEF INVIGILATOR

## SECTION I: COMPULSARY

## QUESTION ONE

- A) What are the **five categories** of **agricultural buildings and structures**? (5 marks)
- B) A Farm manager intends to construct a **concrete silage silo** with a design life of **20 years**. The depreciation cost is expected to be **5.0%** per year and the initial costs were estimated to be **E15, 000.00**. The bank loan is currently at **15.0%** interest and an insurance of **1.0 %** after construction.
- Calculate the annual cost of the structure. (5 marks)
  - What would be the value of the structure after the second year of operation? (5 marks)
  - If the returns obtained from silage sales are **E15, 000.00** annually, what advice would you give to the farm director and why? (5 marks)
- C)
  - What are the **three (3) equations** of **static equilibrium**? (3 marks)
  - Calculate the **magnitude** of the forces **R**, and **L** in **Figure 1** and **M** and **N** in **Figure 2**. (7 marks)

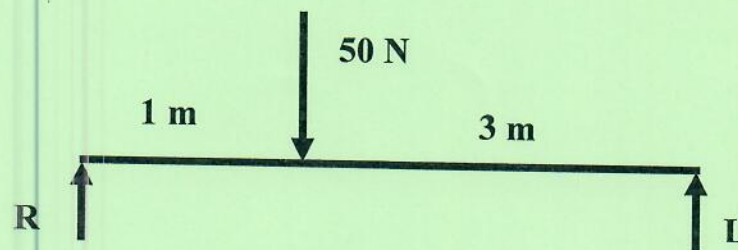


Figure 1. Concrete reinforced ring beam loading.

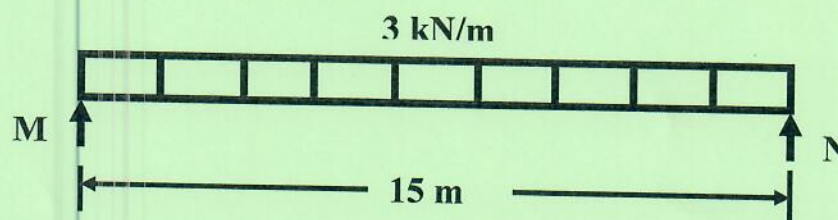


Figure 2. Concrete reinforced ring beam loading.

- D) i. Briefly describe the difference between **load bearing** and **non-load bearing** walls. (5 marks)
- ii. State the **two (2)** commonly used load bearing wall sizes in Swaziland, including the building material used for such walls? (4 marks)
- iii. State any **non-load bearing wall size** including the building material used for such wall sizes. (1 mark)
- [40 marks]

### SECTION B: ANSWER ANY TWO QUESTIONS

#### QUESTION TWO

- A. The concrete ring beam (2000 x 200 x 150) in **Figure 3** failed resulting in structural damage to the building in question.

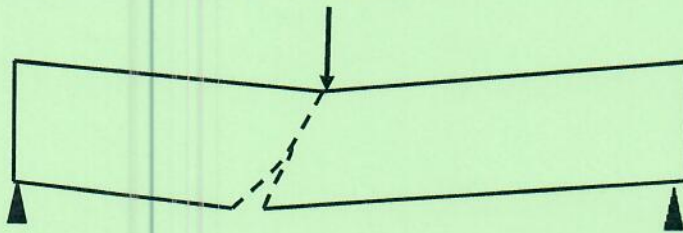


Figure 3. Concrete ring beam failure under load

- i. What was the structural problem that caused the ring beam to fail? (1 mark)
- ii. What could be done to **correct the failure** of the concrete ring beam? (2 marks)
- iii. Provide a design working **drawing or sketch** that would reflect a durable concrete beam, which could no fail under the circumstances in **Figure 1**. Your sketch should indicate the appropriate **dimensions** of the ring beam. (5 marks)
- B) An **axially loaded** concrete column had a uniformly distributed load of 1000 N and a resultant compressive stress of 33.33 N/m<sup>2</sup>.
- i. Calculate the required footing **area** that would **adequately dissipate** the load of the column into the ground. (5 marks)
- ii. If the footing was designed to be **square in shape**, what were the dimensions i.e. **width and length** supposed to be? (4 marks)

- C) i. State the **two (2)** most common **categories** of **agricultural fences** giving at least one example of each? **(2 marks)**
- ii. What is the fence that could be recommended for the control of small ruminants i.e. sheep and goats in vegetable farms? **(1 mark)**
- iii. What type of **fencing posts** are **utilised** in the **construction** of this type of fence? **(2 marks)**
- iv. Briefly discuss the **functions** of fences in **agricultural production**. **(8 marks)**
- [30 marks]**

### QUESTION THREE

- A) Briefly discuss the **significance** of costing **agricultural buildings and structures** before design and construction. **(6 marks)**
- B) i. What are the structural elements other than roofs that make up agricultural buildings? **(4 marks)**
- ii. What are the **nine (9)** types of roof designs that re used in agricultural buildings and structures? **(9 marks)**
- iii. Which type of these roof designs is commonly used by **small holder farmers** in **Southern Africa**? **(2 marks)**
- iv. Why is the roof design stated above used the most by small holder farmers in Southern Africa? **(2 marks)**
- C) A **3000 x 2000 concrete hydrant** protection was designed by an irrigation engineer to secure vandalism of her main water supply line. The hydrant protection was to be built using 6-inch concrete blocks that were **300 mm** long, **150 mm** wide and **150 mm** high. If the foundation was **200 mm** deep, with a standard mortar thickness of **15 mm** between blocks, calculate the number of blocks that would be required for the valve protection. **(13 marks)**
- [30 marks]**

**QUESTION FOUR**

- A)** State the **three (3) types of loads** that can be exerted in agricultural buildings and structures giving at **least one example** of each. **(6 marks)**
- i.** What are the **three** most common types of **stress** in agricultural buildings and structures? **(6 marks)**
  - ii.** A rivet of **10 mm** diameter is connecting two pieces of flat steel in a roof tie. **Calculate** the shear stress of the rivet when the steel bars are subjected to an axial pull of **6.0 kN**. **(5 marks)**
  - iii.** Why is **stress** calculation so important in the design of agricultural buildings and structures? **(4 marks)**
- B)**
- i.** What are the **main properties** of **structural sections** that have to be analysed during the **design** of **agricultural buildings and structures**? **(6 marks)**
  - ii.** Name the three structural steel sections that are used in the design and construction of agricultural buildings and structures **(9 marks)**
- [30 marks]**