



**UNIVERSITY OF SWAZILAND
SUPPLEMENTARY EXAMINATION PAPER**

PROGRAMME: BSC AGRIC II (ABE)

COURSE CODE: ABE 209

BSC ANIMAL SCIENCE (DAIRY) IV

TITLE OF PAPER: FARM BUILDINGS AND STRUCTURES

TIME ALLOWED: TWO (2) HOURS

**INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO
OTHER QUESTIONS.**

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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)

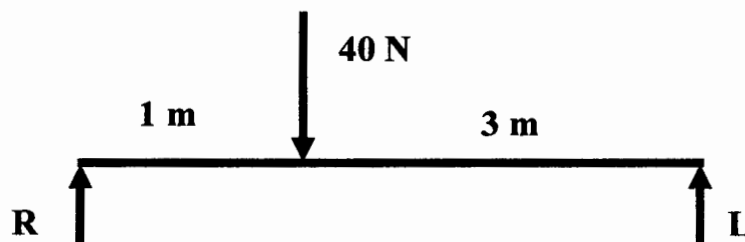


Figure 1 Concrete reinforced ring beam loading.

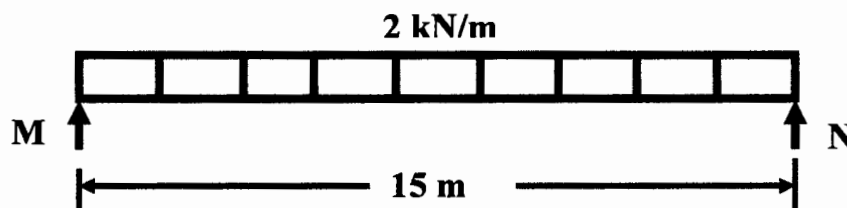


Figure 2. Concrete reinforced ring beam loading.

- D) Briefly **discuss** the **economic importance** of buildings and structures in agricultural production. (10 marks)

[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.

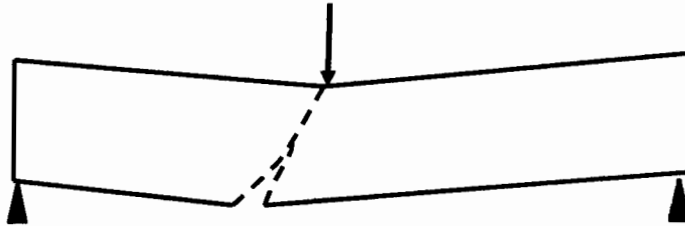


Figure 3. Concrete ring beam failure under load

- 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/m².
- 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)
 - iv. What type of **fencing posts** are **utilised** in the **construction** of this type of fence? (2 marks)
 - v. 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 agricultural buildings and structures? (4 marks)
- ii. What are the **nine (9)** types of roof designs that are 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)
- v. 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. (7 marks)

[30 marks]

QUESTION FOUR

- A) i. 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)
- ii. What are the **three** most common types of **stress** in agricultural buildings and structures? (3 marks)
- iii. 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)
- iv. 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. Calculate the **second moment of area** about the **x-x axis** for a solid steel cross section that is rectangular, **24 mm wide** and **100 mm deep** as shown on **Figure 2**. **(6 marks)**

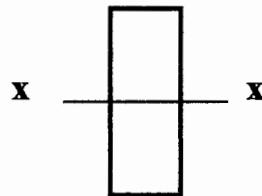


Figure 2. Beam structural section

[30 marks]