



**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.**

**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.**
- i. Calculate the annual cost of the structure. (10 marks)**
- ii. What would be the value of the structure after the second year of operation? (10 marks)**
- iii. 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) 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 1 failed resulting in structural damage to the building in question.

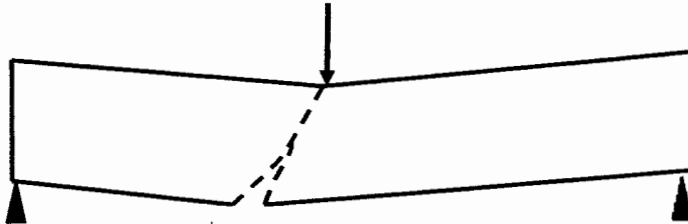


Figure 1. Concrete ring beam failure under load

- 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 not 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) A Farm Director intends to construct a concrete silage silo with a design life expectancy of **20 years**. The depreciation cost is expected to be **5 %** per year and the initial costs were estimated to be **E5000.00**. The bank loan is currently at **17 %** interest and an insurance of **1.0 %** after construction.
- i. Calculate the annual cost of the structure. **(5 marks)**
- i. What would be the **value of the structure** after the **second year** of operation? **(5 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. **(14 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? **(3 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)**
- ii. 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)**

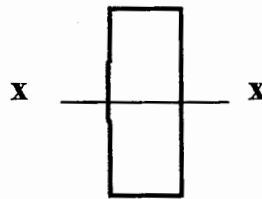


Figure 2. Beam structural section

[30 marks]