



**UNIVERSITY OF SWAZILAND
FINAL EXAMINATION PAPER**

PROGRAMME: BSC ABE II

COURSE CODE: ABE206/ ABE 209

BSc. ANIMAL SCIENCE (DAIRY) II

BSc. ANIMAL SCIENCE II

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

- A) State the **five categories** of farm buildings and structures giving at least **one example** of each. (5 marks)
- B) i. What are the **three (3) equations** of static equilibrium? (3 marks)
- ii. Calculate the **magnitude** of the forces **R**, and **L** in **Figure 1** and **M** and **N** in **Figure 2**. (7 marks)

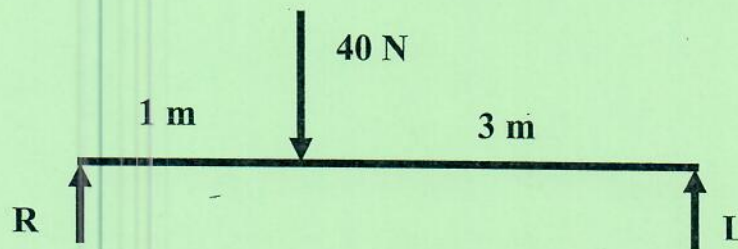


Figure 1. Concrete reinforced ring beam loading.

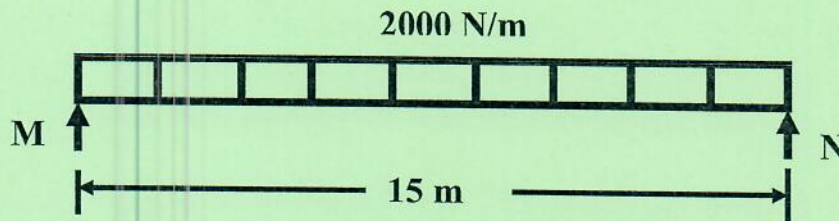
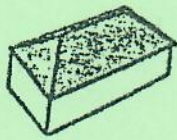


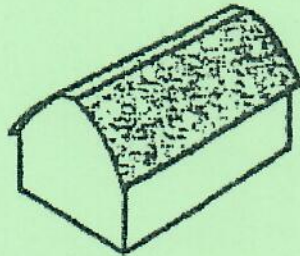
Figure 2. Concrete reinforced ring beam loading.

- iii. What type of loading pattern is exerted in the beam in **Figure 1** and **Figure 2**? (2 marks)
- C) i. What are the structural elements other than roofs that make up buildings? (4 marks)
- ii. Name the **nine (9)** types of roof designs used in agricultural buildings and structures reflected in **Figure 3**. (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)
- v. Which of these roof designs could be recommended for an **industrial manufacturing building**? Please state the **reason why** this roof design is recommended? (6 marks)
- [40 marks]

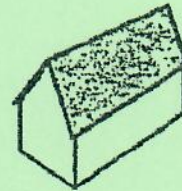
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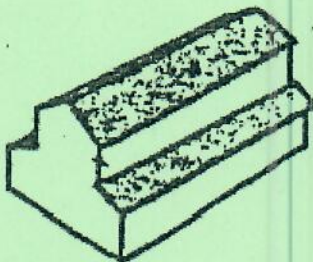
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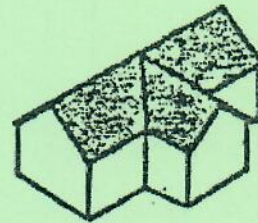
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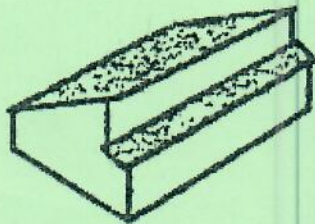
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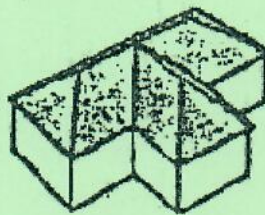
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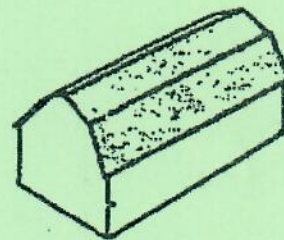
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vii.



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ix.

(9 marks)

Figure 3. Types of building roof designs

SECTION B: ANSWER ANY TWO QUESTIONS

QUESTION TWO

- A) i. What are the **three (3)** most important components of concrete? (3 marks)
- ii. Concrete components **ought** to be **well graded** when making concrete, discuss briefly what this statement means in relation to concrete strength. (5 marks)
- iii. State the **weakness of concrete** as a building material and **explain** how this weakness could be **rectified** to improve the **weakness**. (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. (4 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. Explain what is meant by the mix **1:2: 3** in relation to the **three components of concrete**. (1 mark)
- ii. Briefly discuss how the **workability of concrete** could be tested, clearly reflected its effect in the concrete **compression strength in question**. (8 marks)
- [30 marks]

QUESTION THREE

- A)
- i. State the **three (3)** types of loads that could be exerted in **agricultural buildings and structures** giving at **least one example** of each. (3 marks)
- ii. A **concrete ring beam 150 mm x 150 mm** in cross section x **6.0 m in length** was designed to secure a **maize storage sliding door** in a poultry farm. Calculate the **dead load** of the beam, assuming gravity to be **9.81 m/s²** and the density of concrete as **5.0 kN/m³**. (5 marks)

- B) **Timber** is one of the most common building materials used in a number of agricultural buildings and structures in Swaziland, but it has one **major problem**.
- State the structural **weakness** that timber has as a building material. (3 marks)
 - How could such a problem be corrected in order to meet the design specifications of timber structural sections? (3 marks)
- C) i. What are the **two (2) main categories** of agricultural fences? (2 marks)
- ii. Discuss any **three (3) major functions** of fences in agricultural production. (7 marks)
- iii. Which type of **fence** could be **recommended** for restraining **small ruminants (sheep and goats)**? (1 marks)
- D) An agricultural fence had a **perimeter of 849.00 m** and the **fencing posts** were to be **spaced at 5.00 m**.
- Calculate the **number of posts** that would be required for the **fence**. (3 marks)
 - Given that **each posts was E15.50**, **calculate** the cost of the posts. (3 marks)
- [30 marks]

QUESTION FOUR

- A) 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 **E95, 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. (4 marks)
 - What would be the value of the structure after the second year of operation? (4 marks)
 - If the projected returns obtained from silage sales are **E100, 000.00** annually, what advice would you give to the farm director and why? (1 mark)

- B) i. What is the **main reason** of costing agricultural buildings and structures? (1 mark)
- ii. Calculate the annual cost of a multi-purpose storage for the second year if it was constructed through a bank loan of **E250, 000.00**. The bank **interest rate** is currently **9.5%**, with an **insurance of 2.5%**, **maintenance of 0.9%** and an **annual depreciation of 2.5%**. (4 marks)
- C) i. The **design of agricultural buildings and structures** requires that the designer should have design specifications. **Define specifications** as used in structural design. (2 marks)
- ii. **Discuss briefly the following attributes or components** which ought to be addressed by design specifications.
- a) Space requirement or capacity.
- b) Load carrying capacities. (6 marks)
- D) i. What are the **two (2) categories of walls** that could be used in the **construction of agricultural buildings**? (2 marks)
- ii. Describe the **difference** between the **two wall categories mentioned above (i)** giving an **example of the concrete block sizes** that are possible for each wall category. (2 marks)
- iii. **State and briefly describe the wall size combinations** that could be used during construction when using **concrete blocks** for each of the **concrete block wall categories identified**. (4 marks)
- [30 marks]