UNIVERSITY OF SWAZILAND

FINAL EXAMINATION PAPER

PROGRAMMES: BSC ABE II

BSC ANIMAL SCIENCE (DAIRY) IV

COURSE CODE: ABE 209

TITLE OF PAPER: FARM BUILDINGS AND STRUCTURES

TIME ALLOWED: TWO (2) HOURS

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO OTHER QUESTIONS.

SPECIAL REQUIREMENT: A4 DRAWING PAPER

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SECTION I: COMPULSORY

QUESTION ONE

A) Name the **five (5) categories** of agricultural buildings and structures giving at least one example of each. **(5 marks)**

B) **i.** What are the other **two (2)** structural elements that constitute agricultural buildings other than **walls?** **(2 marks)**

ii. Briefly describe the difference between **load bearing** and **non-load bearing** walls giving examples of the **concrete block wall sizes** that are possible for each category. **(3 marks)**

C) One of the **six main factors** that affect the **choice** of building materials in agricultural buildings and structures is transportation cost to the building site. Prove by calculation that the above statement is correct under the following conditions. A building construction company was building at a site **50 km** away from the nearest building material hardware **(Table 1).**

Table 1. Hardware building materials costs

CONSTRUCTION SITE		**HARDWARE (50 KM AWAY)**	
Material	**Cost (E)**	**Material**	**Cost (E)**
PP Cement (OPC)	80.80 per 50 kg bag	Cement (OPC)	80.00 per 50 kg bag
Concrete blocks	14.50 per block	Concrete blocks	14.00 per block
River sand	1000.00/ 5 ton truck	River sand	900.00/ 5 ton truck

i. If the transport cost was **E10.20 / km,** calculate the benefit of using local material versus using material **source outside** the construction site. **Please** state all your **assumptions** knowing that **100** x **50 kg** cement bags, **1000** concrete blocks and **2 x 5** ton river sand truck loads were needed . **(5 marks)**

ii. State the other **five main factors** that affect the **choice** of building materials in agricultural buildings and structures other than **transport.** **(5 marks)**

D) A small holder farmer intends venturing into broilers raised on deep litter. He was advised to start small with **1000 birds**.

i. Which types and design of structural elements is the farmer supposed to use in order to save money? **(5 marks)**

ii. Calculate the dimensions i.e. **length** and **width** of the ground plan for this proposed farming enterprise given that the space requirement for broilers on deep litter is **6 birds/m^2**. **(5 marks)**

iii. Draw the ground plan for the proposed poultry house using 6 inch concrete blocks. The design drawing should reflect the dimensions and the title block with all the information that it should have. **(10 marks)**

[40 marks]

SECTION B: ANSWER ANY TWO QUESTIONS

QUESTION TWO

A) A small holder farmer was advised to protect his **3.0 ha** vegetable field by fencing it. However, her challenge was how to restrain animals, particularly goats in view of the wide spectrum of agricultural fences available in the market.

i. What type of **fence** could be suitable for this vegetable production enterprise? **(2 marks)**

ii. If **immediate posts** would be spaced at **5.0 m** spacing, how many would be required? **(5 marks)**

iii. Briefly discuss the main functions of fences in agricultural production? **(7 marks)**

B) i. Name the **two** categories of fences used in agricultural production and give an example of each. **(4 marks)**

ii. Discuss the **economic importance** of agricultural buildings and structures in agricultural production. **(10 marks)**

C) i. What are the other **two** most common building materials other than concrete? **(2 marks)**

ii. Briefly, discuss with the aid of a diagram the main weakness of concrete as a building material. **(4 marks)**

[30 marks]

QUESTION THREE

A) i. **State** and **define** the **three (3)** types of **loads** that could be exerted in **agricultural buildings and structures.** **(6 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/s^2** and the density of concrete as **5.0 kN/m^3**. **(5 marks)**

B) i. What are the **two (2)** main types of **stress** that are experienced by structural members in farm buildings and structures? **(4 marks)**

ii. A brick pier of **700 mm x 700 mm** and **3.0 m** high weighs **19 kN/m^3**. It is supporting an axial load from a column of **490 kN**. The load is spread uniformly over the top of the pier. **Calculate** the stress in the brickwork immediately under the column. **Show all your work.** **(9 marks)**

iii. Given that the wind speed experienced by a roof of a **3.2 m** high hay barn was **25 m/s**, compute the wind load using **equation 1**. **(6 marks)**

$$q = 0.0127\,V^2\,k \qquad (1)$$

Where: $k = (h/6.1)^{2/7}$

[30 marks]

QUESTION FOUR

A) **i.** What are the **three (3) equations** of **static equilibrium**? **(3 marks)**

ii. Calculate the magnitude of the forces **R, L, M** and **N** in **Figure 1**. **(8 marks)**

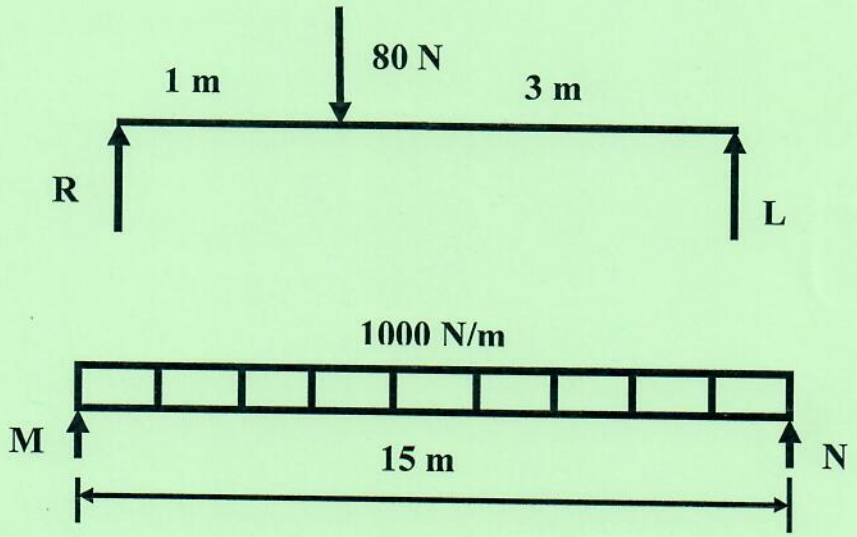

Figure 1. Loading patterns in concrete ring beams.

iii. What type of **loading pattern** is exerted in each of the beams in **Figure 1**?

(2 marks)

B) **i.** What is the **main reason** of costing agricultural buildings and structures? **(2 marks)**

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%.**

(15 marks)

[30 marks]