



UNIVERSITY OF SWAZILAND  
FACULTY OF AGRICULTURE

FINAL EXAMINATION: MAY 2006

B.SC IN AGRICULTURAL EDUCATION YEAR IV  
B.SC IN AGRICULTURE YEAR IV (AEM & APH OPTIONS)

LUM 403: FARM BUILDINGS AND STRUCTURES

TIME ALLOWED: TWO (2) HOURS

INSTRUCTIONS: ANSWER QUESTIONS ONE AND ANY OTHER TWO QUESTIONS

SPECIAL MATERIAL REQUIRED: NONE

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

**QUESTION ONE: COMPULSORY QUESTION**

- a) Define or briefly explain the following terms as they relate to environmental regulations : (i) Sensible heating process (ii) Heating with humidification (iii) Relative humidity (iv) Psychrometric chart (v) Enthalpy **(10 marks)**
- b) A livestock shelter has the following inside dimensions: - 12m wide, 40m long and 3m average height. On a particular day 500 birds, 50 cows and 75 goats were housed in the shelter. The rate of sensible heat production was 395, 170 and 6.9 watts/animal while the moisture production was 835, 365 and 8.0 g/animal-hr for cow, goat and bird respectively.
- i) Estimate the total moisture and heat produced. [Hints: Latent heat equals moisture in g/h x 0.675 Wh/g] **(10 marks)**
- ii) If the enthalpy of the incoming and outgoing air are 35.5 and 69.5KJ/kg of dry air, calculate the mass of dry air that will be required to remove the heat. **(8 marks)**
- (iii) If the moisture contents of the incoming and outgoing air were 0.005 and 0.011 kg/kg of dry air, calculate the mass of dry air that will be required to remove all the moisture produced within the structure. **(8 Marks)**
- iv) Which of the dry air above will you supply in practice and how will you ensure that both heat and moisture are completely removed and the animals are not subjected to any discomfort. **(4 Marks)**

**QUESTION TWO**

- a) Discuss the types and origin of wastes commonly found within the farm environment. **(5 marks)**
- b) Briefly discuss mobilization and retention fees as applicable in building production. **(5 marks)**
- c) What are the two modes of payments often adopted in the execution of contract for building production? **(4 Marks)**
- d) When is a body assumed to be in a state of static equilibrium? **(3 marks?)**
- e) State the three (3) equations of static equilibrium and explain what each of them means **(3 marks)**
- f) Calculate the vertical reactions in the simply supported beam shown in fig 1. **(10 marks)**

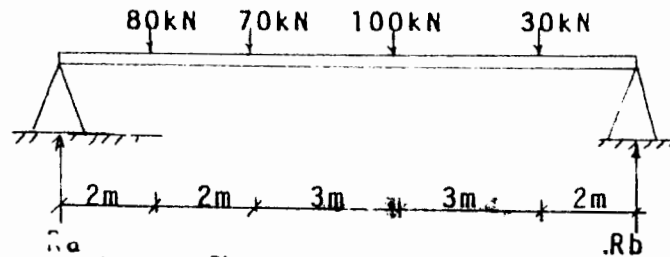


Fig. 1: Simply supported beam

**QUESTION THREE**

a) On the basis of load supported, walls can be divided into two groups. Briefly discuss these two groups pointing out where each may be used. (5 marks)

b) The department of Land Use and Mechanization of the University of Swaziland is proposing to construct a new workshop which will have a flat roof. The length of the building is 30m while the width is 15m. The area of the roof is 15% more than the floor area of the building. The length of the available roofing sheet is 2.4m and is 750mm wide. The end and edge overlaps are respectively 150 and 75mm. If the density of the roofing sheet is  $3.5\text{KN/m}^2$ , calculate the weight of the roofing sheets. (15 Marks)

c) The total heat in Cardiff Hall is 2,500KJ. The temperature outside is  $19.5^\circ\text{C}$  while that of inside is  $27.5^\circ\text{C}$ . The lecture room is a rectangle of sides 17.5m by 15m and a wall height of 3.5m. The wall thickness is 22.5cm. If the heat is to be removed by conduction through the wall, what do you consider an appropriate thermal conductance or conductivity of the wall?

(Hint:  $q = \frac{Ak}{L} \times (t_1 - t_2)$ , where q is the quantity of heat, A is area through which heat is conducted,  $t_1$  and  $t_2$  are temperatures on opposite sides of the wall, L is the wall thickness and k is thermal conductivity of the wall material) (10 Marks)

**QUESTION FOUR**

a) Briefly discuss three sources of heat in a farm structures. (6 marks)

b) Discuss briefly three important reasons for estimating the cost of agricultural structures (6 marks)

c) The University of Swaziland Farm Director intends to construct a concrete silage silo with a design life expectancy of 20 years. The depreciation cost is expected to be 5.0% per year and the initial costs were estimated to be E15, 000.00. The bank loan is currently at 18.5% interest and an insurance of 1.0% after construction as well as a 1.0% annual maintenance cost.

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? (2 marks)
- iii) If the returns obtained from the silage sales are E1, 100.00 annually, what advice would you give the farm director and why. (2 marks)
- d) Calculate the area of floor needed to accommodate 1000 birds assuming that the space requirement is  $0.4\text{m}^2/\text{bird}$ . What do you consider to be appropriate dimensions for such a floor? (4 marks)