

The Open University of Sri Lanka

Faculty of Engineering Technology

Final Examination- 2005



AEI6234 Environmental control in farm structures

AEX6230 Environmental control in agricultural structures

Date : 23-04-2006

SECTION 2: Answer question 1, and any three others.

1. An apple storage is to be built to hold 1800 tons, equally divided into nine rooms. The interior temperature has to be maintained at 32°F while the outside temperature is 72°F. The storage will be filled over a period of four days, the daily input being 450 tons divided equally between the nine rooms, and each day's input must be cooled down to storage temperature within 24 hours. Considering the most energy-efficient configuration for the nine rooms, calculate the refrigeration load in BTU/day during the 24 hours immediately after the last input has been made, and the maintenance refrigeration load thereafter in BTU/day. Assume that the empty storage has been cooled down to 32°F before filling begins, and that heat gain through the floor is negligible.

The following data may be used in your calculations:

Walls and ceiling are insulated to an R of 25. The specific heat of fresh apples is 2500 BTU/ton/°F, the heat of respiration is 700 BTU/ton/day and 4200 BTU/ton/day at 32°F and 72°F respectively, and the recommended storage volume for apples is 105 ft³/ton including space for air circulation etc.

2. What are the ways in which heat is lost from a greenhouse?

A gable roof greenhouse 50' long, 20' wide and 5' high (not including roof height), is constructed of polycarbonate structured sheet having a U value of 0.6 Btu/h-ft² °F for the ends and sides, and glass having a U value of 0.5 Btu/h-ft² °F for the roof which has a pitch angle of 45°. If the inside temperature is 60°F and the outside temperature is 0°F, and there is one air change per hour, calculate the heat loss per hour. The specific heat of air is 0.018 Btu/ft³ °F.

3. Write short notes on three of the following:
 - a) Evaporative cooling
 - b) Silo design and location
 - c) Manure management
 - d) Convective heat transfer

4. Describe the advantages and disadvantages of three different types of poultry housing.
5. Describe, with the aid of detailed sketches, how you would design a low cost poultry housing unit for a small farm of two hundred laying hens in Sri Lanka, using local materials wherever possible. (A proper engineering design with drawings to scale is not required).
6. Describe any popular diary cattle housing system in detail.