



The Open University of Sri Lanka
Faculty of Engineering Technology
Technology (Engineering) Programme of Study
Final Examination – 2009/ 2010
AEX 6230 Environmental Control in Agricultural
Structures

Date : 30/03/2010
Time : 14.00-17.00 hours
Duration: Three (03) hours

SECTION 2: Answer any four questions.

1. An apple storage is to be built to hold 2000 tons, equally divided into four 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 500 tons divided equally between the four rooms, and each day's input must be cooled down to storage temperature within 24 hours.
 - (a) Recommend a suitable arrangement for the four rooms, to maximise efficiency.
 - (b) 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 4000 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. A sheet metal duct of circular cross section carries refrigerated air to a cold storage. The duct has an outer diameter of 200 mm and a wall thickness of 01 mm. The duct is covered with a layer of insulation 50 mm thick. The inner surface of the duct is at 0° C and outer surface temperature of the insulation is 25° C. The thermal conductivity of the sheet metal is 60W/mK and that of the insulation is 0.04 W/mK.
Calculate the conduction heat gain per metre length of duct under steady state conditions.
3. Write short notes on three of the following:
 - a) Radiation heat transfer
 - b) Bamboo as a construction material.
 - c) Long term storage of grain
 - d) Uses of the psychrometric chart
4. Discuss the advantages and disadvantages of four different building materials suitable for the walls of agricultural structures.
5. Describe the essential features of a large scale commercial swine rearing operation.
6. Describe in detail the procedure you would adopt in designing a small dairy farm (of about ten head of cattle), including site selection, building design, selection of building material and construction, in an up country location in Sri Lanka. Environmental issues should also be adequately addressed.