



**Diploma/Degree in Technology (Engineering) Programme**  
Final Examination – 2008/2009  
**AEX 6230 Environmental Control in Agricultural Structures**

Date : 06-04-2009  
Time : 0930-1230  
Duration: Three (03) hours

019

**SECTION 2: Answer any four questions.**

1. An apple storage is to be built to hold 1000 tons, equally divided into five 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 five days, the daily input being 200 tons divided equally between the five rooms, and each day's input must be cooled down to storage temperature within 24 hours.
  - (a) Recommend a suitable arrangement for the five 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 ft<sup>3</sup>/ton including space for air circulation etc.
2. A storage is being designed in which dry potatoes will be piled 10 ft. deep against walls that are 12 ft. high, the bin width being 14 ft. If studs are to be placed 14" apart on centre, the bending moment on the bin wall per foot of length is 705 lb-ft., and the safe fibre stress for the stud material is 1200 psi, determine a suitable stud size.
3. Write short notes on three of the following:
  - a) An equation to calculate heat loss through the walls of a thin walled, cylindrical, insulated sheet metal duct, carrying steam
  - b) Convective heat transfer
  - c) Factors affecting the strength of concrete
  - d) Traditional and improved bins for grain storage
4. Describe how a temperature higher than the outside is developed and maintained inside a greenhouse, without the use of any heating equipment.
5. Describe the construction of a small (about 10 head of cattle) dairy cattle barn suitable for Sri Lanka, maximising the use of locally available raw material, and minimising the use of electrical energy for heating, cooling, and ventilation. Illustrate your answer with a clear diagram (this need not be an engineering drawing to scale).
6. Describe four common poultry rearing systems in detail.