



The Open University of Sri Lanka
 Faculty of Engineering Technology
 Industrial Studies (Agriculture) & Technology (Agricultural Engineering)
 Program of Study
 Final Examination – 2014/2015
 AEI6234/AEX6234 Environmental Control in Farm Structures

Date : 21/09/2015
 Time : 09.30 a.m. – 12.30 p.m.
 Duration : Three (03) hours

Index number:

Section 02 – Answer any four (04) out of the six (06) questions. You may use answer books and/or sheets to answer this section.

- 1) a) Using an example state how heat transfers through conduction. (10 marks)
 b) The roof of a small scale brooder house is rectangular shaped with a length of 9 m and a width of 5 m. It is made out of a 12 cm thick flat layer of wood whose thermal conductivity is $0.13 \text{ Wm}^{-1}\text{K}^{-1}$. The temperatures of the inner and the outer surfaces of the roof in one night are 34°C and 25°C , respectively. Determine the rate of heat transfer through the roof during the night. (05 marks)
 c) Suppose the owner decides to add a same size horizontal plane of concrete on top of the wood plane of the roof. If the thermal conductivity of concrete is $0.56 \text{ Wm}^{-1}\text{K}^{-1}$, and the environmental conditions stay constant, calculate the following:
 (i) Total unit area thermal resistance (05 marks)
 (ii) Rate of heat transfer through the double layered wall (05 marks)
- 2) a) Define the following terms:
 (i) Thermal Convection (05 marks)
 (ii) Thermal Radiation (05 marks)
 b) A heating pipe in a greenhouse carries hot water and releases heat into the greenhouse air by convective heat transfer. The surface temperature of the pipe is 88°C , and the greenhouse air temperature is 20°C . If the convection heat transfer co-efficient is $7.8 \text{ Wm}^{-2}\text{K}^{-1}$, calculate the rate of heat loss from the pipe for unit area. (05 marks)
 c) Discuss the different means of reducing the temperature inside a greenhouse. (10 marks)

- 3) a) Explain how condensation occurs on surfaces of agricultural buildings. (10 marks)
b) Describe the principle behind evaporative cooling. (10 marks)
c) Air is cooled from 35°C to 26°C under sensible cooling. If the original specific humidity of air is 0.0125 kg water vapour/kg dry air, determine the final specific humidity value. (05 marks)
- 4) Write short notes on the following topics. (6.25 marks each)
a) Importance of providing optimal temperature for poultry
b) Importance of providing optimal light intensity for poultry
c) Biogas production
d) Suitability of earth as building material
- 5) a) What are the properties of concrete? (08 marks)
b) Aggregates are used in manufacturing concrete. Discuss the properties of aggregates that affect the quality of concrete. (12 marks)
c) Illustrate the relationship between compressive strength and water:cement ratio in fully compacted concrete after 28 days using a graph. (05 marks)
- 6) Giving examples, discuss the different wall and roofing material that can be used in constructing a grain storage unit in the Dry Zone in Sri Lanka. (25 marks)