



SLIATE

SRI LANKA INSTITUTE OF ADVANCED TECHNOLOGICAL EDUCATION

(Established in the Ministry of Higher Education, vide in Act No. 29 of 1995)

Higher National Diploma in Building Services Engineering
Second Year, Second Semester Examination – 2016
BSE 2202 – Heat Exchangers in Buildings

Instructions for Candidates:
Answer only four questions
All questions carry equal marks

No. of questions : 05
No. of pages : 02
Time : 02 hours

1) a) Classify heat exchangers according to flow type and explain the characteristics of each type. (15 marks)

b) Classify heat exchangers according to construction type and explain the characteristics of one of them with rough sketches. (10 marks)

[Total 25 Marks]

2) a) How does a cross-flow heat exchanger differ from a counter-flow one? (10 marks)

b) What is the difference between mixed and unmixed fluids in cross-flow? (15 marks)

[Total 25 Marks]

3) a) What are the common causes of fouling in a heat exchanger? (05 marks)

b) How does fouling affect to the heat transfer and pressure drop in a heat exchanger? (10 marks)

c) How do the fluid velocity and temperature affect fouling? (10 marks)

[Total 25 Marks]

4) An exhaust pipe is 75mm diameter and it is cooled by surrounding it with a water jacket. The exhaust gas enters at 350 °C and the water enters at 10 °C. The surface heat transfer coefficients for the gas and water are 300 W/m²k and 1500 W/m²k respectively. The wall is thin so the temperature drop due to conduction is negligible. The gases have a mean specific heat capacity (c_p) of 1130 J/kgK and they must be cooled to 100 °C. The specific heat capacity of water is 4190 J/kg K. The flow rates of the gas and water is 200kg/h and 1400 kg/h respectively. Calculate the required length of pipe for,

a) Parallel flow (15 marks)

b) Counter flow (10 marks)

[Total 25 Marks]

5) A cooling tower must cool 340 kg of water per minute. The water is supplied at 42 °C and it is sprayed down into the column of air which enters the bottom of the tower at a rate of 540 m³/min with a temperature of 18 °C and relative humidity of 60%. The moist air leaves the top of the tower saturated at 27 °C. The whole process occurs at a constant pressure of 1.013 bar. Determine,

a) The rate at which make up water must be supplied to replace that the amount of water evaporated. (15 marks)

b) The temperature of the cooled water in the pool. (10 marks)

(Consider $R = 287$ J/kgK for air and 462 J/kgK for vapour)

[Total 25 Marks]