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AU-6001-CBGS

B.E. VI Semester

Examination, December 2020

Choice Based Grading System (CBGS)

Heat and Mass Transfer

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.
ii) All questions carry equal marks.
iii) The use of standard HMT Data book is permitted in examination.

1. a) Derive an expression for steady state heat flow through a composite wall in parallel.
   b) What is critical thickness of insulation? What is it's importance?

2. A metal (K= 45 W/m deg) steam pipe 5 cm interval dia and 6.5 cm external diameter is lagged with a 2.75 cm radial thickness of high temperature insulation having thermal conductivity of 1.1W/m-deg. The surface heat transfer coefficients for inside and out side are 4650 and 11.5 W/m^2 deg, if the steam temperature in 200ºC and ambient temperature is 25ºC, make calculations for
   i) heat loss per m of pipe
   ii) temperature at the interface
   iii) overall coefficients of heat transfer referred to inside and outside surface.

3. a) List the assumptions made while analyzing the heat flow from a finned surface.
   b) A steel rod (K=30W/m-deg) 1 cm in dia and 8 cm long protrudes from a wall which is maintained at 100ºC. The rod is insulated at it's tip and in exposed to an environment with h = 60W/m^2 deg and t_a = 30ºC. Calculate the fin efficiency temp. at tip of fin and rate of heat dissipation.

4. a) Differentiate between natural and faced convection.
   b) State Buckingham π theorem. What are it's merits and demerits.

5. Water (C_p = 4.187 kJ/kgk) in heated at the rate of 1.4kg/sec from 40ºC to 70 ºC by an oil (C_p = 1.9 kJ/kgk) entering at 110ºC and leaving at 60ºC in a counter flow heat exchanger. If U_0 = 350 W/m^2k, calculate the surface area required. Using the same temp. and flow rate of oil, calculate the exit temperatures of oil and water and rate of heat transfer, when the water flow rate is halved.

6. a) Explain the meaning of absorptivity, reflectivity and transmissivity.
   b) What is Planck's law of thermal radiation? Explain how Ebx and T are related.

7. a) A thermocouple indicates a temperature of 800ºC when placed in a pipeline where hot goes in flowing at 870ºC. If the convective heat transfer coefficient between the thermocouple and gas is 60W/m^2k. Find the duct wall temperature. Take E for thermocouple as 0.5.
   b) What is nucleate boiling? Why is it important?

8. Write short notes on any two:
   a) Free a Natural convection heat transfer
   b) Analogy between flow of heat and electricity
   c) Flick's law of equimolar diffusion.
   d) Film wise condensation

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