Ref No: EX/Met/Ch.E/T/211/2019

B.E METALLURGICAL AND MATERIAL ENGG.EXAMINATION, 2019
(2^{nd} Year, 1^{st} Semester)

FLUID FLOW & HEAT TRANSFER

Time: Three hours Full Marks: 100

Answer any ten questions.
Each questions carry equal marks.
Assume any data missing

1. Two parallel planes which are hot black bodies and have different emissivity ε_1 and ε_2 at a temperature T_1 and T_2 respectively. Derive the expression of the total energy absorbed by unit area of surface 2. 10

2. Evaluate the expression of velocity deficiency or defect in turbulent flow using Karman hypothesis. **10**

3. Discuss with figures the variation of fluid temperature in heat exchanger. 10

4. A continuous single effect evaporator is to be fed with 6000kg/hr of solution containing 1 wt% solute. The feed is at a temperature of 300K. It is to be concentrated. The evaporation is at atmospheric pressure (101.3 kPa) and the area of the evaporator is 69.7 m^2. Saturated steam is supplied at 143.3 KPa for heating. Calculate the amount of vapour and liquid leaving and liquid outlet temperature. Using U=2833w/m^2K, h_F=125.79,h_L=419.04,H_s=2691.5, and h_S=461.30 kJ/kg. 10

5. Define free stream velocity, friction velocity, viscosity and shear stress. 10

6. Derive the expression for overall heat transfer coefficient based on inside area when heat flows from the inner surface of insulated pipe to its outer surface. 10

7. Discuss about the mechanism of condensation and boiling het transfer. 10

8. Determine the heat transfer area and length required to cool 6.93kg/s of 95% ethyl alcohol solution (Cp=3810 J/kgK) from 67^0C to 40^0C using 6.30 kg/s water (Cp=4187 J/kg K) at 15^0C taking U_0= 568w/m^2K. for parallel and counter flow heat exchanger. **10**

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9. Evaluate the expressions of shear stress, discharge and average velocity of fluid when flowing between two parallel plates-bottom plate being stationary while top one moving with a constant velocity U considering all usual notations. 10

10. For turbulent flow of an incompressible fluid through a circular pipe of radius r. the velocity distribution is given by $u = u_0 (1- r / r_0)^{1/7}$ where u is the velocity at radius r and u_0 is the velocity at pipe axis. Calculate the total kinetic energy with the kinetic energy when the flow in the pipe is completely laminar and quantity of fluid flowing is constant at Q. 10

11. Derive the expression for LMTD. 10

12. Write short notes on Bernouille's Equation and Kirchhoffs law of radiation. 10