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Ref No: EX/MET/Ch.E/T/211/2017(S)

BACHELOR OF METALLURGICAL ENGG.EXAMINATION, 2017
(2^{nd} Year, 1^{st} Semester supplementary)

FLUID FLOW & HEAT TRANSFER

Time;Three hours Full Marks:100

Answer any five questions.
Assume any data missing

1. (a) A 15cm long cylindrical metal rod slides inside a tube filled with oil. The inner diameter of the tube is 5cm and clearance is 0.05mm. The mass of the bar is 0.5kg when immerged in the oil. What is the viscosity of the oil, if the steady state velocity of the rod is0.1m/s. **10**

   (b)Explain rate of strain or shear rate or rate of shear deformation of the fluids, **06**

   (c) Differentiate laminar and turbulent flow. **04**

2. Evaluate the expressions of shear stress, discharge and average velocity of fluid when flowing over a flat plate considering all usual notations. **20**

3. **(a)** Derive Hagen- Poiseuille's equation using all usual notations. 12

   (b) Show that f= 16/Re for laminar flow in smooth pipe. 08

4. It is planned to install a steel pipeline with inside diameter of 202mm to transport 3800m^3 of oil per day. The pipeline is to be 32km long and delivery end is to be 30m higher than intake. If the fractional pressure drop in pipeline is 5.3Mpa and overall efficiency of the pump motor set is 60%, Calculate the power requirement of the pump motor set using density and viscosity of oil 897kg/m^3 and 50mPa.s 20

5. (a). Discuss about the mechanism of condensation and boiling het transfer.

(b) 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. (4+4)+12=20

6 (a) Derive the expression of LMTD. 8+12=20

(b) 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.

7.Write short notes on any four. 4X5=20

(a) Bernouille's Equation
(b) Kirchhoffs law of radiation.
(c) Flow arrangementvin heat exchanger.
(d) Prandtl's mixing length theory.
(e) Flowmeters.