Ref No: EX/MET/ES/B/Ch.E/T/214/2024

B.E. METALLURGICAL AND MATERIAL ENGINEERING EXAMINATION, 2024

(2^{nd} Year, 1^{st} Semester)

FLUID FLOW & HEAT TRANSFER

Time; Three hours Full Marks:100

Answer any ten questions.
Assume any data missing

1. 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
2. Evaluate the expressions of shear stress, discharge and average velocity of fluid when flowing between two parallel plates-bottom plate being stationary while the top one moving with a constant velocity U taking all usual notations.
3. Show that f= 16/Re for laminar flow in smooth pipe. 10
4. The velocity profile for laminar flow in a circular tube is given by $u = U(1-(\frac{r}{R})^2)$ where U= velocity at the centre line of the tube, a constant, r = radial distance from pipe centerline and R=radius of the tube. Evaluate (i) average velocity (ii)variation of velocity gradient with radius and (iii) velocity gradient at the wall. 10
5. 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 10
6. An orifice meter consisting of 10cm diameter orifice in a 25cm diameter pipe has co-efficient of 0.65. The pipe delivers oil of 0.8 specific gravity. The pressure difference on two sides of the orifice plate is measured by mercury oil differential manometer. If differential gauge reads 80cm of mercury, Calculate the rate of flow in lit/sec. 10

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

8. Derive the expression of LMTD. 10

9. 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

10. Write short notes on Bernouille's Equation. 10

11 Explain inclined Tube manometer and Flow arrangement in heat exchanger Write short notes on flow meters. 10

12 Explain rate of strain or shear rate or rate of shear deformation of the fluids 10