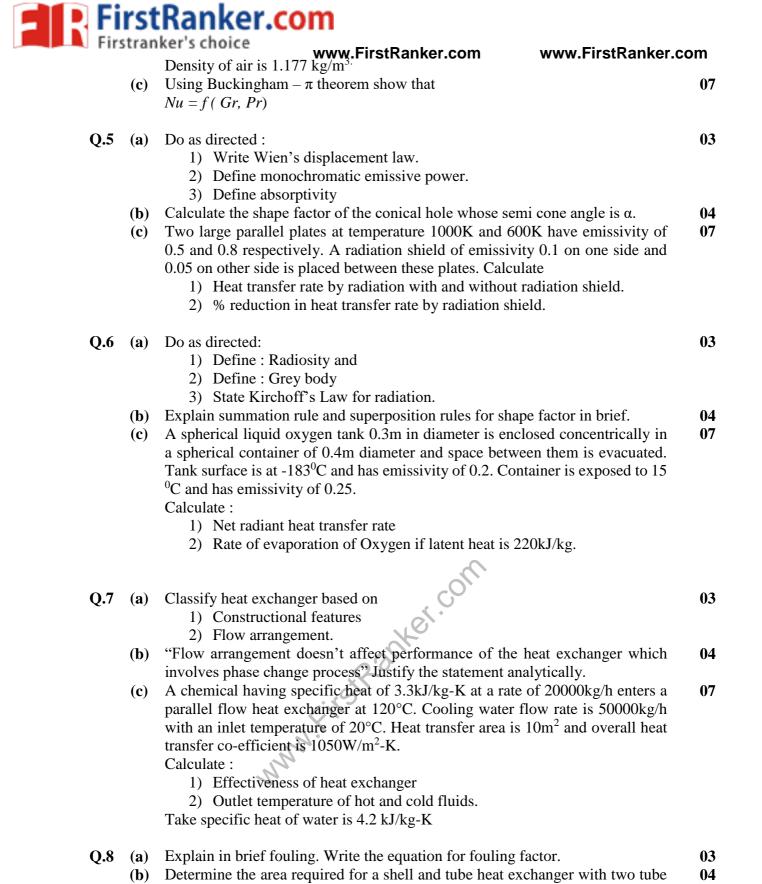


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BE- SEMESTER-V (NEW) EXAMINATION – WINTER 2020

Subject Code:2151909 Date:22/01/2021 **Subject Name: Heat Transfer** Time: 10:30 AM TO 12:30 PM **Total Marks: 56 Instructions:** 1. Attempt any FOUR questions out of EIGHT questions. 2. Make suitable assumptions wherever necessary. 3. Figures to the right indicate full marks. **MARKS** Q.1 (a) Define: 03 1) Fin efficiency 2) Critical radius and 3) Fourier number. (b) Define time constant for the thermocouple." Diameter of thermocouple wire 04 should be as low as possible" Justify above statement analytically Define Boiling and Write different modes of it. Draw boiling curve and show 07 different regimes on that. Explain in brief 1) Film boiling 2) Critical heat flux and 3) Leidenfrost Point Write the equation of fin effectiveness for the infinitely long fin. Based on this 03 **Q.2** state two conclusions for selection of fin. Write the differential equation for steady state heat conduction in radial 04 direction for sphere without heat generation in it. Solve the equation and represent the solution graphically. A steam pipe 10cm in outer diameter is covered with two layers of insulation 07 material each is 2.5 cm thick. Ratio of their thermal conductivity is 3. Compare the effective thermal conductivity of two layers when better insulation material is placed inside layer than when it is on the outside. Differentiate mean film temperature and bulk mean temperature. Q.3 (a) 03 Write equation for hydraulic diameter. Calculate its value for 1) two parallel 04 plates and 2) rectangular duct. Atmospheric air at 275K and free stream velocity of 20m/s flows over 1.5m 07 long flat plate maintained at uniform temperature of 325K. 1) Average heat transfer co-efficient over entire length of 1.5m 2) Heat transfer rate from the plate over 1.5m and 1m wide. 3) Average heat transfer co-efficient over laminar boundary layer.. For turbulent flow: $Nu_L = 0.037(\text{Re}_L^{0.8} - 871) \text{Pr}^{\frac{1}{3}}$ For laminar flow: $Nu_L = 0.664 \text{ Re}_L^{\frac{1}{2}} \text{ Pr}^{\frac{1}{3}}$ For calculation use : $K_{air} = 0.026 \text{ W/mK}$, Pr = 0.708, Kinematic viscosity = $16.8 * 10^{-6} \text{ m}^2/\text{s}$, Dynamic viscosity = 1.98*10⁻⁵ kg/ms Assume transition occurs at $Re = 2 * 10^5$. Q.4 (a) Define hydrodynamic and thermal boundary layer. Represent their respective 03 thickness for the liquid metal. Air at temperature 300K and 1 atm flows flows over a flat plate at a speed of 2 04 m/s. Calculate the mass flow rate enters the boundary layer between 0.2m and 0.4 m from the leading edge. Assume unit depth in z-direction. Take : viscosity of air = $1.85 * 10^{-5}$ kg/m-s.



Define: effectiveness. Develop its equation for the counter flow heat exchanger.

passes to cool oil at rate of 10 kg/s from 60°C to 30°C flowing in the shell using water at 20°C passing through the tubes and heated up to 26°C. The specific

The value of overall heat transfer coefficient is 300 W/m² K. Take correction

heat of the oil is 2200 J/kg K.

factor F = 0.875.

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