Mechanical Engineering Department
Government College of engineering, Amravati
CT-II MEU 603(HEAT TRANSFER) S-2016

Solve any three **Date: 09/03/2016** **Max marks: 15**

Q1.a) Distinguished between local and average heat transfer coefficient

b) Water flows over a flat plate having a uniform heat generation rate. The plate is 15 cm × 15 cm side. Water is at 20°C and the flow velocity is 3 m/s. determine the heat that may be carried away by the water if the maximum temperature of the plate is not exceed 80°C

Q2. Derive an expression for the x directional momentum flow at the boundary layer

Q3.a) Explain the difference in boundary layer development, between internal flow and external flow

b) A solar concentrator causes a heat flux of 2000 W/m^2 on the tube of 60mm ID. Pressurized water flows through the tube at a rate of 0.01 kg/s. if the bulk temperature at inlet temperature is 20°C, what will be the length required to heat water to a bulk temperature of 80°C? Also find the wall temperature at exit

Q4.a) Explain what is meant by buoyancy driven flow

b) Consider a 0.6×0.6 m. thin square plate in room at 30 °C. One side of the plate is maintained at a temperature of 74 °C, while the other side is insulated. Determine the rate of heat transfer from the plate by natural convection if the plate is

- vertical
- horizontal with hot surface facing up
- horizontal with hot surface facing

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Solve any three **Date: 16/03/2018** **Max marks: 15**

Q1. a) Derive the energy equation for laminar boundary layer on a flat plate and assuming the following velocity and temperature profile, derive an expression for local heat transfer coefficient. i) $u = u_\infty$ for all values
ii) $T-T_w/T_\infty-T_w = (y/\delta t)$, δt = thermal boundary layer thickness

Q2. Explain Biot number and its physical significance
A steel ball(k = 35W/m °C, c = 0.46 kJ/kg °C) 5 cm in diameter and initially at a uniform temperature of 450°C is suddenly placed in a controlled environment in which temperature is maintained at 100°C. The convection heat transfer coefficient is 10 W/m² °C. Calculate the time required for the ball to attain a temperature of 150°C. Take ρ = 7800 kg/m³

Q3. Engine oil at a rate of 0.02kg/s flows through a 3mm diameter tube 30m long. This has an inlet temperature of 60 ° C, while the tube wall temperature is maintained at 100° C by steam condensing on its outer surface. Estimate 1. Average heat transfer coefficient 2.Outlet temperature of the oil.

Q4.a) Explain development of boundary layer over a flat plate.
b) A truck travel at 130 km/h I air at 50 °C and its surface is at 10 °C. The truck may be approximated to a rectangular box of 3m×2m×6m. Assuming that there is no flow separation and flow is turbulent although, determine the heat loss from four surfaces. (Neglect front and back) also calculate friction drag