**BBBDNITM, LKO**

**MECHANICAL AND AERONAUTICAL DEPARTMENT**

**SUBJECT-HEAT AND MASS TRANSFER**

**UNIT-3**

**ASSIGNMENT-3**

**SECTION-A**

**Short Questions :(2 Marks)**

1).What is Convective heat transfer?

2).Sketch formation of boundary layer and show laminar, transition & turbulent flow.

3). Write down differential equation for Continuity of fluid flow.

4).State Newton's law of cooling.

5).Differentiate between Natural & Forced convection.

**SECTION-B**

**Questions upto 200 words :(10 Marks)**

6). Derive Von-Karman Momentum equation of boundary layer flow.

7). Air at 200 kPa and 200°C is heated as it flows through a tube with a diameter of 25 mm at avelocity of 10 m./sec. The wall temperature is maintained constant and is 20°C above theair temperature all along the length of tube. Calculate:(i) The rate of heat transfer per unit length of the tube.(ii) Increase in the bulk temperature of air over a 3 m length of the tube.

8).Write down the momentum equation for a steady, two dimensional flow of anincompressible, constant property newtonian fluid in the rectangular coordinate system and

mention the physical significance of each term..A large vertical plate 5 m high is maintained at 100°C and exposed to air at 30°CCalculate the convection heat transfer coefficient.

9).Atmospheric air at 275 K and a free stream velocity of 20 m/s flows over a flat plate1.5 m long that is maintained at a uniform temperature of 325 K. Calculate the averageheat transfer coefficient over the region where the boundary layer is laminar, theaverage heat transfer coefficient over the entire length of the plate and the total heattransfer rate from the plate to the air over the length 1.5 m and width 1 m. Assumetransition occurs at Re= 2xl05.

10). What is Reynold's analogy? Describe the relation between fluid friction and heattransfer?

11). Air at 25°C flows over 1 m x 3 m (3 m long) horizontal plate maintained at 200°C at10 *mls.* Calculate the average heat transfer coefficients for both laminar and turbulentregions. Take Re (critical) = 3.5 x 105.

12).Define Reynold’s, Nusselt and Prandtl numbers with their significance.

**SECTION-C**

**Very Long Questions :(15 Marks)**

13). (i)Explain for fluid flow along a flat plate:

(1) Velocity distribution in hydrodynamic boundary layer

(2) Temperature distribution in thermal boundary layer

(3) Variation of local heat transfer co-efficient along the flow.

(ii) The water is heated in a tank by dipping a plate of 20 cm X 40 cm in size. Thetemperature of the plate surface is maintained at 100°C. Assuming the temperatureof the surrounding water is at 30° C, Find the heat loss from the plate 20 cm side isin vertical plane.

14).Air at 400 K and 1 atm pressure flows at a speed of 1.5 m/s over a flat plate of 2 m long.The plate is maintained at a uniform temperature of 300 K. If the plate has a width of 0.5 m,estimate the heat transfer coefficient and the rate of heat transfer from the air stream to theplate. Also estimate the drag force acting on the plate.

15).Air at 20⁰ C and at a pressure of 1 bar is flowing over a plate at a velocity of 3m/s. If the plate is 280 mm wide and at 56 ⁰C, Calculate the following quantities at x= 280 mm , given that the properties of the air at the bulk mean temperature {(20+56)/2}=38⁰C are-

ρ=1.1374 kg/m3, k =0.02732 W/m⁰C, CP = 1.005 kJ/kg K , v=16.768×10-6 m2/s, Pr= 0.7

1. Boundary layer thickness
2. Local friction coefficient
3. Average friction coefficients
4. Shearing stress due to friction
5. Thickness of boundary layer
6. Local convective heat transfer coefficient
7. Average convective heat transfer coefficient
8. Rate of heat transfer by convection
9. Total drag force on the plate.