**AKGEC/IAP/FM/02**

**AJAY KUMAR GARG ENGINEERING COLLEGE, GHAZIABAD**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**SESSIONAL TEST – 2**

Course: B.Tech Semester: V

Session: 2017-18 Section: ME 1,2,3

Subject: Heat and Mass Transfer Sub. Code: NME-504

Max Marks: 50 Time: 2 hours.

**Note: All questions are compulsory.**

**SECTION A**

**Attempt all Questions.**   **(5 x 2 = 10)**

**1.** Show with neat sketch, the temperature and velocity profile for the case when hot fluid is flowing over a cool flat plate.

**2.** What do you understand by thermal contact resistance, how it differ from thermal resistance.

**3.** What do you mean by extended surface, explain with neat sketch the common type of surfaces which are used in practice?

**4.** what do you mean by effectiveness of a fin. Discuss the physical significance of effectiveness.

**5.** Explain the following in details:

Prandtl number, Nusselt number and its physical significance.

**SECTION B**

**Attempt all Questions. (5 x 5 = 25)**

**6.** A steel tube (k = 45 W/m.K) of outside diameter 7.6 cm, and thickness 1.3 cm, is covered with an insulating material (k = 0.2 W/m.K) of thickness 2 cm. A hot gas at 330°C, with convection coefficient of 200 W/m2K, is flowing inside the tube. The outer surface of the insulation is exposed to ambient air at 30°C, with convection coefficient of 50 W/m2K. Calculate: (i) Heat loss to air from the 5 m long tube. (ii) The temperature drop due to the thermal resistances of hot gases, steel tube, the insulating layer and the outside air.

**7.** Derive the expression of temperature distribution and heat flow rate in a solid sphere with uniform internal heat generation.

**8.** An aluminium sphere weighing 6 kg and initially at temperature of 350°C is suddenly immersed in a fluid at 30°C with convection coefficient of 60 W/m2K. Estimate the time required to cool the sphere to 100°C. Take thermophysical properties of aluminium as: Specific heat = 900 J/kg.K, Density = 2700 kg/m3, Thermal conductivity = 205 W/m.K.

**9.** A fan provides air speed upto 50 m/s, is used in low speed wind tunnel with atmospheric air at 27°C. If this wind tunnel is used to study the boundary layer behavior over a flat plate upto Re = 108. What should be the minimum plate length? At what distance from the leading edge would transition occur, if critical Reynolds number is Rcr = 5 x 105 ?

**10.** How the error is measured, in temperature measurement by thermometric well.

**SECTION C**

**Attempt all Questions.**  **(7.5 x 2 = 15)**

**11.** A hot surface at 100°C is to be cooled by attaching 3 cm long, 0.25 cm diameter aluminium fins (k = 237 W/m.K) to it, with a centre to centre distance of 0.6 cm. The temperature of surrounding air is 30°C and the heat transfer coefficient on surface is 35 W/m2K. Calculate the rate of heat transfer from the surface for a 1 m x 1 m section of the plate. Also determine the overall effectiveness of the fins.

**12.** Discuss the mechanism of lumped parameter analysis and derive the expression for temperature distribution and total heat transfer.