Sample paper - I

Time: Three hours Maximum: 100 marks

Attempt Three Question from Each Section

Each Question Carries Equal marks

Section A:-

Q.1. What is the basic difference among conduction, convection, and radiation?
Q.2. Define thermal conductivity.

Q 3. Write the driving force for electricity, fluid, and heat flow and discuss the similarity among them.

Q 4. What is the ratio of heat flux through area A1 and area A2 of an irregular pipeline shown in the figure below? The area A1 and A2 are same and the curved surface is well insulated for any kind of heat loss at steady state.

Fig. Q.2

Section B:-

Q 5. *The two sides of a wall (2 mm thick, with a cross-sectional area of 0.2 m2) are maintained at 30oC and 90oC. The thermal conductivity of the wall material is 1.28 W/(m·oC). Find out the rate of heat transfer through the wall?*

Q 6. Consider a composite wall containing 5-different materials as shown in the fig. 2.7. Calculate the rate of heat flow through the composite from the following data?

$x_1 = 0.1\ m$	$x_2 = 0.2\ m$	$x_3 = 0.15\ m$
$k_1 = 15\ W/m\cdot{}^oC$	$k_2 = 25\ W/m\cdot{}^oC$	$k_3 = 30\ W/m\cdot{}^oC$
$k_4 = 20\ W/m\cdot{}^oC$	$k_5 = 35\ W/m\cdot{}^oC$	
$h_2 = 1\ m$	$h_3 = 3\ m$	$h_4 = 2.5\ m$
$h_5 = 1.5\ m$	$T_A = 120^oC$	$T_B = 50^oC$

Q 7. The steady state temperature distribution in a wall is , where x (in meter) is the position in the wall and T is the temperature (in oC). The thickness of the wall is 0.2 m and the thermal conductivity of the wall is 1.2 (W/m·oC). The wall dissipates the heat to the ambient at 30 oC. Calculate the heat transfer coefficient at the surface of the wall at 0.2 m.

Q 8. Pressurized air is to be heated by flowing into a pipe of 2.54 cm diameter. The air at 200oC and 2 atm pressure enters in the pipe at 10 m/s. The temperature of the entire pipe is maintained at 220oC. Evaluate the heat transfer coefficient for a unit length of a tube considering the constant heat flux conditions are maintained at the pipe wall. What will be the bulk temperature of the air at the end of 3 m length of the tube?

The following data for the entering air (at 200oC) has been given,

Pr number	0.681
Viscosity	2.57×10^{-5} kg/m s
Thermal conductivity	0.015 W/m °C
Density	1.493 kg/m³
c_p	1.025 kJ/kg °C