Sample paper - IV

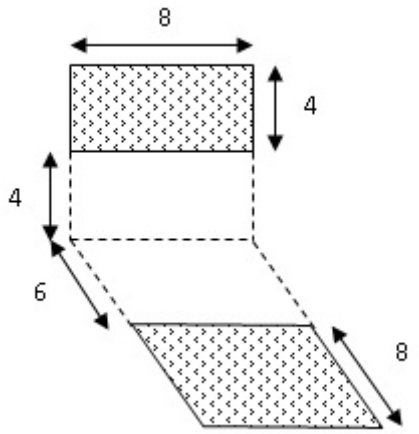
Time: Three hours Maximum: 100 marks

Attempt Three Question from Each Section

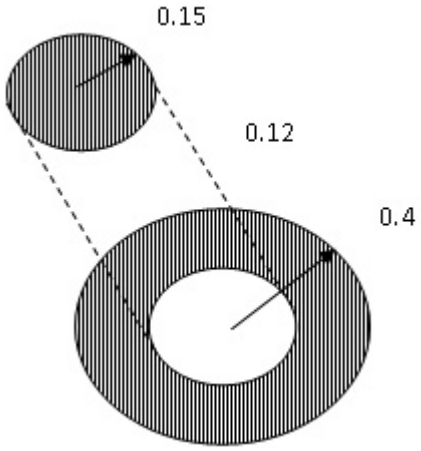
Each Question Carries Equal marks

Section A:-

Q.1. Find the view factor for the following geometry, all dimensions are in meter,



(i)



(ii)

Q.2. What is the physical meaning of LMTD?

Q.3. What is the basic difference between 1-1 and 2-4 heat exchanger? What is the basis to choose a particular type (with respect to pass) of heat exchanger.

Q.4. Why boiling point elevation is important in evaporators?

Section B:-

Q.1. Warm methanol flowing in the inner pipe of a double pipe heat exchanger is being cooled by the flowing water in the outer tube of the heat exchanger. The thermal conductivity of the exchanger, inner and outer diameter of the inner pipe are 45 W/(m·oC), 26 mm, and 33 mm, respectively. The individual heat transfer coefficients are:

	Coefficient (W/(m2·oC))
Methanol, hi	1000
Water, ho	1750

Calculate the overall heat transfer coefficient based on the outside area of the inner tube.

Q.2. *Pressurized air is to be heated by flowing into a pipe of 2.54 cm diameter. The air at 200^{o}C 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 x 10^{-5} kg/m s
Thermal conductivity	0.015 W/m °C
Density	1.493 kg/m^3
c_p	1.025 kJ/kg °C

Q.3.

One side of a 1 cm thick stainless steel wall (k_1 = 19 W/m·°C) is maintained at 180°C and the other side is insulated with a layer of 4 cm fibreglass (k_2 = 0.04 W/m·°C). The outside of the fibreglass is maintained at 60°C and the heat loss through the wall is 300 W. Determine the area of the wall?

Q.4. *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?*