(Time: 3 Hours) **Maximum Marks: 80**

N.B
1. **Question No. 1** is compulsory.
2. Attempt any **three** out of remaining **four** questions.
3. Make Suitable Assumptions if necessary and state them clearly.
4. Figures to the right indicate marks.
5. Illustrate answers with sketches wherever required.

Q1		Answer all**.**	
	a)	Describe radiation shield.	**4**
	b)	Explain Prandtl's theory of Boundary layer-	**4**
	c)	Explain Boling point elevation in Evaporation.	**4**
	d)	Calculate the heat loss by radiation from a steam pipe at 377K to air at 283K.The pipe O.D is 50mm. Emissivity=0.9.	**4**
	e)	Write about Critical and optimum thickness of insulation for pipes.	**4**
Q2	a)	A long aluminium pipe of 100cm diameter at 773K is exposed to air at 373K. Find the time required for the pipe to attain a temperature of 473K. Data: density=2700kg/m^3, Cp=896J/kgK, k=204 W/mK, h=80 W/m^2K.	**8**
	b)	A tube of 60mm OD is insulated with 50mm of silica foam (k=0.055W/mK) followed by 40mm layer of cork (k=0.05W/mK).The temperature at the tube surface is 400K and at the outer surface of the cork is 303 K. Find the Heat loss per metre of the tube.	**8**
	c)	Write Stephan Boltzmann law and Planks law for Heat transfer by radiation.	**4**
Q3	a)	Apply Ryleigh's method of dimensional analysis, to get rate of heat transfer in Forced convection.	**10**
	b)	Derive the relation between Effectiveness and NTU, for cocurrent flow in DPHE.	**10**
Q4	a)	Explain the various methods of feeding in multiple effect evaporators	**6**
	b)	Describe the construction, working& applications of Shell & tube heat exchangers.	**10**
	c)	Write about heat transfer in jacketed vessels.	**4**

Q5 a) A cocurrent cooler is used to cool Oil at 420K to 370K, using water at 285K.The outlet temperature of water is 310K.By lengthening the cooler, the exit temperature of Oil is reduced to 350K, which changes the outlet temperature of water. If the flow rates, properties are kept the same, What is the new length of the cooler, assuming original length as 1 metre? **10**

b) An aluminium rod 25mm in diameter and 100mm long protrudes from a wall, at a temperature 525K into the environment at 288K. Find the heat lost, considering insulated end. Also find the efficiency and temperature at the end of the fin. **10**

Data: k=200W/mK. h=15W/m^2K

Q6 a) Explain the various stages in pool boiling. **10**

b) 100 tubes of O.D 12mm are arranged horizontally in a square array to condense steam at 1 atmosphere. Find the condensation rate, if the tube wall temperature is 371K. **10**

Properties of steam at 372K (mean temp.) are ρ = 960 kg/m^3 k = 0.68 W/mK. Viscosity = 282*10^{-6} kg/ms. Latent Heat of condensation=2257kJ/kg.