UNIVERSAL INSTITUTE OF ENGINEERING & TECHNOLOGY
LALRU , MOHALI -140501

MECHANICAL ENGINEERING

ASSIGNMENT SHEET

Course Name	:	Heat Transfer
Course Code	:	
Class	:	B. Tech
Branch	:	ME
Year	:	2019 – 2020

S. No	Question	Blooms Taxonomy Level
	ASSIGNMENT-I	
1	Describe different types of boundary conditions applied to heat conduction problem?	Remember
2	Derive general conduction equation in Cartesian coordinates and cylindrical co ordinates.	Remember
3	Draw the temperature profile for steady-state conduction through a material with constant thermal conductivity?	Understand
4	Why metals are good thermal conductors, while non-metals are poor conductors of heat? Explain with an example.	Understand
5	Explain the concept of overall heat transfer coefficient. Represent a thermal circuit with conduction and convection.	Understand
6	Explain the heat transfer process for practical interest which involves change of phase?	Remember
7	Explain about the combined mechanism of heat transfer?	Understand
8	If the combustion chamber wall is made up of Firebrick (k=0.145W/mK,(ε=0.85)and is 1.45 cm thickness, Compute the overall heat transfer coefficient for the following data. Gas temperature 800^0C, Wall temperature on gas side =798^0C, Film conductance on gas side 40W /m^2K, Film conductance on coolant side 10 W/m^2K, Radiation shape factor between wall and gas is 1.	Remember
9	An insulated pipe of 50mm outside diameter (ε=0.8) is laid in a room at 30ºC. If the surface temperature is 250ºC and the convective heat transfer coefficient is 10 W/m^2K, calculate the heat loss per unit length of pipe.	Remember
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	ASSIGNMENT –II	
1	A Hollow heat cylinder with r_1=30 mm and r_2=50 mm, k=15W/Mk is heated on the inner surface at a rate of 10 5 W/m^2 and dissipates heat by conduction from the outer surface to a fluid at 100^0 C with h = 400 W/m^2K. Find the temperature inside and outside surfaces of the cylinder and also find rate of heat transfer through the wall.	Remember
2	A tube 2 cm. O.D maintained at uniform temperature of Ti is covered with insulation (k= 0.20 W/Mk) to reduce heat loss to the ambient air Tα with ha=15W/m^2K. Find i) the critical thickness r_c of insulation (ii)the ratio of heat loss from the tube with insulation to that without insulation, (a) if the thickness of insulation is equal to r_c.	Remember
3	A stainless steel fin (k = 20W/Mk) having a diameter of 20 mm and a length of 0.1 m is attached to a wall at 300^0C. The ambient temperature is 50^0C and the heat transfer coefficient is 10 W/Mk. The fin tip is insulated. Determine (a) the rate of heat dissipation from the fin, (b) the temperature at the fin tip, (c) the rate of heat transfer from the wall area covered by the fin was not used and (d) the heat transfer rate from the same fin geometry if the stainless steel fin is replaced by a fictitious fin with infinite thermal conductivity	Remember
4	Two large steel plates at temperatures of 120^0C and 80^0C are separated by a steel rod 300 mm long and 25mm in diameter. The rod is welded to each plate. The space between the plates is filled with insulation, which also insulates the circumference of the rod. Because of a voltage difference between the two plates, current flows through the rod, dissipating electrical energy at a	Understand
5	Define local and mean heat transfer coefficient. On what factors 'h' value depends on?	Understand
6	A metal plate 0.609m in height forms the vertical wall of an oven and is at a temperature of 171^0C. Within the oven is air at a temperature of 93.4^0C and the atmospheric pressure. Assuming that natural convention conditions hold near the plate, and that for this case Nu=0.548(GrPr)1/4 find the mean heat transfer coefficient and the heat taken up by air per second per meter width. For air at 132.2^0C, take	Understand

	k=33.2x10-6Kw/m, μ=0.232x10-4kg/ms, cp=1.005Kj/kgK. Assume air as an ideal gas and R=0.287Kj/kgK.	
7	Water is to be boiled at atmospheric pressure in a mechanically polished stainless steel pan placed on top of a heating unit, The inner surface of the bottom of the pan is maintained at 108°C. If the diameter of the bottom of the pan is 30 cm, determine (a) the rate of heat transfer to the water and (b) the rate of evaporation of water	
8	A black body emits radiation at 200^0K. Calculate (i) the monochromatic emissive power at 1 μ.m wavelength,(ii) wavelength at which the emission is maintained and (iii)the maximum emissive power	
Assignment III		
1	In a Double pipe counter flow heat exchanger 10000 kg/h of oil having a specific heat of 2095 J/kgK is cooled from 80^0C to 50^0C by 8000 kg/h of water entering at 25^0C. Determine the heat exchanger area for an overall heat transfer coefficient of 300 W/m^2K. Take Cp for water as 4180 J/kgK.	Understand
2	It is required to design a shell and tube heat exchanger for heating 9000 kg/hr of water from 15^0 C to 88^0 C by hot engine oil (Cp = 2.35 kJ/kg-K) flowing through the shell of the heat exchanger . The oil makes a single pass, entering at 150^0 C and leaving at 95^0 C with an average heat transfer coefficient of 400 W/m^2 -K, the water flow through 10 thin walled tubes of 25mm diameter with each tube making 8 passes through the shell. The heat transfer efficient on the water side is 3000 W/m^2 -K. Find the length of the tube required for the heat exchanger.	Understand
3	Calculate the heat transfer area required for a 1-1 shell and tube heat exchanger which is used to cool 55000 kg/hr of alcohol from 66 ^{0}C to 40 ^{0}C using 40,000 kg/hr of water entering at 5 ^{0}C. U = 580 W/m^2K, consider a) counter flow b) parallel flow. CP water = 4.18 $\times 10^3$ J/kg K Cp alcohol = 3.76$\times 10^3$ J/kg K	Remember
4	Hot oil with a capacity rate of 2500 W/K flows through a double pipe heat exchanger. It enters at 360°C and leaves at 300°C. Cold fluid enters at 30°C and leaves at 200°C. If the overall heat transfer coefficient is 800 W/m^2K, determine the heat exchanger area required for (i) Parallel flow and (ii) Counter flow.	Understand
5	Saturated steam at 100°C is condensing on the shell side of a shell-and-tube heat exchanger. The cooling water enters the tubes at 30°C and leaves at 70°C. Calculate the effective log mean temperature difference if the arrangement is (i) counter flow, (ii) parallel flow and (iii) cross flow.	Understand
6	Water enters a counter flow, double pipe heat exchanges at 15 ºC, flowing at the rate of 1300 kg/h. It is heated by oil (Cp = 2 J/kg.K) flowing at the rate of 550 kg/h from the inlet temperature of 94 ºC. For an area of 1 m^2 an overall heat transfer coefficient of 1075 W/m^2K, determine the total heat transfer and the outlet temperatures of water and oil?	Understand
7	Water at the rate of 4080kg/h is heated from 35^0C to 75^{0C} by oil having a specific heat of 1900J/Kg K. The exchanger is of a counter flow double pipe design. The oil enters at 110^0C and leaves at 75^0C. Determine the area of the heat exchanger necessary to handle this load if the overall heat transfer coefficient is 320W/m^2K.	Understand

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