INTERNAL ASSESSMENT TEST – 3

Dept: ME	Sem / Div: 6th	Sub:Heat Transfer	S Code: 18ME63
Dt:05/08/2021	Time:9.30 -11 am	Max Marks: 50	Elective: N

Note: Answer any 2 full questions.

QN		Questions	Mark	RBT	CO's
		Part A			
1	a	Derive the expression for effectiveness of a Parallel flow heat exchanger.	10	L3	CO5
	b	A counter flow H.E through which passes 12.5 kg/sec of air to be cooled from 540°C to 146°C , contains 4200 tubes each having a diameter of 30mm. The inlet and outlet temperature of cooling water is 25°C and 75°C respectively. If the water side resistance to the flow is negligible, calculate the length required for this process. Properties of air at the Average temperature are as follows **ρ**=1.009kg/m^3, Cp= 1.0082 KJ/kgk, μ=2.075*10^{-5} N-S/m^2, K=3.003*10^{-2}w/m°C	12	L3	CO5
	c	Mention the types of heat exchanger	3	L2	CO5
		OR			
2	a	Derive the expression for Relationship between Nusselt number, Grashoff's Number and Prandtl number for free convection heat transfer by using Buckingham's Pai Theorem	10	L3	CO3
	b	A vertical door of the hot oven is 0.5m and is maintained at 200°C. It is exposed to air at 20°C. Find i) Local heat transfer coefficient half way of the door. ii) Avg heat transfer coefficient. iii) Thickness of free convection boundary layer at the top of door.	8	L3	CO3
	c	A hot fluid at 300°C flows through a horizontal pipe of 30cm outside diameter and 90cm long. The pipe is exposed to Atmospheric air maintained at 20°C. Determine rate of natural	7	L3	CO3

		convection heat transfer			
		Part B			
3	a	Explain the Drop wise and film wise condensation	8	L2	CO5
	b	Tube Heat exchanger consist of 200 tubes each 20mm Outer diameter and 5m length. Hot fluid flows inside the tube and cold air over it in opposite direction to the hot fluid. Overall heat transfer coefficient based on Outer diameter is 320 W/m^2k. Determine outlet temp of both the fluids and total heat transfer by using the following data. $T_{hi}=120^oC$, $T_{ci}=20^oC$, $M_h=20$ kg/sec , $M_c=5$ kg/sec $Cp_h=2000$ J/kg k , $Cp_c=4000$ J/kg k	8	L3	CO5
	c	A vertical cooling fin approximately a flat plate of 40 cm in height is exposed to steam at atmospheric pressure. if the surface of the fin is heated at 80 °C, Calculate I) Film thickness at the bottom edge of the film. II)Over all heat transfer coefficient III) Heat transfer rate and condensate mass flow rate. Assume unit width of the fin .	9	L3	CO5
		OR			
4	a	Calculate the surface area required for a heat exchanger, it is required to cool 3200 kg/hr of benzene (Cp=1.74 KJ/kg K) from 72^oC to 42^oC. Cooling water Cp=4.18 KJ/kg K at 15^oC as flow rate of 2200 kg/hr. I. Single pass counter flow Heat exchanger. II. 1shell -4 pass tube Heat exchanger. III. Cross flow single pass with both water and benzene unmixed. Take U as 0.28 $KW/m^{2o}C$ for all the cases.	12	L3	CO5
	b	An electrically heated plate 25cm*25cm in which surface is thermally insulated and other surfaces is dissipating heat by free convection into Atmospheric air at 30^oC. Heat flux over the surface	9	L3	CO3

		is uniform and results in mean temperature of 50°C. The plate is inclined at 60° from the vertical. Determine heat loss if, i. Heat surface facing upward. ii. Heated surface facing downward.			
	c	Define Forced convection and Free convection	4	L2	CO3

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