INTERNAL ASSESSMENT TEST – 2

Dept: ME	Sem / Div: 6th	Sub:Heat Transfer	S Code: 18ME63
Dt:25/06/2021	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 temperature distribution for a short fin of uniform cross section without insulated tip starting from fundamental energy balance equation.	10	L3	CO2
	b	A long rod of 12mm c/s made up of low carbon steel protects into air at 35°C from a furnace wall at 200°C. The connective heat transfer coefficient of the material is estimated as 22w/m^{2}k. Conductivity of material is 51w/mk. Determine the location from the wall at which temp will be 60°C. Also calculate temp at 80mm from the base and fin efficiency and effectiveness.	8	L3	CO2
	c	A steel ball bearing of K=50w/mk, $\alpha=1.3*10^{-5}$m^2/s, 40mm in diameter is heated to a temp of 650°C.It is then quenched an oil bath at 50°C where the heat transfer co-efficient is 300w/m^{2}K. Calculate time required for bearing to reach 200°C i) Total time required. ii) Total amount of heat removed for bearing during this time. iii) Instantaneous heat transfers when they are first immersed in oil bath (T=0) & when they reach 200°C.	7	L3	CO2
2	a	What do you mean by Lumped System Analysis? Obtain an expression for temperature distribution for this system in terms of Biot and Fourier numbers	8	L3	CO2
	b	A long cylindrical rod of radius 7.5cm comes out of a Oven at 815°C throughout is cooled by quenching it in a large bath of 38°C	10	L3	CO2

		coolant. If the surface co-efficient of heat transfer between the bar & coolant is 175 W/m^2K and $\alpha=0.0185m^2/hr$, what would be the surface temp of the shaft when its center temperature is 116^oC. Calculate the energy removed from the cylinder during this period- also calculate temperature gradient at the outside surface at this instant of time.			
	c	All fins of rectangular profile are attached to a plane wall with 5mm spacing. The fins have thickness of 1mm length of 10mm & thermal conductivity of 200w/mk. Wall is maintained at a uniform temp of 200^oC & fin dissipate heat by convention into an ambient at 40^oC with surface heat transfer co-efficient of $50w/m^2k$. Determine fin efficiency i) Heat loss from the plane wall per m^2 of the wall surface. ii) Neglect the heat loss from the end, also calculate fin effectiveness.	7	L3	CO2
		Part B			
3	a	Establish a Relationship between Nusselt Number, Prandtl number and Reynold's numbers by using Dimensional analysis.	10	L3	CO3
	b	Determine friction factor and pressure drop for a fully developed laminar flow of ethylene glycol at 40^oC through a pipe of 5cm diameter, 50m long at a rate of 0.1 kg/sec	7	L3	CO3
	c	Two very long slender rods of same diameter given, one rod is of aluminium of K=200w/mk. While the other one whose thermal conductivity is not known. To determine k_2 one end of each rod is thermally attached to a metal surface which is maintained at a temp t_o. Both the rods are losing heat by connection with an h & ambient temp t_f. Surface temp of aluminium at a distance of 40cm from the base was measured & it was found to same as that of the rod of unknown thermal conductivity at a distance of 20cm. From the base Determine the unknown thermal conductivity.	8	L3	CO2
		OR			

4	a	Explain Velocity boundary layer thickness for a flow over a flat plate with a neat sketch.	10	L2	CO3
	b	Dry air at Atmospheric pressure and 20^{o}C is flowing with a velocity 3m/s along the length of a long flat plate of 0.3m wide. Plate is maintained 100^{o}C.calculate the following quantities at x=0.3m I. Boundary layer thickness. II. Local friction coefficient. III. Average friction coefficient. IV. Local shear stress due to friction. V. Thickness of thermal boundary layer. VI. Local convection heat transfer coefficient.	9	L3	CO3
	c	Explain the physical significance of Biot number and Fourier number	6	L2	CO2

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