Code No. 6346 / M

FACULTY OF ENGINEERING

B.E. 3/4 (Mech./AE.) II – Semester (Main) Examination, June 2014

Subject : Heat Transfer

Time : 3 hours **Max. Marks : 75**

Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.

PART – A (25 Marks)

1	Distinguish between steady and transient conduction.	2
2	What do you understand by thermal contact resistance? On what parameters does this resistance depends?	3
3	Define sensitivity (or) time constant of a thermocouple.	2
4	Write the significance of use of charts in transient heat conduction in finite solids.	3
5	Define Groshof number. Explain its significance.	2
6	Define boundary thickness. On what parameters Hydro-dynamic and thermal boundary layers depends.	3
7	Distinguish between total emissive power and monochromatic emissive power of a body.	3
8	Define Wein's displacement law.	2
9	What do you mean by fouling in heat exchangers? What are the demerits of fouling factor?	3
10	Distinguish between film wise and drop wise condensation.	2

PART – B (50 Marks)

11 A furnace is made up two layers. The inside layer is silica brick is 120 mm thick, and the outer side layer of brick is 300 mm thick. The inner and outer temperature are 100^0C and 800^0C respectively. The thermal conductivities of silica and brick are 1.75 w/m.k and 6.2 w/m-k respectively. Calculate 10

a) The rate of heat loss (rate of heat transfer)

b) The temperature drop at the interface

12 Steady cylinder 0.2 m is diameter of 3 m long, initially at 500^0C is suddenly immersed in a fluid at 40^0C. The convective heat transfer coefficient between the cylinder surface and fluid is 200 W/m^2 K. Assuming K = 40 W/m-K, α=1.0 x 10^{-5} m^2/s for the steel cylinder. Calculate after 20 minutes a) The center temperature b) the surface temperature and c) the heat transfer to the water during the initial 20 minutes.

13 Air flows over a flat plate of 80m x 0.5 m at a velocity of 2 m/s. The temperature of air is 500C, calculate a) the boundary layer thickness, b) the drag coefficient both at a distance of 0.8 m from the leading edge of the plate, and c) the drag force on the plate over the entire length. Take ρ = 1.003 kg/m^3 and γ=17.95 x 10^{-6} m^2/s for air at 50^0C.

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14 Two opposed, parallel, infinite planes are maintained at 420 K and 480 K respectively. Calculate the net heat flux between these planes if one has an emissivity of 0.08 and other an emissivity of 0.7 Does it matter which plate has which emissivity? How this heat flux will be affected if :

a) The planes are assumed to be black

b) The temperature differences is doubled by raising the temperature 480K to 540K

15 A counter flow heat exchanger is employed to cool 0.55 kg / s (cp = 2.45 KJ/ kg-K) of oil from 115^0C to 40^0C by the use of water. They inlet and outlet temperature of cooling water are 15^0C and 75^0C respectively. The overall heat transfer coefficient is expected to be 1450 W/m^2 K. Using NTU method, calculate the following : a) the mass flow rate of water b) the effectiveness of heat exchanger and c) the surface area required.

16 A very long copper rod 20 mm in diameter extends horizontally from a plane heated wall maintained at 100^0C. the surface of the rod is exposed to an air environment at 20^0C with convective heat transfer coefficient of 8.5 W/m^2-K. Workout the heat loss if the thermal conductivity of copper is 700 W/m-K. Further estimate how long the rod be in order to be considered infinite.

17 Discuss in detail the various regimes in boiling and explain the condition for the growth of bubbles. What is the effect of bubble size on boiling.

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