Total No. of Printed Pages:2

SUBJECT CODE:- 8282
FACULTY OF ENGINEERING AND TECHNOLOGY
M.E.(Mechanical) Examination Nov/Dec 2015
El-2 Advanced Heat Transfer
(Revised)

[Time: Three Hours] **[Max. Marks: 80]**

"Please check whether you have got the right question paper."

N.B i) Attempt any three question from each section
ii) Use of heat & mass transfer data book is allowed
iii) Neat diagram must be drawn wherever necessary.
iv) Assume suitable data, if necessary.

Section A

Q.1 a) What is the conduction shape factor? What is its importance? 05

b) Both ends of 6mm diameter 'U' shaped copper rod are rigidly fixed to vertical wall. The wall is maintained at 100^0C. 08 the developed length of the rod is 50 cm and its K=300 w/m K. it is exposed to air at 30^0C. the combined connective & radiation heat transfer coefficient is 30 w/m^2K. calculate

i) Temp at the centre of the rod and
ii) Heat loss by the rod.

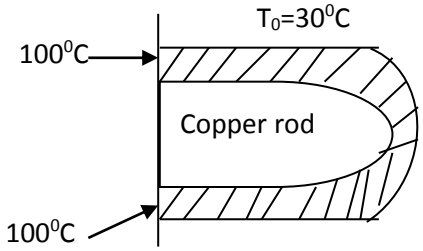

fig.

Q.2 Hot oil in a rectangular tank ($1m \times 1m$ on side) is expressed to surrounding air at 24^0C. The temp of the tank wall is 13 110^0C. In order to increase the heat dissipation, it is proposed to attach straight rectangular fins to the tank surface. As a result the heat dissipation rate increases by 70% and tank surface temp drops to 91^0C. The fins are 5mm thick and are spaced 100mm apart (centre to centre distance). The thermal conductivity of tank and fin material is 230 w/m k and heat transfer coefficient over fins is 42 w/m^2 K Heat loss from the fin tip may be neglected. Calculate the minimum height of the fins.

Q.3 A large plate of aluminum 5-0 cm thick and initially 200^0C is suddenly exposed to the concretion environment. Calculate 13 the temp at a depth of 1.25 cm from one of the faces 1 min after the plate has been exposed to the environment. How much energy has peen removed for unit area from the plate in this time?

Q.4 A furnace wall is made of insulation brick of 12 cm. thick (k=0.6 w/mk),fire brick of 10cms thick(k=0.8w/mk) and 13 backed by 1 cm thick metal plate (k=46 w/mk) the insulation brick is exposed to gases at 900^0C and metal plate to air at 30^0C. The gas side heat transfer coefficient is 100 w/m^2 k and air side is 15 w/m^2 K. the contact resistance between insulation brick and fire brick=$2.6 \times 10^{-4} m^2\ K/w$. The contact resistance between firebrick and metal plate =$1.5 \times 10^{-4} m^2 k/w$ calculate

a) Heat flow thrd the furnace wall/m^2
b) Overall heat transfer coefficient
c) Temperature at the interference

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Q.5 Write a explanatory notes on <u>any two</u> 14

1) Periodic heat flow
2) Camped heat capacity system
3) Flow across the cylinder & sphere
4) Extended surface

SECTION-B

Q.6 Calculate the approximate Gratify humbler and state of the flow is laminar or turbulent for the following 13

a) A control heating radiator , 0.6 m high with a surface temp of 75^0C in a room at 18^0C
($\varrho = 1.2kg/m^3$, $pr = 0.72$, and $\mu = 1.8 \times 10^{-5} kg/ms$)
b) A horizontal oil lamp with surface temperature of 40^0C, 0.4 m long and 0.2m wide containing oil air at 75^0C. (Take ϱ=854kg/m^3, Pr=546, $\beta = 0.7 \times 10^{-3} K^{-1}$ and $\mu = 8.56 \times 10^{-2} kg/m.s$)
c) Air at 20^0C(ϱ=1.2kg/m^3, Pr=0.72, & μ=1.8×10^{-5}kg/ms) adjacent to a 60mm dia, horizontal light bulb with a surface temp of 90^0C.

Q.7 12 cm outside diameter and 2m long tube is used in a big condenser to condense the steam at 0.4 bars. Estimate the unit surface conductance 13

a) In vertical position
b) In horizontal position also find the amount of condensate farmed per hour on both cases
The saturation temp of the steam =74.5^0C average wall temp=50^0C.
The properties of water film at average temp of $\frac{75.4+50}{2} = 62.7^0 C$ are ϱ=982-2kg/m^3 hfg=2480 kj/kg, k=0.65, $\mu = 0.47 \times 10^{-3} kg/m.s$.

Q.8 Two large parallel plane's are at $T_1 = 800K, \in_1 = 0.3, T_2 - 400K, \in_2 = 0.7$,and separated by gray gas having$\epsilon g = 0.2$ $\tau g = 0.8$. Calculate the heat transfer rate between the two plane's and the temp of the gas using radiation network. Compare with the heat transfer without presence of the gas. 13

Q.9 Two very large parallel planes with emissivilies 0.3 and 0.8 .exchange heat. Find the percentage radiation in heat transfer when a polished radiation shield ($\epsilon = 0.04$)is placed between them 13

Q.10 Write a explanatory notes on <u>any two</u> 14

a) Solar radiation
b) Design consideration of heat pipe
c) Radiation shield
d) Multi mode heat transfer