GIET MAIN CAMPUS AUTONOMOUS,
GUNUPUR - 765022

Registration No: | | | | | | | | | | | **M.TECH**

Total Number of Pages : 2

M.TECH 1ST SEMESTER SUPPLE EXAMINATIONS, DECEMBER 2018

HEAT TRANSFER-1

Branch: TE, Subject Code:MTEPC1020

(Regulations 2017)

Time: 3 Hours **Max Marks : 70** **Question Code: SD18002035**

PART-A (10 X 2=20 Marks)

1. Answer the following questions.

a. Why a negative sign is appeared in the Fourier 1-D steady state heat conduction equation?
b. Define Biot Number, and what its significance is.
c. Define black and grey bodies
d. What is isotherm and heat flow lines?
e. Ice and snow are considered as black body, Explain.
f. What do you understand by the term heat transfer through participating media?
g. What do you mean by critical thickness of insulation? Give the expression of critical thickness for a spherical body with insulation.
h. A 100W light bulb may be considered to be an isothermal black sphere at a temperature of 30010C.Find out the efficiency of the bulb if the light flux (i.e., visible light,0.4 $\mu m<\lambda<0.7\ \mu m$) .
i. Explain Prevost's theory of heat exchanger?
j. What is Hausen's Chart? Where is it used?

PART-B (5 X 10=50 Marks)

Answer any five questions from the following.

2 a). Derive the general heat conduction equation in orthogonal curvilinear coordinate system. [6]

b) From the above equation derive the heat conduction equation in Cartesian coordinate system. [4]

3.a) An ice ball of initial diameter 0.06m is suspended in a room at 30^0C.the ice melts by absorbing heat from the ambient, the surface heat transfer coefficient being 11.4W/m^2 ^{0}C. The air in the room is essentially dry.If the shape of the ball remains unchanged, calculate the time required for reduction in its volume by 40%. The density of ice is 929 Kg/$m^3$and its latent heat of fusion is $3.35x10^5$ J/Kg. [6]

b) Derive an expression for temperature distribution for lumped system analysis under transient condition. [4]

4. The wall of a large incubator for eggs contains an 8 cm thick-layer of fiberglass sandwiched between two plywood sheets with thickness of 1 cm. The outside temperature is Tc = 10oC, and the heat transfer coefficient at outer plywood surface is h1 = 5 W/m2.K. The corresponding conditions on the wall surface that faces the eggs are Th = 40oC and h3 = 20 W/m2-K. The heat transfer coefficient is higher on warm side of the wall because a fin recalculates the air that comes in contact with the eggs. Calculate the heat flux through the wall of incubator. [10]

5. On a clear day the strength of solar radiation has been measured as 800 W/m2 (normal to the sun's ray), while total sky radiation (from all directions) falling onto a horizontal surface has been determined as 206 W/m2. Determine illumination onto a horizontal surface if the sun is at Zenith angle of 60o. The spectral intensity varies in the wave length range from 0.4 μm to 0.7 μm. The temperature of sun (Tsun) is 5762 K. Given that f(0.7Tsun) = 0.48681 and f(0.4Tsun) = 0.12099. [10]

6. A semi-infinite solid having uniform temperature of T, is suddenly dipped into a fluid medium of temperature To = T.. The heat transfer coefficient between the fluid and outer surface of the plate is too large. The plate attains the fluid temperature upon dipping. Find the temperature distribution in the plate. [10]

7. A paint baking oven consists of a long, triangular duct in which a heated surface is maintained at 1200K and another surface is insulated. Painted panels, which are maintained at 500K, occupy the third surface. The triangle is of width W=lm on a side, and the heated and insulated surfaces have an emissivity of 0.8. The emissivity of the panel is 0.4. During steady state operation, at what rate must energy be supplied to the heated side per unit length of the duct to maintain its temperature at 1200K? What is the temperature of the insulated surface. [10]

8. Write Short Notes [5]
   a. Radiosity and Irradiation [5]
   b. Duhamel's superposition integral

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