Total No. of Questions : 4]

SEAT No. :

PE69

[Total No. of Pages : 2

[6579]-371

T.E. (Mechanical / Mechanical S.W.) (Insem)

HEAT AND MASS TRANSFER

(2019 Pattern) (Semester - I) (302042)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of Calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) Derive general heat conduction equation in Cartesian coordinates. **[8]**

b) Describe the terms Thermal capacity and Thermal Diffusivity and Thermal contact resistance. **[7]**

OR

Q2) a) A flat wall of furnace is made up of fire brick (k=1.4w/m°C), insulating brick (k=0.2w/m°C) and building brick (k=0.7w/m°C) of thickness 25cm, 12.5 cm and 25 cm respectively. The inside wall is at 600°C and the atmosphere is at 20°C, if the heat transfer coefficient for the outside surface is 10 W/m^2 °C, calculate: **[8]**

i) The loss of heat per m^2 of wall area

ii) Temperature of outside wall surface of the furnace

b) List and discuss any three parameters from the list that affects thermal conductivity of solids. **[7]**

Q3) a) It is required to heat oil to about 350°C for frying purpose. A ladle is used of 4mm × 15mm cross-section. The surrounding is at 35°C. The conductivity of the material is 210 w/m°C, if the temperature should not reach to 45°C at distance of 400mm from the oil; determine the convective heat transfer coefficient. **[8]**

b) What are Fourier and Biot Number? Explain the significance of Fourier and Biot Number. **[7]**

OR

P.T.O.

Q4) a) A copper slab of 400mm×400mm×5mm dimensions has a uniform temperature of 250°C. Its temperature is suddenly lowered to 30°C. Calculate the time required for the copper slab to reach 90°C. Assume convective heat transfer coefficient as 90 W/m^2 °C, assume following data for copper **[8]**

Density: 9000 kg/m^3

Specific heat: 380 J/kg °C

Thermal conductivity: 370 w/m°C

b) Explain the following: **[7]**

i) Fin Efficiency

ii) Fin Effectiveness

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