22510

23242

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: **10**

a) State Fourier's Law and Give its Mathematical Expression.

b) Define film heat transfer coefficient and write its unit.

c) Define condensation. Give its types with one example of each.

d) Define Kirchhoff's Law.

e) Enlist the parts of shell and tube heat exchanger.

f) Write down properties of solution that influences evaporation.

g) Define Natural convection and forced convection.

Marks

2. Attempt any THREE of the following: **12**

a) Derive the expression for heat flow through thick walled cylinder by conduction.

b) Differentiate between natural and forced convection (any FOUR points)

c) Enlist the methods to improve economy of evaporator and explain any one in detail.

d) Write in brief concept of black body.

3. Attempt any THREE of the following: **12**

a) Calculate the rate of heat transfer by radiation from an unlagged steam pipe 50 mm OD at 393K to air at 293K. given : e = 0.9

b) Draw neat labelled diagram of 1-2 shell and tube heat exchanger.

c) In a double pipe counter current flow heat exchanger, 10000 kg/h of an oil having a specific heat of 2095 J/(Kg.K) is cooled from 353K to 323K by 8000 kg/h of water entering at 298K. Calculate the heat exchanger area, for an overall heat transfer coefficient of 300 W/(m^2K). Tak Cp for water as 4180 J/(kgK).

d) Write difference between forward feed and backward feed arrangement in evaporators. (any FOUR points).

4. Attempt any THREE of the following: **12**

a) Calculate the loss of heat by radiation from a steel tube of diameter 70mm and 03 m long at a temperature of 500K, if the tube is located in a square brick conduit 0.3 m side at 300K. Assume ‘e’ for steel as 0.79 and for brick conduit as 0.93.

b) Write Dittus Bolter equation and Sider-Tate equation for Calculating heat transfer coefficient in laminar and turbulant flow.

c) Define thermal conductivity and write its unit. Give it's variation with temperature.

Marks

d) Give Formulas of following

i) Reynold no. (N_{Re})

ii) Nusselt no. (N_{Nu})

iii) Prandlt no. (N_{Pr})

iv) Grashof no. (N_{Gr})

e) Draw neat labelled diagram of Long tube vertical evaporator and Give it's any two advantages.

5. Attempt any TWO of the following: **12**

a) Find the individual heat transfer coefficient using sieder - Tate equation for turbulent flow Data :

ID of tube = 20mm,

N_{Re} = 15745

Viscosity of fluid at bulk mean temperature = 550×10^{-6} pa.s.

Viscosity of fluid at average wall temperature = 900×10^{-6} pa.s.

Npr = 36

thermal conductivity of fluid,

K = 0.25 W/(mK)

b) Draw and explain Graphite Block Heat exchanger.

c) Draw a neat diagram of Forced Circulation type of evaporator and explain in brief its working.

6. Attempt Any TWO of the following: **12**

a) A flat furnace wall is constructed of 45 mm layer of sil-o-cel brick, with a thermal conductivity of 0.138 w/(mk) backed by a 90 mm layer of common brick of conductivity 1.38 W/(m.k) Calculate the total amount of heat transferred considering area of wall as 1 sq. meter.

b) Explain in brief heat transfer to boiling liquids with neat diagram of boiling curves.

c) Describe with neat sketch diagram finned tube heat exchanger.

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