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**SUBJECT CODE NO:- H-124**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**T.E. (Mechanical) (Sem-II)**  
**Heat Transfer**  
**[OLD]**

[Time: Three Hours]

[Max.Marks: 80]

Please check whether you have got the right question paper.

N.B

- 1) Solve any three question from each Section.
- 2) Figure to right indicate full marks.
- 3) Assume suitable data, if necessary.
- 4) Use of Heat & Mass transfer data book & Non Programmable Calculator.

**Section A**

- Q.1 a) Derive the generalized heat conduction equation in Cartesian Co-ordinates under unsteady state with heat generation. 06
- b) A cold storage room has walls made of 220 mm of brick's on the outside 90 mm of plastic foam and finally 16 mm of wood on inside. The outside & Inside air temperatures are 25°C & -3°C respectively. If the inside & outside heat transfer coefficients are respectively 30 & 11  $W/m^2°C$ , and the thermal conductivity of brick, foam & wood are 0.99, 0.022 & 0.17  $W/m°C$ , respectively. Determine
- i) The rate of heat removal by refrigeration if the total wall area is 85m<sup>2</sup>;
  - ii) The temperature of the inside surface of the brick. 07
- Q.2 a) Explain estimation of error in temperature measurement in a thermometer well? 06
- b) A mercury thermometer placed in oil well is required to measure the temperature of compressed air flowing in a pipe. The wall is 140 mm long and made of steel ( $K= 50w/m°C$ ) of 1 mm thickness. The temp recorded by the well is 100°C. While the pipe wall temp is 50°C. Heat transfer coefficient between air & well wall is 30  $W/m^2°C$ . Estimate true temp of air. 07
- Q.3 A vertical plate measuring 180 mm × 180 mm and at 50°C is exposed to atmosphere at 10°C. Compare the free convection heat transfer from this plate with that which would result due to forced convection over the plate at a velocity equal to twice the maximum velocity which would occur in free convection boundary layer. 13
- Q.4 a) Differentiate between Natural & Forced Convection? 06
- b) With neat sketch explain The Boundary Layer on flat plate. 07
- Q.5 Write any two (Short Notes) 14
- a) Thermal Contact Resistance
  - b) Significance of BiotNumber & Fourier Number
  - c) Effectiveness & efficiency of Fin

## Section B

- Q.6 a) Write a note on film wise and drop wise condensation? 06  
 b) Draw the pool boiling curve & explain six regimes of pool boiling curve. 07
- Q.7 a) State & Prove Kirchoff's Law of Radiation. 05  
 b) Consider two large parallel plates one at  $t_1 = 727^\circ\text{C}$  with emissivity  $\varepsilon_1 = 0.8$  and other at  $t_2 = 227^\circ\text{C}$  with emissivity  $\varepsilon_2 = 0.4$ . An aluminium shield with an emissivity  $\varepsilon_s = 0.05$  on both sides is placed between plates. Calculate the percentage reduction in heat transfer rate between the two plates as a Result of the shield. 08  
 Use  $\sigma = 5.67 \times 10^{-8} \text{ W/m}^2\text{K}^4$
- Q.8 Derive an expression for LMTD of parallel flow heat exchanger stating the assumption made? 13
- Q.9 The following data relate to parallel flow heat exchanger in which air is heated by hot exhaust gases. 13
- \* Heat transferred/hr = 155450 kJ
  - \* Inside heat transfer coefficient } =  $120 \text{ W/m}^2\text{C}$
  - \* Outside heat transfer coefficient } =  $95 \text{ W/m}^2\text{C}$
  - \* Inlet & Outlet temp of the hot fluid } =  $450^\circ\text{C}$  &  $250^\circ\text{C}$
  - \* Inlet & Outlet temp of the cold fluid } =  $60^\circ\text{C}$  &  $120^\circ\text{C}$
  - \* Inside and outside dia of tube } = 50 mm & 60 mm
  - \* Calculate the length of the tube?
- Q.10 Write any two (Short Notes) 14
- i) Black, White & Grey Body
  - ii) Fouling & fouling factor
  - iii) Shape factor