Code: 17D11201



M.Tech II Semester Supplementary Examinations January/February 2019

**ADVANCED HEAT & MASS TRANSFER**

(Thermal Sciences & Energy Systems)

(For students admitted in 2017 only)

Time: 3 hours Max. Marks: 60

Answer all the questions

Use of heat and mass transfer data handbook allowed.

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1 A heating furnace of total surface area 30 $m^2$ and volume 10 $m^3$ is maintained at a temperature of 1000℃ over its entire volume. The total pressure of the combustion gases is 2 atm, the partial pressure of water vapour is 0.1 atm and that of $CO_2$ is 0.3 atm. Calculate the emissivity of the gaseous mixture.

**OR**

2 A cylinder 1 m long and 5 cm in diameter is placed in an atmosphere at 45°C. It is provided with 10 longitudinal straight fins of material having k = 120 W/mK. The height of 0.76 mm thick fins is 1.27 cm from the cylinder surface. The heat transfer coefficient between cylinder and atmospheric air is 17 $W/m^2K$. Calculate the rate of heat transfer and the temperature at the end of fins if surface temperature of cylinder is 150°C.

3 Derive the momentum equation.

**OR**

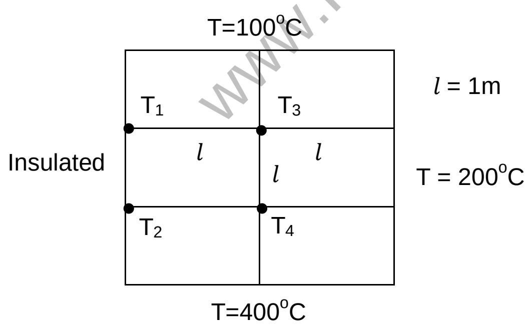
4 Explain the analogy between momentum and heat transfer.

5 Explain with a neat sketch the pool boiling curve for water.

**OR**

6 A refrigerator is designed to cool 250 kg/hr of hot liquid of specific heat 3350 J/kgK at 120°C using a parallel flow arrangement. 1000 kg/h of cooling water is available for cooling purposes at a temperature of 10°C. If the overall heat transfer coefficient is 1160 $W/m^2K$ and the surface area of the heat exchanger is 0.25 $m^2$, calculate the outlet temperatures of the cooled liquid & water and also the effectiveness of the heat exchanger.

7 Calculate the steady state temperatures $T_1$, $T_2$, $T_3$, $T_4$ at the four nodes in the figure given below using the finite difference method.




**OR**

8 Explain clearly Crank Nicolson and fully implicit schemes.

9 Estimate the rate of evaporation of toluene from the bottom of a deep narrow cylindrical vessel to air at 291.7 K flowing over the top surface of the vessel. The diffusivity of air toluene vapour is 0.826 X $10^{-5}$ $m^2/s$ and the saturated vapour pressure of toluene at the liquid surface in the vessel is 0.026 atm. Take the distance between the liquid toluene surface and the top of the vessel as 1.525 m.

**OR**

10 Write down the heat transfer correlations in various applications like I.C engines.

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