Reg. No. : | | | | | | | | | | |

Question Paper Code: 36072

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2017

Sixth Semester

Mechanical Engineering

01UME602 - HEAT AND MASS TRANSFER

(Regulation 2013)

(HMT data book is permitted)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. What are the requirements of fins?
2. Distinguish between steady and transient Heat conduction.
3. Define Nusselt number (Nu).
4. What is meant by Newtonian and non – Newtonian fluids?
5. What is meant by pool boiling?
6. What is meant by Regenerators?
7. State Stefan Boltzmann law.
8. What is the purpose of radiation shield?
9. What is molecular diffusion?
10. Define forced convective mass transfer.

PART - B (5 x 16 = 80 Marks)

11. (a) An aluminium alloy fin of 7 *mm* thick and 50 *mm* long protrudes from a wall, which is maintained at 120 $^{\circ}C$. The ambient air temperature is 22 $^{\circ}C$. The heat transfer coefficient and conductivity of the fin material are 140 W/m^2K and 55 *W/m K* respectively. Determine

    (i) Temperature at the end of the fin

    (ii) Temperature at the middle of the fin

    (iii) Total heat dissipated by the fin. (16)

Or

(b) From the basic principles derive the three dimensional heat conduction equation in cartesian coordinate system. (16)

12. (a) Air at 1 *atm* and 20^0C is heated as it passes through a tube of 30*mm* inside diameter with a velocity of 12 *m/sec*. the temperature of the tube wall is maintained at 100^0C. (i) calculate the Heat Transfer per unit length of tube. (ii) How much would the Bulk temperature increase over a 3 *m* length of the tube. (16)

Or

(b) Air at 20 $^{\circ}C$, at a pressure of 1 bar is flowing over a flat plate at a velocity of 3 *m/s*. if the plate maintained at 60 $^{\circ}C$, calculate the heat transfer per unit width of the plate. Assuming the length of the plate along the flow of air is 2 *m*. (16)

13. (a) Derive the expressions for LMTD (Logarithmic Mean Temperature Difference) for parallel and counter flow type of Heat exchangers. (16)

Or

(b) Water is boiled at the rate of 24 *kg/h* in a polished copper pan, 300 *mm* in diameter, at atmospheric pressure. Assuming nucleate boiling conditions calculate the temperature of the bottom surface of the pan. (16)

14. (a) Two black square plates of size 2 x 2 *m* are placed parallel to each other at a distance of 0.5 *m*. One plate is maintained at a temperature of 1000 $^{\circ}C$ and the other at 500 $^{\circ}C$. Find the heat exchange between the plates. (16)

Or

(b) A gas mixture contains 20% CO_2 and 10% H_2O by volume. The total pressure is 2 atm. The temperature of the gas is $927^\circ C$. The mean beam length is 0.3 *m*. Calculate the emissivity of the mixture. (16)

15. (a) Estimate the diffusion rate of water from the bottom of a test tube 12 *mm* in diameter and 250*mm* long into dry atmospheric air at 30^0C Assume D=$0.20x10^{-4} m^2/sec$. (16)

Or

(b) Air at 25^0C and atmospheric pressure, containing small quantities of iodine flows with a velocity of 7 *m/s* inside a 50*mm* inner diameter tube. Determine the mass transfer coefficient from the air stream to the wall surface Assume D_{AB}(iodine-air)=$0.82X10^{-5} m^2/s$. (16)