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

# Question Paper Code: 36702

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2018

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. Define “thermal diffusivity” of an isotropic material and what is its significance?
2. Distinguish between steady and transient Heat conduction.
3. Define Nusselt number (Nu).
4. Define convection heat transfer co- efficient.
5. What is meant by pool boiling?
6. Classify the Heat exchangers?
7. State Stefan Boltzmann law.
8. What is the purpose of radiation shield?
9. List out the components in which heat and mass transfer takes place simultaneously.
10. Compare Heat transfer with mass transfer.

PART - B (5 x 16 = 80 Marks)

11. (a) A hallow cylinder 5 cm I.D and 10 cm OD has an inner surface temperature of 200˚C and an outer surface temperature of 100˚C. Determine the temperature of the point half way between the inner and outer surfaces. If the thermal conductivity of the cylinder material of 70 w/mK determine the heat flow through the cylinder per linear meter. (16)

Or

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

12. (a) Air at $20^0$C flowing along a heated flat plate at $134^0$C at a velocity of 5 m/s. The plate is 2.5 m long and 2 m wide. Calculate the thickness of the hydrodynamic boundary layer and skin friction coefficient at 50 cm from the leading edge of the plate. The kinematic viscosity of air at $20^0$C may be taken at 15.06 X $10^{-6}$ $m^2$/s. also calculate the local heat transfer co efficient at x= 0.5 m and the heat transferred from the first 50 cm of the plate. (16)

Or

(b) In a long annulus (31.25 *mm* ID and 50 *mm* OD) the air is heated by maintaining the temperature of the outer surface of inner tube at $50^\circ C$. The air enters at $16^\circ C$ and leaves at $32^\circ C$. Its flow rate is 30 *m/s*. Estimate the heat transfer coefficient between air and the inner tube. (16)

13. (a) Derive the expressions for LMTD (Logarithmic mean temperature difference) for parallel and counter flow type of Heat exchangers.. (16)

Or

(b) A condenser is to designed to condense 600 *kg/h* of dry saturated steam at a pressure of 0.12 bar. A square array of 400 tubes, each of 8 *mm* diameter is to be used. The tube surface is maintained at $30^\circ C$. Calculate the heat transfer coefficient and the length of each tube. (16)

14. (a) Two parallel plates 0.5x1 *m*are spaced 0.5 m apart are located in a very large room, the walls of which are maintained at a temperature of $27^0C$. One plate is maintained at a temperature of $900^0C$ and the other at $400^0C$.Their emissivities are 0.2 and 0.5 respectively. If the plates exchange heat between themselves and surroundings, find the net heat transfer to each plate and to the room. Consider only the plate surfaces facing each other. (16)

Or

(b) A pyrometer records the temp of a body as 1400˚C with a red light filter ($\lambda$- =0.65μ) Find the true temp of the body if its emissivity of 0.65μ is 0. 6. (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) Dry air at 27˚C and 1 atm flows over a wet flat plate 50 cm long at a velocity of 50 m/s calculate the mass transfer co-efficient of water vapour in air at the end of the plate. (16)