

MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE
SEMESTER END EXAMINATION

B.Tech. (Agril. Engg.)

Semester : IV (Old)	Term : II	Academic Year : 2017-18
Course No. : APE 243	Title : Heat and Mass Transfer	
Credits : 2 (1+1)	Time : 14.00 to 16.00	Total Marks : 40
Day & Date : Thursday, 26.04.2018		

- Note :
1. Solve ANY EIGHT questions from SECTION "A".
 2. All questions from SECTION "B" are compulsory.
 3. All questions carry equal marks.
 4. Draw neat diagrams wherever necessary.

SECTION "A"

- Q.1 a) Explain the analogy between flow of heat and electricity.
b) Enlist various modes of heat transfer and explain conduction.
- Q.2 Prove that $N_u = f(P_r, R_e)$ with the help of dimensional analysis.
- Q.3 Derive an expression for heat transfer by conduction through a thick plane wall with conductivity varying with temperature.
- Q.4 A steam pipe of 10 cm outside diameter is covered with two layers of insulating material each of 2.5 cm thick, one having thermal conductivity thrice the other. Show that the effective conductivity of two layers is less when better insulating material is inside than when it is on the outside. Determine the percentage reduction.
- Q.5 Differentiate between:
a) Free convection and forced convection.
b) Steady state and unsteady state heat transfer.
- Q.6 Classify the heat exchangers according to direction of flow of fluid and explain any one.
- Q.7 a) Discuss in brief Fick's law of diffusion.
b) Discuss Stefan Boltzmann's Law.
- Q.8 Exhaust gases flowing through the tubular heat exchanger at the rate of 20kg/min are cooled from 450°C to 150°C by water initially at 20 °C. The specific heat of gases may be taken as 1.13 kJ/ kg K, and overall heat transfer co-efficient may be taken as 140 W/m². Calculate the surface area needed if the water flow is 25 kg/min for counter flow.
- Q.9 A single pass steam condenser has to be designed to condense 35000kg/ hr of dry saturated steam at 2.77 cm Hg pressure (saturation temperature =27.6 °C). The cooling water enters the tube at 16 °C and leaves at 21°C. The tubes are of 2.25 cm internal diameter and 2.5 cm outer diameter. The thermal conductivity of tube material is 105 W/ mK. The water and steam side film coefficients are 6960 and 5900 W/ m²K, respectively. Determine the surface area of tubes required. Neglect scale resistance. Given: Latent heat = 2450 kJ/ kg.
- Q.10 Write short notes. (Any Two)
- a) Fouling Factor
b) Kirchoff's Law
c) Total emissivity

(P.T.O.)

SECTION "B"

Q.11 State True or False.

- 1) $\rho V D / \mu$ is called Grashof number.
- 2) Evaporator is an example of heat exchanger.
- 3) White body absorbs all the radiations.
- 4) $Q = -kA(dt/dx)$ is called Fourier's Law.

Q.12 Fill in the blanks.

- 1) Reynold's number lies between _____ to _____ in transient region.
- 2) An automobile radiator is an example of _____.
- 3) _____ of wall is expressed as $\Delta x / kA$.
- 4) A body which absorbs all the radiation energy incident on it is defined as _____.



Q.
Q.
Q.
Q.8
Q.9
Q.10