

MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE
SEMESTER END EXAMINATION

B.Tech. (Agril. Engg.)

Semester : IV (New)	Term : II	Academic Year : 2015-16
Course No. : APE 243	Title : Heat and Mass Transfer	
Credits : 2 (1+1)	Time : 14.00 to 16.00	Total Marks : 40
Day & Date : Tuesday, 26.04.2016		

- 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 Exhaust gases flowing through the heat exchanger at the rate of 20 kg/min are cooled from 450⁰C to 150⁰C by water initially at 20⁰C. The specific heat of gases may be taken as 1.13 kJ/kg⁰K and overall heat transfer coefficient is 140 W/m²k. Calculate the surface area needed if water flow is 25 kg/min for a) Parallel and b) counter flow heat exchangers.
- Q.2 An air conditioned room has one of the wall which is 5m x 3m of 35 cm thick brick. The conditioned space is maintained at 20⁰C when the outside temperature is 45⁰C. The variation of the thermal conductivity with temperature is given by
- $$K = 0.95 + 1.3 \times 10^{-7} T^2;$$
- where T is in degree Kelvin, k is in W/m⁰K. Calculate the heat gained by the conditioned space through this wall.
- Q.3 Derive the expression for heat conduction through a flat composite wall.
- Q.4 What are the different modes of heat transfer? Explain the mechanism of each mode of heat transfer with its governing laws.
- Q.5 A cold room has one of the walls 5 m x 2.5 m made of brick 12 cm thick insulated externally by cork slabbing of 8 cm thick. Cork is protected externally by 2.5 cm wood. Estimate the heat infiltration through the wall in 24 hours, if the interior of the cold room is maintained at a temperature of 0⁰C and the outside temperature is 20⁰C. $K_{(brick)}$, $K_{(cork)}$ and $K_{(wood)}$ are 0.93, 0.044 and 0.175 W/ m⁰K, respectively. What will be the interface temperatures?
- Q.6 A 10 mm cable is to be laid in atmosphere of 20⁰C ($h_o = 8.5$ W/m²K). The surface temperature of the cable is likely to be 65⁰C due to heat generated within. Discuss the effect of insulating the cable with rubber having $k = 0.155$ W/m⁰K.

(P.T.O.)

- Q.7 a) One face of a copper plate 3 cm thick is maintained at 400°C , and the other face is maintained at 100°C . How much heat is transferred through this plate. K (copper) = $370 \text{ W/m}^{\circ}\text{C}$.
- b) Give classification of different bodies based on their radiating properties.
- Q.8 a) What is intensity of radiation? How it is determined.
- b) Explain the concept of black body radiation.
- Q.9 a) State and explain Kirchoff's law.
- b) What are the different types of extended surfaces? Explain the purpose of extended surfaces.
- Q.10 Write short notes on.
- 1) Gray body
 - 2) Critical insulation thickness for pipes

SECTION "B"

- Q.11 State True or False.
- 1) Conduction heat transfer takes place in solids only.
 - 2) Mass transfer takes place due to concentration gradient.
 - 3) Temperature gradient is the driving force for transfer of heat.
 - 4) In SI system, thermal conductivity is expressed as $\text{Kcal/h. m}^2^{\circ}\text{C}$
- Q.12 Fill in the blanks.
- 1) Radiator of the tractor is the example of _____ heat exchanger.
 - 2) $^{\circ}\text{K} = ^{\circ}\text{C} + \underline{\hspace{2cm}}$.
 - 3) The fraction of the incident radiation absorbed is called _____.
 - 4) _____ body does not transmit any radiations.

