B.Tech

MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE
SEMESTER END EXAMINATION

B.Tech. (Agril. Engg.)

Semester	: IV (New)	**Term**	: II	**Academic Year**	: 2016-17
Course No.	: APE 243	**Title**	: Heat and Mass Transfer		
Credits	: 2 (1+1)				
Day & Date	: Saturday, 29.04.2017	**Time**	: 14.00 to 16.00	**Total Marks**	: 40

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 radiation.

Q.2   a) The interior wall of a furnace is maintained at a temperature of 900 ^{0}C. The wall is 60 cm thick , 1 m wide, 1.5 m broad of material whose thermal conductivity is 0.4 W/m^{0}K. The temperature of the outside surface of wall is 200 ^{0}C. Determine the heat transfer through the wall and thermal resistance to heat flow.

b) Explain in short critical thickness of insulation.

Q.3   Derive an expression for heat transfer by conduction through a flat composite wall.

Q.4   A hollow steel sphere contains 100 watts electrical filament and the following data is known:-

Internal radius = 24 cm.

External radius = 32 cm.

Inner surface film co-efficient of heat transfer = 30 W/ m^{2} ^{0}K.

Outer surface film co-efficient of heat transfer = 10 W/ m^{2} ^{0}K.

Neglecting the thermal resistance of the metal and assuming a steady state, determine the internal temperature if the outside temperature is 22^{0}C.

Q.5   Differentiate between

a) Free convection and forced convection.

b) Steady state and unsteady state heat transfer.

Q.6   Classify and explain the heat exchangers according to direction of flow of fluid.

Q.7   Discuss in brief Stefan Boltzman's Law of Radiation and total emissivity.

Q.8   A small body at 27 ^{0}C is placed in a large furnace whose walls are maintained at 1000^{0}K. The total absorptivity of the body at 27 ^{0}C varies with temperature of the radiation as follows:-

Temperature, K : 300   500   1000

α : 0.75   0.6   0.5

Determine the rate of absorption and emission of radiation by the small body.

(P.T.O)

Q.9 Prove that $N_u = f(P_r, R_e)$ with the help of dimensional analysis.

Q.10 Write short notes (Any Two).
1) Fouling Factor
2) Fourier's Law
3) Fick's Law of Diffusion

SECTION "B"

Q.11 State True or False.
1) Unsteady state heat flow means constant heat flow rate with time.
2) Evaporator is an example of heat exchanger.
3) Body which absorbs the entire radiation energy incident on it is called grey body.
4) The value of emissivity for black body is one.

Q.12 Fill in the blanks.
1) _____ lies in between 2100 to 2300 in transient region.
2) An automobile radiator is an example of _____ exchanger.
3) Thermal resistance of wall is expressed as _____.
4) A body which absorbs all the radiation energy incident on it is defined as _____.

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