KERALA AGRICULTURAL UNIVERSITY
B.Tech (Food . Engg) Degree Programme 2015 Admission
IInd Semester Final Examination- June – July 2016

Cat. No: Fden 1202

Title: Heat and Mass transfer (1+1)

Marks: 50.00

Time: 2 hours

I Answer the following   (10 x 1 =10)

1. Define pervos theory
2. Economic thickness
3. Heat exchanger
4. Define Newton Rickman's law
5. Fourier law
6. Define thermal conductivity
7. Differentate gray body and blackbody
8. Analogy between heat transfer and mass transfer.
9. Define Fick's law of diffusion
10. Fouling factor.

II   Write short notes ANY FIVE   (5 x 2 =10)

1. Explain kirchhoff's law.
2. Factors considered in the design of heat exchangers.
3. Explain Newton's law of cooling.
4. What do you mean by scaling of heat exchangers.
5. Overall heat transfer coefficient.
6. Absorbtivity, reflectivity and transmissivity.
7. Give the application of forced convection.

II. Explain ANY FIVE of the following   (5 x 4 =20)

1. Derive an expression for log mean temperature difference (LMTD) equation for a single pipe double pass counter flow heat exchanger.

2. Briefly explain different modes of heat transfer.

3. Derive an expression for steady state heat flow through a composite cylinder.

4. A reactor wall 320mm thick is made of an inner layer of fire brick (K = 0.84 W/m*C) covered with a layer of insulation (K=0.15W/m*C). The reactor operates at a temperature of 1325*C and ambient temperature is 225 *C. Determine the thickness of fir and insulation which gives minimum heat loss, taking the maximum temperature of insulation material as 1200*C.

5. Fruit juice having a specific heat of 3.85kj/kg*K is being pre heated from 5*c to 45*C in a counter flow double pipe heat exchanger. Heating agent is hot water entering at 75*C and leaving at 65*C. The flow rate of fruit juice is 1.5kg sec and the area of the heat exchanger is 10.0 square meter. Calculate the overall heat transfer coefficient.

6. A boiler wall made of steel is 50mm thick and is covered with a n insulating material thick. The temperature at outer and inner surface are 60 and 320*C respectively. Determine the rate of heat flow through the boiler water. Assume the thermal conductivities for steel and insulation as 58 W/m/*K and 0.116W/m/*K.

7. Explain the application of mass transfer process in food processing.

IV. Write essay on ANY ONE   (1 x 10=10)

1. Obtain the 3D equation governing the heat flow by conduction when body is generating heat at steady state for homogeneous material.

2. Determine the area required in a parallel flow heat exchanger to cool oil from 60*C using water available at 25*C. The outlet temperature of the water is 26*C. The specific heat of the oil is 2200J/KgK. The overall heat transfer coefficient is 300W/sqmK. Compare the area required for a counter flow exchanger. Assume mass flow rate of the oil is 10Kg/s.

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