



KERALA AGRICULTURAL UNIVERSITY
B.Tech.(Agri. Engg.) 2019 Admission
IV Semester Final Examination- November 2021

Fape 2203

Heat and Mass Transfer (2+0)

Marks: 50
Time: 2 hours
(10x1=10)

I Fill in the blanks

1. The critical radius of insulation for spherical surface is given as
 2. A body which absorbs all the radiations falling on it is called
 3. The expression for Logarithmic mean radius is
 4. The SI unit of convective heat transfer coefficient is
 5. Prandtl number is a ratio of Kinematic Viscosity and of a fluid.
- State True/False**
6. According to Fourier's Law conductive heat transfer is proportional to wall thickness.
 7. Heat transfer from higher temperature to low temperature takes place according to first law of thermodynamics
 8. Heat conduction in gases is due to elastic impact of molecules
 9. Film coefficient is defined as thermal conductivity /equivalent thickness of film
 10. Steam is likely to have highest thermal conductivity.

II Write short notes on ANY FIVE of the following

(5x2=10)

1. What is thermal conductivity of a substance?
2. Write basic energy equation and draw temperature profile along the length of fin.
3. Define the Grashof number (Gr) and its significance in heat transfer.
4. Write two examples of each insulating materials used for low and high temperature applications.
5. Define Shape Factor.
6. Define the term capacity ratio and write down its value for boiler and condenser.
7. Define Fick's Law of Diffusion?

III Answer ANY FIVE of the following

(5x4=20)

1. Define the term Mass Transfer Coefficient and derive its expression for water vaporization, based upon concentration difference.
2. Assume sun to be a black body emitting radiation with maximum intensity at $\lambda = 0.49 \mu\text{m}$, determine surface temperature of sun and heat flux at surface of sun.
3. What is white body? State and prove Kirchhoff's law of radiation
4. What are the basic considerations in designing of any Heat exchanger?
5. The flow rates of hot and cold water streams running through a parallel flow heat exchanger are 0.2 kg /s and 0.5 kg/s. The inlet temperatures on hot side and cold side are 75°C and 20°C respectively. The exit temperature of hot water is 45°C . If the individual heat transfer coefficient on both sides are $650 \text{ W/ m}^2 \text{ }^\circ\text{C}$, calculate the area of heat exchanger.
6. Determine the shape factor values between two short coaxial cylinders of diameters 0.5 m and 1 m, of length 1 m and also between the cylinders to each end annular surface.
7. What do you understand by the term Thermal Boundary Layer? How Prandtl Number affects thermal and hydraulic boundary layer of a hot surface?

IV Write an essay on ANY ONE of the following (1x10=10)

1. Derive the expression for efficiency of an insulated tip fin and also enumerate the assumptions made for derivation
2. Explain Fourier's Law. Derive the three dimensional Fourier Conduction equation.
