

# AMCH8 HEAT TRANSFER

## UNIT-1 PRINCIPLES OF HEAT TRANSFER

- 1.1 Introduction, Modes of Heat Transfer, Fourier Law of Heat Conduction,
- 1.2 Newton's Law of Cooling for Convection,
- 1.3 Thermal Radiation, Electrical Analogy,
- 1.4 Heat Transfer by Combined Modes and Through Composite Bodies.

## UNIT-2 GENERAL HEAT CONDUCTION EQUATION

- 1.1 Introduction, General Heat Conduction Equation for an Anisotropic Materials in Cartesian Coordinates, Cylindrical Coordinates, Spherical Coordinates,
- 1.2 Thermal Diffusivity, Initial and Boundary Conditions.

## UNIT-3 STEADY-STATE CONDUCTION

- 3.1 Introduction, Heat flow through a Slab or a Plane Wall,
- 3.2 Heat flow through Radial Systems
- 3.3 Cylinders Heat Flow Through Radial Systems, Spheres,
- 3.4 Heat Flow through Composite Wall, Overall Heat Transfer Coefficient,
- 3.5 Heat Flow through Wall with Variable Thermal Conductivity,
- 3.6 Critical Thickness of Insulation, Steady state Conduction with Internal Heat Generation,
- 3.7 Steady-State Conduction–Two Dimension.

## UNIT-4 STEADY-STATE CONDUCTION WITH HEAT DISSIPATION TO ENVIRONMENT

- 4.1 The Controlling Coefficients, A Thin Rod,
- 4.2 The Rectangular Fin, The Circular Fin, Fin Efficiency and Effectiveness,
- 4.3 Condition for Using Fins.

## UNIT-5 UNSTEADY STATE CONDUCTION

- 5.1 Unsteady-State Process,
- 5.2 Solids of Infinite Thermal Conductivity- Lumped Heat Capacity Analysis,
- 5.3 Solution of Unsteady-State One Dimensional Heat Conduction Equation.

## UNIT-6 FORCED CONVECTION

- 6.1 Convection, Hydrodynamic Boundary Layer, Thermal Boundary Layer,
- 6.2 Determination of Dimensionless Correlation for Forced Convection,
- 6.3 Empirical Correlations for Flow Inside Tubes, Empirical Correlation for Flow Outside Tubes, Differential Equations, of Boundary Layer on a Flat Plate,
- 6.4 Solution of Differential Equations of Boundary Layer, The Integral;
- 6.5 Equations of the Boundary Layer, Analogy between Fluid Friction and Heat Transfer,
- 6.6 Heat Transfer in Laminar Flow in Tubes, Solution for Constant Wall Temperature,
- 6.7 Heat Transfer in Turbulent Flow in Tubes.

## **UNIT-7 FREE OR NATURAL CONVECTION**

- 7.1 Characteristic Parameters in Natural Convection,
- 7.2 Determination of Dimensionless Correlation for Free Convection,
- 7.3 Empirical Correlations for Free convection,
- 7.4 Momentum and Energy Equations for Laminar, Free Convection Heat Transfer on a Vertical Flat Plate, Integral Equations for Momentum and Energy on a Flat Plate.

## **UNIT-8 THERMAL RADIATION**

- 8.1 Thermal Radiation in Electromagnetic Spectrum , Radiation Properties,
- 8.2 Planck's Law for Monochromatic Thermal Radiation of a Black Body,
- 8.3 Emissive Power and Radiation Intensity, Monochromatic Emissive Power of a Black Body, Stefan- Boltzmann Law of Black Body Radiation,
- 8.4 Heat Exchange by Radiation between Black Surfaces,
- 8.5 Radiation Shape Factor and Reciprocity Theorem,
- 8.6 Heat Exchange between Non- black Bodies, Heat Exchange by Radiation between Gray Surfaces, Radiation Shields, Radiation from Gases and Vapours.

## **UNIT-9 MASS TRANSFER BY MOLECULAR DIFFUSION**

- 9.1 Introduction to Mass Transfer, Fick's Law of Diffusion,
- 9.2 Definitions of Quantities, Fick's Law in Terms of Mass and Mole Fractions,
- 9.3 Equivalence of Diffusion in Stationary- Media - Species Conservation Equation,
- 9.4 Diffusion in Binary Gas mixture.

### **Reference books:**

1. Introduction to Heat Transfer Book by Frank P. Incropera
2. Heat and Mass Transfer: Fundamentals & Applications Book by Afshin Jahanshahi Ghajar and Yunus A. Cengel
3. Process Heat Transfer Book by Donald Kern