

# AMME09 HEAT TRANSFER

## UNIT-1 PRINCIPLES OF HEAT TRANSFER

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

## UNIT-2 GENERAL HEAT CONDUCTION EQUATION

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

## UNIT-3 STEADY-STATE CONDUCTION

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

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

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

## UNIT-5 UNSTEADY STATE CONDUCTION

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

## UNIT-6 FORCED CONVECTION

- 6.1 Convection, Hydrodynamic Boundary Layer, Thermal Boundary Layer, Determination of Dimensionless Correlation for Forced Convection,
- 6.2 Empirical Correlations for Flow Inside Tubes, Empirical Correlation for Flow Outside Tubes, Differential Equations, of Boundary Layer on a Flat Plate,
- 6.3 Solution of Differential Equations of Boundary Layer, The Integrals; Equations of the Boundary Layer, Analogy between Fluid Friction and Heat Transfer,
- 6.4 Heat Transfer in Laminar Flow in Tubes, Solution for Constant Wall Temperature, 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, Empirical Correlations for Free convection,
- 7.3 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, Planck's Law for Monochromatic Thermal Radiation of a Black Body,
- 8.2 Emissive Power and Radiation Intensity, Monochromatic Emissive Power of a Black Body, Stefan- Boltzmann Law of Black Body Radiation,
- 8.3 Heat Exchange by Radiation between Black Surfaces, Radiation Shape Factor and Reciprocity Theorem,
- 8.4 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, Definitions of Quantities, Fick's Law in Terms of Mass and Mole Fractions,
- 9.2 Equivalence of Diffusion in Stationary- Media - Species Conservation Equation, 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.