

<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>				<b>III Year B.E. (Mechanical Engg.) (Full Time)</b>			
<b>Subject Code &amp; Name</b>	<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>MER5C3 HEAT TRANSFER</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
<b>Duration of Theory Paper: 3 Hrs</b>	3	1	2	3	1	1	5

**Learning Objectives:**

1. To make a fundamentally strong base theory of heat transfer.
2. To understand different modes of heat transfer.
3. To model and simulate heat transfer phenomenon.
4. To extend the theory of heat transfer equipment.

**Prerequisite(s):** Fluid Mechanics, Engineering Thermodynamics, Applied Mathematics.

**COURSE CONTENTS**

**UNIT- I**

**Steady State Heat Conduction:** One Dimensional Heat Conduction Equation, General Heat Conduction Equation, Heat Conduction in Cylinders and Spheres, Heat generation in Plane wall and cylinders, Variable Thermal Conductivity, Thermal Contact Resistance, Illustrative Problems

**UNIT- II**

**Heat Transfer from Extended Surfaces and Transient Heat Conduction:** Steady flow of heat along a rod, Governing differential equations and its solutions, Heat dissipation from infinitely long fin, Heat dissipation from fin having insulated tip, Fin performance, Critical Radius of Insulation, Lumped System Analysis, Transient Heat Conduction in Large Plane Walls and Long Cylinders, Illustrative Problems

**UNIT- III**

**Fundamentals of Convection:** Physical Mechanism on Convection, Velocity Boundary Layer and Thermal Boundary Layer, Derivation of Differential Convection Equation, Natural Convection over Surfaces, Natural Convection from Finned Surfaces and PCBs, Forced Convection across Cylinders, Spheres and Tube Banks, Combined Natural and Forced Convection.

**UNIT-IV**

**Fundamentals of Thermal Radiation:** Introduction, Radiative Properties, View Factor Relations, Radiation Heat Transfer, Radiation Shields and the Radiation Effects.

**UNIT- V**

**Heat Exchangers:** Classification of Heat Exchangers, Nature of Heat Exchange process, Mechanical design of heat exchange surfaces, Performance analysis, Overall heat Transfer Coefficient, Effectiveness-NTU method, Cooling of Electronic Equipments, Illustrative Problems.

**Learning outcomes:**

Upon Completing the Course, Student will be able to:

1. List and Tabulate the Temperature Measuring Devices.
2. Determine the thermal conductivity of an insulating powder.
3. Calculate the overall heat transfer coefficient and intermediate temperatures in Composite Wall Apparatus
4. Effectiveness and efficiency of pin fin by using pin fin apparatus
5. Determine and verify the value of Stefan Boltzmann constant experimentally..

6. Determine the effectiveness and overall heat transfer coefficient of Parallel and Counterflow type Heat Exchanger.
7. Determine the effectiveness and overall heat transfer coefficient of Shell and tube type Heat Exchanger

**BOOKS RECOMMENDED**

- [1] Cengel YA., *Heat Transfer-A Practical Approach*, Tata McGraw Hill, New Delhi 2e, 2002.
- [2] Rudramoorthy R. *Heat Transfer-Theory and Problems*, Pearson Education, New Delhi, 2006
- [3] Christopher A, *Essential Heat Transfer*, Pearson Education, New Delhi, 2001.
- [4] Nag, P.K., *Heat Transfer*, Tata McGraw Hill, New Delhi, 1e, 2006.

**List of Practical Assignments:**

1. List and Tabulate the Temperature Measuring Devices
2. To determine the thermal conductivity of an insulating powder
3. To Calculate the overall heat transfer coefficient and intermediate temperatures in Composite Wall Apparatus
4. To determine the Effectiveness and efficiency of pin fin by using pin fin apparatus
5. To Determine and verify the value of Stefan Boltzmann constant experimentally
6. Determining the effectiveness and overall heat transfer coefficient of Parallel and Counterflow type Heat Exchanger
7. Determining the effectiveness and overall heat transfer coefficient of Shell and tube type Heat Exchanger.