

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
*(Formerly West Bengal University of Technology)*  
**SYLLABUS FOR BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING**  
**(Effective from academic session 2018-19)**

**Semester-V**

<b>Subject Code :</b> PC-ME501	<b>Category:</b> Professional Core Courses
<b>Subject Name :</b> Heat Transfer	<b>Semester :</b> Fifth
<b>L-T-P : 3-1-0</b>	<b>Credit: 4</b>
<b>Pre-Requisites:</b> Engineering Thermodynamics	

**Course Objectives:**

1. The aim of the course is to build a solid foundation in heat transfer exposing students to the three basic modes namely conduction, convection and radiation.
2. Rigorous treatment of governing equations and solution procedures for the three modes will be provided, along with solution of practical problems using empirical correlations.
3. The course will also briefly cover boiling and condensation heat transfer, and the analysis and design of heat exchangers.

**Course Contents:**

<b>Module No.</b>	<b>Description of Topic</b>	<b>Contact Hrs.</b>
1	Introduction to three modes of heat transfer, Derivation of heat balance equation- Steady one dimensional solution for conduction heat transfer in Cartesian, cylindrical and spherical geometry, concept of conduction and film resistances, critical insulation thickness, lumped system approximation and Biot number, heat transfer through pin fins- Two dimensional conduction solutions for both steady and unsteady heat transfer-approximate solution to unsteady conduction heat transfer by the use of Heissler charts.	14
2	Heat convection, basic equations, boundary layers- Forced convection, external and internal flows- Natural convective heat transfer- Dimensionless parameters for forced and free convection heat transfer-Correlations for forced and free convection- Approximate solutions to laminar boundary layer equations (momentum and energy) for both internal and external flow- Estimating heat transfer rates in laminar and turbulent flow situations using appropriate correlations for free and forced convection.	10
3	Interaction of radiation with materials, definitions of radioactive properties, Stefan Boltzmann's law, black and gray body radiation, Calculation of radiation heat transfer between surfaces using radiative properties, view factors and the radiosity method.	9
4	Types of heat exchangers, Analysis and design of heat exchangers using both LMTD and $\epsilon$ - NTU methods.	7
5	Boiling and Condensation heat transfer, Pool boiling curve.	4

6	Introduction to mass transfer, Similarity between heat and mass transfer.	4
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**Course Outcomes:**

1. After completing the course, the students will be able to formulate and analyze a heat transfer problem involving any of the three modes of heat transfer
2. The students will be able to obtain exact solutions for the temperature variation using analytical methods where possible or employ approximate methods or empirical correlations to evaluate the rate of heat transfer
3. The students will be able to design devices such as heat exchangers and also estimate the insulation needed to reduce heat losses where necessary.

**Learning Resources:**

1. A. Bejan, Heat Transfer, John Wiley, 1993
2. J.P. Holman, Heat Transfer, Eighth Edition, McGraw Hill, 1997.
3. F.P. Incropera and D.P. Dewitt, Fundamentals of Heat and Mass Transfer, 6<sup>th</sup> Edition, John Wiley, 2007.
4. M. Kaviany, Principles of Heat Transfer, John Wiley, 2002
5. Y.A. Cengel, Heat Transfer: A Practical Approach, McGraw Hill, 2002