Course Type	Course Code	Name of Course	L	T	P	Credit
DE	**MED546**	**Conduction and Radiation**	3	0	0	9

Course Objectives
This is introductory course on conduction and radiation heat transfer. This course aims to provide fundamentals concepts and their application in conduction and radiation heat transfer. They will be learning different solution methods to handle the complex problem in conduction and radiation.
Learning Outcomes
Upon successful completion of this course, students will: 1. have a broad understanding of conduction and radiation heat transfer. 2. have analytical and mathematical tools to handle complex heat transfer problem. 3. be able to provide some basic solution to real life conduction and radiation heat transfer problems.

Modules	Topics	Lecture hours	Learning outcomes
1	Review of basic concepts: Introduction to heat transfer, Modes of heat transfer, Differential formulation of the heat conduction equation, Different types of boundary conditions, One dimensional steady state heat conduction with energy generation and variable thermal conductivity. Heat conduction for non isotropic materials, Extended surface: Variable area fins, Introduction to Bessel differential equation and Bessel function	6	Students will review the basic heat transfer. They will learn about steady state conduction and its application. Heat transfer enhancement by extended surface also will be discussed
2	Multi-Dimensional steady-state conduction: SturmLiouville Boundary-Value Problem, Orthogonality, separation of variable method, Non-homogeneous Boundary conditions: The method of superposition, 3-D analysis	4	Students will learn to handle multi-dimensional heat conduction and different mathematical approach for its analysis
3	Transient heat conduction: Introduction, Lumped capacity analysis: Improved lumped models, Time dependent Boundary Conditions: Duhamel's superposition integral. Transient heat flow in a semiinfinite solid: The similarity method, The integral method. Time periodic boundary condition conduction problems, Graphical method for conduction problems	6	Transient heat conduction and its analysis will be learned. Learning about time dependent boundary condition and solution.
4	Conduction with phase change: Introduction, The heat equation for moving boundary problems, Nondimensional form of the governing equations and important governing parameters, Simplified Model: Quasi steady Approximation, Exact solutions: Stefan's solution, Neumann's solution.	7	Specific topics discussing about moving boundary problem and phase change will be analyzed.

5	Perturbation Solution: Introduction, Solution procedure; Perturbation solution examples: transient conduction with surface radiation, conduction with variable thermal conductivity. Introduction to heat conduction in porous media: Simplified heat transfer model	6	Conduction with porous media and perturbation solution will be learned in this module.
6	Review of radiation heat transfer, View factors, The crossed strings method, The inside sphere method, The unit sphere method, Radiant energy transfer through absorbing, emitting and scattering media. Radiative transfer equation (RTE), Beer-Lambert's Law, solution for the straight path, radiative heat flux, Equivalent beam length, Enclosure analysis in the presence of an absorbing or emitting gas.	10	Students will be able to analyze the radiation heat transfer. They will learn different techniques to evaluate view factor. They will also learn about gas radiation.

Text Books:

1. Latif M. Jiji., Heat Conduction, 3rd Edition, Springer, 2009.
2. M. F. Modest, Radiative Heat Transfer, Academic Press, 3rd Edition, 2013.

References:

3. E. R. G. Eckert and Robert M. Drake, Analysis of Heat and Mass Transfer, McGraw-Hill, 1st Edition, 1987.

4. Vedat S. Arpaci, Conduction Heat Transfer, Addison-Wesley series, 1st Revised Edition, 1966.

5. F. Incropera, D. J. Dewitt, T. Bergman and A. Lavine, Fundamentals of heat and mass transfer, Wiley & Sons Inc., 7th Edition, 2011.