HANYANG UNIVERSITY

2019 HISS Syllabus

(Heat Transfer)

Professor:	**Balaram Kundu**
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Home Univ.:	Jadavpur University
Dept.:	Mechanical Engineering

Description:	The main objectives of this course will be to develop the fundamental principles and laws of heat transfer. The course will cover the basic concepts of various modes of heat transfer, namely conduction, convection, and radiation in details. These modes will be explained through physical descriptions, mathematical formulations, and illustrations. The primary equations obtained from the heat transfer phenomena will also be highlighted in an easy way to determine temperature and heat transfer as a function of various thermophysical parameters. Finally, this course is designed for mechanical engineering students to develop the problem-solving skills for the engineering practice and research on heat transfer.

Objective:	a) To cover the basic principles of heat transfer, b) To calculate heat transfer by conduction, convection and thermal radiation for practical situations, c) To analyze and calculate heat transfer in complex systems involving several heat transfer mechanisms, and d) To develop an intuitive understanding of the subject matter by emphasizing the physics and physical arguments.
Preparations:	***Pre-requisites:*** Basic knowledge of Physics and Mathematics. **Text Books:** 1. Fundamentals of Heat and Mass Transfer by Incropera / Dewitt / Bergman /Lavine, 2. Heat Transfer by M.N. Ozisik, 3.Heat Conduction by M.N. Ozisik, 4. Convection Heat Transfer by A. Bejan.

Schedule:	Week 1	Basic concepts of heat transfer, Fourier and non-Fourier heat conduction, general heat conduction equation for different coordinate systems, types of boundary conditions, steady heat conduction, transient heat conduction, and critical thickness of insulation. Solution of the general 1-D unsteady problem by separation of variables.
	Week 2	Numerical solution of conduction problems–Basic ideas of finite difference method–forward, backward and central differences–Discretization for the steady heat equation. Heat transfer from extended surfaces. Fundamentals of convection, velocity and thermal boundary layers, momentum and energy equations, one-dimensional solution for Couette and Poiseuille flow.
	Week 3	External forced convection, internal forced convection, natural convection, and scale and approximate analyses for determining Nusselt number. General solution of Von-Karman integral momentum equation, integral solution for flat surfaces.
	Week 4	Fundamentals of thermal radiation, concept of black body, derivation of black body radiation laws from first principles, radiation heat transfer from a real body, shape factor, radiosity, irradiation method for gray diffuse enclosures, radiation network, and radiosity matrix. Heat exchangers: Types of heat exchangers, introduction to LMTD method and its correction factor, fouling factor, Effectiveness-NTU method for heat exchangers, rating and sizing problems.

Evaluation:	Midterm (%)	Final (%)	Attendance (%)	Assignments (%)	Participation (%)	Etc. (%)
	30	40	05	20	05	00