THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Advanced Heat Transfer

MECHENG 7510

Credit Hours:
3.00 - 3.00

Course Levels:
Graduate (5000-8000 level)

Course Components:
Lecture

Course Description:
Analytical and numerical techniques for advanced topics in conduction, convection, and radiation.

Prerequisites and Co-requisites:
Prereq: 6505 (705), 6507 (707), or 6510 (710), or permission of instructor.

Course Goals / Objectives:
- Learn fundamental concepts in conduction, convection, and radiation beyond what is taught in intermediate heat transfer
- Develop a set of advanced analytical skills as applied to heat transfer
- Develop a set of numerical skills as applied to conduction, convection, and radiation

Course Topics:
- Review of separation of variables, superposition etc. for steady and unsteady heat conduction
- Integral methods in heat conduction, Duhamel's integral
- External laminar forced convection, boundary layer equations including energy equation, dimensional analysis, scaling (order of magnitude) analysis, similarity and integral solution of BL flow and energy equations
- Internal laminar forced convection, Navier-Stokes and energy equations for internal flows, analytical solutions in limiting cases, numerical solution to energy equation
- External laminar natural convection, dimensional and scaling analysis, integral and similarity solutions
- Internal laminar natural convection, dimensional and scaling analysis, perturbation and asymptotic methods
- Radiative transfer equation (RTE) for participating media and its solution: analytical solution for simple geometry, numerical solution using method of spherical harmonics, discrete ordinates method, and Monte Carlo method
- Radiative properties of surfaces from electromagnetic wave theory
- Radiative properties of molecular gases, band models, global models
- Non-gray radiation, treatment of RTE for spectral variation
- Combined mode heat transfer

Designation:
Elective