Prerequisites: Basic Heat Transfer and Fluid Mechanics undergraduate courses, or consent of Instructor.

This class will be focused on numerical modeling of heat transfer and fluid flow phenomena. This will be achieved primarily through hands-on learning of user-friendly but industrial-strength software for Finite Element Analysis (FEA) such as the COMSOL Multiphysics package. We will learn to solve practical engineering problems involving Conductive and Convective -and to a more limited extent Radiative- Heat Transfers as well as Fluid Mechanics phenomena, through the use of custom-built numerical models in COMSOL. It is not expected that the students be already familiar with FEA software, and they will be progressively introduced to the needed concepts and user-interface issues pertinent to COMSOL in particular and to FEA techniques in general. We will review briefly some basic Heat Transfer, Fluid Flow, and Finite Element methods concepts as needed as we move along, and analyze numerical solutions with the goal to improve our understanding of the physics of the problems investigated, as well as to improve model-building and simulation skills. Of particular interest will be design, parametric, and optimization studies. A significant part of the class work will be the development of numerical models of a practical engineering piece of equipment or situation. It is expected that by the end of the class the students will be familiar and comfortable enough with the software that they will be readily able to model complex problems such as those encountered in Senior Design class projects, industrial internships, lab work, and later in their engineering careers.