University of St. Thomas - School of Engineering

ENGR 382 – Heat Transfer and Fluid Flow

Fall Semester 2009

Instructors:	Dr. John Abraham
Contact Info:	jpabraham@stthomas.edu, 651-962-5766
Office Hours:	By Appointment
Location:	Lecture: OSS LL10
Required Texts:	Thermal Sciences, An Introduction to Thermodynamics, Fluid Mechanics, and Heat Transfer by M. Potter and E. Scott. Supplementary note from John Abraham
Course Objectives:	To provide an overview of fluid mechanics and heat transfer. An effort will be made to apply theory to practice relating to typical industrial problems faced by today's engineering companies. A complete understanding of these topics is required for the application of engineering knowledge in the thermal sciences. This course provides the foundation for many of the courses which follow.
Learning Objectives:	1. Given a verbal description of thermal situation, students will be able to construct a control volume which characterizes the system. 2. Students will be able to calculate pressure variations in non-moving fluids. 3. Students will be able to apply mass, momentum, and energy conservation to flowing fluids. 4. Given a description of a piping/pump system, students will be able to calculate pressure drops internal to the system. 5. Students will be capable of calculating drag on objects submerged in a flowing fluid. 6. Students will be capable of analyzing steady and unsteady conduction heat transfer in one or multidimensional systems. 7. Given a description of a flowing fluid, students will be able to calculate convective heat transfer coefficients and apply these coefficients to steady or unsteady convection or combined heat transfer problems. These applications will extend to flat plates, blunt objects, internal flow, and natural convection.

8. Student will learn the techniques of heat exchanger design and characterization.

9. Students will be able to calculate heat transfer due to thermal radiation.

10. Students will use the ANSYS software to simulate steady/unsteady heat transfer and fluid flow.

Learning Outcomes:

1. Students will utilize science, engineering, and mathematics for solving engineering problems in the thermal sciences. (a) **(H, E).**

2. Students will learn to apply the fundamentals of heat transfer and fluid mechanics to the design and evaluation of thermal systems. (e) **(H, E).**

3. Students will use commercial software to solve problems heat transfer and fluid mechanics. Special attention will be paid to the interpretation and analysis of data from state-of-the-art software. (e, i, j) **(DP).**

4. Students will apply the aforementioned skills to real-world design problems and will convey solutions in a formal technical report. One such design project will be completed during the course of the semester. These group projects will be directed toward current thermal engineering design and will involve optimizing a thermal solution to meet a desired need in the presence of incomplete knowledge. (a, e, g, h, i, j) **(DP).**

Course Methodology

Class sessions will consist of lectures, student presentations and problem solving. Laboratory will have hands-on work and computer activities.

Lab

The class includes a weekly lab which will complement lecture materials. The lab will expose students to modern

	computational tools and their application to design problems in heat transfer	
Grading Components:	Homework **(H)**	Weekly homework assignments will be due. The problems will relate to the current material in the course (Learning Outcomes 1, 3, and 4).
	Exams **(E)**	Two exams - each equally weighted - will be given during the semester. Both exams will be open book (Learning Outcomes 1, 3, and 4).
	Design Projects **(DP)**	Will be discussed in class (Learning Outcomes 2, 4, and 5).

Attendance Policy:

Students are expected to attend all class sessions. Circumstances that prevent attendance will be honored up to two instances. Absences in excess of two times may result in an incomplete grade for the course. Contact the instructor when a special situation arises. All absences require that the instructor be informed in advance.

Classroom Policy:

The class will be conducted with a mature and respectful atmosphere. Everyone will be expected to actively participate. Disrespectful students will be asked to leave.

Awards will be given throughout the semester for outstanding work.

If you need course accommodations due to a disability, please make an appointment in the Enhancement Program-Disability Services, located on the St. Paul campus in Aquinas Hall, room 110, 651-962-6315.

Classroom Ethics

Cheating and plagiarism will not be tolerated. These activities will result in students receiving a failing grade in the course.

All students are expected to understand and follow the University of St. Thomas policies on Academic Integrity.

These are described at: http://www.stthomas.edu/policies/student_policy_book/Academic_rights_and_procedures.htm

Topics
Introduction to Heat Transfer
Steady Conduction Heat Transfer
Unsteady Conduction Heat Transfer
Introduction to Fluid Mechanics
Hydrostatics
Conservation of Mass, Momentum, and Energy for Flowing Fluids
Pressure Losses in Piping Systems
Fans and Blowers
Introduction to Convective Heat Transfer
External Convection
Internal Convection
Heat Exchangers
Natural Convection
Radiation Heat Transfer

Revised: September 7, 2009. John Abraham, School of Engineering, University of St. Thomas