ME 519: Theory of Heat Transfer

Instructor

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Class Time: Tuesday and Thursday, 12:00-2:00 PM.

Classroom: SOC B65

Office Hours: Thursdays 2-3pm or by appointment

Course Description

This class will focus on the investigation of advanced heat transfer theory using analytical and numerical methods. The mathematical treatment of steady and unsteady conduction, forced and natural convection, thermal radiation and multimode heat transfer will be discussed with an emphasis on non-dimensionalization and scaling approaches. The various heat transfer modes will be discussed in terms of real life engineering and research applications, in the fields of aerospace, energy, manufacturing, and biological systems.

Grading

Homework	20%
Exam 1	25%
Exam 2	25%
Project	25%
Quizzes/Participation	5%

Homework will be assigned every two weeks and will count for 20% of the final grade. Homework should be turned in during the Tuesday class of the week it is due. Late homework will not be accepted.

Quizzes will be given periodically to assess the comprehension of the class and to gather feedback on areas which require more class time.

The final project will focus on learning about state of the art research that uses heat transfer theory to address real life engineering challenges. The project will consist of a literature search, report and presentation. Grading will be based on your report, presentation and reviews by your fellow classmates.

Class Policies

1. Academic dishonesty will not be tolerated. Students are expected to follow the BU Code of Student Responsibilities (http://www.bu.edu/dos/policies/student-responsibilities/)
2. Cell phone use during class or exams is not allowed.

Course Materials

Blackboard will be used for all class communications and documents.

Textbook

A. Bejan, Heat Transfer, John Wiley & Sons, New York, 1993.

Complementary Readings

1. H.S. Carslaw, J.C. Jaeger, Conduction of Heat in Solids, Oxford Scientific Publications, 1986.
2. W.M. Kays, M. Crawford, Convective Heat and Mass Transfer, McGraw-Hill, 1993.
3. T.L. Bergman, A.S. Lavine, F.P. Incropera, D.P. DeWitt, Fundamentals of Heat and Mass Transfer, Wiley, 2011.

Syllabus

Week	Dates	Topics	Readings	Assignments Due
1	9/4 9/6	introduction; modes of heat transfer conduction; 1D SS conduction	Ch. 1	
2	9/11 9/13	dimensional analysis; fins; scaling thermoelectrics	2.7,2.8	
3	9/18 9/20	2D conduction; separation of variables superposition	3	
4	9/25 9/27	Transient; semi-infinite; lumped Transient	4	HW #1
5	10/2 10/4	melting and solidification cryogenics; review	4.7	
6	10/9 10/11	Monday Schedule, No Class Exam 1 (1D, 2D conduction, transient)		
7	10/16 10/18	numerical methods numerical methods transient	3.3, Notes	HW #2
8	10/23 10/25	V&V; UQ; convection forced convection; boundary layer	5	
9	10/30 11/1	external flow; dimensionless numbers turbulent flow	5	
10	11/6 11/8	internal flow; laminar flow turbulent flow	6	HW #3 Project Topic
11	11/13 11/15	natural convection flow batteries	7	
12	11/20 11/22	radiation; blackbody; NASA 11/22 Thanksgiving No class	10	
13	11/27 11/29	intensity; emissive power; view factors; gray surfaces; directional	10	HW #4 Project References
14	12/4 12/6	absorptivity; reflectivity; real materials enclosures; gas radiation	10	
15	12/11 12/13	multi-modal heat transfer; mass transfer Final project	11	 Final Project
16	12/18 12/20	Review Final Exam		HW #5