ME512 HEAT CONDUCTION, SPRING 2008
MW 8:40 – 9:55 AM, 212 Hammond

Instructor: Professor James G. Brasseur
205 Reber Building, 814/865-3159 (office)
email: brasseur@psu.edu

Text: D Poulikakos, *Conduction Heat Transfer*, Prentice Hall 1994; This text is out-of print; copies are being made by Penn State media services to be placed in the student bookstore soon. Last time it cost $30.40.

Schaum's Outline Series: Spiegel, Mathematical Handbook of Formulas and Tables (in University bookstore, or cheap off internet)

Undergraduate Text in Heat Transfer, such as FP Incropera and DP DeWitt, *Fundamentals of Heat and Mass Transfer*.

NOTE: This class is normally a T/R class, so next Monday 21 January (Martin Luther King Jr. day) would not normally remove one class. So I would like to make it up. We need to discuss.

Course Outline

Week (roughly)	**Topics**	**Reading**
1-2	Governing laws of physics and their mathematical representations and interpretations; boundary conditions; special cases	Chs 1-3 (ID 1-2)
2-4	The useful technique of Separation of Variables; applications and interpretations; • Steady State situations with fixed BCs • Time-dependent heat transfer with fixed BCs	4.1 - 4.3 4.5 (ID 3-4) 5.1-5.3 (ID-5)
4-6	The Principle of Superposition, a practical tool; • Time-dependent temperature approaching steady state • Time-dependent temperature with no steady state • The approximation of periodic BCs	4.4 (ID-5) 5.4 5.5 6.1
7	Handling time-dependent BCs using Duhamel's approach	6.2
8	Self-similar time-dependent temperature distributions	5.6 (ID-5)
	IN-CLASS EXAM 1 MARCH 2006, 8:00-9:55AM	
9-11	Integral and Simple Numerical Methods; the importance and application of analytic and approximate solutions. • Integral Methods • The Finite Difference Approximation of derivatives and its application to the solution of differential equations of heat transfer; the problem of boundary conditions	 5.7-5.8 Ch 11 (ID-6)
12-13	Another approach to estimate time-dependent temperature distributions: Application of the Laplace Transform	Ch 8
14	IN-CLASS EXAM 19 APRIL 2006, 8:00-9:55AM	
15	Heat sources and sinks (as time permits)	Ch 7

Heat Transfer References to put on reserve in Engineering Library

TJ260.A7 VS Arpaci, *Conduction Heat Transfer*, 1966

QC321.C28 HS Carslaw and JC Jaeger, *Conduction of Heat in Solids*, 1959

TA335.F47 JH Ferziger, Numerical Methods for Engineering Application, 1998

TJ260.G7513 U Grigull and H Sandner, *Heat Conduction*, 1984

QC321.H624 JM Hill and JN Dewynne, *Heat conduction*, 1987

QC320.I45 FP Incropera and DP DeWitt, *Fundamentals of Heat and Mass Transfer*

QC320.M9 GE Myers, Analytical methods in conduction heat transfer, 2nd Ed, 1998.

QC321.O34 MN Ozisik, *Heat Conduction*, 1993, 2nd Ed

TJ260.P634 D Poulikakos, *Conduction Heat Transfer*, Prentice Hall 1994GE Myers, Analytical methods in Conduction Heat Transfer, 1987

Math References to put on reserve in Engineering Library

QA261.K73 Krishnamurty, K. Vector Analysis and Cartesian Tensors with Selected Applications, 1967.

QA911.A69 Aris, R. Vectors, Tensors and the Basic Equations of Fluid Mechanics, 1962

QA433.S28 Schey, HM., Div, grad, curl, and all that : an informal text on vector calculus, 1997.

QA404.C6 Churchill, V, Fourier series and boundary value problems, 1987

Grading

20% out-of-class analyses

15% 2-D computer analysis

20% in-class exam 1

20% in-class exam 2

25% final exam

Office Hours: by appointment and drop-in if possible

Review Incropera and DeWitt (5th edition)

(ID-1) Ch 1 (pay particular attention to 1.3.2)

(ID-2) Ch 2 (pay particular attention to 2.4)

(ID-3) Ch 3 (pay particular attention to 3.2, 3.5, 3.6.1)

(ID-4) Ch 4, through 4.3

(ID-5) Ch 5 (lumped capacitance is good engineering modeling, 5.5-5.8 is this course)

(ID-6) Sections 4.4, 5.9 (the simplest numerical methods)

Assignments

Assignment 1a, review of ME 410: due in first class of the second week

Assignment 1b: problem 2.7, due in second class of the second week