ME 144 A Heat Transfer

Semester	Spring 2020	
Classroom	Lafayette 207	
Meeting time	8:30--9:45	
Instruction	Thor, New Asgard 201 C, drthor@uvm.edu	Office hours: T 1:00--2:00
	Peter Quill, Earth 512 A, star-lord@uvm.edu	Office hours: M 8:00-9:00
TA(s)	Loki, Asgard 201 D, iamloki@uvm.edu	Office hours: W 1:00--2:00
	Bruce Banner, Votey 001F, iamhulk@uvm.edu	Office hours: F 8:00--9:00
Prerequisites	ME143	
Credit hours	3	
Textbook	Fundamentals of Heat and Mass Transfer 8th Edition By Bergman et al., Wiley	
Software	Python 3 (Anaconda distribution) git	

Course description

One- and two-dimensional steady and unsteady thermal conduction; natural and forced internal and external convection; thermal radiation; heat exchangers; boiling and condensation heat transfer

Course objectives

a) To demonstrate the ability to understand and identify relevant modes of heat transfer in physical problems.

b) To demonstrate the ability to analyze 1-D and multi-dimensional steady-state heat conduction in bodies with various thermal boundary conditions and with possibly multiple component materials.

c) To demonstrate the ability to model and solve unsteady 0-D (lumped capacitance method) and 1-D heat transfer problems; effects of thermal boundary conditions.

d) To demonstrate the ability to model and solve 1D unsteady heat transfer involving phase change (melting, solidification)

e) To demonstrate the ability to understand the mechanisms of convective heat transfer and to demonstrate the ability to utilize analytical and empirical relations for the solution of engineering heat transfer problems.

f) To demonstrate the ability to understand and apply basic numerical methods (finite difference, finite volume) to solve steady and unsteady heat transfer problems.

Grade distribution and assessment

Homework	10 %
Quizzes	20 %
Midterm grade	30 %
Project	40 %

Notes: (i) Midterm grade = 0.15[lowest midterm grade] + 0.85[highest midterm grade]. (ii) The instructor(s) may assign an individual or team project as a midterm exam

Individual question grading scheme (over 10 points)

10	Correct answer
8	Answer uses the correct physics and/or mathematics but has one small error (e.g. typo)
6	One significant error violating the physics and/or mathematics of the problem.
4	Two significant errors violating the physics and/or mathematics of the problem.
2	An attempt to answer.
0	Self-explanatory.

Letter grade distribution

100.0--93.00	A	73.00--76.99	C
90.00--92.99	A-	70.00--72.99	C-
87.00--89.99	B+	67.00--69.99	D+
83.00--86.99	B	63.00--66.99	D
80.00--82.99	B-	60.00--62.99	D-
77.00--79.99	C+	59.99--00.00	F

Policies

Late assignment

Late assignments are bad!

Tentative schedule

Week	Content
1	Thermodynamics, Modes of heat transfer, heat transfer coefficients
2	Conduction, Fourier's law, thermal properties of matter, heat equation, boundary conditions, temperature distribution
3	1D Conduction, Planar system thermal resistance, composite wall, contact resistance, thermal energy generation
4	1D conduction,Radial systems, extended surfaces
5	Exam, 2D conduction, Finite volume
6	2D conduction + Transient conduction,Linear Algebra and time-stepping methods, Analytical solutions
7	Conduction wrap up
8	Convection, Review of fluid mechanics, intro to convection, External flows
9	Convection, External flows (cont'ed), Internal flows
10	Exam (in class), Convection, Internal flows
11	Convection, Internal flows, Free and forced convection
12	Free convection, Boiling and Condensation
13	Boiling and condensation, Radiation
14	Radiation
15	Review