University of Arkansas
Mechanical Engineering Department
MEEG 54503 - Advanced Heat Transfer - Online Syllabus
Course Materials on Blackboard

Instructor - Rick J. Couvillion, PhD, PE. Adjunct Professor, rjc@uark.edu

Text and References - Lecture notes are provided in lieu of a textbook. References listed below.

- Frank P. Incropera and David P. DeWitt, *Fundamentals of Heat and Mass Transfer*, 5th Ed, Wiley, 2002.
- Vedat S. Arpaci, *Conduction Heat Transfer*, Addison-Wesley, 1966.
- W.M. Kays and M.E. Crawford, *Convective Heat and Mass Transfer*, 3rd Ed., McGraw-Hill, 1993.
- S. Carslaw and J.C. Jaeger, *Conduction of Heat in Solids*, Oxford, 1959.
- Adrian Bejan, *Convection Heat Transfer*, Wiley, 1984.
- H. Schlicting, *Boundary Layer Theory*, McGraw-Hill, 1960.
- Louis C. Burmeister, *Convective Heat Transfer*, Wiley, 1983.
- M. Modest, *Radiative Heat Transfer*, McGraw-Hill, 1993. (Text used in MEEG 5473)
- Siegel and Howell, *Thermal Radiation Heat Transfer*.

Prerequisite - Undergraduate Heat Transfer, Excel, some programming.

Communication - Official mode of communication is through uark.edu email. Students are responsible for checking their UARK accounts regularly. All communication between student and instructor and between student and student should be respectful and professional. If the class finds discussion groups useful, they can be set up on Blackboard.

Access to a reliable internet connection is required for this course. An internet access problem is not an excuse for late, missing, or incomplete coursework. If you experience problems with your internet connection while working on this course, it is your responsibility to find an alternative access point, such as a public library or wi-fi hotspot.

Topics - See tentative course schedule below.

Recorded Lectures and Lecture Notes - The lecture notes can be downloaded in the Weekly Lessons folders on Blackboard. Recorded lectures that accompany the lecture notes are also accessed in the Weekly Lessons folders. Course content and schedule are shown below.

Drills - There will usually be a Zoom drill each week. Drills will focus on questions about the lectures and the homework. Drills will be recorded and made available for streaming or download along with some previously recorded drill sessions that are in the Recorded Drills folder on Blackboard.

Grade Basis - Three Exams - 80%, Programs/Homework - 20%. Exams may require a proctor approved by the instructor and the MSE program. Approval form available in the 'Downloads' folder.

Homework - Homework assignments 01 - 04 must be submitted before Exam 01 will be given. Homeworks 05 - 07 must be submitted before Exam 02. Exam 01 should be taken in week 3, Exam 02 in week 6, and Exam 03 at the end of week 8. Homework done by hand should be scanned and submitted as a single pdf file. Submit homework to instructor by email. One or more programs may require computer programming using Excel, Basic, Matlab, or C.

Units - Making units mistakes is unacceptable for senior and graduate engineers and will be severely penalized. All results should have units. If a problem is stated in US units, it is to be worked in US units, not converted to SI and converted back to US. Recall that 1 lbf = 32.17 lbm-ft/s^2, 1 hp-s = 550 ft-lbf, 1 Btu = 778 ft-lbf.

Academic Honesty - Academic honesty is expected, and dishonesty as described in the UA academic integrity policy will be penalized. Penalties will range from getting zero on a homework, quiz, project, or exam to failure of the course and/or report to the College of Engineering Academic Integrity Monitor. However, these penalties will pale in comparison to the instructor knowing that you are a person who cannot be trusted. If a potential employer asks, the instructor will be obligated to express his concerns about your integrity.

Students are not permitted to collaborate on any quiz or exam without specific permission from the instructor in advance, including collaboration through GroupMe, WhatsApp, or any other form of technology to exchange information associated with a quiz or exam. Improper use of technology is considered academic misconduct that can result in the same penalties as cheating in a face-to-face (in person) class. Listed below are some of what is considered academic misconduct for quizzes or exams.

- Taking a screen shot of an online quiz or exam question, posting it to Chegg, GroupMe, or WhatsApp, and asking for assistance.
- Answering an online quiz or exam question posted to Chegg, GroupMe or WhatsApp.
- Giving advice, assistance, or suggestions on how to complete a question associated with a quiz or exam.
- The use of online websites (Quizlet, Chegg) or search engines (Google) when exam instructions indicate these are not allowed.
- Gathering to take an online quiz or exam with others and sharing answers in the process.
- Exchanging material associated with a quiz or exam through any form of technology (GroupMe, WhatsApp, etc.) or using any unauthorized resources (Googling answers, use of websites such as Quizlet, Course Hero, Chegg, etc).

Week	Lecture Notes	Recorded Lectures	Topics
1	01	01	2D Heat Equation
	02	02A, 02B	Nondimensioning, Anisotropic Media
			Homework 01
2	03	03	2D Solutions, Shape Factors
	04	04	Numerical 2D Solutions
			Homework 02
	05	05	Transient Heat Transfer
	06	06	Transient 2D Conduction with Generation
	07	07	Transient with Time-varying Inputs - Duhamel's Theorem
			Homework 03
3	08	08	Transient Numerical Methods
	09	09	Steady State Dimensionless Solution with Simulation
			Homework 04
			Exam 01 - Notes 01-09 - 30% of exam average
	10	10	Mass, Momentum Conservation in Fluids
	11	11	Energy Conservation
			Homework 05
	12	12A	Boundary Layer Flow
4	12	12B	Boundary Layer Flow - cont
	13	13	Boundary Layer Flow - cont
	14	14	Analogies, Examples
	15	15	Internal Flow Intro
			Homework 06
5	16	16	Nusselt Number in Ducts
	17	17	Turbulence Intro
	18	18	Turbulent Velocity Distribution
	19	19	Turbulent Drag, Temperature Distribution, Nusselt No
			Homework 07
6	20	20	Turbulent Duct Flow
			Homework 08
			Exam 02 - Notes 10-20 - 40% of exam average
	21	21	Radiation Intro
	22	22	Blackbody Emission, Band Emission
7	23	23	Emissivity, Irradiation, Absorptivity
	24	24	View Factors
	25	25A	Exchange Among Surfaces
8	25	25B	Exchange Among Surfaces
			Homework 09
			Exam 03 - Notes 21-25 - 30% of exam average