Department of Mechanical Engineering
Phone: +1.903.566.7003
Fax: +1.903.566.7148
Uttyler.edu/engineering

MENG 5343 – Advanced Heat Transfer
Course Syllabus

Semester / Year	Spring 2023
Catalog Description	Multidimensional steady and transient heat conduction; forced and natural convection; radiation exchange
Prerequisites	MENG 3316 (Heat Transfer)
Section Number	030 and 040
Instructor Name	Hayder Abdul-Razzak, PhD, PE
Contact Information	832.439.7080; habdulrazzak@uttyler.edu
Class Type / Instruction Mode / Location	Face-to-face and Zoom
Class Time	5:00 p.m. – 7:45 R
Office Hours	5:00 p.m. – 6:30 p.m. MW Appointments may be scheduled in addition to regularly scheduled office hours.
No. of Credits	3
Required Textbook	Heat Transfer, 1st edition, by Nellis and Klein, Cambridge University Press, 2009 (ISBN 978-1-107-67137-9)
Optional References	FE Supplied Reference Handbook, NCEES (National Council of Examiners for Engineering and Surveying)
Additional Rules and Requirements	
Evaluation Method	Exercises 20%/ Paper (Project) 20%/ Exams 30%/ Final Exam 30%
Grading Policy / Scale	A = > 90, B = > 80, C = > 70, D = > 60, F < 60, F if 50% or less on the Final Exam
Important Events / Dates	Census date: Monday, January 23 Last Day to Withdraw date: Monday, March 23 Final Exam date: TBD
Attendance / Makeup policy / other rules	**ATTENDANCE.** Regular attendance is required. In case you have to miss a class, it is your responsibility to keep up with the class work and be informed of all announcements made in the class. **THERE WILL BE NO MAKE-UP EXAMS.** The percentage of any exam missed by a student will be added to his/her final comprehensive exam only if prior approval is granted. The student is responsible to contact the instructor at least a week before the scheduled exam date to get an excuse from the exam. If you have to miss an exam due to emergencies (such as medical and other emergencies) please inform the instructor as soon as possible before or immediately after the exam. Class average for each exam will be announced in class and also posted in Canvas after each exam. Final course grades will be determined on the basis of the class average. If you miss any exam without getting **prior approval from the instructor at least a week before the exam date**, it will be counted as zero in the calculation of your final course grade. If

	you intend to be absent for a university-sponsored event or activity, you (or the event sponsor) must notify the instructor at least a week prior to the date of the planned absence.
Course Learning Objectives / ABET & PEOs Relation	By the end of this course, students will be able to: 1. Derive analytical solutions to heat transfer problems 2. Use analytical solutions to determine temperature distribution 3. Analyze systems using the principles of conduction, convection, and radiation 4. Analyze multimode heat transfer problems to determine heat transfer rates as well as temperature distribution 5. Apply numerical methods to solve heat transfer problems 6. Enhance literature research and oral presentation skills transfer
Tentative Topics / Course Plans	Steady and unsteady conduction in one or more dimensions; forced and natural convection; thermal radiation, black bodies, grey radiation networks, spectral and solar radiation; numerical simulation of conduction, convection, and radiation. Problems and examples emphasize modeling of complex systems drawn from current heat transfer applications. See "Tentative Course Outline" table below.
University Policies	https://www.uttyler.edu/academic-affairs/files/syllabus_information_2021.pdf

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Tentative Course Outline

W	Date	TOPIC	Readings
1	12-Jan	Introduction, conduction heat transfer Resistance concepts, circuits and approximations 1-D conduction with generation	1.1, 1.2, 1.3, 2.8
2	19-Jan	1-D conduction, numerical solution Extended surfaces, fin efficiency and resistance	1.4, 1.5, 1.6
3	26-Jan	Extended surfaces-fin behavior, finned surfaces Bessel functions Introduction to separation of variables	1.7, 1.8, 2.2
4	2-Feb	Separation of variables and superposition Lumped capacitance problems-analytical solutions and the lumped time capacitance time constant Numerical solutions to lumped capacitance problems	2.4, 3.1, 3.2
5	9-Feb	Transient 1-D problems – semi-infinite bodies and the diffusive time constant Introduction to Laplace transforms Laplace transforms for 1-D transient problems	3.3, 3.4
6	16-Feb	Exam #1	
7	23-Feb	Numerical solutions to 1-D transient problems Boundary layer concepts Boundary layer equations	3.5
8	2-Mar	Dimensional analysis and correlation, turbulent concepts Integral method- momentum solutions/Integral method – energy equation solutions Internal flow concepts	3.8, 4.1, 4.2
9	9-Mar	Internal flow correlations Internal flow energy balance Reynolds average equations, inner Coordinates	4.3, 4.5, 4.9, 4.8, 5.1
10	**13-Mar to 18-Mar**	**SPRING BREAK**	
11	23-Mar	Exam #2	
12	30-Mar	Introduction to radiation, blackbodies Blackbody radiation exchange	5.2, 5.3, 4.5, 4.6
13	6-Apr	Real surfaces Diffuse gray surface radiation exchange Semi-gray surface radiation exchange	10.1, 10.2, 10.3
14	13-Apr	Introduction to heat exchangers Effectiveness-NTU method Heat exchangers with phase change numerical models of counter/parallel flow HX	10.4, 10.5
15	20-Apr	Heat exchangers with phase change numerical models of counter/parallel flow HX Numerical solution to cross-flow HX Paper Review/Project	10.4, 10.5
		Final Exam	