THE UNIVERSITY OF TEXAS-PAN AMERICAN

College of Engineering and Computer Science

Department of Mechanical Engineering

MECE 3360-01 Heat Transfer – 3 Credits – Fall 2011

Room: ENGR 1.236 **Time:** TR 9:10 – 10:25 am

Instructor: Dr. Constantine Tarawneh **Office:** ENGR 3.228 **Phone:** (956) 665-2607

Office Hours: MTWR 1:10 - 2:25 pm **Strict**, or by Appointment

Email: tarawneh@utpa.edu **Website:** http://mece.utpa.edu/~tarawneh/

Prerequisites: Fluid Mechanics (MECE 3315).

Textbook: F. P. Incropera and D. P. DeWitt, ***Fundamentals of Heat and Mass Transfer***, Sixth Edition, John Wiley & Sons, © 2007.

Contents:

Theory of heat transfer by steady and transient conduction. Free and forced convection heat transfer in external and internal flows. Heat exchangers. Radiation heat transfer.

Objectives:

At the conclusion of the course, the student should be able to:

1. Describe the three modes of heat transfer and give examples of engineering applications.
2. Analyze the performance of devices that involve conduction heat transfer such as fins and heat sinks.
3. Find heat transfer coefficients for heat convection situations from theory and from empirical relations for a variety of engineering geometries including pipe flow, external flow, and buoyancy-driven flow.
4. Analyze heat exchanger performance for gas-gas, gas-liquid, and liquid-liquid applications.
5. Apply the methods of black and non-black analysis to radiation heat transfer devices.
6. Find the thermal properties of fluids and materials using property tables and figures.
7. Communicate the knowledge of heat transfer in written and verbal form.

Grading Policy:

There will be weekly homework assignments (15%) and quizzes (5%), two in-class midterm exams (27.5% each), and a final exam (25%). Exams will be **closed-book and notes** but you will be allowed to bring one 11″ × 8.5″ formula sheet (both sides). [$A \geq 88\%$, $88\% > B \geq 78\%$, $78\% > C \geq 68\%$, $68\% > D \geq 58\%$, $F < 58\%$].

Homework Policy:

Homework will be assigned every week. The homework problems will be posted on my Web Site. To ensure that students do their own work, one of the problems from each homework will be chosen for a ten minute quiz that will be administered after the homework is handed in. The student's performance on the quiz will be used in grading the homework assignment. Any discrepancy between the student's performance on the quiz and the homework assignment may result in loss of credit in the total homework grade. After the homework is graded and returned, solutions will be made available in a folder put outside my office.

In solving the homework assignment, the following **four steps** should be followed very carefully:

1. Briefly summarize the problem statement.
2. Provide a schematic diagram of the problem.
3. Solve the problem showing your work in detail by stating your assumptions and providing the equations you used and the numerical values you obtained.
4. Write a sentence or two discussing your findings.

Failure to follow the aforementioned four steps will result in points deducted from your homework assignment.

CHAPTER	TOPIC	SECTIONS COVERED
1	*Introduction*	All
2	*Introduction to Conduction*	All
3	*One-Dimensional, Steady-State Conduction*	All
5	*Transient Conduction*	5.1 – 5.3
	Midterm Exam 1	
6	*Introduction to Convection*	All except 6.7
7	*External Flow*	All except 7.7 & 7.8
8	*Internal Flow*	8.1 – 8.6 & 8.10
	Midterm Exam 2	
9	*Free Convection*	9.1 – 9.6 & 9.11
11	*Heat Exchangers*	All except 11.6
12	*Radiation: Processes and Properties*	All
13	*Radiation Exchange between Surfaces*	13.1 – 13.3
	Final Exam	

Course Outcomes & Assessment: At the conclusion of this course, students will be able to:

1. Analyze problems dealing with conduction, convection and radiation heat transfer (H, Q, T).
2. Formulate and solve problems which deal with two or more of the three modes of heat transfer which includes continuity and the first law of thermodynamics (H, Q, T).
3. Design and optimize cooling systems for electronic components (H, Q, T).
4. Size heat exchangers to meet given design specifications (H, Q, T).
5. Understand the concepts of black and non-black body radiation (H, Q, T).

Key: H - Homework, Q - Quiz, T - Test

Contribution of Course Outcomes to Program Outcomes

	1	2	3	4	5	6	7	8	S1	S2	S3	E1	E2	E3	E4	E5
1	X									X						
2	X							X		X						
3	X		X					X		X			X			
4	X		X					X		X			X			
5	X									X						

Program Educational Outcomes

It will be demonstrated that the student:

1. Is able to use knowledge of mathematics, basic sciences and engineering to analyze (identify, formulate, and solve) problems in mechanical engineering.
2. Is able to design and conduct experiments and interpret the results.
3. Is able to design mechanical devices, systems or processes that meet given specifications.
4. Is able to function in multi-disciplinary teams.
5. Is able to communicate ideas effectively in graphical, oral and in written media.
6. Understands the professional responsibility of an engineer and how engineering solutions impact safety, economics, ethics, politics, and societal, cultural and contemporary issues.
7. Understands the need for lifelong learning to keep abreast of current practice.
8. Is able to use state of the art computational hardware and software for analysis, design and documentation (techniques, skills, and modern engineering tools necessary for engineering practice).

Program Specific Outcomes for Mechanical Engineering

Fundamentals in Science and Mathematics: It will be demonstrated that the student:

S1) Has knowledge of chemistry and calculus-based physics with depth in at least one.

S2) Has the ability to apply advanced mathematics to problems involving thermal and mechanical systems.

S3) Has the ability to apply statistics and linear algebra to problems involving thermal and mechanical systems.

Fundamentals in Engineering: It will be demonstrated that the student:

E1) Has the ability to create and annotate two-dimensional drawings, and generate three dimensional computer based solid models of mechanical components.

E2) Has the ability to design and analyze components and systems for mechanical and energy performance.

E3) Has the ability to specify and evaluate materials and manufacturing steps for mechanical components.

E4) Has the ability to conceive and conduct experiments to measure the performance of materials, components and systems and to communicate the results.

E5) Has the ability to acquire new skills and specialized knowledge from published sources.

Mechanical Engineering Department Classroom Policies

Attendance:

1. Attendance will be taken every time the class meets. Any student arriving to class **5 minutes** after the class has started will not be allowed in class. Students will be allowed a **maximum** of 5 absences for the whole semester for classes meeting three times a week, 3 absences for classes meeting twice a week, and 2 absences for classes meeting once a week. A **point** will be deducted from the total (100%) for each **unexcused** absence exceeding the maximum allowable.
2. Students **will not** be permitted to leave the classroom during lectures and exams except for **extreme emergencies**.

Homework and Exams:

1. **Absolutely** no assignments will be accepted late.
2. Make-ups for in-class exams for **extreme emergencies** will be scheduled at the end of the semester.

Plagiarism:

Any instance of cheating or plagiarism will result in **loss of credit** for the work, and will be reported to the Chair of the ME Department and/or the Dean of Students for appropriate action which may include **loss of credit** for the course or **dismissal** from the University.

Drop Policy:

Students can withdraw from a course through the *Office of the Registrar* on or prior to:

- September 14th, 2011, Wednesday: Twelfth class day (Census date); courses dropped by this date do not count toward six course drop limit.
- September 27th, 2011, Tuesday: Last day to change course to non-credit.
- November 14th, 2011, Monday: Last day to drop a class or withdraw from the University with a grade of "DR" or "W" recorded. After this date, student remains enrolled in course and receives whatever letter grade he/she earns.

American Disabilities Act Statement:

If you have a documented disability which will make it difficult for you to carry out the work as I have outlined and/or if you need special accommodations/assistance due to a disability, please contact the Office of Services for Persons with Disabilities (OSPD), Emilia Ramirez-Schunior Hall, Room 1.101 immediately, or the Associate Director at MAUREEN@UTPA.EDU, 665-7005. Appropriate arrangements/accommodations can be arranged.

ACKNOWLEDGEMENT OF RECEIPT OF SYLLABUS

By signing below, I hereby affirm that I have received a copy of the syllabus for **MECE 3360 Heat Transfer** and have been informed by the **Instructor** that it is my responsibility to **carefully** read and understand this document.

_____
Student ID Number

_____
Printed Name

_____
Signature

_____
Date