MCEN 3022: Heat Transfer
CU-Boulder/Colorado Mesa University Mechanical Engineering Partnership Program
Spring 2017

Instructor:	Peter Mitrano, peter.mitrano@colorado.edu, Phone: 970-248-1997
Office Hours:	MW 4:30-6:00 pm, T/TH 1:00-5:00 pm in AEC 213 Or drop by with questions.
Lecture:	T/TH 8:30 - 9:45 am, AEC 205
Prerequisites:	MCEN 3012 Thermodynamics, MCEN 3021 Fluid Mechanics

Web Site: A course web site will be established through Desire2Learn. This web site will contain some basic information on the course, but is not intended to duplicate all announcements, deadlines, etc. communicated during class or via email.

Email: A course e-mail list has been established, and all students who are registered for the course are automatically subscribed. Although most course information will be transmitted during classtime, email will be used for various announcements regarding homework questions, feedback on exams, etc. Thus, students are expected to check their email on a regular and frequent basis.

Text Book: Fundamentals of Heat and Mass Transfer, 7th Ed., Bergman, et al., Wiley 2011

Description: The study of fundamentals of heat transfer by conduction, convection, and radiation, by providing applications to heat exchangers, solar panels, and mass transfer. Also covers methods for solving heat transfer problems and design of engineering equipment involving heat transfer processes. One team Heat Exchanger design/build project is required.

Grading:

The break down of your final grade is shown below. You are guaranteed the letter grade shown below if you meet the corresponding numerical cutoff.

Homework	15%	A-	90.00
Project	15%	B-	80.00
Midterms (2)	43%	C-	70.00
Final Exam	25%	D-	60.00
CI completion	2%	F	< 60
Class participation 0.5% (extra credit)			

Important Dates:

Feb 23 (Thurs)	Exam #1 (in class)
Mar 2 (Thurs)	Project GAANT, materials, budget due
Mar 21, 23	No class (Spring Break)
Apr 4 (Tues)	Exam #2 (in class)
Apr 27 (Thurs)	Project demo presentations
TBD	Final Exam

Course Outline:

Chapter	Topic
1	Introduction
2	Introduction to Conduction
3 (except 3.8,3.9)	One-Dimensional Steady State Conduction
5 (except 5.9)	Transient Conduction
6	Introduction to Convection
7 -10 (except 7.7,7.8,8.7,8.8, 9.8,10.5,10.10.10.11)	Convection. Relevant Sections will be covered to allow one to determine a heat transfer coefficient
11	Heat Exchangers (to be covered after Ch. 8)
12 (except 12.9)	Radiation: Processes and Properties
13	Radiation Exchange Between Surfaces

Exams:

- Exams will be given during scheduled class time. Exams will be closed notes, but open book (course text only). You will also be able to use designated class handouts and a 4" x 6" note card (both sides).
- Note that electronic devices other than calculators are not allowed, so if you have an electronic version of the text, printouts of relevant sections would need to be made prior to the exam.
- No make-up exams will be given. If there is an extreme emergency, contact me *before* the exam date for permission to be excused. If excused, the final exam grade will be used in place of the missed exam. If the final exam is excused, the grade on the previous exams will be averaged and used in place of the final exam. If more than one exam is missed, an incomplete/fail will be given for the course.
- Exam solutions will be posted on the course web site following the exam. If it is believed that an exam has been graded unfairly, please resubmit within one week for re-grade of entire exam; include cover page that describes specific concerns on grading.
- If accommodations are requested for exams, please notify me at least one week prior to the exam.

Homework:

- Assignments are due at the start of class. If a student comes to class late, his/her homework should be handed in at end of class and will be marked as "late"; 10% will be deducted from late homeworks except for the first instance, which will not be penalized. Homeworks will not be accepted after class since the solutions will be posted on the course web site following the class period in which they are due. Exceptions are made in the case of illness, only if proper documentation of the illness is provided. Arrangements should be made in advance in the case of trips out of town. Work will normally be due in advance of such trips.
- Although the total points of various homework sets may vary, all will be normalized and weighted equally at the end of the course. At the end of the semester, the lowest homework grade will be dropped, and no exceptions will be made to drop additional homeworks.
- Each student will hand in her/his own homework assignment. Discussion of homework problems with fellow students is allowed and encouraged; however, direct copying from

any source is not permitted. If it is believed that a homework set has been graded unfairly, please resubmit within one week for re-grade of entire assignment; include cover page that describes specific concerns on grading. Please refer to homework solutions to assess other problems.

- For some assignments, only selected problems may be graded. No prior indication will be given.
- On the front page of each homework set, the CU honor pledge should be written and signed by the student. The specific text for the pledge is "On my honor, as a University of Colorado at Boulder student, I have neither given nor received unauthorized assistance on this work."
- Each new problem should be started on a new page except for sufficiently short answers. The full name of each student should be given in the upper-right-hand corner of each page, along with consecutive page numbers.

Homework Solution Format:

Use Engineering paper. Staple problem set. Name in upper-right corner with page number.

1. Restate, in a concise fashion, the information that is given in the problem statement. For quantities in which the nomenclature is not obvious, be sure to define accordingly.

2. Draw a schematic diagram of the physical system under consideration. Label each of the quantities pertaining to the diagram, including distances, material properties, boundaries, etc. Also, define the coordinate direction.

3. Identify what information needs to be found.

4. List the appropriate mathematical relationships (the equation governing the system) necessary to solve the problem.

5. List all assumptions appropriate to problem.

6. Solve the governing equations to completion (integration, solution of algebraic expressions, etc.) prior to the substitution of numerical values.

7. Substitute known numerical values using a consistent set of units, and solve for the numerical quantity of interest. Draw a box around the final answer and corresponding unit.

8. Are the results reasonable (i.e., do they make physical sense)? Are the assumptions used in problem solution valid?

Goals: The outcomes for this course are that students will be able to:

- ✓ SO (a) & PC: Apply principles of engineering, basic science, and mathematics (including multivariate calculus and differential equations) to model, analyze, design, and realize a physical heat transfer system
- ✓ SO (e): to identify, formulate, and solve engineering problems
- ✓ SO (k): to use the techniques, skills, and modern engineering tools necessary for engineering practice

Project:

In groups of 4, you will design and build a heat exchanger, specifically a water-water concentric-tube heat exchanger. After designing the system and predicting effectiveness and outlet temperatures as a function of flow rates and inlet temperatures in an excel spreadsheet, you will test your prediction via measurement of the outlets. Your heat exchanger should fit in a 2 ft x 2 ft x 2 ft space. Each team is responsible for obtaining their own materials. Input/output connections will be garden hose ¾-inch NPT. Heat Exchangers (Ch. 11) will be covered in mid-March. Project presentations will be on April 27th.

Design/build/test	50%
Predictive analysis	25%
Peer Evaluation	20%
Level of effectiveness	5%

Educational Access Services:

In coordination with Educational Access Services, reasonable accommodations will be provided for qualified students with disabilities. Please meet with the instructor the first week of class to make arrangements. Nancy Conklin, the Coordinator of Educational Access Services, can be contacted at 248-1826, naconkli@coloradomesa.edu, or in person in Houston Hall, Suite 108.

Tutorial Learning Center:

The TLC is a **FREE** academic service for all Colorado Mesa University students. Tutors are available on a walk-in basis for many courses. Do you have a quick question? Do you need homework clarification or feedback on a paper? Are you reviewing for a test? Help is available at the TLC!

At the main campus, come to Houston Hall 113 to meet with one of our friendly peer tutors. We are open on Monday through Thursday from 8am-6pm, and Fridays from 8am-5pm. We are also open Sundays from 1pm-6pm! Tutoring at branch campuses and distance tutoring is also available. Check out the website for schedules and locations at www.coloradomesa.edu/tutoring or call 248-1392 with any questions.

Quality and Presentation of Written Work:

Written work in this course must satisfy a quality standard. If it does not, it will be returned to the student ungraded and a zero grade will be recorded. Presentation must be neat and organized. Problem solutions involving derivations and calculations must include explanatory comments between steps and results must be set off clearly. The units must be clearly labeled. Homework assignment solutions must be white paper if typed or computer-printed. Take the time to make your work presentable!

Academic Ethics:

If a student violates academic ethics in this course, the consequences will be an automatic F in the course, a letter of reprimand placed in the student's College file, and referral of the

matter to the Honor Council for possible further action. The basic rule is that a student may not present as their own the work from any other source.

All students of the University of Colorado at Boulder are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include: cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic misconduct shall be reported to the Honor Code Council (honor@colorado.edu; 303-735-2273). Students who are found to be in violation of the academic integrity policy will be subject to both academic sanctions from the faculty member and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). Other information on the Honor Code can be found at http://www.colorado.edu/policies/honor.html and at http://www.colorado.edu/academics/honorcode/.

Classroom Behavior:

Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender, gender variance, and nationalities. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. See policies at http://www.colorado.edu/policies/classbehavior.html and at http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student_code.

Disabilities:

If you qualify for accommodations because of a disability, please submit to your professor a letter from Disability Services in a timely manner (for exam accommodations provide your letter at least two weeks prior to the exam) so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities. Contact Disability Services at 303-492-8671 or by e-mail at dsinfo@colorado.edu.

If you have a temporary medical condition or injury, see Temporary Injuries under Quick Links at Disability Services website and discuss your needs with your professor.

Observance of Religious Holidays:

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, if course attendance or an exam date conflicts with the observance of a religious holiday, the student must notify the instructor at least two weeks in advance so that appropriate accommodations can be made. See full details at http://www.colorado.edu/policies/fac_relig.html.

Discrimination and Harassment:

The University of Colorado at Boulder policy on Discrimination and Harassment, the University of Colorado policy on Sexual Harassment and the University of Colorado policy on Amorous Relationships apply to all students, staff and faculty. Any student, staff or faculty member who believes s/he has been the subject of sexual harassment or discrimination or harassment based upon race, color, national origin, sex, age, disability, creed, religion, sexual orientation, or veteran status should contact the Office of Discrimination and Harassment (ODH) at 303-492-2127 or the Office of Judicial Affairs at 303-492-5550. Information about the ODH, the above referenced policies and the campus resources available to assist individuals regarding discrimination or harassment can be obtained at http://www.colorado.edu/odh.