

ME 4300 Winter 2005 Thermal-Fluid System Design

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Office Hours: 3:30 - 5:20pm T. Th., (Instructor) 3:30 - 5:20pm T. Th., (TA)

Lecture/Lab: 5:30-7:20pm T TH; @ 0211 Manoogian (will also use Engineering PC Lab 2359 for software tutorial and presentation)

Prerequisites: **ME4210** Heat Transfer: Theory and Laboratory,
ENG 3060 Technical Communication II: Report Writing

Reference: B.K.Hodge and R. B. Taylor: Analysis and Design of Energy Systems,
3rd ed., Prentice Hall, 1999
Suryanarayana, N. V., and Arici, O.: Design and Simulation of Thermal Systems,
McGraw Hills, 2003
W. S. Janna: Design of Fluid Thermal Systems, 2nd ed., PWS, 1998
Y. Jaluria, Design and Optimization of Thermal Systems, McGraw Hills,
1998
L. C. Burmeister, Elements of Thermal-Fluid System Design, Prentice Hall, 1998
A. Bejan, G. Tsatsaronis, M. Moran, Thermal Design & Optimization. Wiley,
1996.

Material Fee: 25.00 \$

Course Learning Objective:

Students who successfully complete ME4300 will be able to **conceptually design and present a thermal/fluid system to meet specific needs**. Specifically, they will be able to

1. To function as a team to design a thermal/fluid system or process to meet specific needs. (B,D,F,G,H,I,J; 1,3,4,5)
2. To be familiar with the design process (i.e., evaluating different technical alternatives while bearing in mind practical constraints and criteria) and to better understand the environmental impacts in engineering design (F,H,I; 1,3,4,5)
3. To identify thermal-fluid engineering problems in the design project, and apply knowledge of thermodynamics, fluid mechanics, and heat transfer for formulation and design analysis (A,B,C,D,G,H,I,J; 1,2,3,4,5)
4. To use computer and internet tools, patent, and technical literature resources for design, analysis and presentation (A,B,C,D,F,G,H,I; 1,3,4,5)

(Letters in brackets refer to BSME Program Outcomes A-J listed at the end of the syllabus. Numbers in brackets refer to the methods of evaluation, with 1= Reports/Logbooks; 2= Quizzes; 3=Projects & Competition; 4. Presentation; and 5= Interview and Peer-review)

The course learning objectives strongly contributes to the **BSME program Outcomes** that successful students will:

- A. be able to understand scientific principles and apply them to the practice of engineering;
- B. be able to communicate effectively;
- C. possess the problem-solving skills, background, and confidence necessary to educate themselves continually throughout their careers;
- D. be able to apply computers as tools for engineering;
- F. be able to practice engineering with ethical standards and a responsibility to society;
- G. be able to develop creative solutions to engineering problems;
- H. be able to work well as part of a team;
- I. be able to apply the design process to engineering problems, including the consideration of different technical alternatives while bearing in mind cost, environmental concerns, safety, and other constraints;

The course learning objectives also contributes to the BSME Outcomes that successful students will:

- E. be able to apply the basic principles of measurement, data analysis, and design of experiments, learned through “hands-on” laboratory experience;
- J. be able, based on their first-hand design experience, to analyze, construct, test, and evaluate an engineering design.

Course Format:

To simulate a realistic competitive environments similar to the workplace, The class is divided into teams competing on same or similar design project. The design analyses usually include thermal-fluid, environmental, economic and sometimes educational analyses. The class format include: lectures, computer lab, presentations, and weekly group discussion and interactions in additional to the regular scheduled class. The pace of the design process in the class is set by the 4 **milestones:**

- MS 1 focuses on clarity of Problem Statement and effectiveness of the Specifications/Constraints, and design Criteria/Philosophy.
- MS 2 focuses on engineering soundness and innovation. In addition to Thermal/Fluid considerations such as energy balance, operation in steady state and transient conditions, environmental, safety, and cost analyses are also an important part of the design analysis.
- MS 3 focuses on the thoughtfulness and logic (design philosophy) of decision matrices. Since you have competitors, make sure you know how to defend your decision.
- MS 4 focuses on the design analysis and system integration.

Grading Policies:

Team work is greatly emphasized in this team design course. Team score consists of half of your final grade. The final presentation and report scores are also used to weigh the mean of the peer review grade. The grade distribution are as follows:

▪ Milestone reports (3)	(Team score)	12 %
▪ Final Report	(Team score)	18 %
▪ Final Presentation	(Team score)	15 %
▪ Team Logbook	(Team score)	5 %
▪ Milestone Presentation	(Indiv. score)	5 %
▪ Homework	(Indiv. Score)	10 %
▪ Quizzes on Design Analysis	(Indiv. Score)	15 %
▪ Participation & attendance	(Indiv. score)	5 %
▪ Peer review	(Indiv. score)	15 %*

(*weighted by overall team scores)

Roughly: A: 90+, A-: 87+, B+: 83+, B: 80+, B-: 77+, C+: 73+, C: 70+, C-: 67+, E: below 67.

Deferred grades: Note that a grade of 'I' should only be assigned:

1. if the student IS NOT currently failing the class and,
 2. if there is NOT a substantial quantity of work yet to be completed,
 3. if there is no extra work required of the instructor beyond the normal duties of grading the paper/exam,
 4. if there is no need for the student to attend the class in subsequent terms. (An 'I' grade MUST be made up within one year of assignment of the grade.)
- Note also that the grade of 'X' should be assigned if there is no basis on which to provide a grade for the student (i.e., the student never showed up in the class).

Other Course-Specific Policies:

Cheating Cheating is unethical and unprofessional. Cheating will result in a failing grade for the course. Please see the student conduct section for more details. Teamwork is encouraged in this course; however, cheating policy also applies relevantly to claiming undeserved credit among group members or from competing teams, such as falsifying technical data or log book, espionage on competing teams' activities, or other unprofessional conducts. (Refer to the attached Student Conduct Statement)

Withdrawal The College of Engineering DOES NOT ALLOW Withdrawal from courses after the FIFTH week of classes except under exceptional circumstances. FAILING of a class is NOT an acceptable excuse for withdrawal after the 5th week.

Make-up & Deadlines The students are expected to attend exams and turn in homeworks, and milestone reports on their due dates. Only under exceptional circumstances and with written proof, can make-up arrangements be made prior to the due date.

Deferred Deferred grades are not allowed, except under exceptional circumstances, with written proof, and with prior approval.

Grade	written proof, and with prior approval.
Teamwork and individual credit:	<p>Students are expected to interact as a individual with team members, and with both the instructor and the TA.</p> <p>Each team will name a contact person.</p> <p>Within a team, cooperation between task groups and individuals is necessary. Each team will decide how to assign tasks among its members.</p> <p>The project is a team project. Therefore, the milestone reports and the final report should be the result of a team activity.</p> <p>The final report must follow an outline and format which will be prescribed. Each student will give an oral presentation of some part of the project results.</p> <p>The final written report of the design will contain a special appendix. In it, the self evaluation (1 page) and the contributions which have been made by each student will be agreed upon (with individual signature) by the team and clearly and explicitly described.</p> <p><u>Participation:</u> Everyone is expected to attend all class and team meetings. Failing to do so will result in a low participation score.</p> <p>The participation of individual team member is also rated by instructor and TA as well as in a confidential peer review on the day on the final exam.</p>
<u>Team Logbook:</u>	<p>Each team must keep their own logbook as their meeting minutes and progress reports. A uniform format is used as the following:</p> <ol style="list-style-type: none"> 1. Meeting Date/Time/Place: 2. Members Present: 3. Accomplishment since last meeting: 4. Agenda of this meeting: 5. Plan for next meeting: 6. Secretary of this log: <p>Please send it as an attachment with a name of Tx_mmdd.doc (where the "x" is the team number and the "mmdd" are the month and date of the meeting) file to all team members plus the Instructor and TA. The Secretary must be rotated among the team members. The meeting log must be sent out by the secretary within 24 hours of the meeting.</p>
Exam	<p>Oral exam is carried out in the presentation period</p> <p>Usually closed-book exams for quizzes</p> <p>Final exam covers design projects of other teams as well.</p>

Tentative Schedule of Activities

Week	Date	Activity
1	Jan.11	Introduction; Engineering Design Processes, Team formation
	Jan. 13	Computer Software demonstrations, Team formation
2	Jan. 18	Energy analysis: Thermodynamics, Chemical Reactions, and Fuel Reforming; Project assignment
	Jan. 20	Library & Patent lecture with Steve McMinn (Tel: 7-6317), Computer Lab
3	Jan 25	Renewable Energy Technology
	Jan. 27	Computer Lab
4	Feb. 1	Alternative Design and Decision Matrix
	Feb. 3	Computer Lab, MS1 (Problem Statement, Background) report due
5	Feb. 8	Milestone 1 presentation
	Feb. 10	Computer Lab
6	Feb. 15	Flow analysis –Statics, Conservations Laws, Pipe Flow,
	Feb. 17	Fluid Machinery, and Fluid Network.
7	Feb. 22	Piping system design example – gaseous (automotive exhaust sys.)
	Feb. 24	Piping system design example – liquid (fuel injection)
8	March 1	Thermal Management and Heat transfer, MS 2 (Alternative Design proposals) report due
	March 3	Milestone 2 Presentation, Quiz
9	March 8	Economic and Safety Analyses, Decision Matrix
	March 10	Thermal/Fluid transient
<u>10</u>	March 15	Spring Break Week
	March 17	
11	March 22	Milestone 3 (Decision Matrix, Final Design) report due
	March 24	Milestone 3 presentation
12	March 29	System Identification and Description and Component
	March 31	Design System simulation and analysis
13	April 5	SAE Congress Week
	April 7	On-site project discussion
14	April 12	Final design system integration
	April 14	Review and Interview
15	April 19	Final Reports due
	April 21	Final Presentation
16	April 26	Study day
	April 28	Final Exam and Peer-review

Student Conduct:

It is the responsibility of each student to adhere to the principles of academic integrity. Academic integrity means that a student is honest with him/herself, fellow students, instructors, and the University in matters concerning his or her -educational endeavors. Thus, a student should not falsely claim the work of another as his/her own, or misrepresent him/herself so that the measures of his/her academic performance do not reflect his/her own work or personal knowledge. In this regard, cheating will not be tolerated. All homework, presentation, and quiz must be an individual effort unless specifically noted. Since teamwork is specially encouraged in this team design project, unethical conducts such as copying or spying on competing teams, unlawful claiming credit for copy-righted materials, and unlawful use of education softwares used in the class, which should not be used for any outside consulting without the written approval of the software vendors. **STUDENTS WHO CHEAT ON ANY ASSIGNMENT OR DURING ANY EXAMINATION WILL BE ASSIGNED A FAILING GRADE FOR THE COURSE.** Therefore avoid all appearance of improper behavior! Students who witness cheating should report the incident to the instructor as soon as possible. Students are also welcome to discuss any concerns related to cheating with Dr. Ron Gibson, Chair of Mechanical Engineering.