San José State University Mechanical Engineering  
Department ME182-Thermal Systems Design  
Section 01, #42776, Fall 2013

Instructor:   Dr. Ernest M. Thurlow
Office Location: Eng. 336 1/2hr before class and 1/2hr after class
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Email: erniethurlow@yahoo.com
Office Hours: Monday/Wednesday/11:30-12:00pm or 1:15-1:30pm
Class Days/Time: Monday and Wednesday/12:00pm-1:15pm
Classroom:   Eng. 329
Prerequisites: ME111, Fluid Mechanics, C- or better
              ME114, Heat Transfer, C- or better
GE/SJSU Studies Category: Three (3) semester units of engineering science topics

Faculty Web Page and MYSJSU Messaging
Yahoo Group:  http://groups.yahoo.com/group/ME182_F2013

Course Description
Design of power systems and cooling/heating systems by engineering groups/teams using course information, class examples, and computer software. Designs will be discussed in written team reports for each of the three project designs. The final project, the “alternative fuel design”, will be presented to the class.

Course Time Requirements
Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of forty-five hours over the length of the course (normally 3 hours per unit per week with 1 of the hours used for lecture) for instruction or preparation/studying or course related activities including but not limited to internships, labs, clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus.
Course Goals and Student Learning Objectives

Students completing ME 182 should have an understanding of how to
- Synthesize previously learned principles in thermodynamics, fluid mechanics, and heat
  transfer in the analysis and design of thermal and fluid systems such as piping networks,
  heat exchangers, and electronics cooling systems
- Understand engineering codes of ethics and how to numerically solve problems to resolve
  code of ethics’ issues.
- Apply energy analysis in optimizing and designing of thermal-fluid devices and systems.
- Gain an understanding of how thermal systems’ components such as pumps, fans, valves,
  piping, and heat exchangers work.
- Apply economic principles in the design of thermal-fluid devices and plants.
- Determine how various types of energy sources may affect health and welfare, society, the
  economy, and the environment.
- Improve teamwork and communication skills.

Course Content Learning Outcomes

Upon successful completion of this course, students will be able to:
1) Analyze electronic packaging and cooling techniques
2) Understand methods used to model electronic networks using thermal resistance techniques
3) Determine feasibility and important factors to consider when designing cooling for a
   system of components.
4) Perform a cost estimation of capital equipment and present worth analyses of project after
   specified project timeline.
5) Compare design alternatives using a Present Worth economic analysis.
6) Choose a pump, fan, fluid mover to perform adequate fluid flow rate.
7) Design a series piping system network.
8) Design and analyze a parallel piping system network. (Hardy-Cross Method)
9) Research and make a presentation on a topic related to alternative energy sources or energy
   resource usage addressing effects on human health and welfare, society, politics,
   economics, and the environment.
10) Develop a realistic thermal-fluid design of a solar power assisted water (SAW)
    heating/cooling system.
11) Simulate and optimize a thermal-fluid system using a computer (F-Chart, EES, MS Excel)
12) Work as a team-dividing up tasks, setting deadlines, reviewing each other’s work, resolving
    conflicts.
13) Use the library and internet to search for technical information.
14) Write technical reports and memos.
15) Understand codes of ethics and conduct for engineers in the workplace.

Required Texts/Readings

Text 1. Course Packet from Bookstore*

*Available at Student Bookstore

Additional Readings

*Fundamentals of Engineering Economics, Chan S. Park, Prentice Hall (Course Packet)
*Elements of Thermal-Fluid System Design, L. C. Burmeister, Prentice Hall, Inc. (Course Packet)
*Design and Simulation of Thermal Systems, N.V. Suryanarayana and O. Arici, McGraw Hill, Inc. (Course Packet)
*Fundamentals of Heat Transfer, Incropera & DeWitt, J.Wiley and Sons
*Heat Transfer, J.P. Holman, McGraw-Hill

Other equipment / material requirements (optional)

Project #1, $30? Price limit for additional supplies

Classroom Protocol

High ethical standards are required of every student at San Jose State University. It is your responsibility to foster an atmosphere of honesty and integrity. All exams and homework (unless otherwise instructed) must be your own work. Copying another’s work or allowing another to copy your work are both considered cheating and may result in failure of the course. However, you are encouraged to discuss homework and projects with other students in the class. Also, please be punctual to class and do not leave class or interrupt class during lecture. Cell phones must be put in offline mode during class.

Dropping and Adding

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester’s Catalog Policies section at http://info.sjsu.edu/static/catalog/policies.html. Add/drop deadlines can be found on the current academic calendar web page located at http://www.sjsu.edu/academic_programs/calendars/academic_calendar/. The Late Drop
Policy is available at http://www.sjsu.edu/aars/policies/latedrops/policy/. Students should be aware of the current deadlines and penalties for dropping classes.

Information about the latest changes and news is available at the Advising Hub at http://www.sjsu.edu/advising/.
Assignments and Grading Policy

Quizzes (2) 15%
Homework 15%
Project #1 (Electronics Cooling Project) 17%
Project #2 (Solar Assisted Water Heating/Piping Project) 17%
Project #3 Codes of Ethics, (Homework and Quiz) 12%
Alternative Fuel Presentation 12%
Final Exam 12%
Total 100%

Grade Distribution:
A  90.0-100
A- 87.0-89.9
B+ 84.0-86.9
B  80-83.9
C+ 73-76.9
C  70-72.9
D+ 63-69.9
D  60-62.9

A final exam score that is 10 points or more higher than your course average may result in a grade somewhat higher than indicated here.

Exams:

Three quizzes and one final exam will be given. They must be taken on the scheduled dates unless a) you can show a note from doctor or the SJSU health center documenting illness or other emergency or b) you make other arrangements with the instructor before the exam date. The Final Examination is on December 12th at 9:45-12:00pm in Eng. 329

Homework:

Homework format should be neat, and every step in the solution process should be shown. Assumptions, knowns, and unknowns should be included. Summarize the problem statement at the beginning. Feel free to work the problems using Mathcad, EES, or any other program you wish. However, during exams all problems will be done without aid of a computer. You are encouraged to discuss homework problems with your classmates (or the instructor). No credit will be given for late homework.

University Policies

Academic integrity

Your commitment as a student to learning is evidenced by your enrollment at San Jose State University. The University’s Academic Integrity policy, located at http://www.sjsu.edu/senate/S07-2.htm, requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The Student Conduct and Ethical Development website is available at http://www.sa.sjsu.edu/judicial_affairs/index.html.

Instances of academic dishonesty will not be tolerated. Cheating on exams or plagiarism (presenting the work of another as your own, or the use of another person’s ideas without
giving proper credit) will result in a failing grade and sanctions by the University. For this class, all assignments are to be completed by the individual student unless otherwise specified. If you would like to include your assignment or any material you have submitted, or plan to submit for another class, please note that SJSU’s Academic Policy S07-2 requires approval of instructors.

**Campus Policy in Compliance with the American Disabilities Act**

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Presidential Directive 97-03 requires that students with disabilities requesting accommodations must register with the [Disability Resource Center](http://www.drc.sjsu.edu/) (DRC) at http://www.drc.sjsu.edu/ to establish a record of their disability.

**Student Technology Resources**

Computer labs for student use are available in the Academic Success Center located on the 1st floor of Clark Hall and on the 2nd floor of the Student Union. Additional computer labs may be available in your department/college. Computers are also available in the Martin Luther King Library.

A wide variety of audio-visual equipment is available for student checkout from Media Services located in IRC 112. These items include digital and VHS camcorders, VHS and Beta video players, 16 mm, slide, overhead, DVD, CD, and audiotape players, sound systems, wireless microphones, projection screens and monitors.

**SJSU Writing Center**

The SJSU Writing Center is located in Room 126 in Clark Hall. It is staffed by professional instructors and upper-division or graduate-level writing specialists from each of the seven SJSU colleges. Our writing specialists have met a rigorous GPA requirement, and they are well trained to assist all students at all levels within all disciplines to become better writers. The [Writing Center website](http://www.sjsu.edu/writingcenter/about/staff/) is located at http://www.sjsu.edu/writingcenter/about/staff/.

**Peer Mentor Center**

The Peer Mentor Center is located on the 1st floor of Clark Hall in the Academic Success Center. The Peer Mentor Center is staffed with Peer Mentors who excel in helping students manage university life, tackling problems that range from academic challenges to interpersonal struggles. On the road to graduation, Peer Mentors are navigators, offering “roadside assistance” to peers who feel a bit lost or simply need help mapping out the locations of campus resources. Peer Mentor services are free and available on a drop—in basis, no reservation required. The [Peer Mentor Center website](http://www.sjsu.edu/muse-peermentor/) is located at http://www.sjsu.edu/muse-peermentor/
<table>
<thead>
<tr>
<th>Date</th>
<th>General Lecture Topic</th>
<th>Reading</th>
<th>For Review</th>
<th>Projects/Exams/Quizzes</th>
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<tbody>
<tr>
<td>28-Aug</td>
<td>Conduction, Convection, and Radiation Heat Transfer Review</td>
<td>Heat &amp; Mass Xfer, Cengel</td>
<td>Cengel, Chp 1</td>
<td>Project #1 Assigned</td>
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<td>2-Sept</td>
<td>Labor Day, No Class</td>
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<td>4-Sept</td>
<td>Ext/Int Convection(Nu#), Radiation Heat Transfer( T&lt;sup&gt;4&lt;/sup&gt; ), Thermal Resistance Networks( T )</td>
<td>Heat &amp; Mass Xfer, Cengel</td>
<td>Cengel, Chp 3</td>
<td>Hmwk#1 (Econ) Due</td>
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<td>11-Sept</td>
<td>Heatsink Design (L/kA + 1/ha), Contact Resistance and Thermal Interfaces</td>
<td>Heat &amp; Mass Xfer, Cengel, Handouts</td>
<td>Cengel, Chp 7,8</td>
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<tr>
<td>16-Sept</td>
<td>Heatsink Design Analyses Algorithm (Single Fluid)</td>
<td>Heat &amp; Mass Xfer, Cengel, Handouts</td>
<td>Cengel, Chp 7,8</td>
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<td>18-Sept</td>
<td>Fans and System Pressure Drop, Solidworks Flow Simulation Model Development (Lids and BCs)</td>
<td>Fans and Pressure Drop Course Notebook, Handout</td>
<td>Burmeister, Chp 2</td>
<td>Hmwk#2 (Thml Res) Due</td>
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<td>30-Sept</td>
<td>Solidwork Flow Simulation(Meshing and Results)</td>
<td>Handout</td>
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<td>2-Oct</td>
<td>Heat Exchangers (Two Fluid), Heatpipe, TECs, Solidworks Flow Simulation (Post Processing)</td>
<td>Heat &amp; Mass Xfer, Cengel</td>
<td>Cengel, Chp 11</td>
<td>Quiz#2, Elect. Cooling</td>
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<td>7-Oct</td>
<td>Project #1 Work Day, Solidworks Flow Simulation</td>
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<td>9-Oct</td>
<td>Project #1 Work Day, Solidworks Flow Simulation</td>
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<td>16-Oct</td>
<td>Series Piping Network Review (ΔP=pL/DV&lt;sup&gt;2&lt;/sup&gt;/2)</td>
<td>Series Piping in Course Notebook</td>
<td>Hodge and Taylor, Pg 19-31</td>
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<td>21-Oct</td>
<td>Series Piping Network Design + Valve Types and Minor Loss Types</td>
<td>Series Piping in Course Notebook</td>
<td>Hodge and Taylor</td>
<td>Hmwk#4 (HXgers) Due</td>
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<td>23-Oct</td>
<td>Field Trip/Guest Speaker</td>
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<td>28-Oct</td>
<td>Simple Parallel Piping Networks</td>
<td>Engineering Fluid Mech, &amp; Course Notebook</td>
<td>Hodge and Taylor, Pg 32-38</td>
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<td>30-Oct</td>
<td>Introduction to Hardy Cross Parallel Pipe Method (R+S-1=Loop#)</td>
<td>Engineering Fluid Mech, &amp; Course Notebook</td>
<td>Hodge and Taylor, Pg 43-70</td>
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<td>4-Nov</td>
<td>Hardy Cross Method (Derivation and Iteration using MS Excel)</td>
<td>Engineering Fluid Mech, &amp; Course Notebook</td>
<td>Hodge and Taylor, Pg 43-70</td>
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<td>6-Nov</td>
<td>Pump Design and Pump Affinity Laws</td>
<td>Engineering Fluid Mech, &amp; Course Notebook</td>
<td>Burmeister, Chp 2</td>
<td>Hmwk#5 (Piping) Due</td>
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<td>11-Nov</td>
<td>Veteran's Day, No Class</td>
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<td>13-Nov</td>
<td>Project #2 Review and Economic Considerations</td>
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<td>18-Nov</td>
<td>Project #2 Work Day</td>
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<td>20-Nov</td>
<td>ASME and NSPE Codes of Ethics</td>
<td>Handouts</td>
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<td>25-Nov</td>
<td>ASME and NSPE Codes of Ethics</td>
<td>Handouts</td>
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<td>27-Nov</td>
<td>Codes of Ethics, Case Studies</td>
<td>Handouts</td>
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<td>2-Dec</td>
<td>Alternative Fuel Work Day/Presentations Begin</td>
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<td>4-Dec</td>
<td>Alternative Fuel Work Day/Presentations</td>
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<tr>
<td>9-Dec</td>
<td>LAST DAY OF INSTRUCTION FALL 2011 Final Examination Review, Alternative Power Presentations</td>
<td>All Text, Handouts, Course Notebook</td>
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<td>12-Dec</td>
<td>(12/12, Thurs, 9:45-12:00pm) FINAL EXAM</td>
<td>Final Examination</td>
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*Blue* = Completed or Holiday