**MECHANICAL ENGINEERING PROGRAM**

**ABET COURSE SYLLABUS**

## ME 440 Thermal System Design (4 Units) Required

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| **Course Description: (2013-15 Catalog)** | Design and optimization of thermal systems. Engineering economics, thermal component sizing, steady-state simulation, and optimization techniques applied to the design and performance analysis of thermal systems. 3 lectures, 1 laboratory. |
| **Prerequisite Courses:** | ME 303, ME 343, ME 347. |
| **Prerequisites by Topic:** | Coverage of all topics presumes completion of basic engineering science courses in thermodynamics, fluid mechanics and heat transfer. |
| **Textbook: (and/or other required material)** | Introduction to Heat Transfer, by Bergman, Lavine, Incropera & DeWitt, 6th Edition, John Wiley and Sons, 2011.<br><br>Fundamentals of Fluid Mechanics, by Munson, Young, Okiishi, and Huebsch, 6th Edition, John Wiley and Sons, 2009.<br><br>EES Engineering Equation Solver, F-Chart Software. |
| **References:** | Fundamentals of Engineering Thermodynamics, by M. Moran and H. Shapiro, 6th Edition, John Wiley and Sons, 2008. |
| **Course Coordinator/Instructor:** | Christopher C. Pascual, Professor of ME |
| **Course Learning Outcomes:** | 1. Evaluate thermal systems based on life-cycle economics.<br>2. Solve heat exchanger problems using the long-mean-temperature difference method and the effectiveness method. Choose an appropriate heat exchanger for a thermal system application.<br>3. Select an appropriate pump for a complex piping network. Evaluate the effect of pipe diameter, flow rate, pipe length, pipe roughness, and minor losses on system capital and operating costs.<br>4. Perform a thermal system simulation and solve for a workable solution using the method of successive substitution.<br>5. Generate an objective function and the appropriate constraints for a complete thermal system design problem.<br>6. Perform a thermal system optimization. Evaluate the solution based on the objective function. |

| **Relationship of Course to MECHANICAL ENGINEERING Program Outcomes:** | | | | | | | | | | | | |
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| *a* | *b* | *c* | *d* | *e* | *f* | *g* | *h* | *i* | *j* | *k* | *l* | *m* |
| **H** | **L** | **H** | **H** | **H** | **M** | **H** | **M** | **H** | **M** | **H** | **H** | **H** |

**Topics Covered:**

Engineering Economics (6 lectures)
Heat Exchangers (6 lectures)
Pumps and Piping Systems (5 lectures)
System Simulation and Introduction to Optimization (3 lectures)
Lagrange Multipliers and Search Methods (5 lectures)
Multivariable Optimization (4 lectures)
Testing (1 lecture)

**Laboratory Projects:**

1. EES Program (1 week)
2. Design Project Including Parametric Study (8 weeks)
3. Optimization Problem (1 week)

**Class/Lab Schedule:** Three 50-minute lectures per week. One 170-minute lab per week.

**Contribution of Course to Meeting the Professional Component:**

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| (a) College-level mathematics and basic sciences: | 0 credits |
| (b) Engineering Topics: | 3 credits |
| Design: | 1 credit |
| (c) General Education: | 0 credits |
| (d) Other: | 0 credits |

**Prepared by:**
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**Date:**
8/16/13