MECHANICAL ENGINEERING PROGRAM

ABET COURSE SYLLABUS

ME 420 Thermal System Design (4 Units) Required

Course Description: (2019-20 Catalog)	Radiation and combined mode heat transfer. Design of thermal systems. Engineering economics, thermal component sizing, and steady-state simulation techniques applied to the design and performance analysis of thermal systems. 3 lectures, 1 laboratory.
Prerequisite Courses:	ME 303, ME 347, ME 350.
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)	Fundamentals of Heat and Mass Transfer, by Bergman and Lavine, 8th Edition, John Wiley, 2017. Fox and McDonald's Introduction to Fluid Mechanics, by Pritchard and Mitchell, 9th Edition, John Wiley, 2015. EES Engineering Equation Solver, F-Chart Software.
References:	Fundamentals of Engineering Thermodynamics, by Moran, Shapiro, Boettner, and Bailey, 8th Edition, 2014.
Course Coordinator/Instructor:	Christopher C. Pascual, Professor of ME
Course Learning Outcomes:	The student will be able to: 1. Understand the physical processes governing radiation heat transfer and be able to solve multimode heat transfer problems. 2. Evaluate thermal systems based on life-cycle economics. 3. Solve heat exchanger problems using the long-mean-temperature difference method and the effectiveness-NTU method. 4. Choose an appropriate heat exchanger for a thermal system application. 5. 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. 6. Find and use appropriate technical resources to perform a thermal system simulation and solve for a workable solution using the method of successive substitution. 7. Collaborate effectively on a team to generate an objective

function and the appropriate constraints for a complete thermal system design problem. Use analysis techniques to refine and select the design of a component and system.

8. Perform a thermal system design and optimization. Evaluate the solution based on the objective function.
9. Write an effective project report and/or give a coherent and effective oral presentation based on their design.

Relationship of Course to Mechanical Engineering Student Outcomes:

SO 1: Mastered (M)
SO 2: Mastered (M)
SO 3: Mastered (M)
SO 4:
SO 5: Mastered (M)
SO 6:
SO 7: Mastered (M)

Topics Covered:

Radiation Heat Transfer and Multimode Heat Transfer (9 lectures)
Engineering Economics (6 lectures)
Heat Exchangers (5 lectures)
Pumps and Piping Systems (5 lectures)
System Simulation and Introduction to Optimization (3 lectures)

Laboratory Projects:

1. EES Program (1 week)
2. Design Project(s) 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:

(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:
3/05/19