ME 335 COURSE PROFILE

DEGREE PROGRAM: Mechanical Engineering

COURSE NUMBER: ME 335	**COURSE TITLE:** Heat Transfer
REQUIRED COURSE OR ELECTIVE COURSE: Required	**TERMS OFFERED:** Fall, Winter, Spring
TEXTBOOK / REQUIRED MATERIAL: Bergman, Lavine, Incropera, Dewitt, Fundamentals of Heat and Mass Transfer, 7th ed., Wiley (2011) / Kaviany, Principles of Heat Transfer, 1st ed., Wiley (2001)	**PRE / CO-REQUISITES:** Enforced pre-req of C in ME 320. I, II, IIIa (3 credits)
COGNIZANT FACULTY: J. Fu	**COURSE TOPICS:** 1. Different modes of heat transfer (conduction, convection, and radiation) and their rate equations. 2. Thermodynamics first and second laws. 3. Thermal properties of matter including thermal conductivity. 4. Heat diffusion equation. 5. Boundary and initial conditions. 6. 1-D, steady-state heat conduction in Cartesian and Radial systems. 7. Thermal resistance and thermal circuit modeling. 8. 1-D, steady-state heat conduction from extended surfaces (fin problems). 9. Transient conduction and lumped capacitance method. 10. Velocity and thermal boundary layers. 11. Boundary layer equations and similarity and Reynolds Analogy. 12. Thermal analysis for fully developed laminar flow in circular tubes. 13. Heat transfer correlations for forced internal and external convection. 14. Heat transfer correlations for free convection. 15. Radiation intensity and blackbody radiation. 16. Emission, absorption, reflection, and transmission by real surfaces. 17. View factor and radiation exchange between surfaces.
BULLETIN DESCRIPTION: Different modes of heat transfer; thermal properties; heat diffusion equation; steady-state heat conduction; thermal circuit modeling; heat transfer from extended surfaces; lumped capacitance model; convection boundary layers; boundary layer equations and similarity; forced convection and free convection; blackbody radiation; emission, absorption, and reflection by real surfaces; radiation exchange between surfaces.	
COURSE STRUCTURE/SCHEDULE: Lecture: 2 days per week at 1.5 hours	

COURSE OBJECTIVES: for each course objective, links to the Program Outcomes are identified in brackets.	1. To make students familiar with fundamental heat transfer concepts: conservation of energy, mechanisms of energy conversion, and mechanisms of heat transfer (conduction, convection, and radiation) [1, 2, 4, 6, 7] 2. To teach students how to apply energy balance analysis for integral and differential control volumes. [1, 2, 6] 3. To make students familiar with thermal circuit analysis for engineering systems and calculations for conduction, convection, and radiation thermal resistances. [1, 2, 6] 4. To make students familiar with the lumped capacitance method for transient conduction problems in engineering systems [1, 2, 6] 5. To teach students how to use heat transfer correlations for convection problems involved in engineering systems. [1, 2, 6] 6. To teach the physics of thermal radiation, view factor, and radiation exchange between surfaces. [1, 2, 6] 7. To enable students to perform thermal analysis of practical engineering problems using heat transfer concepts [1, 2, 4, 6, 7] 8. To teach students the relation of thermal systems analysis to environmental concerns [4, 7]
COURSE OUTCOMES: for each course outcome, links to the Course Objectives are identified in brackets.	1. An ability to apply conservation of energy principles for engineering systems [1-8] 2. An ability to relate the rate of heat transfer to the potential for heat flow (difference in temperature) and thermal resistances [1, 3, 5, 7] 3. An ability to determine thermal resistance for conduction, convection, and radiation heat transfer, using fundamental relationships and correlations. [1, 3, 5, 6, 7}4. An ability to perform thermal circuit analysis for engineering systems. [1, 3, 5, 6, 7] 4. An ability to perform thermal circuit analysis for engineering systems. [1, 3, 5, 6, 7] 5. An ability to design thermal systems for various thermal engineering applications [1-8] 6. A knowledge of modern thermal science and its impact on environmental concerns. [1-8]
ASSESSMENT TOOLS: for each assessment tool, links to the course outcomes are identified	1. Regular homework problems. 2. Midterm and final exams.

PREPARED BY: J. Fu
LAST UPDATED: 10/2017