ME 336 COURSE PROFILE

DEGREE PROGRAM: Mechanical Engineering

COURSE NUMBER: ME 336	**COURSE TITLE:** Thermodynamics II
REQUIRED COURSE OR ELECTIVE COURSE: Elective	**TERMS OFFERED:** Fall, Winter
TEXTBOOK / REQUIRED MATERIAL: : Fundamentals of Thermodynamics by Borgnakke and Sonntag, 9th Ed. Wiley 2017	**PRE / CO-REQUISITES:** MECHENG 235. I, II (3 credits)
COGNIZANT FACULTY: C. Borgnakke	**COURSE TOPICS:** 1. Conservation principle for mass, energy and entropy 2. Power producing devices and refrigeration systems 3. Work and heat transfer in ideal processes, exergy, and irreversibility 4. Extension of simple cycles to realistic and more efficient cycles, combined cycles 5. Mixtures of gases, applications with moist air 6. Combustion of hydrocarbon fuels, fuel cells 7. Chemical reactions and gaseous dissociation
BULLETIN DESCRIPTION: Thermodynamic power and refrigeration systems; exergy and evaluation of thermodynamic processes and cycles; equations of state, and compressibility factors; mixtures; combustion of hydrocarbon fuels; chemical reactions; gaseous dissociation. Design and optimization of thermal systems.	
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 advanced concepts and devices used in thermal science [1, 2] 2. To teach the behavior of simple pure substances and ideal mixtures [1, 7] 3. To teach the general formulation of conservation laws for mass, energy and entropy for various physical systems [1, 2, 7] 4. To teach application of process knowledge to the analysis of complete systems [1, 4, 7] 5. To teach evaluation of processes involving phase change of water in air [4, 7] 6. To show students some real devices and cycles used in industry [1, 4, 7] 7. To introduce students to combustion of hydrocarbon fuels and emissions [4] 8. To familiarize students with chemical equilibrium concepts and processes [1, 2, 4, 6] 9. To introduce students to the workings of fuel cells [2, 4]
COURSE OUTCOMES: for each course outcome, links to the Course Objectives are identified in brackets.	1. Analyze different subsystems, indicate where there is work, heat transfer and give the best approximating process [1, 3, 4] 2. Given a set of properties, find the correct phase and remaining properties for a substance [2] 3. Given a physical setup, find process and compute associated work/heat transfer that is the most reasonable approximation [1, 3] 4. Given a physical device and process, compute the work and heat transfer [3, 4, 6] 5. Given a physical setup, formulate the ideal approximation to the behavior and compute the corresponding work and heat transfer [3, 4] 6. Given an actual device, formulate the corresponding ideal device [3, 4, 6] 7. Formulate performance and compute power for simple heat engines/refrigerators [3, 4] 8. Evaluate processes in moist air, evaporation and condensation of water [5] 9. Ability to analyze processes that includes mixtures of gases and trace components [2, 7] 10. Given a fuel type, compute the energy release and combustion temperature [7] 11. Analyse the energy and entropy for a combustion process and evaluate the electrical potential for a fuel cell [7, 8] 12. Energy levels and component composition should be found for equilibrium situations involving simple chemical reactions and/or combustion [7, 8]
ASSESSMENT TOOLS: for each assessment tool, links to the course outcomes are identified	1. Regular homework assignments [2-12] 2. Exams [6-12]

PREPARED BY: C. Borgnakke
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