ME 433 COURSE PROFILE

DEGREE PROGRAM: Mechanical Engineering

COURSE NUMBER: ME 433	**COURSE TITLE:** Advanced Energy Solutions
REQUIRED COURSE OR ELECTIVE COURSE: Elective	**TERMS OFFERED:** Fall, Winter (2 sections each semester)
TEXTBOOK / REQUIRED MATERIAL: No required textbook. Recommended texts: Energy Studies, 2nd Edition, Shepherd, W., Shepherd D.W. Imperial College Press, London, 204 ISBN #1860943225 and Intro to Engin and the Environ, 1st Edition, E.S. Rubin, McGraw Hill, 2001	**PRE / CO-REQUISITES:** MECHENG 235. I (3 credits)
COGNIZANT FACULTY: M. Wooldridge **BULLETIN DESCRIPTION:** Introduction to the challenges of power generation for a global society using the thermodynamics to understand basic principles and technology limitations. Covers current and future demands for energy; methods of power generation including fossil fuel, solar, wind and nuclear; associated detrimental by-products; and advanced strategies to improve power densities, efficiencies and emissions.	**COURSE TOPICS:** 1. Energy resources and concerns 2. Review of thermodynamic conservation principles 3. Fundamentals of combustion 4. Power generation for the transportation sector, vehicle emissions 5. Petroleum resources, high efficiency, high power density & low emission engine strategies 6. Bio-fuels and hydrogen 7. Coal, stationary power generation, process heating & manufacturing 8. Batteries, hybrid electric vehicles & the grid, fuel cells 9. Solar energy (thermal and direct conversion) 10. Nuclear energy 11. Geothermal energy
COURSE STRUCTURE/SCHEDULE: Lecture: 2 per week @ 1 hour 20 minutes	

COURSE OBJECTIVES: for each course objective, links to the Program Outcomes are identified in brackets.	1. To make students familiar with the basic energy transfer processes that govern existing and proposed methods of power generation for a global society. [1, 4] 2. To make students familiar with the traditional and non-traditional fuel sources in terms of energy content, accessibility, required processing steps and projected remaining reserves. [1, 4, 7] 3. To teach the evaluation of heat, work and energy transfer steps associated with advanced powertrain strategies and stationary power systems. [1, 2, 6] 4. To teach the fundamental thermodynamics, physics and chemistry relevant to evaluating combustion emissions and efficiencies. [1, 2, 6]
COURSE OUTCOMES: for each course outcome, links to the Course Objectives are identified in brackets.	1. Identify and quantify the important energy transfer for solar, nuclear, fossil fuel combustion and wind power generation schemes. [1, 3, 4] 2. Quantify the limiting efficiencies for solar, nuclear, fossil fuel combustion and wind power generation schemes. [1, 3] 3. Quantify the energy densities/specific energy content of a fuel. [2] 4. Identify the opportunities and challenges of advances in energy carriers used for energy storage and delivery. [1, 3] 5. Identify the thermodynamic conditions limiting vehicle emissions using fossil and biofuels. [4]
ASSESSMENT TOOLS: for each assessment tool, links to the course outcomes are identified	1. Regular homework problems [1-5] 2. Two exams [1-5] 3. Final written project report [1-5] 4. Video/oral presentation [1-5]

PREPARED BY: M. Wooldridge
LAST UPDATED: 5/11/2023 – K. Oldham