ME 489 COURSE PROFILE

DEGREE PROGRAM: Mechanical Engineering

COURSE NUMBER: ME 489	**COURSE TITLE:** Sustainable Engineering and Design
REQUIRED COURSE OR ELECTIVE COURSE: Required	**TERMS OFFERED:** Fall
TEXTBOOK / REQUIRED MATERIAL: Coursepack compilation of textbook chapters.	**PRE / CO-REQUISITES:** ME 235 (C- or better); Credit for only one: CEE 265 or ME 489
COGNIZANT FACULTY: S. Skerlos	**COURSE TOPICS:** 1. Overview of Sustainability Engineering 2. Ecological Footprints 3. Life Cycle Assessment 4. Material Resources and Sustainability 5. Air Resources and Sustainability 6. Water Resources and Sustainability 7. Toxicity and Risk 8. Energy Resources and Sustainability 9. Global Warming and Carbon Footprints 10. Economics and Sustainability
BULLETIN DESCRIPTION: ME 489 covers economic, environmental and social aspects of sustainability as they pertain to engineering design. The course covers life cycle assessment, carbon/water/energy footprints, economic assessments, mass/energy balances, air/water pollutants, modeling of environmental pollutant concentrations, engineering economics, social considerations, pollution prevention, resource conservation, human and eco-toxicity, life cycle costing, and energy systems.	
COURSE STRUCTURE/SCHEDULE: Lecture: 2 days per week at 90 minutes each	

COURSE OBJECTIVES: **for each course objective, links to the Program Outcomes are identified in brackets.**	1. Teach students equations that represent population growth and resource consumption [1, 4]. 2. Teach students about pollution of concern to human health and the environment [4, 6]. 3. Teach students the steps of a life cycle assessment and the difference between life cycle assessment and life cycle thinking [2, 4]. 4. Teach student models of resource consumption to estimate future production rate for materials and times to resource exhaustion [1, 4]. 5. Teach students box models for estimating pollutant concentrations in air- and watersheds based on pollutant emissions into these systems [1, 4, 6]. 6. Teach students the concept of acceptable risk and how toxic substance dose-response data are used to assess risk to humans [4, 6]. 7. Teach students the greenhouse gases and climate concepts such as airborne fraction, albedo, climate forcing/sensitivity, and global warming potential [1,2, 4, 6]. 8. Teach students how to calculate carbon off-sets and carbon footprints [1, 2, 4, 5, 6]. 9. Teach students how to compare costs today with benefits in the future to arrive at calculations of payback, return on investment, and net present value of alternative pollution prevention strategies [1, 4].
COURSE OUTCOMES: **for each course outcome, links to the Course Objectives are identified in brackets.**	1. Can use mass and energy balances to calculate the concentration of pollutants caused by engineering systems [1,4,5,7,8]. 2. Can identify common air and water pollutants and the concerns they raise for human health and the environment [2,5,6,7,8]. 3. Can calculate energy efficiency and pollutant emissions released from combustion based systems [5,7,8]. 4. Understands how life cycle assessment can help in characterizing the environmental impact of different engineering systems [4,8]. 5. Can calculate net present value and life cycle cost estimates for systems relevant to environmental impact [9].
ASSESSMENT TOOLS: **for each assessment tool, links to the course outcomes are identified**	1. Homework [1,2,3,4,5] 2. Quizzes [1,2,3,4,5] 3. Examinations [1,2,3,4,5] 4. Term Project [4]

PREPARED BY: S. Skerlos
LAST UPDATED: 5/11/2023 – K. Oldham