Mechanical Engineering Dept. Department

Syllabus
ME 441: Energy and the Environment (3-0-3)

Course Catalog Description:

Engineering and environment. Overview of environmental issues. Case studies in design for the environment. Automobiles and the environment. Batteries and the environment. Power plants and the environment. Refrigeration and the environment. Environmental life cycle assessments. Pollution control technologies and instrumentation. Thermodynamic assessment of environmental impacts. Case studies in mechanical engineering for environmental modeling. Smog control. CFCs and ozone layer. Acid rain. Global warming and climate change. Toxic metals. Environmental policy. Economic analysis. Environmental risk and decision.

Course Pre-requisites:

- ME 203: Thermodynamics I

Course Objectives:

1. Introduce and evaluate the environmental impact of energy production and consumption.
2. Introduce the concepts of environmental lifecycle assessments and thermodynamics assessments of environmental impacts
3. Discuss and explore alternatives in major domain of energy consumption including transportation, energy generation, energy storage and refrigeration

Course Learning Outcomes:

CLO1. Be able to understand various renewable and non-renewable energy technologies and their application.

CLO2. Be able to understand and evaluate the environmental impact of energy production, consumption and associated climate change.

CLO3. Analyse and assess the environmental impact of energy conversion through life cycle and thermodynamic assessments.

CLO4. Be able to collect the right set of data for an existing energy conversion system and carry out any subsequent processing and analysis.

CLO5. Be able to design an alternative energy conversion system with a lower environmental impact.

CLO6. Become acquainted with the advances in technology and its implementation through policies to reduce environmental impact.

Learning Resources:

- Järvelä, M. and Juhola, S. eds., 2011. Energy, policy, and the environment: modeling sustainable development for the North (Vol. 6). Springer Science & Business Media.
- 2. List Essential References Materials (Journals, Reports, etc.): https://www.sciencedirect.com/journal/green-energy-and-environment https://www.springer.com/journal/40095
- Albright, L., 2012. Energy Systems Engineering: Evaluation and Implementation. McGraw-Hill Professional.
- Notes provided by instructor
- Other learning material such as computer-based programs/CD, professional standards or regulations and software. • https://www.nrcan.gc.ca/maps-tools-publications/tools/data-analysis-software-modelling/retscreen/7465 • https://sam.nrel.gov/#:~:text=The%20System%20Advisor%20Model%20(SAM,Technology%20developers • https://www.engineering-4e.com/power-cycles-calculator • https://www.csusm.edu/sustainability/takeaction/knowurimpact.html • https://footprint.wwf.org.uk/#/

Lecture Assessment Plan:

Assessment Task	Week Due	Weight
Term Project and case studies	14	35.0%
Final Exam	15	25.0%
Major Exam	8	20.0%
Assignments	weekly	10.0%
Quizzes	weekly	10.0%

Lecture Weekly Schedule:

Week#	Topics
1	Introduction to Energy, its uses and impacts
2	Case studies in design for environment (smog control, acid rain, etc.)
3	Automobiles/personal transportation and environment
4	Automobiles/personal transportation and environment (Continue)
5	Batteries/energy storage and environmental challenges (toxic metals)
6	Power plants and environment
7	Refrigeration and associated environmental effects
8	Environmental life cycle assessments
9	Environmental life cycle assessments (Continue)
10	Pollution control technologies
11	Thermodynamic assessment of environmental impacts
12	Case studies for environmental modeling
13	Global warming and climate change

Week#	Topics
14	Environmental policy and economic analysis
15	Environmental risk and decision making