ME 4823 Introduction to Renewable Energy Systems (Elective)

Catalog Description: ME 4823 Introduction to Renewable Energy Systems (3-0-3)  
Prerequisites: ME 3322 Introduction to Thermodynamics and ME 3340 Fluid Mechanics  
Corequisites: ME 3345 Heat Transfer  
Renewable energy systems are introduced. Various energy conversion and storage technologies are explained and analyzed, along with their respective advantages and limitations.


Topics Covered:

1. Principles, overview, and importance of renewable energy.
2. Review of thermal sciences, i.e., pertinent thermodynamics/transport phenomena.
4. Fluidic power generation (aerial and waterway).
5. Biomass and biofuels.
7. Energy systems, storage, and transmission/transportation.
8. Opportunities for, and challenges to, societal implementation.

Course Outcomes:

Outcome 1: To provide students an appreciation for the need and promise of simultaneously alternative and “clean” energy technologies such as renewable energy systems.

1.1 Students will enhance their knowledge of present and pending energy challenges within society.

Outcome 2: To teach the prevalent types and applications of renewable energy systems and expose students to near-term implementations of the technology.

2.1 Students will engage in various assignments (i.e., tests, homeworks, project) with qualitative discussion/commentary requirements to exhibit their awareness of various types and applications of renewable energy systems.

Outcome 3: To teach students the basic principles of operation of prevalent renewable energy converters.

3.1 Students will engage in various assignments (i.e., tests, homeworks, project) to qualitatively exhibit their understanding of the physics-based operating principles associated with select renewable energy technologies.

Outcome 4: To train students to apply thermal science fundamentals to the design/analysis of renewable energy system components.

4.1 Students will engage in various assignments (i.e., tests, homeworks, project) to quantify the design and analysis of renewable energy technology operations.

4.2 Students will perform design/analysis exercises related to synthesizing renewable energy systems, inclusive of a conceptual design seed project.

Outcome 5: Expose students to the diversity of beneficial applications currently utilizing renewable energy
(e.g., “solar cell roofs”) and future implementations of such technologies.

5.1 Students will participate in tours, receive guest lectures, and see demonstrations of state-of-the-art renewable energy activities occurring on campus.

Outcome 6: Introduce students to societal catalysts and challenges regarding renewable energy implementation (“clean energy” incentives, energy security, codes and regulatory needs, etc.).

6.1 Students will demonstrate their understanding of societal catalysts and socio-economic considerations via quiz and exam discussion questions, as well as related commentary within group projects as introduced in (7.1) below.

Outcome 7: To provide a platform for students to complete conceptual design problems based upon state-of-the-art scenarios for utilizing renewable energy within developing or developed regions.

7.1 Students will develop conceptual design solutions for effectively using renewable energy systems based upon prescribed scenarios.

7.2 Students will be introduced to renewable energy system design software HOMER for its implementation in their conceptual design problems.

Outcome 8: To enable students to work in groups on design projects assigned to them.

8.1 Students will demonstrate their ability to work in teams by collectively resolving a conceptual renewable energy solution for a prescribed challenge (ref. (7.1)-(7.2)).

Outcome 9: To enhance a student’s ability to communicate in written form.

9.1 Students will provide written reports detailing their renewable energy systems concepts inclusive of preliminary results.

Correlation between Course Outcomes and Student Outcomes:

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GWW School of Mechanical Engineering Student Outcomes:

(a) an ability to apply knowledge of mathematics, science and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Prepared by: Comas Haynes