

**1. Department, Course Number, and Course Title:**

**MECHANICAL ENGINEERING**

**ME 416 ENERGY SYSTEMS**

**2. Designation:** Required  Elective   
Lower Division  Upper Division

**3. Course Description:** Unconventional energy conversion systems, energy storage, thermoelectric power and refrigeration, absorption refrigeration, and cryogenics.

**4. Prerequisites:** ME 326 B

**5. Text and Materials:** Advanced Energy Systems, Nikolai V. Khartchenko, Taylor & Francis, 1998  
References:  
Threkeld, J., Thermal Environmental Engineering, Prentice-Hall.  
Culp, A., Principles of Energy conversion, McGraw-Hill Book Co.  
Wood, B.D., Applications of Thermodynamics, 3<sup>rd</sup> ed., Addison-Wesley Publishing Co., 1993.  
Sorensen, H.A., Energy Conversion Systems, John Wiley & Sons, 1983

**6. Course Objectives:**

Course Outcomes

- the ability to calculate energy conversion efficiencies for a variety of practical power systems.
- an appreciation for the history and technology advancements of energy conversion systems.
- the ability to perform preliminary design analyses to explore alternative means of energy conversion, storage, and utilization.
- the ability to evaluate candidate refrigeration and cryogenic systems, and estimate their costs.
- the ability to size energy storage systems.
- an introductory understanding of direct energy conversion techniques and their applications.
- the broad education necessary to understand the impact of engineering solutions in a global/societal context.
- an ability to communicate effectively.
- a desire to be a flexible and adaptable team player in engineering design projects.

**7. Topics Covered:** (in Order of Presentation)

- Introduction : Fundamentals of Energy (Ch. 1)
- Fuel Combustion and Gasification (Ch. 2)
- Steam Power Plant Technology (Ch 4)
- Gas Turbine Based Combined Cycle Power Plants (Ch 6)
- Cogeneration
- Refrigeration and Cryogenics (References )
- Fuel Cell (Ch 8)
- Direct Energy Conversion (References )
- Advanced Energy Storage Systems (Ch.10)
- Design and Analysis of Various Alternative Energy Systems (References)
- Cryogenics (References)

**8. Class Schedule:** Number of Sessions per week: 2  
Duration of each session: 1 hour 40 minutes

**9. Contribution of course to meeting the professional component:**

This course is part of the 25 units of upper division technical electives required for the mechanical engineering program.

Engineering Science 2 units  
Engineering Design 2 units

## 10. Relationship of course to program objectives:

This course relates to the program objectives by contributing to the following measurable outcomes at the level indicated for all engineering graduates:

### Knowledge outcomes:

- an ability to apply knowledge of mathematics, science, and engineering (abet a)
- the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (abet h)
- knowledge of current events and societal contemporary issues -- non-engineering related. (abet j)
- a knowledge of computer aided design and simulation software
- a knowledge of how mechanical engineering integrates into inter-disciplinary systems

### Skill outcomes:

- 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 (abet c)
- an ability to function on multidisciplinary teams (abet e)
- an ability to communicate effectively (abet g)
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (abet k)
- an ability to select materials and manufacturing processes
- an ability to visualize designs from engineering drawings
- an ability to think in a logical sequential process

### Attitudes Outcome:

- a recognition of the need for an ability to engage in lifelong learning (abet i)
- a desire to be a flexible and adaptable team player (collaborative attitude)

## 11. Prepared by: