COURSE INFORMATION FORM

**DISCIPLINE**  
INTE

**COURSE TITLE**  
Energy Management, Efficiency and Conservation

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**CATALOG DESCRIPTION**

Introduces fundamental concepts of energy management, including energy production and costs and efficiency/conservation methods available for energy use reduction. Analysis of methods by which energy is used, and its environmental and financial impacts and consequences. Investigation of methods to identify and assess energy conservation opportunities. Optional field trips.

**PREREQUISITES**

None

**EXPECTED STUDENT OUTCOMES IN THE COURSE (ESO)**

Upon completion of this course, the student will be able to:

1. Explain the environmental, economic and political impacts of energy consumption
2. Analyze the energy industry
3. Justify the need for energy management programs
4. Describe the components of an effective energy management program
5. Explain the basic principles for saving energy resources, reducing costs, and energy planning for the future
6. List all energy consuming equipment within a building and in the building envelope
7. Analyze energy conservation measures (ECMs) in the areas of heating, ventilation and air conditioning (HVAC), lighting, motors, building envelope, and other building equipment
8. Explain and use various data acquisition, monitoring, auditing, and system balancing equipment for energy analysis
9. Analyze energy bills and billing history, including rate analysis
10. Design energy use scenarios to determine the optimal rate from energy suppliers
11. Assess opportunities for improving the operation, maintenance, and energy efficiency of each energy system and piece of equipment at a building site
12. Construct a building and systems load profile
GENERAL EDUCATION OUTCOMES (ESO)
Specify which general education outcomes, if any, are substantially addressed by the course. Numbers in parentheses identify the Expected Student Outcomes linked to the specific General Education Outcome.

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<th>Outcomes</th>
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PROGRAM-LEVEL OUTCOMES

CAREER AND TECHNICAL EDUCATION PROGRAM OUTCOMES
Specify which Career and Technical program outcomes, if any, are substantially addressed by the course by completing the “Career and Technical Education template” to show the relationship between course and program outcomes to assessment measures.

The student will demonstrate:

1. The ability to think critically and apply problems solving skills.
2. Competence in the entry-level skills of technical profession in Industrial technology.

CLASS-LEVEL ASSESSMENT MEASURES
Student accomplishment of expected student outcomes may be assessed using the following measures. (Identify which measures are used to assess which outcomes.)

1. Quizzes and Exams (1 – 12)
2. Homework and classroom exercises (6 – 12)
3. Written assignments (1 – 12)
DISCIPLINE  INTE ________________________________

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Individual instructors may order this outline as fits the needs of their individual courses. In addition, they may place more emphasis on some areas than on others. What is assured is that this particular list is covered in the course. Other topics may be added to a course as the instructor sees fit, and as time and interest allow. An *asterisk can be used to mark an item as optional.

I. Foundations of Energy
   A. Fundamental concepts of energy
   B. Environmental impacts of energy consumption
   C. Economic impacts of energy consumption
   D. Political impacts of energy consumption

II. Energy Supply
    A. Electricity supply
    B. Natural gas
    C. Fuel oil*

III. Components of an Effective Energy Management Program
    A. Energy awareness campaign and incentives
    B. Documenting present costs
    C. Analyzing energy savings opportunities
    D. Strategies for control of consumption
    E. Low-cost and no-cost strategies for energy management
    F. Prioritizing Energy Conservation Recommendations (ECRs)
    G. Implementation of ECRs
    H. Documentation of savings from ECRs
    I. Case studies of effective energy management programs*

IV. Data Acquisition, Monitoring, Auditing and System Balancing Equipment for Energy Analysis
    A. Data loggers
    B. Universal data recorder
    C. Flue gas analyzer
    D. Thermometer
    E. Utility meters
    F. Combustion analyzers
    G. Infrared thermography
    H. Airflow velocity measures
    I. Electrical meters
    J. Refrigeration measures
    K. Light meter
    L. Sling psychrometer

V. Energy bill analysis
    A. Power factor correction
    B. Peak demand limiting
    C. Rate structure

VI. HVAC energy conservation measures (ECMs)
    A. Equipment sizing, selection and maintenance
    B. Heating combustion efficiency
    C. System efficiency
    D. Steam traps
    E. Chiller optimization
    F. Coefficient of Performance and Energy Efficient Rating
    G. Stratified air consideration
    H. Psychrometric charts
    I. Economizer cycles
    J. Waste heat recovery
K. Operating and maintenance considerations

VII. Other building equipment ECMs
   A. Energy Star and other Energy Efficiency Ratings
   B. Domestic Water Heating ECMs
   C. Compressed Air ECMs

VIII. Building Envelope ECMs
   A. Overview of Green Building
   B. Weatherization
      1. Conduction and infiltration heat loss/gain
      2. Vapor barriers
      3. Insulation levels
      4. Radiant heat gain/loss
      5. Solar shading
      6. Infiltration
      7. Building ventilation
      8. Thermal mass of building
   C. Calculations for energy efficiency and green building envelope improvements

IX. Electrical ECMs
   A. Lighting systems
      1. Day lighting
      2. Lighting requirements
      3. Lighting energy conservation recommendations
      4. Incentive lighting programs
   B. Pumps, fans, motors

X. Case Study*
   A. Analysis of ECMs for a given facility
   B. Prioritize ECMs for a given facility