Faculty is required to have the outline submitted to the Academic Affairs Office. The course outline is the form used for approval of new courses by the Academic Affairs and Standards Council.

DEPT. RNEW                        COURSE NUMBER:  1300

NUMBER OF CREDITS:  3

COURSE TITLE: Introduction to Traditional and Renewable Energy

CATALOG DESCRIPTION : This course is designed to introduce students to various forms of energy stemming from both renewable and non-renewable sources. Students will study many sources of energy including solar thermal power, solar photovoltaics, bioenergy, hydroelectricity, tidal power, wind energy, wave energy, geothermal energy, and fossil fuels. The *First Law of Thermodynamics* is studied along with conversion and efficiency of various forms of energy. The economics, potential, and environmental impact will be covered for each topic.

AUDIENCE : Students enrolled in the Energy Technology A.A.S. degree and individuals interested in learning basic concepts involving renewable and fossil fuel technologies.

FULFILLS MN TRANSFER CURRICULUM AREA(S) *(Leave blank if not applicable)*
Area: by meeting the following competencies:
Area: by meeting the following competencies:
Area: by meeting the following competencies:

PREREQUISITES OR NECESSARY ENTRY SKILLS/KNOWLEDGE: None

LENGTH OF COURSE : One Semester

THIS COURSE IS USUALLY OFFERED:
Every other year ☐ fall ☑ spring ☐ summer ☐ undetermined ☐

Four goals are emphasized in course at Minnesota West Community & Technical College:

1) ACADEMIC CONTENT: The academic objectives of this course are:
   a. Students will gain a basic understanding about renewable and fossil fuel energy.
   b. Students will identify the principles of physics as they relate to various forms of energy
   c. Students will understand the underlying technological principles, their economics, and their environmental impact as they relate to various forms of energy.

2) THINKING SKILLS: This course will help students improve the effectiveness of their thinking skills through:
   a. Developing a basic understanding about direct and indirect solar based power.
   b. Identification of the potential impact of power integration utilizing various energy sources
c. Identification of immediate and future resources for current energy sources

d. Realization of the global potential of various energy sources

3) COMMUNICATIONS SKILLS: This course will help students improve their oral and written communication skills through:
   a. Assigned written papers regarding the history, economics, and potential and environmental impact of various energy sources.
   b. Electronic discussion communications with the class regarding selected course topics

4) HUMAN DIVERSITY: This course will help students recognize, understand, and appreciate human diversity through:
   a. Working with students as a team to accomplish the course project online presentation
   b. Assisting students

TOPICS TO BE COVERED:
   a. Force, energy, and power relationships
   b. Energy conservation: The First Law of Thermodynamics
   c. Conversion and efficiency
   d. Solar Thermal Energy
      a. The nature and availability of solar radiation
      b. Active and passive solar heating
      c. Solar Thermal Engines and Electricity Generation
      d. Economics, Potential and Environmental Impact
   e. Solar Photovoltaics
      a. History
      b. PV in Silicon: Basic Principles
      c. Crystalline PV: Reducing Costs and Raising Efficiency
      d. Thin Film PV
      e. PV Systems for Remote Power
      f. Grid Connected PV Systems
      g. Economics, Potential and Environmental Impact
   f. Bioenergy
      a. Bioenergy Past and Present
      b. Biomass as a Fuel
      c. Bioenergy Sources: Energy Crops and Waste Products
      d. Combustion of Solid Biomass
      e. Production of Gaseous Fuels from Biomass
      f. Production of Liquid Fuels from Biomass
      g. Economics, Potential and Environmental Impact
   g. Hydroelectricity
      a. History
      b. Stored Energy and Available Power
      c. Types of Hydroelectric Plants
      d. The Francis Turbine
      e. Propellers
      f. Impulse Turbines
      g. Small-Scale Hydroelectricity
      h. Economics, Potential and Environmental Impact
h. Tidal Power
   b. Technical Factors
   c. Integration
   d. Economics, Potential and Environmental Impact

i. Wind Energy
   a. History
   b. Wind Turbines
   c. Aerodynamics of Wind Turbines
   d. Power and Energy from Wind Turbines
   e. Economics, Potential and Environmental Impact
   f. Integration
   g. Offshore Wind Energy

j. Wave Energy
   a. Recent History
   b. Physical Principles of Wave Energy
   c. Wave Energy Resources
   d. Wave Energy Technology
   e. Economics, Potential and Environmental Impact
   f. Integration

k. Geothermal Energy
   a. Overview
   b. Physics of Geothermal Resources
   c. Technologies for Geothermal Resource Exploitation
   d. Economics, Potential and Environmental Impact

l. Natural Gas
   a. Overview
   b. History
   c. Technologies
   d. Economics, Potential and Environmental Impact
   e. World Consumption

m. Coal
   a. Overview
   b. History
   c. Technologies
   d. Economics, Potential and Environmental Impact
   e. World Consumption

n. Energy Integration
   a. How Much Renewable Energy is Available?
   b. Are Renewable Energy Supplies Available Where We Want Them?
   c. Are Renewable Energy Supplies Available When We Want Them?
   d. Some Systems Solutions
      i. Grid Strengthening
      ii. Demand Management
      iii. PV, micro-CHP and Emergency Generators
      iv. Hydrogen – the Fuel of the Future?
   e. Balancing Economic Options

o. Career Opportunities/Exploration
LIST OF EXPECTED COURSE OUTCOMES:
   a. Understand the fundamentals and basic principles of operating and maintaining wind, solar, and fossil fuel power generation and distribution facilities
   b. Understand the fundamentals and basic principles of operating and maintaining biofuel plants
   c. Understand the fundamentals and basic principles of operating and maintaining natural gas pipelines
   d. Identify career opportunities/career exploration as they relate to the various energy industries

LEARNING/TEACHING TECHNIQUES used in the course are:
X Collaborative Learning  X Problem Solving
X Student Presentations  X Interactive Lectures
☐ Creative Projects   ☐ Individual Coaching
X Lecture    ☐ Films/Videos/Slides
☐ Demonstrations    ☐ Other (describe below)
☐ Lab

ASSIGNMENTS AND ASSESSMENTS FOR THIS CLASS INCLUDE:
X Reading    X Tests  X Individual Projects
☐ Oral Presentations X Worksheets  X Collaborative Projects
☐ Textbook Problems  X Papers  ☐ Portfolio
X Group Problems  ☐ Term Paper
☐ Other (describe below)

EXPECTED STUDENT LEARNING OUTCOMES:
   1. Students will gain a foundational understanding about sources used to provide energy in today’s society.
   2. Students will be able to identify major components of various energy systems and the technologies associated with them.
   3. Students will understand the economics, potential impact and environmental impact of various energy systems.
   4. Students will gain an understanding of the issues relating to energy integration.

The information in this course outline is subject to revision

Veteran Services: Minnesota West is dedicated to assisting veterans and eligible family members in achieving their educational goals efficiently. Active duty and reserve/guard military members should advise their instructor of all regularly scheduled military appointments and duties that conflict with scheduled course requirements. Instructors will make every effort to work with the student to identify adjusted timelines. If you are a veteran, please contact the Minnesota West Veterans Service Office.

To receive reasonable accommodations for a documented disability, please contact the campus Student Services Advisor or campus Disability Coordinator as arrangements must be made in advance. In addition, students are encouraged to notify their instructor.

This document is available in alternative formats to individuals with disabilities by contacting the Student Services Advisor or by calling 800-658-2330 or Minnesota Relay Service at 800-627-3529 or by using your preferred relay service.

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