MOHAWK VALLEY COMMUNITY COLLEGE

UTICA AND ROME, NEW YORK

COURSE OUTLINE

Introduction to Alternative Energy Cr-3, P3

FM244

CATALOG DESCRIPTION:

### FM246 Introduction to Alternative Energy Cr-3, P3

This course is a comprehensive reference and guide for both professional engineers as well as engineering students interested in energy systems with essential knowledge of major energy technologies, including how they work, how they are quantitatively evaluated, what they cost, and their benefit or impact on the natural environment. Topics covered include fossil fuel combustion, carbon sequestration, nuclear energy, and wind energy. Use of biofuels is also covered..

Student learning outcomes:

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

* Evaluate a number of alternative energy systems
* Contrast Energy Systems for Cost and Environmental Benefit
* Evaluate Efficiencies of Energy Systems
* Analyze Energy Systems for Consumer Production
* Discuss Sustainable Development Plans
* Develop a Life Cycle Cost and Energy Consumption Plan

DETAILED COURSE OUTLINE:

# 1. Introduction

(3 period)

1. Historic Growth in Energy Demand
2. Correlation between Energy Use and Wealth
3. Pressure on CO2 Emissions
4. Industrial versus Emerging Countries

# 2. Systems Tools for Energy Systems (3 period)

1. Energy Conservation versus Alternative Energy Development
2. The Concept of sustainable Development
3. Steps in the Application of the Systems Approach
4. Life Cycle Analysis and the Sustainable Approach

# 3. Economic Tools for Energy Systems (3 period)

1. The Time Value of Money
2. Evaluation Without Discounting
3. Levelized Cost of Energy
4. Methods of Intervention in Energy

# 4. Climate Change and Climate Modeling (3 period)

1. The Greenhouse Effect
2. Carbon Cycle and Solar Radiation
3. Modeling Climate and Climate Change
4. Climate in the Future

# 5. Fossil Fuel Resources (3 period)

1. Characteristics of Fossil Fuels
2. Current Rates of Consumption
3. Decarbonization Theory
4. Hubbert Curves

# 6. Stationary Combustion Systems (3 period)

1. Rankine Vapor Cycle
2. Brayton Gas Cycle
3. Supercritical Cycle
4. Combined Cycle
5. Cogeneration & Combined heat and Power

# 7. Carbon Sequestration (3 period)

1. The Photosynthesis Reaction
2. Indirect Sequestration
3. Geological Storage of CO2
4. Direct Carbon Sequestration

# 8. Nuclear Energy Systems (3 period)

1. Nuclear Reactions and Resources
2. Resource Availability
3. Established Reactor Designs
4. Nuclear Energy and Carbon Emissions

# 9. The Solar Resource (3 period)

1. Direct, Diffuse and Global Insolation
2. Definition of Solar Geometric Terms
3. Effect of Diffusion on Solar Performance
4. Effect of Surface Tilt on Solar Performance

# 10. Solar Voltaic Technologies

(3 period)

1. Fundamentals of PV Performance
2. Losses in PV Cells
3. Unit Costs of PV Panels
4. Design and Application of Practical PV Systems

# 11. Solar Thermal Technologies

(3 period)

1. Flat Plate Collectors
2. Evacuated Tube Collectors
3. Heat Exchangers and Thermal Storages
4. Types of Passive Solar Heating Systems
5. Passive Ventilation

# 12. Wind Energy Systems

(3 period)

1. Components of a Turbine
2. Alternative Turbine Designs: Horizontal versus Vertical
3. Rated Capacity and Capacity Factor
4. Analysis of Turbine Blade Design

# 13 Transportation Energy Systems

(3periods)

1. Petroleum and Carbon Free Transportation
2. Vehicle Performance
3. Battery Vehicles
4. Hybrid Vehicles
5. Biofuels
6. Hydrogen Fuel Cells

# 14 Systems Perspective on Transportation Energy

(4 periods)

1. Passenger Transportation
2. Freight Transportation
3. Modal Shift to More Efficient Modes
4. Units for Measuring Transportation Energy Efficiency