Course: ENPM 654 Energy Systems Management
Semester: Summer, 2015
Days: Tuesdays and Thursdays, from 2 June through 23 July 2015
Time: 6:00-8:40PM
Location: UMCP (JMP 2216) and via DETS to remote sites and online.
Instructor: Dr. B. Valentine.
Phone: (571) 265-6520
Email: bgvalentine@verizon.net

Course Description

(ELMS website)

Prerequisites: A Bachelor’s degree in Mechanical or Chemical Engineering; students with other engineering degrees, please discuss your undergraduate preparation with the instructor. Completion of the course ENME 489N- Special Topics in Mechanical Engineering: Residential and Industrial Energy Audit – is recommended although not required.

Office: 2146 Martin Hall by appointment. Send me an email, arrangements can be made anytime. Students from the remote campuses can call me on the telephone anytime.

Student learning goals: The course is designed to provide the necessary background for the student to assume the role of Energy Manager in a modern industrial or commercial operation. An Energy Audit of a commercial operation provides information about current supply and use of energy in a commercial operation; and the Energy Manager uses that information together with knowledge of various options to develop and execute an Energy Performance plan. Course topics include an overview of Energy Auditing, introduction to Energy Management software that will be used throughout the course, overview of energy use in a commercial setting including sources and prices, analysis of various systems and subsystems used in industrial operations including motors and drives, pumps, compressed air, steam, electrical supply, and control systems. Additional topics including economics, management theory, regulatory policy, and international standards for Energy Management will also be covered.

Course Schedule and Due Dates: See attached schedule.

Expectations for Students: Class attendance is expected. Written assignments will be submitted on line and on time. A course project will be assigned, and this project will involve energy modeling of a UMCP campus building, given seasonal energy loads.

Grading procedures:
Class participation: 5%
Homework assignments: 20%
Midterm Exam (in class): 15%
Final Exam (take-home): 20%
Course Project: 40%
**Textbook**

The textbook will be available in the bookstores and can be downloaded as an e-book from a number of vendors.


**Course Outline**

**Week 1**

**Tue 6/2/15**
Course Overview
- Overview of topics to be covered in the course
- Overview of homework assignments (5 assignments for the course)
- Overview of building energy auditing leading to the course project
- Assignment of course project
- Overview of ION EEM Energy Management software to be used in the course

Introduction to Energy Management
- The role of the Energy Manager in business and industry
- Overview of present Energy Manager responsibilities within a broad cross-section of US industries
- Position of the Energy Manager within a business framework
- Expectations of today’s Energy Managers
- US and International organizations supporting and certifying Energy Managers

*HW #1 Assigned*

**Thur 6/4/15**
Industrial Utilities: Electric Power
- Electricity suppliers
- Transmission and distribution requirements
- Electricity rates: contract, peak loads, purchase agreements, rebates
- Electricity metering
- Electricity billing
- Introduction to electrical power efficiency

Industrial Utilities: Natural Gas
- Sources of natural gas
- Natural gas suppliers and distribution
- Natural gas pricing and billing
- Natural gas efficiency of use

Industrial Utilities: Water
- Overview of water use in various industries
- Regulations for water use
- Water accounting
- Water discharge
- Introduction to water treatment methods

**Week 2**

**Tue 6/9/15**
Industrial energy systems: Power consumption and efficiency
- Turbines
- Boilers
- Heat exchangers: air
- Heat exchangers: liquid
- Motors and drives
- Pumps
- Chillers
- Cooling towers

*HW #2 Assigned*

**Thur 6/11/15**
Industrial energy systems: System efficiency analysis
- Combustion
- Steam and condensate
- Compressed air

*HW #1 Due*

**Week 3**

**Tue 6/16/15**
Industrial and commercial buildings: Design for efficiency
- Analysis of the building envelope
- HVAC and its analysis

*HW #3 Assigned*

**Thur 6/18/15**
Industrial and commercial buildings: Design for efficiency
- The building electrical system and load requirements
  - Lighting analysis
    - Codes and standards
    - Optimal day lighting
    - Retrofit to new lighting technologies
  - Building insulation
  - Indoor air quality

*HW #2 Due*
**Week 4**

Tue 6/23/15
Energy management control systems
- Overview of measurement and controls
- Measurements: Temperature, humidity, air quality
- Network architectures: Wireless
- Network architectures: Electrical
- Control hardware
- Control software
- Control strategies
- Control commissioning
- Strategies for control system modernization

*HW #4 assigned*

*Interim project report due*

Thur 6/25/15

**Mid-term test: 1 hour**
Thermal energy management
- Waste heat recovery overview
- Technologies for waste heat recovery
- Recovery efficiency
- Thermal energy storage
- Seasonal variation
- Economic analysis

Overview of Industrial Waste Management

*HW #3 due*

**Week 5**

Tue 6/30/15
Economic analysis: General considerations
- The time value of money
- Methods to evaluate returns on investments
- Selecting the best investments for efficiency improvements
- Introduction to the analysis and use of financial statements
- Taxes and their management

Thur 7/2/15
Management considerations
- Evaluating effective energy management
- General reporting requirements
- Contracting for technical needs
- Proactive and preventative maintenance
- Energy Manager’s role in meeting regulatory requirements

*HW #4 due*
Week 6

Tue 7/7/15
Distributed energy generation
- Cogeneration systems: Fuel cells, micro turbines, others
- Renewable energy systems: Selecting the proper system
- Integration of distributed generation with purchased utility energy
- The effects of electric utility deregulation
- Industrial case studies

HW #5 assigned

Thur 7/9/15
Achieving the highest Energy Management standards
- LEED and green buildings
- US building ratings
- International building performance ratings
- Costs to achieve the ratings
- Case studies

Week 7

Tue 7/14/15
- DOE certified software for pump, motor, steam, compressed air systems
- Other US system software
- Other International software
- Requirements for certification of applied use in industrial energy management

Thur 7/16/15
Energy Management in specialized industries
- Hazardous materials industries
- Semiconductor and electronics component industries
- Waste management industries
- Special fabrication industries
- Pharmaceutical and medical product industries
- Defence and aerospace contracting industries
- Case studies

HW #5 due

Week 8

Tue 7/21/15
Summary: The road to achievement of Energy Management standards
- Case studies of ISO 50001 implementation
- Case studies of business sustainability implementing energy management standards

Begin project presentations: All groups
Thur 7/23/15

*Project Presentations Continued.*
*Completed Project Reports Due*
*Final Exam Assigned*

**Final exam to be returned by 4 PM Monday, July 27, 2015**

**Code of Academic Integrity**

The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity of the Student Honor Council, please visit http://shc.umd.edu/SHC/HonorPledgeInformation.aspx.