ADVANCED ENERGY AND FUELS MANAGEMENT

GRADUATE SCHOOL, COLLEGES OF AGRICULTURAL SCIENCES, BUSINESS, ENGINEERING, LIBERAL ARTS, AND SCIENCE

Advanced Energy and Fuels Management Faculty

Please see departmental web pages for detailed information on the research activities of individual faculty members. Please see also departmental entries in this catalog.

Achenbach, Laurie, Microbiology
Altman, Ira, Agribusiness Economics
Anderson, Kenneth, Geology
Daneshdoost, Morteza, Electrical and Computer Engineering
DeRuntz, Bruce, Engineering Technology
Eberle, Phillip, Agribusiness Economics
Haddock, John, Microbiology
Kraft, Steven, Agribusiness Economics
Lant, Christopher, Geography and Environmental Resources
Lightfoot, David, Plant, Soil, and Agricultural Systems
Marzolf, John, Geology
Mathias, James, Mechanical Engineering and Energy Processes
Michalisin, Michael, Management
Mondal, Kanchan, Mechanical Engineering and Energy Processes
Pearson, John, Management
Secchi, Sylvia, Agribusiness Economics
Wiltowski, Tomasz, Mechanical Engineering and Energy Processes

The Professional Science Masters in Advanced Energy and Fuels Management (PSM) is a 36-hour post-graduate degree that combines graduate level technical training in energy resources and technology with business skill development programs. This intensive program is designed to prepare graduates for leadership positions in the energy industry. The program includes nine (9) business-related credit hours, twelve (12) science/technology-related credit hours, three (3) credit hours of energy policy studies, six (6) credit hours of graduate level electives, and a six (6) hour capstone internship completed with an industrial partner.

Program Description

Societal and economic pressure to reduce reliance on imported resources and diversify energy supply options has resulted in the emergence of new industries and diversification of existing industries in the energy sector. The rapid growth of these industries has created a strong demand for personnel trained in both technical aspects of the energy industry and also in business, to take management and leadership roles. The overarching academic objective of the Professional Science Master's (PSM) in Advanced Energy and Fuels Management is to satisfy this need by proving high quality professional training that ensures that graduates have acquired the diverse skill set sought and demanded by industry.

The proposed course of study is designed to achieve this objective by providing core technical training covering energy resources, energy production technology and energy policy issues, coupled with business training in project and personnel management, business leadership skills and fiscal management. In addition to these core requirements, students participating in this program will have the opportunity to take six (6) credit hours of science/technology electives to allow them to gain additional specialized graduate level training related to their own specific interests and career goals.

The proposed program consists of a 36-hour program of study, structured in accord with the PSM model originally developed by the Sloan Foundation. The program is designed to be completed in one academic year (based on full time study), with additional course work to be completed in the preceding summer semester and the capstone internship to be completed in the final summer semester. This intensive program is designed to minimize the time students would need to be away from full-time employment while maintaining academic rigor.

This program includes business, science/technology and policy elements, broken down as follows and is designed to provide the diverse skill set demanded by industry.

- 9 Business-related credit hours
- 12 Science/technology-related credit hours
- 3 Credit hours of energy policy studies
- 6 Credit hours of electives
- A capstone 6 credit hour internship in industry completed over the summer semester following completion of other requirements
The program is composed of the following existing and proposed courses. All specified courses are required (core) curriculum elements. A preliminary list of science/technology electives is included, but this list is not all inclusive. Several academic units indicated their intention to develop courses that would be suitable as science electives for participants in this program. In addition, courses outside the sciences have included in this list for students who may wish to take additional supplemental coursework.

Summer Semester (6 Hours)
GEOL 588-3 Global Energy Resources
BA 540-3 Managerial & Organizational Behavior

Fall Semester (12 hours)
PSAS 433-3 Introduction to Agricultural Biotechnology
Or MBMB 421-3 Biotechnology
ABE 442-3 Energy Economics & Policy
BA 510-3 Managerial Accounting & Control Concepts
Elective (3 hrs.)

Spring Semester (12 hours)
BA 5xx New Course; TBD Project Management (3hrs.)
ME 568 Alternative Fuel & Energy (3 hrs.)
GEOL 420-3 Petroleum Geology or
GEOL 421-3 Organic Geochemistry
Elective (3hrs)

Summer Session (6 hours)
Internship (6 hrs.) This internship will require the student to complete a specified project for the employer supporting the internship, the nature of which will be approved by PSM faculty in consultation with the employer prior to the initiation of the project. A project report, including both written and oral

CORE COURSES:

ABE 442, Energy Economics & Policy
Economic principles and methods are used to examine economic and policy issues relevant to energy production and use. Topics include: key aspects of energy supply, demand, markets, and regulation; environmental externalities of fuel production and use; the relationships among energy use, economic growth and the environment; alternative energy sources.

BA 510, Managerial Accounting & Control Concepts
Basic cost concepts, measures, methods and systems of internal accounting useful for managerial planning, implementation, control and performance evaluation. Includes cost analysis relevant for non-routine decision-making. Prerequisite: enrollment in College of Business and Administration graduate program or consent of department, 410 and M.B.A. program “computer ability” foundation requirement met, or equivalent.

BA 540, Managerial & Organizational Behavior
Case analysis of human problems in the business organization. Application of findings of behavioral science research to organization problems. Development of direction and leadership skills. Prerequisite: enrollment in College of Business and Administration graduate program or consent of department, 440 or equivalent.

BA 5xx, Project Management (TBD)
Projects and project teams characterize today’s workplace and the project manager is considered the linchpin. This course provides exposure to project management related knowledge, tools, techniques, and skills while focusing on effective project planning and management. Relevant cases and software will be part of the pedagogy in delivering this course.

GEOL 420, Petroleum Geology
The geological occurrences of petroleum including origin, migration and accumulation; a survey of exploration
methods, and production problems and techniques. Laboratory study applies geological knowledge to the search for and production of petroleum and natural gas. Prerequisite: 221, 224.

**GEOL 421, Organic Geochemistry**
The nature, origin and fate of natural and artificial organic materials in rocks and sediments. Topics include characterization of fossil fuels using biological marker compounds, petroleum source rock evaluation, and organic pollutants in the environment. Prerequisite: 325 or consent of instructor.

**GEOL 588-3 Global Energy Resources.**
Ready access to energy is essential to sustaining modern societies. This course will discuss the nature of the resources that have been, are, or potentially could be used to provide energy in the US and around the globe, including fossil fuels, nuclear energy resources, bioenergy resources and emerging energy resources such as geothermal, wind, tidal, and solar energy.

**MBMB 421, Biotechnology**
(Same as Microbiology 421.) Topics covered will include the genetic basis of the revolution in biotechnology, medical applications including genetic screening and therapeutic agents, industrial biotechnology and fermentation, and agricultural applications. Three hours lecture. Prerequisite: Microbiology 302, or consent of instructor.

**ME 568, Alternative Fuel & Energy**
The course covers the alternatives for energy resources and the impact of the human growth on the energy usage and its environmental consequences. The course describes the fossil fuel era, renewable energy resources, and hydrogen fuel era. The fundamentals of each of these fuel types, their conversion to usable energy and the potential of each of these fuels for the future are discussed. Prerequisite: ENG 300 and ME 410, or instructor's consent.

**PSAS 433, Introduction to Agricultural Biotechnology**
(Same as Animal Science 433 and Plant and Soil Science 433.) This course will cover the basic principles of plant and animal biotechnology using current examples; gene mapping in breeding, transgenic approaches to improve crop plants and transgenic approaches to improve animals will be considered. Technology transfer from laboratory to marketplace will be considered. An understanding of gene mapping, cloning, transfer and expression will be derived. Prerequisite: restricted to departmental approval.

**ELECTIVES:**

**ABE 440 Natural & Environmental Resource Economics & Policy**
Student will study the application of socioeconomic principles to problems related to natural and environmental resources. The course covers the policy context within which policies related to natural and environmental resources are developed and implemented as well as the range of policy tools available for addressing environmental/natural resource problems. The institutional setting for dealing with natural and environmental resources is presented along with the role of property rights and entitlements. Contemporary resource problems are used as examples.

**ABE 453, Agribusiness Planning Techniques**
Application of mathematical programming to agribusiness and farm planning, including enterprise selection, resource allocation, least cost ration formulation, decision making under risk and uncertainty, transportation and location problems. Emphasis placed on modeling problems and interpretation of results.

**BA 503, Management of Change**
The methods and processes of planned change are examined. Special emphasis is placed on the design and implementation of continuous improvement systems and related issues of managing constant change. Change models are viewed in the context of international competitiveness and a dynamic global environment. Prerequisite: enrollment in the College of Business and Administration or consent of department.

**BA 530, Financial Management**
Provide a broad overview of basic concepts, principles, and recent innovations in financial management. Topics covered will include risk and return, valuation, capital budgeting, capital structure and cost of capital, dividend policy, financial planning, international financial management and corporate restructuring. Prerequisite: enrollment in the College of Business and Administration graduate program or consent of the department, 510 and economics foundation requirement, Finance 330 with a grade of C or better.

**BA 550, Marketing Management**
A managerial approach to the study of marketing. Emphasis is on the nature and scope of the marketing manager’s responsibilities and on marketing decision-making. Prerequisite: enrollment in the College of Business and Administration or consent of the department.

**ERP 501, Economic Systems & Environmental Change**
Investigation of the social forces driving natural resource use and environmental change, including population growth, the globalization and migration of economic activity, changing land use patterns, and economic and technological trends in the major resource use sections; energy, agriculture, water, and forestry. Principles of environmental impact assessment, ecological footprint analysis and industrial ecology are introduced. The challenge of sustainable development sets the stage for an analysis of the future adequacy of the natural resources based on which societies and economics depend. Prerequisite: 500

**ERP 502, Environmental Decision Making**
Analytical concepts relevant for environmental professional will be taught and demonstrated through case studies. Topics to be covered include risk assessment and risk
management formulation of environmental impact statements, cost effectiveness and cost benefit analysis, and methods of conflict resolution. The role of economic incentives in encouraging conservation, the role of multiple institutional players environmental decision-making at various geographic scales (local, state, international, global), and the use of the Internet as a source of environmental information will be emphasized.

**ME 408, Energy Conversion Systems**
Principles of advanced energy conversion systems, nuclear power plants, combined cycles, magnetohydrodynamics, cogeneration (electricity and process steam) and heat pumps. Constraints on design and use of energy conversion systems; energy resources, environmental effects and economics. Prerequisite: 301 or 400.

**ME 435, Design of Mass Transfer Processes**
Design principles of mass transfer processes. The rate mechanism of molecular, convective and interphase mass diffusion. The design of selected industrial mass transport process operations such as absorption, humidification, water cooling, drying and distillation. Prerequisite: 302.

**ME 446-3 Energy Management.**
Fundamentals and various levels of analysis for energy management of commercial buildings and industrial processes and buildings. Use of energy management systems and economic evaluations are required in course projects. Prerequisite: 302.

**ME 5xx, Catalysis in Energy Processes**
The course will provide a broad introduction to scientific and engineering concepts associated with heterogeneous catalysis and its application in modern energy processes. Topics covered in the course will include introduction to heterogeneous catalysis, steam reforming processes, synthesis gas production and reaction, water gas shift reaction, hydrogen production and storage, methanol and ethanol production, hydrogen fuel cells, and Fischer Tropsch synthesis. Prerequisite: Senior standing or consent of instructor.

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**Advanced Energy and Fuels Management Courses (AEFM)**

**AEFM 585-6 Internship in Advanced Energy & Fuels Management**
Supervised work experience with a public or private agency or firm through which students acquire practical, professional training to complement their course work in effective analysis, synthesis and management of energy processes and fuels as well as in efficiency relating to clean fuel technologies and energy policies relevant to the energy sector. Restricted to enrollment in AEFM. Graded S/U only.

**AEFM 601-1 (per semester) Continuing Enrollment**
For those graduate students who have not finished their degree programs and who are in the process of working on and completing their internship reports. The student must have completed a minimum of 30 hours of course work before being eligible to register for this course. Concurrent enrollment in any other course is not permitted. Graded S/U or DEF only.