

**ENGINEERING MANAGEMENT  
INTERDISCIPLINARY BACCALAUREATE PROGRAM**

The program leads to the degree, Bachelor of Science in Applied Science, with a major in Engineering Management

**SCHOOL OF ENGINEERING & APPLIED SCIENCE  
MIAMI UNIVERSITY**

**2005-06**

For the Paper Science and Environmental Engineering technical specialties, contact the Department of Paper & Chemical Engineering, 229 Gaskill Hall (513-529-2200) or visit our web page <http://www.eas.muohio.edu/pse>.

Many of today's highly competitive global businesses involve technology and require people that have a solid technical background coupled with business and liberal education. Engineering management offers an interdisciplinary approach to address complexities in today's workplace. This program provides a broad academic background, including engineering, business, science, mathematics, and the liberal arts.

Industry recognizes the importance of an interdisciplinary education for management and sales in businesses involved with sophisticated technology. Through the engineering management program you will have both the business and technical background to manage and understand technical aspects of industry. You will develop the engineering and business expertise, social awareness, and cultural perspective necessary to address technological problems in their larger organizational and societal contexts. You will have the opportunity to enhance your interpersonal skills both inside and outside the classroom.

The engineering management curriculum consists of an engineering and business core complemented by a concentration in one of the following technical specialties: Environmental Engineering, Manufacturing Engineering, or Paper Science & Engineering. The environmental engineering technical specialty concentrates on understanding biological engineering and economic solutions to pollution problems and pollution prevention. The manufacturing engineering technical specialty is based on a combination of traditional electrical and mechanical engineering with an emphasis on manufacturing a high quality, cost-competitive product. The paper science and engineering technical specialty emphasizes chemistry, chemical engineering, and paper engineering.

Opportunities are available to obtain valuable work experience and financial assistance through participation in the co-op or internship programs. This professional experience before graduation makes students more valuable to prospective employers. The co-op program, which takes five years to complete, and internship program are optional programs for all technical specialties. Students may also choose to work with their professors on research projects (REU – Research Experience for Undergraduates). This program provides for financial assistance to conduct research.

As a graduate you will be qualified to fill entry level positions that require high levels of interaction with the business functions of operations, purchasing and procurement, personnel, accounting or marketing. Examples of such positions include technical sales and service, production line supervision, quality control, and environmental protection with responsibility for pollution abatement and regulatory implementation programs.

**ENGINEERING MANAGEMENT CURRICULUM**  
**Paper Science & Environment Science Specialties**  
**2005-2006**

**English (9 hours) 6%**

ENG 111 College Composition  
 ENG 112 Composition and Literature  
 ENG 313 Intro to Technical Writing

**Mathematics/Statistics & Computer Science 11% (16 hours)**

MTH 151 Calculus I  
 MTH 251 Calculus II  
 MTH 245 Differential Equations for Engineers  
 STA 368 Introduction to Statistics

**Fine Arts, Humanities, & Social Science (12 hours) 8%**

ECO 201 Principles of Microeconomics\*  
 ECO 202 Principles of Macroeconomics\*  
 Miami Plan Fine Arts Elective  
 COM 135 Public Express/Critical Inquiry  
 (COM 136 or 231 may be substituted for COM 135 for the major but they do not fulfill the humanities requirement.)

**U.S. and World Cultures (6 hours) 4%**

Miami Plan World Cultures Elective  
 Miami Plan U.S. Cultures Elective

**Natural Science (25 hours) 17%**

CHM 141,144 College Chemistry and Lab  
 CHM 142,145 College Chemistry II  
 CHM 231 Fundamentals of Organic Chemistry  
 PHY 181, 182 The Physical World  
 Miami Plan Biological Science Elective

**Thematic Sequence (9 hours) 6%**

Liberal Education sequence outside your major, focused around a theme.

**Remaining Business Core Courses\* (18 hours) 13%**

ACC 222 Introduction to Managerial Accounting  
 MGT 291 Organizational Behavior and Theory  
 MGT 302 Operations Management  
 MKT 291 Principles of Marketing  
 MGT Tracks (select one track):  
 Materials Management Track  
 MKT 431 Logistics Management  
 MGT 432 Purchasing and Materials Management  
 Operations Management Track  
 MGT 451 Operations Planning & Scheduling  
 MGT 453 Productivity Improvement  
 Purchasing/Procurement Track  
 MGT 432 Purchasing & Materials Management  
 MGT 433 Adv Topics in Purchasing/Materials Mgt  
 Human Resources Track  
 MGT 303 Human Resources Management  
 MGT 405 Management-Union Relations Entrepreneurship Track  
 BUS 408 Entrepreneurship for Engineers & Scientists  
 MKT 481 Product Planning & Strategy

\*ECO 201,202 under Social Science are also Business Core

**Engineering Science Courses (22 hours) 15%**

EAS 101 Computing, Engineering & Society  
 EAS 102 Problem Solving & Design  
 PSE 204 Material and Energy Balances Engineering or EAS  
 PSE 219 Static and Mechanics of Materials  
 MME/PSE 314 Engineering Thermodynamics  
 MME/PSE 341 Engineering Economics  
 MME/PSE 313 Fluid Mechanics

**Integrative Core Courses (6 hours) 5%**

EGM/MGT 311 Project Management  
 Engineering Design Capstone Courses  
 PSE requires PSE 411  
 ENV requires PSE 471, 472

**Engineering Specialty Courses (20-21 hours) 15% (Choose one Technical Specialty area)**

Paper Science & Engineering: 21 hours

PSE 201 Principles of Paper Science & Engineering  
 PSE 202 Pulp, Paper and Products  
 PSE 301 Pulping  
 PSE 311 Unit Operations Laboratory I  
 PSE 404 Papermaking  
 PSE 482 Process Control

Choose two of the following four courses:

PSE 403 Heat Transfer  
 PSE 405 Industrial Environmental Control  
 PSE 415 Chemical Kinetics & Reactor Design  
 PSE 425 Surface & Colloid Science of Papermaking  
 PSE 461 Coating Technology

Environmental Engineering: 20 hours

PSE 244 Intro to Environmental Engineering  
 PSE 311 Unit Operations Lab I  
 PSE 405 Industrial Environmental Control  
 PSE 415 Chemical Kinetics & Reactor Design  
 PSE 441 Pollution Prevention in Environmental Mgt  
 PSE 442 Air Pollution Control  
 PSE 4xx Solid and Hazardous Waste Management

**SAMPLE CURRICULUM  
ENGINEERING MANAGEMENT  
PAPER SCIENCE TECHNICAL SPECIALTY  
2005-06**

**Please consult your adviser before scheduling classes. Actual course offerings may vary.**

**First Year**

First Semester

CHM 141 College Chemistry (MPF IVB)	3
CHM 144 College Chemistry Laboratory (MPF IVB)	2
ENG 111 College Composition (MPF I)	3
MTH 151 Calculus I or 153 Calculus I (MPF V)	5
EAS 101 Computing, Engineering & Society	1
Miami Plan Biological Science (MPF IVA)	<u>3</u>
	17

Second Semester

CHM 142 College Chemistry	3
CHM 145 College Chemistry Laboratory	2
ENG 112 Composition and Literature (MPF I)	3
MTH 251 Calculus II	4
EAS 102 Problem Solving & Design	3
ECO 201 Principles of Microeconomics (MPF IIC)	<u>3</u>
	18

**Second Year**

First Semester

PSE 201 Principles of Paper Science & Engineering	2
PSE 219 Statics and Mechanics of Materials	3
CHM 231 Organic Chemistry and Lab	4
MTH 245 Differential Equations/Engineers	3
PHY 181.P The Physical World (MPF IVB)	<u>4</u>
	16

Second Semester

PSE 202 Pulp, Paper and Products	2
PSE 204 Materials and Energy Balances	3
ENG 313 Introduction to Technical Writing	3
MME/PSE 313 Fluid Mechanics	3
MME/PSE 314 Engineering Thermodynamics	3
PHY 182.P The Physical World (MPF IVB)	<u>4</u>
	18

**Third Year**

First Semester

ECO 202 Prin of Macroeconomics (MPF IIC)	3
PSE 301 Pulping	3
PSE 311 Unit Operations Lab I	2
MKT 291 Principles of Marketing	3
MGT 302 Operations Management	3
STA 368 Introduction to Statistics	<u>4</u>
	18

Second Semester

MME/PSE 341 Engineering Economics	3
Miami Plan Fine Arts Course (MPF IIA)	3
Miami Plan US (MPF IIIA)	3
ACC 222 Intro to Managerial Accounting	3
MGT 291 Organ Behavior and Theory	3
Engineering Electives (PSE)	<u>3</u>
	18

**Fourth Year**

First Semester

Engineering Elective (PSE)	3
PSE 404 Papermaking	3
Miami Plan Thematic Sequence	3
EGM/MGT 311 Project Management	3
Management Track Course	<u>3</u>
	15

Second Semester

COM 135 Public Express/Critical Inq (MPF IIB)	3
Management Track Course	3
Miami Plan World Cultures Course (MPF IIIB)+	3
PSE 411 Advanced Paper Manufacturing (MPC)	3
PSE 482 Process Control	3
Engineering or EAS (TBA) *	<u>3</u>
	18

**\* PSE Courses** (select two)

- PSE 403 Heat Transfer
- PSE 405 Industrial Environmental Control
- PSE 425 Surface & Colloid Science of Papermaking
- PSE 461 Coating Technology

The Miami Plan for Liberal Education Foundation (MPF) requirement includes 6 hours of English Composition (ENG 111-112 fulfills this requirement); 12 hours in Fine Arts, Humanities, and Social Science with a minimum of 3 hours in each (COM 135 fulfills 3 hours of the humanities requirement; ECO 201, 202 fulfills 6 hours of the social science requirement); 6 hours in U.S. and World Cultures; 9 hours of Natural Science, including one laboratory course with a minimum of 3 hours in Biological Science and 3 hours in Physical Science (PHY 181-182 and CHM 141, 142, 144, 145 more than fulfill the Physical Science requirement); 3 hours of Mathematics, Formal Reasoning or Technology (MTH 151 fulfill this requirement). **At least one of these foundation courses must provide a historical perspective (H).** The actual order in which you take these courses is up to you. The outline above is just one sample of how the courses might be arranged. You must also complete 12 hours of Focus: Advanced Liberal Learning courses, including 9 hours in an approved Thematic Sequence (MPT) and a 3 hour Senior Capstone Experience (MPC) (PSE 411 fulfills this capstone requirement).

This sample curriculum lists 6 hours of the 9-hour thematic sequence requirement. It is assumed that the first 3 hours are utilized as a Miami Plan foundation requirement. Selection of some thematic sequences may reduce overall number of hours required from that shown above. Minimum of 128 hours is required for degree completion.

\*The suggested curriculum is in transition and under development

**ENGINEERING MANAGEMENT**  
**PAPER SCIENCE TECHNICAL SPECIALTY COURSE DESCRIPTIONS**  
**SCHOOL OF ENGINEERING & APPLIED SCIENCE - MIAMI UNIVERSITY**  
**2005-06**

**EAS 101 COMPUTING, ENGINEERING & SOCIETY** Introduces computing and engineering professions and their role in society. Explores different engineering and computing disciplines, examines ethical and societal issues related to the disciplines and their impact on the world. An active forum for discussion of ideas and issues.

**EAS 102 PROBLEM SOLVING AND DESIGN** This course introduces an approach to problem solving for computing and engineering students. The students will learn systematic approaches to problem solving. Topics covered include: problem identification, analyzing requirements, research existing and alternative solutions, analyzing solutions quantitatively, synthesizing and evaluating data, prototyping, and testing. Students will also develop their oral and written skills for technical communications. Co-requisite: EAS 101, MTH 151.

**EGM 311 PROJECT MANAGEMENT** Focuses on the fundamental aspects of managing complex projects, the central role of project management in organizations, the project life cycle and techniques for project planning, scheduling and controlling using situations from technical disciplines. Cross-listed with MGT 311. Prerequisite: STA 368, DSC 205 or equivalent.

**PSE 201 PRINCIPLES OF PAPER SCIENCE AND ENGINEERING** Introduction to the pulping and papermaking. Carry out experiments in paper science. Apply engineering skills to problem solving related to paper and allied industries. Prerequisite: EAS 101, 102 or instructor approval.

**PSE 202 PULP, PAPER, AND PRODUCTS** Discovery of how pulping, papermaking, and converting are utilized to develop the required performance properties of products from paper. Conduct laboratory investigations to determine properties of paper, conduct a paper machine run, and carry out a handsheet study. Prerequisite: PSE 201, or instructor approval.

**PSE 204 MATERIAL AND ENERGY BALANCES** Techniques used to calculate material and energy balances with special emphasis on paper industry applications. Prerequisite: grade of "C-" or better in CHM 141,142 and MTH 151,251. Co-requisite: PHY 181.

**PSE 219 STATICS AND MECHANICS OF MATERIALS** This course provides an introduction to the fundamentals of the mechanics of materials for engineering students in Electrical, Chemical, and Paper Engineering. The course stresses statics, mechanics of deformable media, and material behavior. Elements of dynamics, elasticity, and viscoelasticity will be covered. The central theme of the course that binds these subjects together is proper problem formulation in terms of kinematics, constitutive behavior, equilibrium, and compatibility. Prerequisites: PHY 181, EAS 102

**PSE 301 PULPING** Detailed discussion of mechanical and chemical pulping processes and chemical and engineering principles involved. Prerequisite: A grade of C- or better in CHM 231 or CHM 251.

**PSE 311 UNIT OPERATIONS LABORATORY I** Laboratory course; students conduct experiments and do computer simulations in the areas of material and energy balances and fluid dynamics. Emphasizes acquisition of knowledge about instrumentation commonly used in paper industry. Both oral and written laboratory reports required. Prerequisites: STA 368, and a grade of "C-" or better in PSE 204. Pre-requisite: PSE/MME 313.

**313 FLUID MECHANICS** Fundamentals and application of the mechanics of fluids including properties, statics and dynamics of fluids, dimensional analysis and similitude, steady state flow, and topics in compressible flow. Prerequisites: C- or better in MTH 251, PHY 181, and either MME 211 or PSE 219, or permission of instructor. Cross-listed with MME 313.

**PSE 314 ENGINEERING THERMODYNAMICS** Study of the fundamental principles of thermodynamics. Emphasis placed on engineering applications such as power cycles, refrigeration, and heat transfer systems. Prerequisite: MTH 251, PHY 181. Cross-listed with MME 314

**PSE 341 ENGINEERING ECONOMICS** Engineering economics decisions; break-even and minimum cost analysis; engineering methods of resource allocation; concepts of interest; time evaluations of tactical and strategic alternatives. Prerequisite: ECO 201, MTH 151. Corequisite: STA 368. Cross-listed with MME 341.

**PSE 403/503 HEAT TRANSFER** Continued study of unit operations with emphasis on heat transfer. Study of steady and unsteady conduction, and laminar, turbulent, boiling, and condensing convective heat transfer. Radiation heat transfer, heat exchangers, evaporators, and transfer units. Prerequisites: grade of C- or better in PSE/MME 313, MTH 245, PSE/MME 314.

**PSE 404 PAPERMAKING** Papermaking processes with emphasis on chemical engineering principles involved. Prerequisite: grade of "C-" or better in PSE 313 and credit for PSE 202 and PSE 311. Co-requisite: PSE/MME 341.

**PSE 405/505 INDUSTRIAL ENVIRONMENTAL CONTROL** Survey of environmental issues facing pulp and paper industry and how the industry addresses these issues. In-plant pollution abatement alternatives discussed as well as external treatment. Computer-based modeling applications introduced and applied to problems. Design considerations involved in selecting among alternative pollution control strategies are presented and applied to examples. Prerequisite: PSE 311.

**PSE 411 ADVANCED PAPER MANUFACTURING** Provides students with the opportunity to synthesize their accumulated knowledge and skills in paper science, paper engineering, economics, statistical methods, environmental technology, writing, and teamwork fundamentals. Student teams determine the raw materials and processing conditions required to produce paper that matches a sample of "unknown paper". They develop strategies for monitoring and improving team effectiveness continuously. They carry out the engineering, environmental impact, and economic analyses required for a major paper mill capital project. And, they learn how to apply high ethical standards to such projects. Prerequisite: senior standing in paper science and engineering or engineering management, or by permission of the instructor.

**415/515 CHEMICAL KINETICS & REACTOR DESIGN** Chemical Kinetics of homogeneous and heterogeneous reactions, kinetic theories, mechanism and modeling, reactor design, design of multiple reactions; temperature and pressure effects. Non-ideal reactors, survey of catalytic and biochemical reaction systems. Prerequisites: PSE 204, 313, 314, MTH 245.

**PSE 425/525 SURFACE AND COLLOID SCIENCE OF PAPERMAKING** Covers basis concepts associated with papermaking process and properties of paper. Includes descriptions of basic colloid properties of fibers, fines, and other papermaking materials. Prerequisite: grade of "C-" or better in CHM 231.

**PSE 461/561 COATING TECHNOLOGY** Methods used in coating paper and properties of coating formulation. Prerequisite: PSE 202, PSE/MME 313.

**482/582 PROCESS CONTROL** Study of system dynamics and control schemes used for continuous processes. Block diagrams, steady-state and dynamic response, Laplace transforms, computer simulations and closed loop control. Stability, tuning, and controller synthesis. Prerequisite: PSE 312 and grade of C- or better in PSE/MME 313, 314 and MTH 245.

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ENGINEERING MANAGEMENT  
ENVIRONMENTAL ENGINEERING TECHNICAL SPECIALTY\*  
2005-06**

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**Freshman Year**

First Semester

CHM 141 College Chemistry (MPF IVB)	3
CHM 144 College Chemistry Laboratory (MPF IVB)	2
ENG 111 College Composition (MPF I)	3
MTH 151 Calculus I or 153 Calculus I (MPF V)	5
EAS 101 Computing, Engineering & Society	1
Miami Plan Biological Science (MPF IVA)	<u>3</u>
	17

Second Semester

CHM 142 College Chemistry	3
CHM 145 College Chemistry Laboratory	2
ENG 112 Composition and Literature (MPF I)	3
MTH 251 Calculus II	4
EAS 102 Problem Solving & Design	3
ECO 201 Principles of Microeconomics (MPF IIC)	<u>3</u>
	18

**Sophomore Year**

First Semester

CHM 231 Organic Chemistry and Lab	4
PSE 219 Statics and Mechanics of Materials	3
PSE 244 Introduction to Environmental Engineering	3
MTH 245 Differential Equations for Engineers	3
PHY 181.P The Physical World (MPF IVB)	<u>4</u>
	17

Second Semester

ENG 313 Intro to Technical Writing	3
PSE 204 Material & Energy Balances	3
MME/PSE 313 Fluid Mechanics	3
MME/PSE 314 Engineering Thermodynamics	3
PHY 182.P The Physical World (MPF IVB)	<u>4</u>
	16

**Junior Year**

First Semester

MKT 291 Principles of Marketing	3
MME/PSE 341 Engineering Economics	3
STA 368 Introduction to Statistics	4
MGT 302 Operations Management	3
Miami Plan Fine Arts Course (MPF IIA)	3
PSE 311 Unit Operations Laboratory I	<u>2</u>
	18

Second Semester

ECO 202 Principles of Macroeconomics (MPF IIC)	3
COM 135 Public Express/Critical Inquiry (MPF IIB)	3
MGT 291 Organizational Behavior and Theory	3
PSE 415 Chemical Kinetics and Reactor Design	3
PSE 441 Pollution Prevention in Environ Mgt	3
PSE 442 Solid & Hazardous Waste Management*	<u>3</u>
	18

**Senior Year**

First Semester

ACC 222 Introduction to Managerial Accounting	3
Miami Plan U.S. Cultures Course (MPF IIIA)	3
PSE 405 Industrial Environmental Control	3
PSE 471 Engineering Design I (MPC)	1
EGM/MGT 311 Project Management	3
Miami Plan Thematic	<u>3</u>
	16

Second Semester

Management Track Course	3
Management Track Course	3
PSE 472 Engineering Design II (MPC)	2
PSE 442 Air Pollution Control	3
Miami Plan World Cultures Course (MPF IIIB)+	3
Engineering or EAS (TBA)*	<u>3</u>
	17

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**EGM 311 PROJECT MANAGEMENT** Focuses on the fundamental aspects of managing complex projects, the central role of project management in organizations, the project life cycle and techniques for project planning, scheduling and controlling using situations from technical disciplines. Cross-listed with MGT 311. Prerequisite: STA 368, DSC 205 or equivalent.

**PSE 204 MATERIAL AND ENERGY BALANCES** Techniques used to calculate material and energy balances with special emphasis on paper industry applications. Prerequisite: grade of "C-" or better in CHM 141,142 and MTH 151, 251. Co-requisite: PHY 181.

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**PSE 244 INTRODUCTION TO ENVIRONMENTAL ENGINEERING** This course introduces concepts of environmental engineering, including quantitative problem solving, mass balances, professional ethics, solid and hazardous waste, water supply and treatment, and air pollution and control. It includes lectures by guest speakers, field trips, and seminars each Friday. In addition, team design projects will be assigned to expose students to engineering design as applied to environmental pollution control. Prerequisites: CHM 137 or 141 and MTH 151.

**PSE 311 UNIT OPERATIONS LABORATORY I** Laboratory course; students conduct experiments and do computer simulations in the areas of material and energy balances and fluid dynamics. Emphasizes acquisition of knowledge about instrumentation commonly used in paper industry. Both oral and written laboratory reports required. Prerequisite: STA 368, and a "C-" or better in PSE 204 PSE/MME 313.

**313 FLUID MECHANICS** Fundamentals and application of the mechanics of fluids including properties, statics and dynamics of fluids, dimensional analysis and similitude, steady state flow, and topics in compressible flow. Prerequisites: C- or better in MTH 251, PHY 181, and either MME 211 or PSE 219, or permission of instructor. Cross listed with MME 313.

**PSE 314 ENGINEERING THERMODYNAMICS** Study of the fundamental principles of thermodynamics. Emphasis placed on engineering applications such as power cycles, refrigeration and heat transfer systems. Prerequisites: MTH 251, PHY 181. Cross-listed with MME 314.

**PSE 341 ENGINEERING ECONOMICS** Engineering economic decisions; break-even and minimum cost analysis; engineering methods of resource allocation; concepts of interest; time evaluation of tactical and strategic alternatives. Prerequisite: ECO 201, MTH 151. Co-requisite: STA 368. Cross-listed with MME 341.

**PSE 405/505 INDUSTRIAL ENVIRONMENTAL CONTROL** Survey of environmental issues facing pulp and paper industry and how the industry addresses these issues. In-plant pollution abatement alternatives discussed as well as external treatment. Computer-based modeling applications introduced and applied to problems. Design considerations involved in selecting among alternative pollution control strategies are presented and applied to examples. Prerequisite: PSE 311.

**PSE 415 CHEMICAL KINETICS AND REACTOR DESIGN** Chemical Kinetics of homogeneous and heterogeneous reactions, kinetic theories, mechanism and modeling, reactor design, design of multiple reactions; temperature and pressure effects. Non-ideal reactors, survey of catalytic and biochemical reaction systems. Prerequisite: PSE 204, 313, 314, MTH 245.

**PSE 441 POLLUTION PREVENTION IN ENVIRONMENTAL MANAGEMENT** Provides understanding of how corporations respond to governmental regulation by setting up environmental management systems which employ the principles of pollution prevention. Engineering concepts such as material balances, energy balances, risk assessment, and life cycle assessment have impacted new process designs. In this course a basis for evolution and maturation of pollution prevention as a fundamental methodology to ensure compliance and economic sustainability of industrial processes will be provided. The understanding of the concepts of pollution will be demonstrated by participation in a class project sponsored by industry at one of their facilities. Prerequisites: BOT 131 or ZOO 121, CHM 142, PSE 204 and Junior standing Co requisite: PSE/MME 341 is recommended.

**PSE 442 AIR POLLUTION CONTROL** This course will introduce students to the formation and control of air pollutants, engineering theories and principles pertaining to the design of air pollution control operations, and environmental legislation. Solutions to environmental problems will be investigated, considering both technical and economical aspects. Prerequisites: PSE 204, 314, and 341.

**PSE 471, 472 ENGINEERING DESIGN I & II** Involves application and synthesis of accumulated knowledge in a major, open-ended, industrial research/design project. Critical elements of the design process and real world constraints (environmental impact, economical and social factors, marketability, ergonomics, safety, aesthetics, and ethics) are considered. Emphasis is placed on oral and written communication skills. Students from different academic backgrounds are assigned to multidisciplinary project teams in order to utilize their varied experiences, knowledge, learning styles, and skills to achieve a successful conclusion to each project. Prerequisite: senior standing or permission of instructor.

**PSE 4xx Solid and Hazardous Waste Management**