



Environmental Resource Management

“restoring the past....preserving the future”



2008-2009
Student Handbook

The Pennsylvania State University
Environmental Resource Management Program
206 ASI Building
University Park, PA 16802
erm.cas.psu.edu

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INTRODUCTION

Welcome to the Environmental Resource Management (ERM) major at the Pennsylvania State University! This hand book is designed to give you an overview of the ERM program, as well as to serve as a guideline for students in the major. This book describes the structure of the major, the program's B.S. graduation requirements, and the diverse job opportunities that await graduates of the program. Also included in this handbook is a program check-sheet, a comprehensive recommended course scheduling sheet, and a complete list of prescribed courses for the major.

When you enter the ERM program, you will be assigned an academic advisor. Your academic advisor will help you plan your courses and serve as your source of information about the major, the curriculum, or any other questions you may have regarding the program and the University. The ERM Program Coordinator and primary student adviser is Dr. Robert D. Shannon.

For more information about our program, please contact either:

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WHAT IS ERM?

The ERM major is an inter-disciplinary environmental science major designed for students who want to use problem-solving, decision-making, and communication skills to address environmental and resource management issues. For over 30 years, the ERM program has been preparing students to successfully and creatively analyze, manage, and protect the environmental resources of Pennsylvania, the nation, and the world. If you are interested in environmental protection, conservation, sustainability, managing natural resources, and experiencing both field and lab-based learning, then the ERM program is for you!

The ERM major offers a flexible, comprehensive curriculum that provides students with a solid background in the sciences. The program educates its students in fundamental environmental subjects including air, water & soils. The ERM major also educates its students in the management aspect of environmental science, which includes courses in both economics and law.

In addition to taking science based courses, students in the major specialize in one or several focus areas tailored to their own interest. These focus areas range from environmental engineering, to environmental economics, to water resources and most everything in between! Having one or several focus areas incorporated into the student's academic program enhances the student's marketability and knowledge base upon graduation.

WHERE ARE THE JOBS?

There are many employers in both the private and public sectors specifically looking for graduates with environmental science degrees because of the breadth and depth in environmental training. The Environmental Resource Management major prepares students to enter into several different environmental fields upon graduation. Students in the major can enter into private environmental consulting, the public, private or non-profit sector, or into one of the many government agencies that hire environmental professionals. As a graduate of the program, you can look forward to a variety of exciting career opportunities, including, but not limited to; ecosystem restoration, contaminated site remediation, soil, air and water quality improvement, and addressing other environmentally-related issues. Some examples of companies and organizations that have hired ERM graduates in the past include the Environmental Protection Agency (EPA), the Department of Conservation and Natural Resources (DCNR), County Conservation Districts, the Chesapeake Bay Foundation, the Department of Environmental Protection (DEP), and more!

To supplement the versatile science degree, ERM students can enhance their marketability in the environmental arena by carefully selecting appropriate courses to qualify for Professional Certifications. In addition to educational requirements, most professional certifications have experience requirements—a few years of "practice" and skill development on the job are needed to qualify for the actual "professional" title. ERM students can easily obtain certifications to become professionals in training in a variety of areas. Some examples of certifications in the environmental field include Professional Wetland Scientist (PWS), Certified Professional Soil Scientist (CPSS), Certified Hazardous Materials Manager (CHMM) and more! See the ERM Website or your advisor for more information about certifications (<http://erm.cas.psu.edu/Certifications.html>).

PLANNING YOUR ACADEMIC PROGRAM

Students are responsible for developing and implementing their academic plan in conjunction with an ERM advisor. Your advisor can be an invaluable resource, mentor and friend. Students are encouraged to meet with an ERM advisor on a regular basis (at least once a semester). E-mail is the most effective method for arranging an appointment or for getting a question answered by your advisor. Contact them well in advance of registration and other deadlines.

Students should also take an active role in planning their course work in order to meet all requirements and to graduate in a timely manner. Keep track of your progress by reviewing your Degree Audit on eLion (<https://elion.oas.psu.edu/>) and updating your ERM checksheet (page 11) each semester.

USEFUL INFORMATION ABOUT REQUIRED ERM COURSES

- Required courses only offered in the Fall Semester at UP: ERM 151, ERM 411, ERM 431, ERM 435, BIOL 110, ASM 327, GEOSC 303.
- Required courses only offered in the Spring Semester at UP: ERM 300, BIOL 220W, E RRE 201, ERM 430, ERM 433, ERM 413W.
- *While course scheduling during past years is generally a reliable indicator of future offerings, changes are often made from one year to the next. Verify course availability with the department or program offering the course.*
- Mathematics: MATH 110 and 111 are the standard math courses for ERM students, but MATH 140 and 141 are required if you intend to minor in Environmental Engineering. This math sequence is also required for admission into the Environmental Engineering minor.
- Physics: Most students take PHYS 250, but PHYS 211 is required if you intend to minor in Environmental Engineering or if your area of specialization is in the physical sciences or engineering. Students interested in graduate study should consider a 2-semester sequence in Physics (e.g., PHYS 211 and 212 or PHYS 250 and 251).
- ERM 300: Students must satisfactorily complete ERM 151; MATH 111 or 141; CHEM 111, 112, 202; BIOL 220W; and STAT 240 before registering for ERM 300. This course is a required prerequisite for ERM 412 and ERM 450.
- ERM 495 (Internship): Practical professional experience is a valuable asset when seeking a permanent job after graduation. All students should consider getting ERM-related experience either through summer jobs or internships. To receive academic credit for an internship, you must register for ERM 495 (1-12 credits) during the summer, fall or spring semesters. Internships are graded under the Satisfactory/Unsatisfactory (SA/UN) grading system. Most internships provide a salary or hourly wage, others pay expenses only, and some are unpaid. Up to 6 credits of ERM 495 can be used to meet the specialization requirement. Information on internships and the "ERM Internship Guidelines Booklet" are available on the ERM website or at the ERM office.
- ERM 496 (Independent Studies): ERM 496 provides opportunities for students to achieve a greater depth of knowledge in a particular topic, carry out research, or explore problems or issues not covered in existing courses. It is the responsibility of the student to identify an area or subject and to make arrangements with a faculty member to sponsor the study. Advisors and the ERM office can help to identify sponsors. At least 40 hours of work are required for each credit. Students must file an Independent Study form in the ERM office before registering for ERM 496.

CHOOSING YOUR SPECIALIZATION OR MINOR

The ERM major requires that each student develop a specialization relevant to the environment. This can be achieved by completing a University minor or by completing 18 credits of courses in a specialization of the student's choice. A University minor will be noted on your transcript; a specialization will not.

Your advisor and/or other faculty members can be very helpful in making your decision about a minor or courses in your specialization. Your faculty advisor must approve the choice of a minor or a specialization, and sign the "Entrance to Minor" application form before taking courses in that minor or specialization. The ERM Program Coordinator serves as the professor in charge of the specializations. If you choose an official University minor, the professor in charge of the minor must also approve the minor application.

UNIVERSITY MINORS

Approved University minors are a combined grouping of courses in a topical area and usually consist of 18-21 credits. There are a variety of environmental minors at Penn State that are relevant to ERM students. The requirements for each minor are defined in the Baccalaureate Degree Programs Bulletin. Be sure that you are aware of the specific prerequisites for the minor early in your academic career. In some cases, a course selection for an official University minor is also listed as a prescribed ERM course (see ERM checksheet). When this "overlap" occurs, the course may be counted for both the minor and the prescribed ERM course. However, students must still satisfy the 18 credit specialization requirement for the ERM major, and 12 of the 18 credits in the specialization requirement must be courses taken at the 300-400 level. Thus, minors that include prescribed ERM courses provide the opportunity for additional specialized course work, independent study, or internships, usually without increasing the number of credits needed to graduate from the major.

Listed below are some appropriate minors, but keep in mind that this list is not all-inclusive. If you are interested in a specific minor or specialization that is not mentioned, please consult with your ERM advisor.

SELECTED MINORS

Biology	Geography
Climatology	Geosciences
Earth Systems	Global Business Strategies in Earth, Energy and Materials Industry
Energy, Environmental & Mineral Economics	International Agriculture
Environ. & Renewable Resource Economics	Plant Pathology
Environmental Engineering	Science, Technology, & Society
Environmental Soil Science	Watersheds and Water Resources
Forest Science	Wildlife & Fisheries Science
Geographic Information Sciences	

SPECIALIZATIONS

The following specializations and courses are intended to be illustrative. Tailor selections to your interests and career goals. It is appropriate to consider courses that are not on the list. Remember to gain your advisor's counsel and approval before taking courses in your chosen specialization.

Each student must schedule 12 credits of 300-400 level courses as part of the 18-credit specialization. A combined total of 6 credits of ERM 495 (Internship) and/or ERM 496 (Independent Study) can be applied to the specialization. Check the latest Baccalaureate Degree Programs Bulletin for course restrictions and prerequisites.

AIR POLLUTION/AIR QUALITY

ERM	430 Air Pollution Impacts Terrestrial Ecosystems	METEO	122 Atmospheric Environment
F SC	430 Air Pollution to Combustion Sources		497A Air Quality Forecasting (3)
ME	430 Fundamentals of Air Pollution		
	405 Indoor Air Quality		

BIOLOGY-ECOLOGY

BIOL	407 Plany Anatomy		
	412 Evolution of Infectious Diseases	ERM	450 Wetland Conservation
	414 Taxonomy of Seed Plants	FOR	203 Field Dendrology
	415 Ecotoxicology		308 Forest Ecology
	417 Invertebrate Zoology	FOR/WFS	430 Conservation Biology
	419 Ecol. & Environ. Problem Solving		408 Mammalogy
	427 Evolution		422 Ecology of Fishes
	428 Population Genetics		446 Wildlife & Fisheries Population Dynamics
	429 Animal Behavior		447W Wildlife Management
	441 Plant Physiology		452 Ichthyology
	446 Physiological Ecology		453 Ichthyology Lab
	448 Ecology of Plant Reproduction	MICRB	201 Introductory Microbiology
	450W Experimental Field Biology		202 Introductory Microbiology Lab
	463 General Ecology		400 Intro. Environmental Microbiology

CLIMATE CHANGE & GLOBAL WARMING

EARTH	002 Earth System	GEOG	412W Climatic Change and Variability
	103 Earth Future-Predicting Climate Change		430 Human Use of Environment
GEOG	030 Geog. Sustainability-Human/Environ		438W Human Dimensions of Global Warning
	110 Climates of the World	GEOSC	320 Geology of Climate Change
	310W Intro to Global Climatic Systems	STS	201 Climate Change, Energy & Biodiversity

ENERGY & SOCIETY

EGEE	101 Energy & the Environment	ENNEC	100 Minerals and Resources
	102 Energy Conservation for Environmental Protection		484W Energy Economics
	120 Oil: International Evolution	MNG	490 Applied Financial & Invest. Analysis
	401 Energy in a Changing World		400 Mining & Our Environment
	438 Sustainable Energy Options	MIN E	445 Env. Concerns in Mining Industry
EMS	101 Resource Wars		415 Mgmt. in Mineral Ind. for Env., Legal, Health & Safety Prob.
	301 Global Finance for Earth Energy & Mat. Indus.	S T S	201 Climate Change, Energy & Biodiversity
	420 Energy and Modern Society		420 Energy & Modern Society
			471 Radiation, Reactors & Society

ENVIRONMENTAL HEALTH AND TOXICOLOGY; INDUSTRIAL HYGIENE

BMB	433 Molecular & Cellular Toxicology	I H S	400 Prin. of Industrial Health & Safety
BIOL	415 Ecotoxicology		430 Ind. Health-Safety Program Mgmt.
C E	471 Environmental Sanitation		445 Ind. Hygiene & Toxicology
CHEM	402 Environmental Chemistry		450 Environmental Health & Safety
E R M	431 Environmental Toxicology		490 Industrial Health & Safety Seminar
H P A	410 Princ. of Public Health Admin.	L I R	444 Occupational Health
	440 Princ. of Epidemiology	MICRB	201 Introductory Microbiology
	445 Health Economics		202 Introductory Microbiology Lab
GEOSC	498 Hazardous Waste Operations & Emergency Response		400 Intro. Environmental Microbiology
FD SC	407 Food Toxins	S T S	401 Microbial Physiol. & Structure
			471 Radiation, Reactors & Society

RESOURCE ECONOMICS AND POLICY*

AG BM	450 Internat. Dev., Renewable Res., & the Environment	E RRE	431W Econ. Analysis of Environ.
AGECO	134 Sustainable Ag. Science & Policy	PHIL	118 Intro. to Environ. Philosophy
ECON	302 Intermed. Microecon. Analysis		403 Environmental Ethics
	304 Intermed. Macroecon. Analysis	PL SC	001 Intro. to Amer. National Govt.
	428 Environmental Economics		002 American Public Policy
ENNEC	100 Intro. to Energy & Earth Sciences Econ.		003 Intro. to Comparative Politics
	482 Econ. of Minerals in the Environ.		135 Politics of the Ecological Crisis
	484W Energy Economics		417 Amer. Local Govt. & Admin.
	491 Mineral Policy Analysis	R SOC	419 Bureaucracy & Public Policy
E RRE	429 Natural Resource Economics	SOC	327 Society and Natural Resources
			447 Environment, Energy & Society

* Note: The Environmental and Renewable Resource Economics (E RRE) minor is also available and includes many courses on this list.

Please see the specific minor requirements online at http://www.psu.edu/bulletins/bluebook/major/e_rremin.htm

SOIL RESOURCES*

A B E	477 Land Waste Disposal	SOILS	412W Soil Ecology
FOR	470 Watershed Management		415 Soil Morph., Mapping & Land Use
GEOSC	452 Intro. to Hydrogeology		416 Soil Genesis & Classification
E R M	433 Trans. of Pollutants in Soils		418 Nutrient Management in Ag. Systems
	450 Wetland Conservation		419 Soil Environmental Chemistry
SOILS	100 Soil Judging		420 Remediation of Contaminated Soils
	401 Soil Comp. & Phys. Properties		422 Nat. Res. Consv. & Comm. Sustainability
	402 Chem. of Soils & Fertilizers		450 Environmental Geo. Inf. Systems (GIS)
	405 Hydropedology		

* Note: The Environmental Soil Sciences (ESOIL) minor is also available and includes many courses on this list. Please see the specific minor requirements online at <http://www.psu.edu/bulletins/bluebook/major/esoilmin.htm>

WASTE MANAGEMENT

A B E	477 Land Waste Disposal	GEOSC	498 Hazardous Waste Operations
C E	476 Solid and Hazardous Wastes	SOILS	418 Nutrient Mgmt in Ag. Systems
ERM	430 Air Pollut. Impacts to Terrestrial Ecosystems		420 Remediation of Cont. Soils
	433 Transformation of Pollutants in Soils	MIN E	415 Mgmt In the Mining Industry for Environmental, Legal, Health & Safety Problems

WATER RESOURCES*

BIOL	417 Invertebrate Zoology	GEOG	362 Image Analysis
	450W Experimental Field Biology		431 Water Resources
C E	361 Engineering Hydrology	GEOSC	412 Water Resources Geochemistry
	471 Environmental Sanitation		419 Organic Geochemistry of Natural Waters and Sediments
	472W Env. Eng. Capstone Design		452 Introduction to Hydrogeology
	473 Water Quality Management	MNG	400 Mining and Our Environment
	475 Water Quality Chemistry		444 Groundwater in Mining
ENT	425 Freshwater Entomology		445 Environ Concerns in the Mining Ind.
ERM	435 Limnology	SOILS	422 Nat. Res. Cons. & Comm. Sustainability
	450 Wetland Conservation	W F S	410 General Fishery Science
FOR	470 Watershed Management		422 Ecology of Fishes
	471 Watershed Management Lab.		452 Ichthyology
GEOEE	408 Contaminant Hydrology		453 Ichthyology Laboratory

* Note: The Watersheds & Water Resources (WWR) minor is also available and includes many courses on this list. Please see the specific minor requirements online at http://www.psu.edu/bulletins/bluebook/major/w_w_r.htm

ENVIRONMENTAL EDUCATION

A concurrent B.S. degree program combines the Environmental Science Option in Agricultural and Extension Education with the ERM major and can provide teaching certification (Grades K-12) in environmental education and general science. The Agricultural and Extension Education requirements are in the Baccalaureate Degree Program Bulletin. Concurrent degrees with teaching certification can be earned with approximately one additional year of course work.

Student: _____
 PSU ID: _____
 Advisor: _____

The Pennsylvania State University
ENVIRONMENTAL RESOURCE MANAGEMENT
 121 Credits Required

Specialization/Minor: _____
 Program Year: _____
 Expected Graduation Date: _____

REQUIREMENTS FOR THE MAJOR

Course	Cr.	Grade	Sem.	Course	Cr.	Grade	Sem.
Prescribed Courses (82/84 credits)				Supporting Courses (24 credits)			
AG 150S	(2)	_____	_____	<u>Communications</u> (select 1)			
AG BM 200	(3)	_____	_____	AEE 360, 440, CAS 211/213/ 214W/215/250/352, WFS 440	(3)	_____	_____
ASM 327*	(3)	_____	_____				
BIOL 110 GN*	(4)	_____	_____				
BIOL 220W GN*	(4)	_____	_____	<u>Ecology</u> (select 1)	(3)	_____	_____
CAS 100 GWS	(3)	_____	_____	BIOL 415/436/446/448/450W ENT 420/425			
CHEM 110*	(3)	_____	_____	ERM 430/431/435/450, HORT 445			
CHEM 111*	(1)	_____	_____	SOILS 412W, WFS 422/430/446			
CHEM 112	(3)	_____	_____				
CHEM 202	(3)	_____	_____	<u>Specialization/ Minor</u> (Consult w/ advisor; 18 cr.)			
ECON 002/AG BM 101 GS	(3)	_____	_____	_____			
ENGL 015 GWS	(3)	_____	_____	_____			
ENGL 202C GWS	(3)	_____	_____	_____			
ERM 151*	(1)	_____	_____	_____			
ERM 300*	(3)	_____	_____	_____			
ERM 411*	(3)	_____	_____	_____			
ERM 412*	(3)	_____	_____	_____			
ERM 413W*	(3)	_____	_____	_____			
ERM 43_*	(3)	_____	_____	_____			
ERM 43_*	(3)	_____	_____	_____			
E RRE 201*	(3)	_____	_____	_____			
GEOG 160 GS	(3)	_____	_____	Electives			
GEOG 303	(3)	_____	_____	_____			
MATH 110/140 GQ	(4)	_____	_____	_____			
MATH 111/141 GQ	(2/4)	_____	_____	_____			
PHYS 211/250 GN	(4)	_____	_____	_____			
SOILS 101*	(3)	_____	_____	_____			
STAT 240	(3)	_____	_____	_____			

*C-required

Last Updated 6/2008

GENERAL EDUCATION

Course	Cr.	Grade	Sem.
Skills (15 credits)			
<u>Communications</u> (GWS 9 credits) [satisfied by 9 credits from ENGL 015, ENGL 202C and CAS 100 in prescribed courses]			
<u>Quantification</u> (GQ 6 credits) [satisfied by 6 credits from MATH 110/140 and MATH 111/141 in Prescribed Courses]			
Knowledge Domain (30 credits)			
<u>Natural Sciences</u> (GN 9 credits) [satisfied by 9 credits from BIOL 110, BIOL 220W, CHEM 110, CHEM 111, CHEM 112, and PHYS 211/250 in Prescribed Courses]			
<u>Arts</u> (GA 6 credits)			
_____	(3)	_____	_____
_____	(3)	_____	_____
<u>Humanities</u> (GH 6 credits)			
_____	(3)	_____	_____
_____	(3)	_____	_____
<u>Social & Behavioral Sciences</u> (GS 6 cr) [satisfied by 6 credits from ECON 002/AG BM 101 and GEOG 160 in Prescribed Courses]			
<u>Health & Physical Activity</u> (GHA 3 cr)			
_____		_____	_____
_____		_____	_____
US Cultures and International Cultures Requirement (3 credits US and 3 credits IL for freshmen after SP 2005) [can be satisfied by GA/US, GA/IL, GH/US or GH/IL]			
_____	(IL)	_____	_____
_____	(US)	_____	_____

Recommended Course Scheduling for ERM Majors*

<i>Semester 1 (FALL)</i>		<i>Semester 2 (SPRING)</i>	
CHEM 110	3	CHEM 112	3
ECON 002 or AG BM 101	3	ENGL 015	3
MATH 110 or 140**	4	MATH 111 or 141**	2/4
AG 150S	2	CAS 100	3
ERM 151	1	Arts/Humanities Selection (GA/GH)	3
Arts/Humanities Selection (GA/GH)	3		
<i>Total Credits:</i>	16	<i>Total Credits:</i>	14/16
<i>Semester 3 (FALL)</i>		<i>Semester 4 (SPRING)</i>	
BIOL 110 (fall only)	4	STAT 240	3
CHEM 111	1	BIOL 220W (spring only)	4
CHEM 202	3	PHYS 211 or 250**	4
GEOG 160	3	SOILS 101	3
Arts/Humanities Selection (GA/GH)	3	Health and Physical Activity (GHA)	1.5
Health and Physical Activity (GHA)	1.5		
<i>Total Credits:</i>	15.5	<i>Total Credits:</i>	15.5
<i>Semester 5 (FALL)</i>		<i>Semester 6 (SPRING)</i>	
AG BM 200	3	ENGL 202C	3
ERM 411 (fall only)	3	E RRE 201 (spring only)	3
A S M 327 (fall only)	3	ERM 300 (spring only)	3
GEO SC 303 (fall only)	3	Specialization/Minor Courses ²	6
Arts/Humanities Selection (GA/GH)	3		
<i>Total Credits:</i>	15	<i>Total Credits:</i>	15
<i>Semester 7 (FALL)</i>		<i>Semester 8 (SPRING)</i>	
Ecology Selection ¹	3	Communications Selection ¹	3
ERM 412	3	ERM 413W (spring only)	3
ERM 43__	3	ERM 43__	3
Specialization/Minor Courses ²	6	Specialization/Minor Courses ²	6
<i>Total Credits:</i>	15	<i>Total Credits:</i>	15

*Some modifications may be necessary for students who: require remedial courses in chemistry, mathematics or English; or transfer into the major from another institution or major at Penn State. Consult with an ERM adviser before registering for classes.

** For those students interested in obtaining the Environmental Engineering minor, MATH 140, MATH 141, and PHYS 211 are required. Students with a non-engineering specialization area (soils, water resources, wildlife, biology, ecology, environmental policy) may take MATH 110, MATH 111, and PHYS 250.

¹ See approved list on ERM Checksheet.

² Select from approved list. Students must consult with their adviser when making these selections.

PREScribed COURSES IN THE ERM CURRICULUM

[AG 150S](#) BE A MASTER STUDENT (2) Students explore agricultural issues and research methodologies through literature review, library searches, field studies, and critical thinking. Prerequisite: first- or second-semester standing.

[AG BM 200](#) INTRODUCTION TO AGRICULTURAL BUSINESS MANAGEMENT (3) Application of management principles and processes to agricultural business firms in their planning and operating in domestic and international markets.

[A S M 327](#) SOIL AND WATER RESOURCE MANAGEMENT (3) Soil and water management systems and practices including hydrology, surface drainage, open channels, and erosion, subsurface drainage, impoundments and irrigation. Prerequisite: [PHYS 250](#)

[BIOL 110](#) (GN) BIOLOGY: BASIC CONCEPTS AND BIODIVERSITY (4) A study of the evolution of the major groups of organisms including the fundamental concepts of biology.

[BIOL 220W](#) (GN) BIOLOGY: POPULATIONS AND COMMUNITIES (4) A study of the structures and functions of organismic interactions from simple populations to complex ecosystems. (BIOL 220W, 230W, and 240W each carry only 1 credit of "writing"; all three courses must be taken to meet the writing requirement.) Prerequisite: BIOL 110

[CAS 100](#) (GWS) EFFECTIVE SPEECH (3) Introduction to speech communication: formal speaking, group discussion, analysis and evaluation of messages.

[CHEM 110](#) (GN) CHEMICAL PRINCIPLES I (3) Effective Date: SU2007 Basic concepts and quantitative relations. Prerequisite: satisfactory performance on the Chemistry and Math FTCAP tests-- i.e., placement beyond the level of CHEM 101 and MATH 022; or [CHEM 101](#) , and [MATH 022](#) or [MATH 041](#)

[CHEM 111](#) (GN) EXPERIMENTAL CHEMISTRY I (1) Effective Date: SU2007 Introduction to quantitative experimentation in chemistry. Prerequisite: or concurrent: [CHEM 110](#) or [CHEM 106](#)

[CHEM 112](#) (GN) CHEMICAL PRINCIPLES II (3) Effective Date: SU2007 Continuation of CHEM 110, including an introduction to the chemistry of the elements. Prerequisite: [CHEM 110](#) or [CHEM 106](#) . Prerequisite or concurrent: [CHEM 111](#)

[CHEM 202](#) FUNDAMENTALS OF ORGANIC CHEMISTRY I (3) Effective Date: SU2007 Introduction to organic chemistry, with emphasis on the properties of organic compounds of biochemical importance. Because of duplication of subject matter, students may not receive credit for both CHEM 202 and CHEM 210. Prerequisite: [CHEM 101](#) or [CHEM 110](#) or [CHEM 106](#)

[ECON 002](#) (GS) INTRODUCTORY MICROECONOMIC ANALYSIS AND POLICY (3) Methods of economic analysis and their use; price determination; theory of the firm; distribution.

OR:

[AG BM 101](#) (GS) ECONOMIC PRINCIPLES OF AGRIBUSINESS DECISION MAKING (3) Introduction to economic principles and their application to real world examples of agribusiness management issues.

[ENGL 015](#) (GWS) RHETORIC AND COMPOSITION (3) Instruction and practice in writing expository prose that shows sensitivity to audience and purpose. Prerequisite: [ENGL 004](#) or satisfactory performance on the English proficiency examination.

[ENGL 202C](#) (GWS) EFFECTIVE WRITING: TECHNICAL WRITING (3) Writing for students in scientific and technical disciplines. (A student may take only one course for credit from ENGL 202A, 202B, 202C, and 202D.) Prerequisite: [ENGL 015](#) or [ENGL 030](#) ; fourth-semester standing.

[E R M 151](#) CAREERS AND ISSUES IN ENVIRONMENTAL RESOURCE MANAGEMENT (1) Career opportunities and topical issues in the environmental sciences.

[E R M 300](#) BASIC PRINCIPLES AND CALCULATIONS IN ENVIRONMENTAL ANALYSIS (3) This course will teach basic problem solving skills while using examples taken from environmental media--air, water, and soil. Prerequisite: [BIOL 220W](#) ; [CHEM 111](#) , [CHEM 112](#) , [CHEM 202](#) ; [E R M 151](#) , [MATH 111](#) or [MATH 141](#) ; [STAT 240](#)

[E R M 411](#) LEGAL ASPECTS OF RESOURCE MANAGEMENT (3) Legal systems and lawmaking processes; property rights in land, water, and wildlife resources; jurisdictional problems in planning resource use. Prerequisite: [E R M 151](#)

[E R M 412](#) RESOURCE SYSTEMS ANALYSIS (3) The concept of systems; techniques of analysis, including input/output, mathematical programming, and simulation; application to resource systems. Prerequisite: [BIOL 220W](#) , [E R M 151](#) , [E R M 300](#) , and [STAT 240](#) ; [MATH 111](#) or [MATH 141](#)

[E R M 413W](#) CASE STUDIES IN ECOSYSTEM MANAGEMENT (3) Application of biological, physical, and social science principles to ecosystem management problems; introduction to environmental impact analysis and review. Prerequisite: [E RRE 201](#) , [BIOL 220W](#) , [SOILS 101](#) . Prerequisite or concurrent: [E R M 412](#)

[E R M 430](#) (PPATH) AIR POLLUTION IMPACTS TO TERRESTRIAL ECOSYSTEMS (3) Overview of the direct and indirect effects of air pollutants on terrestrial plants and ecosystems. Prerequisite: [BIOL 220W](#) or [FOR 308](#)

[E R M 431](#) ENVIRONMENTAL TOXICOLOGY (3) Effects of pollutants on animal health at the chemical, physical, and cellular level. Prerequisite: [BIOL 110](#) , [CHEM 110](#) , [CHEM 112](#)

[E R M 433](#) TRANSFORMATION OF POLLUTANTS IN SOILS (3) Processes regulating fate and transport of metals, organics, nutrients, salts, pathogens, and radionuclides in soil systems. Prerequisite: [CHEM 111](#) , [CHEM 112](#) , [SOILS 101](#)

[E R M 435](#) (W F S) LIMNOLOGY (3) Biogeochemistry and natural history of freshwater ecosystems. Prerequisite: [BIOL 110](#) , [BIOL 220W](#) , [CHEM 110](#)

[E R M 450](#) (W F S) WETLAND CONSERVATION (3) Wetland types, classification, functions and values; hydrology, soils, and plants; introduction to wetland identification and delineation; wetland regulations. Prerequisite: [E R M 300](#) or [W F S 209](#)

[E RRE 201](#) (AG EC) INTRODUCTORY ENVIRONMENTAL AND RESOURCE ECONOMICS (3) Apply principles of economics to analyze environmental protection policies and natural resource use decision. Examine contemporary policy issues. Prerequisite: [AG BM 101](#) or [ECON 002](#)

[GEOG 160](#) (GS) MAPPING OUR CHANGING WORLD (3) Fundamental concepts of GIS, cartography, remote sensing, and GPS in the context of environmental and social problems.

[GEOSC 303](#) INTRODUCTION TO ENVIRONMENTAL GEOLOGY (3) Origin of earth and earth materials; natural resources, geologic barriers and hazards, and relationships to human use of the environment.

[MATH 110](#) (GQ) TECHNIQUES OF CALCULUS I (4) Functions, graphs, derivatives, integrals, techniques of differentiation and integration, exponentials, improper integrals, applications. Students may take only one course for

credit from MATH 110, 140, 140A, and 140B. Prerequisite: [MATH 022](#) or satisfactory performance on the mathematics proficiency examination

[MATH 111](#) (GQ) TECHNIQUES OF CALCULUS II (2) Analytic geometry, partial differentiation, maxima and minima, differential equations. Prerequisite: [MATH 110](#)

[MATH 140](#) (GQ) CALCULUS WITH ANALYTIC GEOMETRY I (4) Functions, limits; analytic geometry; derivatives, differentials, applications; integrals, applications. Students may only take one course for credit from MATH 110, 140, 140A, 140B, and 140H. Prerequisite: [MATH 022](#) , [MATH 026](#) ; or [MATH 040](#) or [MATH 041](#) or satisfactory performance on the mathematics proficiency examination

[MATH 141](#) (GQ) CALCULUS WITH ANALYTIC GEOMETRY II (4) Derivatives, integrals, applications; sequences and series; analytic geometry; polar coordinates. Students may take only one course for credit from MATH 141, 141B, and 141H. Prerequisite: [MATH 140](#) , [MATH 140A](#) , [MATH 140B](#) , or [MATH 140H](#)

[PHYS 211](#) (GN) GENERAL PHYSICS: MECHANICS (4) Calculus-based study of the basic concepts of mechanics: motion, force, Newton's laws, energy, collisions, and rotation. Concurrent: [MATH 140](#)

[PHYS 250P](#) (GN) INTRODUCTORY PHYSICS I Selected topics in mechanics, heat, and sound. Prerequisite: [MATH 022](#) , [MATH 026](#) ; or [MATH 040](#) ; or [MATH 041](#) or satisfactory performance on the mathematics proficiency examination

[SOILS 101](#) (GN) INTRODUCTION TO SOILS (3) A study of soil characteristics and their relationship to land use, plant growth, environmental quality, and society/culture.

[STAT 240](#) (GQ) INTRODUCTION TO BIOMETRY (3) Statistical analysis, sampling, and experimentation in the agricultural sciences; data collection, descriptive statistics, statistical inference, regression, one factor AOV, probability. Students may take only one course from STAT 200, 220, 240, 250 for credit. Prerequisite: 3 credits in mathematics

SUPPORTING AND OTHER COURSES

COMMUNICATIONS SELECTION: (3) Choose from AEE 360, 440; CAS 211, 213, 214W, 215, 250 or 352

ECOLOGY SELECTION: (3) Choose from: BIOL 415, 446, 448, 450W, 482, 499A; ENT 420, 425; ERM 430, 431, 432, 435, 450; HORT 445; SOILS412; WFS 422, 430, 446

ERM 495* INTERNSHIP (1-12) A SUPERVISED PRACTICUM IN THE ENVIRONMENTAL FIELD. TO BE OFFERED ONLY FOR SA/UN GRADING. Prerequisite: PRIOR APPROVAL OF ASSIGNMENT BY INTRUCTOR.

ERM 496* INDEPENDENT STUDIES (1-18)

SPECIALIZATION OR MINOR (18 CREDITS MINIMUM)

*ERM students may apply up to 6 credits of ERM 495 and/or ERM 496 toward their 18 credit specialization area.

