CE 1000 – Civil Engineering and Environmental Science Seminar
Fall 2004
Required

2003-2006 Catalog Data: **CE 1000: Civil Engineering and Environmental Science Seminar.** Seminar provides a common meeting time for students and faculty for department activities, such as invited speakers, projects presentations, educational surveys, cross-course project coordination, and policy announcements. Students must enroll every semester that they are matriculated in CEES at OU after the freshman year, but in no case can a student graduate without successfully completing four semesters of seminar. (F, Sp)

Prerequisite: None

Textbook(s) and/or other required material: None

Course Objectives: Expose students to Engineering professionals through interaction with the engineering community.

Coordinator: Varies, School of Civil Engineering and Environmental Science

Prerequisites by Topic: None

Topics: Various

Class/laboratory schedule: One 90-minute lecture per week

Computer Usage: None (except demonstrations)

Design Projects: None

Laboratory Projects: None

Assessment Methods Used:
1. Standard course evaluation.

Contribution to Professional Component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science – 0 credit hours or 0%
Engineering Design – 0 credit hours or 0%

Relationship of Course to Program Outcomes:
1.1: vii
2.1: v

Relationship of Course to ABET Criterion 3 (a – k):
f, h, i, j

Prepared by: K.A. Strevett **Date**: May 14, 2005

CE 1111 – Introduction to Civil Engineering and Environmental Science
Fall 2004
Required

2003-2006 Catalog Data: **1111 Introduction to Civil Engineering and Environmental Science.** Prerequisite: Mathematics 1523. Introduction to fundamental concepts (principles of mechanics, energy balances, simple circuits), problem solving and computing software for civil engineers, environmental engineers, and environmental scientists. (F).

Prerequisite: Mathematics 1523

Textbook(s) and/or other required material: None

Course Objectives: To gain fundamental skills critical to being a successful civil / environmental engineer / scientist, as listed below:

1. Have a basic understanding of civil engineering, environmental engineering, and environmental science issues.
2. Be able to tackle a complex problem by breaking it down into its components and developing solution pathways.
3. Be able to use basic methods (e.g., conservation of mass) and basic tools (e.g. Excel) to analyze components of a complex problem.
4. Effectively work in teams and communicate results in oral and written form using common tools (e.g., Word, Powerpoint).
5. Improve your skill as a self-guided learner.

Coordinator: Dr. David A. Sabatini, Professor, School of Civil Engineering and Environmental Science

Prerequisites by Topic:
1. Mathematics: elementary functions

Topics:
1. Engineering calculations
2. Mass and flow balance
3. Spreadsheets
4. Hydrological processes
5. Presentations with PowerPoint
6. Design of a dam
7. Engineering economics
8. Group dynamics

Class/laboratory schedule: One 75-minute lecture per week

Computer Usage: Spreadsheets and word processing used on various homework assignments.

Design Projects: Determine optimal height of a dam to satisfy multiple constraints of (1) minimum cost of constructing and operating the dam and (2) minimum cost of water purchase if dam height and reservoir volume do not provide sufficient water storage in combination with annual variations of rainfall and runoff.

Laboratory Projects: None

Assessment Methods Used:

2. Standard course evaluation
3. Readiness Assessment Tests (RATs) – individual quizzes on a reading assignment followed by taking the same quiz in the group – promotes self-learning, peer-teaching and group dynamics
4. Peer evaluations

Contribution to Professional Component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science – 0.5 credit hours or 50%
Engineering Design – 0.5 credit hours or 50%

Relationship of Course to Program Outcomes
1.1: ii, vii; 1.2: i, ii, iii; 1.3: i
2.1: iv; 2.2: iii; 2.3: i, ii

Relationship of Course to ABET Criterion 3 (a – k):
a, c, d, e, g

Prepared by: David A. Sabatini **Date**: February 14, 2005

CE 1213 – Computer Applications in Civil Engineering and Environmental Science
Fall 2004
Required

2003-2006 Catalog Data: **CE 1213: Computing Applications in Civil Engineering and Environmental Science.** Prerequisite: Mathematics 2423, Physics 2514 or concurrent enrollment. Introduction to a computer-aided engineering and environmental science. Introduction to application software and tools relevant to civil engineering and environmental science such as Autocad, Java and spreadsheets. (F)

Prerequisites: Mathematics 2423, Physics 2514 or concurrent enrollment.

Textbook(s) and/or other required material:
1. B. V. Liengme, *A Guide to Microsoft Excel 2002 for Scientists and Engineers*, Butterworth-Heinemann, 2002.
2. M. Dix and P. Riley, *Introduction to Autocad 2000*, Prentice-Hall, 2000.
3. S. J. Chapman, *Introduction to Java*, Prentice-Hall, 1999.

Reference: None

Course Objectives: To provide students with a diverse set of computational skills that will help them as students and as practicing civil or environmental engineers or environmental scientists.

Coordinator: Dr. Tohren C. G. Kibbey, Assistant Professor, School of Civil Engineering and Environmental Science

Prerequisites by Topic: None

Topics:

1. Spreadsheets (11 classes)
   Introduction to Excel, Entering and working with formulas, Relative vs. absolute references, Filling cells, Formatting spreadsheets, Good spreadsheet practice
   Built-in Functions
      IF (and related functions)
      Engineering/Science/Mathematics functions
      Statistical functions
2. Programming with Java (12 classes)
   Introduction to Java, Basic Elements of Java: variables and constants data types, assignment and mathematical expressions, standard input and output, The structure of a Java program.
3. Scientific/Engineering Graphics with AutoCAD (7 classes)
   Scientific/Engineering Graphics Basics
   AutoCAD Basics, Layers, Dimensioning, Templates

Class/laboratory Schedule: Two 75-minute lectures per week.

Computer Usage: AutoCAD, spreadsheets (Excel), Java (JBuilder)

Design Projects: Vehicle routing problem programming design project.

Laboratory Projects: Multiple in-class programming/computation exercises.

Assessment Methods Used:
1. Standard course evaluation
2. Peer evaluation

Contribution to Professional Component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science - 2 credit hours or 67%
Engineering Design - 1 credit hour or 33%

Relationship of Course to Program Outcomes:
1.1: ii, vii; 1.2: i, ii, iii
2.1: i

Relationship of Course to ABET Criterion 3 (a – k)
a, c, e, k

Prepared by: Tohren Kibbey **Date:** March 2, 2005

CE 2113 – Statics and Dynamics
Fall 2005
Required

2003-2006 Catalog Data: **2113: Statics and Dynamics (Crosslisted with AME 2113).** Prerequisite: Physics 2514 and Mathematics 2433 or concurrent enrollment in Mathematics 2433. Vector representation of forces and moments; general three-dimensional theorems of statics and dynamics; centroid and moments of area and inertia. Free-body diagrams, equilibrium of a particle and of rigid bodies, principles of work and energy; principle of impulse-momentum. Motion of particles and rigid bodies in translating and rotating reference frames. Newton's law of motion and Lagrange's equation, including application to lumped-parameter systems. (F, Sp, Su)

Prerequisite: Physics 2514 and Math 2433 or concurrent enrollment in 2433

Textbook(s) and/or other required material:

1. *Vector Mechanics for Engineers - Statics*, by Ferdinand B. Beer and E. Russell
2. Johnston, Jr., 7th ed., 2004, with accompanying workbook (ISBN 0073130877), McGraw-Hill Book Co.

Course Objectives: General: To develop an analytical and methodic approach to solving relatively simple mechanical problems: i.e. the ability of reducing the mechanical problem at hand to an idealized mathematical model and applying relevant theoretical concepts and methods to arrive at the desired solution.

Selected topics: To develop the ability to operate on force and moment vectors to obtain resultants or components; Develop an understanding of equilibrium of forces and free-body-diagrams; Introduce to the students the analysis of simple structures; Introduce frictional forces; Develop ability to obtain centroid and moment of inertia of areas; Introduce certain aspects of kinematics and kinetics of particles, if time permits.

Coordinator: Dr. Kianoosh Hatami, Assistant Professor, School of Civil Engineering and Environmental Science

Prerequisites by Topic:
1. Calculus
2. Physics

Topics:
1. Force resultants and resolution of forces into components
2. Rectangular components of a force, Unit vectors, Addition of forces
3. Equilibrium of a particle, Free-body diagrams
4. Rectangular components of a force in space, Equilibrium of a particle in space
5. Vector product of two vectors, Moment of a force about a point, Varignon's theorem
6. Scalar product of two vectors, Mixed product of vectors

7. Moment of a force about a given axis, Moment of a couple
8. Equivalent systems of forces, Reduction of a system of forces to a wrench
9. Equilibrium of rigid bodies in two dimensions
10. Spring Break
11. Equilibrium of rigid bodies in three dimensions
12. Centroids and Centers of Gravity, Distributed Loads on Beams
13. Analysis of trusses by the method of joints and sections
14. Analysis of frames
15. Problems involving friction
16. Moments of inertia

Schedule: Three 50 minute lectures per week

Computer Usage: Matlab, spreadsheets and word processing used for various homework assignments

Design Projects: None

Laboratory Projects: None

Assessment Methods Used:

5. Standard course evaluation

Contribution to Professional Component:

Math and Basic Sciences – 0 credit hours or 0%
Engineering Science – 3 credit hours or 100%
Engineering Design – 0 credit hours or 0%

Relationship of Course to Program Outcomes

1.1: ii, 1.2: i

Relationship of Course to ABET Criterion 3 (a – k):

a, e

Prepared by: K.A. Strevett **Date**: May 14, 2005

CE 2153 - Mechanics of Materials
Spring 2005
Required

2003-2006 Catalog Data: **2153: Mechanics of Materials.** Prerequisite: 2113. Basic principles of mechanics, including the definition of stress and strain, transformations and principal values for the stress and strain tensors, kinematics relations, review of conservation equation and the development and application of constitutive laws for idealized materials. Elementary elasticity and Hooke's law; Poisson's ratio; solution of elementary one- and two-dimensional statically indeterminate problems; stresses and strains due to temperature changes; stresses induced by direct loading, bending and shear; deflection of beams; area-moment and moment distribution; combined stresses; structural members of two materials; columns. (F, Sp)

Prerequisite: CE 2113

Textbook(s) and/or other required material:
1. Gere and Timoshenko, *Mechanics of Materials*, 3rd Edition, PWS-Kent Publishing Co., 1984

Course Objectives: Understand analysis and design of members subjected to axial loading, shear, torsion, and bending stress, strain, strength behavior.

Coordinator: Dr. Musharraf Zaman, David Ross Boyd Professor, School of Civil Engineering and Environmental Science

Prerequisites by Topic:
1. Statics and equilibrium
2. Properties of areas and volumes
3. Free-body diagrams

Topics:
1. Review of statics
2. Concepts of stress and strain
3. Hooke's Law and linear elasticity
4. Modulus of elasticity
5. Stress, strain and deflection of axially loaded members
6. Shear stress and strain
7. Shear modulus
8. Torsional stress and strain
9. Pure shear

10. Torsional deformations
11. Power transmission in circular shafts

12. Beams
13. Shear and bending moments diagrams
14. Bending stresses and strains in beams
15. Composite beams
16. Shear stresses in beams
17. Transformation of plane stress
18. Principal stresses and strains
19. Mohr's circle
20. Pressure vessels
21. Deflection of beams
22. Beam deflections by integration
23. Statically indeterminate structures
24. Columns and Euler's stability

Class/laboratory schedule: Two 75-minute lectures per week.

Computer Usage: Spreadsheets

Design Projects: None

Laboratory Projects: None

Assessment Methods Used:
1. Standard course evaluation

Contribution to Professional Component:
Math and Basic Sciences – 0 credit hour or 0%
Engineering Science - 2.5 credit hour or 84%
Engineering Design - 0.5 credit hour or 16%

Relationship of Course to Program Outcomes
1.1:ii, vii; 1.2: i, ii, iii

Relationship of Course to ABET Criterion 3 (a – k):
a, c ,e, g, k

Prepared by: K.A. Strevett **Date**: May 14, 2005

CE 2223 – Fluid Mechanics
Spring 2005
Required

2003-2006 Catalog Data: **2223: Fluid Mechanics.** Prerequisites: 2113, Environmental Science 2313, Mathematics 2433 and concurrent enrollment in Mathematics 3113. Coverage of the fundamentals of fluid statics and dynamics. Formulation of the equation of fluid flow, i.e., Navier-Stokes equations, Eulers equations, Bernoulli equations, etc. and their application. Examples of ideal fluid flow and viscous fluid flow, such as flow in open and closed conduits. (Sp)

Prerequisites: Mathematics 2433, and concurrent enrollment in Mathematics 3113 (Note: Environmental Science 2313 is not required in the Architectural Engineering Program)

Textbook(s) and/or other required material:
Potter, M.C.; Wiggert, D. C. *Mechanics of Fluids*, 3rd Edition, Brooks/Cole, 2002

Course Objectives: To provide students with an understanding of fundamentals of fluid statics and fluid motion, with emphasis on engineering applications.

Coordinator: Dr. Tohren C. G. Kibbey, Assistant Professor, School of Civil Engineering and Environmental Science

Prerequisites by Topic: None

Topics:
1. Introduction/Basic Considerations (1cl.)
2. Fluid Statics: forces on plane and curved surfaces, buoyancy, stability, linearly accelerating containers (4 cl.)
3. Fluids in Motion/Integral Forms: introduction, Bernoulli equation, conservation of mass, energy equation, momentum equation (5 cl.)
4. Dimensional Analysis and Similitude (3 cl.)
5. Internal Flow: Introduction, laminar flow, Turbulent flow in pipes, Minor losses (5 cl.)
6. External Flow: Introduction, drag and lift, boundary layer theory (3 cl.)
7. Open Channel Flow (2 cl.)
8. Compressible Flow (2 cl.)
9. Piping Systems (2 cl.)

Class/laboratory schedule: Two 75-minute lectures per week.

Computer Usage: Spreadsheets

Design Projects: None

Laboratory Projects: None

Assessment Methods Used:
1. Standard course evaluation

Contribution to Professional Component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science – 2.5 credit hours or 83%
Engineering Design – 0.5 credit hours or 17%

Relationship of Course to Program Outcomes:
1.1:ii, vii

Relationship of Course to ABET Criterion 3 (a – k):
a, c, e

Prepared by: Tohren Kibbey **Date:** March 2, 2005

CE 3213 – Water Resources Engineering
Fall 2004
Required

2003-2006 Catalog Data: **CE 3213: Water Resources Engineering.** Prerequisite: 2223. Municipal water demands, surface water hydrology, ground water hydrology, water distribution systems, pump design, wastewater collection systems, storm water management, water law. (F)

Prerequisites: CE 2223

Textbook(s) and/or other required material:
Water Resources Engineering, D. A. Chin, Prentice-Hall, 2000

Course Objectives: Introduce the student to selected topics in water resources engineering, including the following: hydrology, hydraulics, water supply and distribution, pump design, wastewater collection, and storm water management. Students must demonstrate both a conceptual understanding and familiarity with practical design tools. All major concepts will be presented in the context of designing infrastructure elements for Sooner City. In order to successfully complete the project and the course, students must not only master the technical material, *they must also develop the critical thinking skills necessary to handle open-ended design problems*, including analyzing and assessing multiple alternatives. Since infrastructure design spans many sub-disciplines of civil and environmental engineering, we will require students to collaborate, via the web or formal memos or common meetings, with other CEES classes working on similar aspects of the design.

Coordinator: Dr. Randall L. Kolar, Associate Professor, School of Civil Engineering and Environmental Science

Prerequisites by Topic: Fluid Mechanics

Topics:

1. Introduction to water resources engineering
1. Municipal water demands
2. Sources of water
3. Basic surface water hydrology and the water budget
4. Basic ground water hydrology and well hydraulics
6. Design of water distribution systems
7. Pump analysis & design (system curves, pumps in parallel & series)
8. Quantities of waste
9. Open channel hydraulics
10. Design of sanitary sewers
11. Urban hydrology & design of storm sewers
12. Introduction to water law

Class/laboratory schedule: Two 50-minute classes per week; one 120-minute computer/problem solving laboratory

Computer Usage: Most homework assignments require the use of spreadsheets to solve problems. Tasks for the design project requires solution of simultaneous nonlinear equations, so students use academic editions of commercially-available software, such as Haestad Methods CAD products. Graphics and word processing needed for reports.

Design Projects: Sewer and water infrastructure for the city, including pump design.

Laboratory Projects: None

Assessment Methods Used:
1. Standard course evaluation.
2. Reflective writing assignments
3. Review of course technology submittal
4. Peer evaluation

Contribution to Professional Component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science - 1 credit hour or 33%
Engineering Design – 2 credit hours or 67%

Relationship of Course to Program Outcomes:
1.1: i, vi; 1.2: i, iii; 1.3: i
2.1: ii, iv; 2.2: iii, vi; 2.3: i, ii

Relationship of Course to ABET Criterion 3 (a – k):
a, c, d, e, g, i, j, k

Prepared by: K.A. Strevett **Date**: May 14, 2005

CE 3243 – Water and Wastewater Treatment Design
Spring 2005
Required

2003-2006 Catalog Data: **3243: Water and Wastewater Treatment Design.** Prerequisite: 2223, 3213, and ES 2313. Design of municipal water and wastewater treatment plants. Emphasis is placed on the characterization of water and wastewater and physical, chemical and biological treatment methods. Sludge processing, advanced treatment methods and treatment plant hydraulics are also considered. **Laboratory** (Sp)

Prerequisite: CE 2223, CE 3213, and ES 2313

Textbook(s) and/or required material:

M. Hammer and M.J. Hammer, *Water and Wastewater Treatment Technology*, 5th Ed., Prentice Hall, 2004 (ISBN: 0-13-097325-4)

Course Objectives: Evaluate a scenario requiring water or wastewater treatment and draw an appropriate process flow schematic for full-scale treatment of the water or wastewater being evaluated. The contaminants removed and residuals produced by each operation or process must also be identified in all schematics; formulate reactor design equations by implementing mass balance concepts and integrating them with simple chemical and biological kinetic expressions, as appropriate; professionally convey engineering design calculations using a written format; apply established equations and approaches to the design of the water and wastewater operation/process. Laboratory

Coordinator: Dr. Keith A. Strevett, Associate Professor, School of Civil Engineering and Environmental Science

Prerequisites by Topic:
1. Calculus
2. General chemistry
3. General physics
4. Fluid mechanics
5. Material Balance
6. Water Resources

Topics:
1. Introduction: Materials Balance; Example Problems
2. Water Treatment: Overview and Water Chemistry; Example Problems
3. Reaction Kinetics; Water Quality; Example Problems
4. Coagulation and Softening; Reactors; Example Problems
5. Mixing and Flocculation; Example Problems
6. Sedimentation and Filtration; Example Problems
7. Disinfection and Adsorption; Example Problems
8. Wastewater Treatment: Design Overview; Microbiology
9. Wastewater Treatment: Water Quality Indicators
10. Spring Break
11. Pretreatment Treatment; Example Problems

12. Primary Treatment; Example Problems
13. Secondary Treatment-Suspended; Example Problems
14. Secondary Treatment-Fixed; Example Problems
15. Tertiary Treatment; Example Problems
16. Sludge Treatment; Sludge Disposal; Example Problems

Class/laboratory schedule: Two 120-minute lectures and one 120-minute laboratory session per week

Computer Usage: WaterPro, spreadsheets and word processing used on various homework assignments and laboratory reports.

Design Projects: Two design projects that relate to the Sooner City concept. The first design is a water treatment plant. The second design is a wastewater treatment plant design. Teams of three or four will work closely together and complete designs. Final designs are submitted in written form as well as a summary presentation given by the groups.

Laboratory Projects:
1. Water Treatment Plant (1 week) and Wastewater Treatment Plant (1 week) Visit
2. Water Chemistry: pH Measurement, Conductivity, Turbidity, Alkalinity, Hardness (2 weeks)
3. Water Treatment Design I: Coagulation, Flocculation (1 week)
4. Water Treatment Design II: WaterPro Disinfection Design (1 week)
5. Wastewater Quality: BOD, COD, ThOD, Oxygen Update (2 week)
6. Wastewater Treatment Design: Oil-Water Clarifier (4 weeks)
7. Required participation in ASCE Brown-Bag Presentations (3 weeks)

Assessment Methods Used:
1. Standard course evaluation
2. Review of course written submittal
3. Peer evaluations
4. Review of course technology submittal

Contribution to Professional Component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science - 1 credit hours or 33%
Engineering Design - 2 credit hours or 67%

Relationship of Course to Program Outcomes:
1.1: i, v, vi, vii; 1.2: i, ii, iii; 1.3: i
2.1: ii, iv, v; 2.2: iii; 2.3: i, ii

Relationship of Course to ABET Criterion 3 (a – k):
a, b, c, d, e, f, g, j, k

Prepared by: Keith A. Strevett **Date:** January 14, 2005

CE 3334 – Measurements In CEES
Spring 2005
Required

2003-2006 Catalog Data: **3334: Measurements In CEES.** Prerequisite: Mathematics 2423, Physics 2524, Chemistry 1415, and Environmental Science 2313. Introduction to measurement (laboratory and field) techniques, data analysis, and interpretation and applications to civil and environmental engineering and environmental science problems. Topics include statistics, land surveying, remote sensing, GIS, environmental sampling and analysis, and sensors. **Laboratory** (Sp)

Prerequisites: Mathematics 2423, Physics 2524, Chemistry 1415
(Note: Environmental Science 2313 is not required in the Architectural Engineering Program)

Textbook(s) and other required material:
Course Packet

Course Objectives: To provide students with awareness of space and of methodologies to measure distance, elevation, direction, and description of these features.

Coordinator: Dr.Baxter E. Vieux, Professor, School of Civil Engineering and Environmental Science

Prerequisites by Topic:
Mathematics 2423
Physics 2524
Chemistry 1415

Topics:
Weeks 1-4, Test 1
1. Measurements and statistics
2. Probability concepts
3. Confidence Intervals
4. Standard error and Specifications

Weeks 5-9, Test 2
5. Topographic Mapping
6. GPS measurements of horizontal and vertical measurement
7. Working with coordinates and GIS

Weeks 9-14
8. Environmental Sampling
9. Calibration of Sensors
10. Term project

Class/laboratory schedule: Two 50-minute lectures twice per week

Computer Usage: Computer exercises for data analysis, GIS and statistical analysis

Design Projects: Term project involves data analysis and report writing

Laboratory Projects:
1. Statistics and repeated measurements
2. Calipers and measurement uncertainty
3. Differential leveling
4. GPS and acquisition of horizontal and vertical data
5. GIS mapping and evaluation of data sources
6. Topographic mapping
7. Environmental sampling

Assessment Methods Used:
1. Standard course evaluation

Contribution to Professional Component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science – 2 credit hours or 50%
Engineering Design – 2 credit hours or 50%

Relationship of Course to Program Outcomes:
1.1:ii, v
2.1:iv; 2.3: i

Relationship of Course to ABET Criterion 3 (a – k):
a, b, c, d, e, g, k

Prepared by: K.A. Strevett **Date**: May 14, 2005

CE 3364 - Soil Mechanics
Fall 2004
Required

2003-2006 Catalog Data: **3364: Soil Mechanics.** Prerequisite: CE2223, CE3403. General treatment of the physical and mechanical properties of soils. Theories of lateral earth pressure, consolidation, bearing capacity, slope stability and groundwater flow. **Laboratory** (F)

Prerequisites: CE2223, CE3403

Textbook(s) and/or other required material:
Braja Das, *Principles of Geotechnical Engineering*, 3rd Ed., PWS, 1993

Course Objectives: To provide students with an understanding of the fundamental behavior of soil with regard to applications in geotechnical engineering.

Coordinator: Dr. Gerald A. Miller, Associate Professor, School of Civil Engineering and Environmental Science

Prerequisites by Topic:
1. Fluid Mechanics
2. Materials

Topics:
1. Soil phase relationships
2. Index properties of soil
3. Soil classification
4. Soil compaction
5. Permeability and seepage, flow nets
6. Total, effective and neutral stresses in soils
7. Stresses in soils; Boussinesq, Newmark, and induced stresses by various types of surface loads
8. Consolidation and settlement
9. Shear strength of soil, direct shear, unconfined and triaxial compression tests; influence of water presence, p-q diagrams
10. Lateral earth pressure; active, at rest, passive; effect of surcharge loads
11. Slope stability—method of slices
12. Soil bearing capacity—Terzaghi's method, granular vs. fine-grained soils

Class/laboratory schedule: Three 50-minute lectures and one 170 minute laboratory session per week.

Computer Usage: Spreadsheets, graphing software

Design Projects: Semester long “Sooner City” Earth Dam design project.

Laboratory Projects:

1. Laboratory tour/slide show on Geotechnics
2. Soil identification/phase relationships - ASTM D2488
3. Soil classification - ASTM D2487, D422, D4318
4. Soil survey exercise
5. Soil compaction - ASTM D698, D1557
6. Permeability and seepage
7. Video seminar (deep dynamic compaction, trenchless technology)
8. Oedometer test - ASTM D2435
9. Geotechnical exploration exercise
10. Direct shear test - ASTM D3080
11. Unconfined compression test - ASTM D2166
12. Triaxial compression test - ASTM 4767
13. Geosynthetics seminar

Assessment Methods Used:
1. Standard course evaluation
2. Review of course written submittals
3. Peer evaluation

Contribution to Professional Component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science – 2.5 credit hours or 83%
Engineering Design – 0.5 credit hours or 17%

Relationship of Course to Program Outcomes:
1.1: v, vi; 1.2: i, ii, iii; 1.3: i
2.1: iv; 2.3:i, ii

Relationship of Course to ABET Criterion 3 (a – k):
a, b, c, e, f, g

Prepared by: K.A. Strevett **Date**: May 14, 2005

CE 4114: Aquatic Chemistry
Fall 2004
Required

2003 - 2006 Catalog Data: **4114: Aquatic Chemistry (Crosslisted with Environmental Science 4114; Slashlisted with 5114).** Prerequisite: Senior standing and one year of general chemistry. Environmental kinetics and thermodynamics in aquatic systems; acid/base, precipitation/solubility, metal complexation, and oxidation/ reduction reactions; environmental colloidal and solid-liquid interface chemistry. No student may earn credit for both 4114 and 5114 or Environmental Science 4114 and 5114. **Laboratory** (F)

Prerequisites: Senior standing and one year of general chemistry.

Textbook(s) and/or other required material:
Jensen, J. N. (2003), *A Problem Solving Approach to Aquatic Chemistry*, Wiley, New York.

Objectives: The objective of this course is to quantify and predict the distribution of aquatic chemical species as a function of environmental conditions such as pH, partial pressures of O_2(g) and CO_2(g), and temperature. The course focus is application of a chemical equilibrium approach to determine chemical speciation. Analytical, graphical, and numerical (i.e., computer) approaches are used for this purpose. Chemical kinetics are also used to determine speciation.

Coordinator: Dr. Elizabeth C. Butler, Associate Professor, School of Civil Engineering & Environmental Science

Prerequisites by Topic:
1. Introductory chemistry
2. Algebra
3. Calculus

Topics:

Week 1	Thermodynamics/chemical equilibria
Weeks 2-3	Aqueous species (acids, bases, salts); acid base equilibria/tableau method
Week 4	Log C-pH diagrams; carbonate system (open and closed)
Weeks 5-7	Alkalinity
Weeks 8-9	Buffer capacity; complexation reactions
Weeks 10-11	Precipitation/dissolution reactions
Weeks 12-14	Oxidation/reduction reactions
Week 15	Chemical kinetics
Week 16	Chemical kinetics; problem solving; mock final exam

Class/laboratory schedule: One 150-minute lecture and one 170-minute laboratory per week

Computer Usage: Spreadsheets for data analysis and graphing, word processing for writing laboratory and project reports, MINEQL+ for solving chemical equilibrium problems.

Design Projects:

- Homework questions and in-class problems requiring calculation of the pH of diluted acidic/basic wastewaters prior to discharge to surface waters.
- MINEQL+ assignment requiring calculation of the polyphosphate dose required to prevent iron oxide precipitation in drinking water distribution pipes.
- MINEQL+ project requiring calculation of the lime dose required for orthophosphate removal from wastewater.

Laboratory Projects (includes both wet laboratories and MINEQL+ workshops):

Week 1	No Laboratory or MINEQL+ Workshop
Week 2	No Laboratory or MINEQL+ Workshop
Week 3	MINEQL+ Workshop 1: Equilibrium constants/activity corrections
Week 4	MINEQL+ Workshop 2: Acid/base equilibria
Week 5	MINEQL+ Workshop 3: Carbonate system/alkalinity
Week 6	Laboratory 1: Carbonate system/alkalinity
Week 7	OU Fall student holiday: no class
Week 8	Laboratory 2: Hardness determination
Week 9	MINEQL+ Workshop 4: Complexation reactions
Week 10	Laboratory 3: Calcium carbonate equilibria
Week 11	OU College of Engineering Open House: no class
Week 12	MINEQL+ Workshop 5: Precipitation/dissolution reactions
Week 13	MINEQL+ Project Workshop
Week 14	Thanksgiving holiday: no class
Week 15	Laboratory 4: Environmental redox reactions
Week 16	No Laboratory or MINEQL Workshop

Assessment Methods Used:

1. Standard course evaluation

Contribution to Professional Component:

Math and Basic Sciences – 0 credit hours or 0%
Engineering Science - 3 credit hours or 75%
Engineering Design - 1 credit hours or 25%

Relationship of Course to Program Outcomes:

1.1: i, v; 1.2: i
2.3: i

Relationship of Course to ABET Criterion 3 (a – k)

a, b, c, e, k

Prepared by: Elizabeth C. Butler **Date**: February 10, 2005

CE 4123 - Open Channel Flow
Spring 2005
Elective

2003-2006 Catalog Data: **4123 Open Channel Flow.** Prerequisite: Engineering 3223. Theory, analysis and design of channels, aqueducts, headworks, siphons, spillways and hydraulic structures. An in-depth study of critical flow and measurement techniques. Backwater analysis by analytical, calculator and computer methods. Special emphasis on practical problems of general interest. (F)

Prerequisites: CE 2223

Textbook(s) and/or other required material:
T. W. Sturm, *Open Channel Hydraulics,* McGraw-Hill, 2001

Course Objectives: Introduce the student to a broad range of topics in open channel hydraulics, including the following: energy, momentum, and continuity equations, uniform flow, gradually-varied flow, rapidly-varied flow, and sediment transport. Class activities will allow the student to gain a qualitative understanding as well as a sound theoretical background. Students must demonstrate, via quizzes, homework assignments, and exams, both a conceptual understanding and familiarity with analysis and design tools. Concepts learned in class will then be applied to practical hydraulic design problems. Upon successful completion of the course, the student should have the tools needed to solve most steady-flow open channel problems, such as analysis and design of natural and man-made channels, computation of water surface profiles, floodplain analysis, and design of hydraulic structures.

Coordinator: Dr. Randall L. Kolar, Associate Professor, School of Civil Engineering and Environmental Science

Prerequisites by Topic:
1. Fluid mechanics
2. Laptop computer

Topics:
1. Introduction to open channel flow
2. Review of fluid mechanics, including the governing conservation equations
3. Uniform flow and its computation
4. The energy principle and critical depth
5. Gradually-varied flow and computation of water surface profiles
6. HEC-RAS
7. The momentum principle, rapidly-varied flow, and channel controls
8. Sediment transport

9. Hydraulic structures and transient flow

Class/laboratory schedule: Two 75-minute lectures per week

Computer Usage: Extensive computer usage throughout course using PC-based software for channel analysis & design (e.g., Haestad Methods FlowMaster) and water surface profiles (HEC-RAS). Also, graphic and word processing software required for project report.

Design Projects: Floodplain analysis and bridge design for Sooner River.

Laboratory Projects: None

Assessment Methods Used:

1. Standard course evaluation

Contribution to Professional Component:

Math and /Basic Sciences – 0 credit hours or 0%
Engineering Science - 2 credit hours or 67%
Engineering Design - 1 credit hour or 33%

Program Objectives and Related Strategy and Actions:

1.1: iv
2.1: iv

Criterion 3 Contents:

a, c, e, j, k

Prepared by: K.A. Strevett **Date**: May 14, 2005

CE 4234 - Applied Environmental Microbiology
Fall 2004
Required

2003-2006 Catalog Data: **4234 Applied Environmental Microbiology (Slashlisted with 5234).** Prerequisite: 3234, Engineering 2213 and 3223. Basic environmental microbiology and bioenvironmental engineering. Presentation of the diversity and importance organisms involved in solid and liquid waste reduction. The course examines basic microbiology, biodegradation mechanisms, bioavailability, biotreatability studies, groundwater remediation (both oxic and anoxic), and bioengineering process technologies. No student may earn credit for both 4234 and 5234. **Laboratory** (F)

Prerequisites: CE 3243: Water and Wastewater Treatment

Textbook(s) and/or other required material:
1. Chapelle, F.H., Groundwater Microbiology and Geochemistry, Wiley, NY, 1993
2. Alexander, M., Biodegradation and Bioremediation, Academic Press, NY, 1994
3. Laboratory: Pepper, I.L., Gerba, C.P., and Brendecke, J.W., Environmental Microbiology, Academic Press, New York, 1997

Course Objectives: This course will provide introduction to biotic systems important to environmental remediation. The course emphasizes microbial ecology, microbial physiology, and bacterial metabolism.

Coordinator: Dr. Keith A. Strevett, Associate Professor, School of Civil Engineering and Environmental Science

Prerequisites by Topic:
1. Understanding of basic calculus.
2. Understanding of basic analysis and parameters studied in CE 3234 mass balance and fate processes

Topics:
1. Introduction to AEM
2. Groundwater Microbiology
3. Biogeochemistry
4. Microbial Nutrition
5. Reaction Kinetics
6. Biokinetics
7. Bioenergetics
8. Introduction to Bioremediation
9. Central Metabolism
10. Petroleum HC Metabolism
11. Halogenated HC Metabolism
12. Bioavailability
13. Technologies

Class/laboratory schedule: Three 50-minute lectures plus one 4-hour laboratory per week

Computer Usage: Three homework assignments germane to kinetics and site expressions require students to develop spreadsheets. The project requires the students to use Mathcad and a modeling program from USEPA (Bioplume).

Design Projects: Students work in groups of four and determine Best Technology Approach to open-ended, real-life site. 1998 site was Dover AFB and site contaminants were TCE, DCE, and PCE.

Laboratory Projects:
1. Laboratory Safety; Introduction to GC, LC
2. Sterile Technique and Microscope Introduction
3. Sulfur and Nitrogen
4. Chemical/Biological Oxygen Demand
5. Culture Media/Nutrients
6. Microbial Sampling – Surface Water
7. Algae and Photosynthesis
8. Isolation – Soil Bacteria
9. Microbial Sampling – Groundwater
10. Isolation – Landfill Leachate
11. Coliform/Total Bacteria, Actinomycetes
12. Assimilable Organic Carbon
13. Phenol Degradation
14. BTEX Degradation

Assessment Methods Used:
1. Standard course evaluation
2. Peer evaluations
3. Review of course technology submittal
4. Review of course written submittal

Contribution to Professional Component:
Math and Basic Science – 0 credit hours or 0%
Engineering Science - 4 credit hours or 100%
Engineering Design – 0 credit hours or 0%

Relationship of Course to Program Outcomes:
1.1: i, v; 1.2: i, ii, iii
2.1: ii, iv, v; 2.2: iii; 2.3: i, ii

Relationship of Course to ABET Criterion 3 (a – k)
a, b, c, d, e, f, g, j, k

Prepared by: Keith A. Strevett **Date:** May 15, 2005

CE/ES 4263 - Hazardous and Solid Waste Management
Fall 2004
Required

2003-2006 Catalog Data: **G4263 Hazardous and Solid Waste Management. (Crosslisted with ES 4263).** Prerequisite: 3212. Sources and types of solid wastes; identification and classification of hazardous wastes; waste handling, transportation, treatment and disposal techniques, federal and state legislation; and environmental and health effects. (F)

Prerequisites: None. There is a typographical error in the Course Catalog

Textbook(s) and/or other required material:
R.J. Watts. *Hazardous Wastes: Sources, Pathways, Receptors*, Wiley: NY, 1998

Course Objectives: To provide students with an understanding of solid and hazardous waste management, including waste minimization techniques, treatment and disposal alternatives, environmental impact and health effects, and regulatory issues.

Coordinator: R. Fenton Rood, M.P.H., Director of Waste Systems Planning for ODEQ

Prerequisites by Topic: None

Topics:
1. Introduction to solid and hazardous waste management (1 cl.)
2. History of industrialization, overview of chemicals, toxicology (1 cl.)
3. Chemical fate and transport in the environment (1 cl.)
4. Quantities and sources of solid and hazardous wastes (3 cl.)
7. Hazardous waste laws and regulations (RCRA, CERCLA, OSHA, other) (1 cl.)
8. Treatment, storage and disposal of hazardous wastes (1 cl.)
9. Sanitary landfills and land disposal of hazardous wastes (1 cl.)
10. Incineration and air pollution control, site monitoring methods (1 cl.)
11. Site assessment (1 cl.)
12. Pollution prevention, waste minimization, source reduction (3 cl.)
15. Household hazardous wastes, brownfields (1cl.)

Class/laboratory schedule: One 150-minute lectures per week

Computer Usage: Spreadsheets and word processing, web (EPA, related)

Design Projects: None

Laboratory Projects: None

Assessment Methods Used:
1. Standard course evaluation

2. Peer Evaluation

Contribution to Professional Component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science – 2.5 credit hours or 83%
Engineering Design – 0.5 credit hour or 17%

Relationship of Course to Program Outcomes:
1.1: i
2.1: ii

Relationship of Course to ABET Criterion 3 (a – k)
a, c, e, h, j

Prepared by: Tohren Kibbey **Date:** March 2, 2005

CE 4903.002/ES 4913 – Civil Engineering Design - Environmental Capstone
Spring 2005
Required

2003-2006 Catalog Data: **4903 Civil Engineering Design.** Prerequisite: 4813, senior standing in Civil Engineering curriculum. Solution of major design problems by a team approach requiring the synthesis of several disciplines and adaptation as a civil engineering system; problems to be varied within the several areas of civil engineering according to the student's major interest. The design project will be under direct staff supervision. (Sp)

Prerequisite: ES 4813.

Textbook(s) and/or other required material:
None

Course Objectives: The capstone design experience is a course in which students draw upon various aspects of their undergraduate coursework to develop a comprehensive, engineered solution to an open-ended problem. The design problem is addressed by multidisciplinary student design teams. The semester project addresses a real-world problem and is coordinated with practicing engineers. Faculty coordinators serve in an advisory capacity and coordinate class meetings and presentations. Because of the required prerequisites, students are presumed to have been adequately trained in the fundamental principles of engineering analysis and have been introduced to the concepts of engineering design; class presentations are on non-traditional topics.

Coordinator: Dr. Keith Strevett, School of Civil Engineering and Environmental Science

Prerequisites by Topic: Completion of, or concurrent enrollment in, all professional electives and required engineering courses up through the first semester of the senior year.

Topics:
Week 1. Course overview, Project scope and description
Week 2. Organizational management
Week 3. Team working session
Week 4. Team working session
Week 5. Team working session
Week 6. Team working session
Week 7. Preliminary Design (35%) Submittal - peer evaluations
Week 8. 35% completion review
Week 9. Team working session
Week 10. Team working session

Week 11. Preliminary Design (65%) Submittal - peer evaluations
Week 12. 65% completion review
Week 13. Team working session
Week 14. 100% design submittal, design presentation (practice) - peer evaluations
Week 15. Final presentations

Class/laboratory schedule: Two 170 minute class meetings per week

Computer Usage:
1. Extensive use of word processing and spreadsheets in developing reports
2. Specialized programs for completing various aspects of project, e.g., AUTOCAD, and developing presentations, e.g., PowerPoint, Harvard Graphics, etc.

Design Projects: The focus of the comprehensive design project varies from year to year.

Laboratory Projects: Project specific

Teamwork:
1. All work will be conducted in a professional atmosphere similar to that found in any consulting engineering design firm. Students will be organized into design teams and led by a project manager. Project managers will be chosen by personnel from the Capstone Advisory Board based upon resumes submitted by the students.

Assessment Methods Used:
1. Standard course evaluation with supplemental questions.
2. Peer/self evaluations
3. Practitioner evaluation of major design effort, written report and oral presentation

Contribution to Professional Component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science – 0 credit hours or 0%
Engineering Design – 3 credit hours or 100%

Relationship of Course to Program Outcomes:
1.1.vi; 1.2.i, ii, iii, iv; 1.3: iii
2.1.ii, iii, v; 2.3.i, ii

Relationship of Course to ABET Criterion 3 (a – k)
d, e, f, g, h, i, j, k

Prepared by: Robert C. Knox **Date:** June 19, 2005

CE 5020/ES 5010 - Corporate Environmental Management
Fall 2004
Elective

2003-2006 Catalog Data: New course. Description not in current catalog

Prerequisite: Senior or graduate standing or permission of instructor

Textbook(s) and/or other required material:

1. Andrew J. Hoffman, *Competitive Environmental Strategy - A Guide to the Changing Business Landscape*, Island Press, 2000
2. Michael V. Russo (Ed.), *Environmental Management - Readings and Cases*, Houghton Mifflin, 1999
3. Additional reading materials required for the class are drawn from e journals accessible through the OU library Internet connection

Course Objectives: The goal of this course is for the student to gain an appreciation of the dimensions of the natural environment in today's business environment with the express goal of providing a sense of what issues are of central policy importance, as well as what career opportunities may lay in store for the civil engineering or environmental science student with an interest in the development of a sustainable society.

Coordinator: Dr. Mark Meo, Professor, School of Civil Engineering and Environmental Science, and Science and Public Policy Fellow

Prerequisites by Topic: None

Topics:
Competitive Environmental Strategy, From Environmental Management to Environmental Strategy, Regulatory Drivers, International Drivers, Resource Drivers, Market Drivers, Altering Strategic Objectives, Strategy Originates within the Organization, The Organization Lies within a Broader Institutional Context, Environmental Strategy in an Institutional Context: Two Sectoral Studies, Environmental Strategy and Sustainable Development

Library Reading (i) "Beyond Greening: Strategies for a Sustainable World," Stuart Ha ***Harvard Business Review***, Vol. 75, No. 1, Jan-Feb, 1997; (ii) "Global Sustainability and the Creative Destruction of Industries," Stuart Hart and Mark Milstein, ***MIT Sloan Management Review***, Vol. 41, No. 1, Fall, 1999; (iii) "The Next Step in Becoming 'Green': Life-Cycle Oriented Environmental Management," Mark Sharfman, Rex Ellington, and Mark Meo, ***Business Horizons***, Vol. 40, No. 3, May-June 1997, pp. 13-22.; (iv) "Innovating Our Way to the Next Industrial Revolution," Peter Senge, Goran Carstedt, and Patrick Porter, ***MIT Sloan Management Review***, Vol. 42, No. 2, Winter, 2001; (v) "The Great Leap: Driving Innovation from the Base of the Pyramid," Stuart Hart and Clayton Christensen, ***MIT Sloan Business Review***, Vo. 44, No. 1, Fall, 2002; (vi) "Conoco and the Vapor Recovery Project: Using Innovation to Preserve Autonomy," Mark Sharfman, Rex Ellington, and Mark Meo, ***Journal of Industrial Ecology***, Vol. 3, No. 1, 1999; (vii) "The

Introduction of Postconsumer Recycled Material into TYVEK®: Production, Marketing, and Organizational Challenges," Mark Sharfman, Rex Ellington, and Mark Meo, ***Journal of Industrial Ecology***, Vol. 5, No. 1, 2001.

Case Study: Pacific Lumber Company; *Case Study*: Oil in the Ecuadorean Rainforest; *Case Study*: Design Tex, Incorporated; *Case Study*: McDonald's Environmental Strategy; *Case Study*: Deja Shoe; *Case Study*: The Clamshell Controversy; *Case Study*: Bayerische Motoren Werke AG

American Behavioral Scientist, Vol. 44, No. 2, October 2000. "Green Technology and Public Policy," Edited by Mark Meo and Mark Sharfman.; Rondinelli and Berry paper, pp. 168-187; Anex paper, pp. 188-212; Allenby paper, pp. 213-228; Ehrenfeld paper, pp. 229-244; Sharfman et al., pp. 277-302.

Class/laboratory schedule: One 150-minute lecture per week

Computer Usage: Library access to Internet

Design Projects: None

Laboratory Projects: None

Assessment Methods Used:
1. Standard Course Evaluation.

Contribution to Professional Component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science - 0 credit hours or 0%
Engineering Design - 0 credit hours or 0%

Relationship of Course to Program Outcomes:
1.1: iv
2.1: iv

Relationship of Course to ABET Criterion 3 (a – k)
h; j

Prepared by: K.A. Strevett **Date**: May 14, 2005

CE 5021 - Technical Communications
Spring 2005
Elective

2003-2006 Catalog Data: **G5021: Technical Communications (Crosslisted with Environmental Science 5021).** Prerequisite: CEES graduate standing or permission of instructor. Focused on enabling students to improve oral and written communications skills. Examines appropriate formats for various technical publications, as well as methods and practices for developing effective oral presentations. Each student will be required to develop an oral presentation about his/her written product. (F)

Prerequisites: The course is open to all CoE students who can identify a faculty member willing to work with them on the semester project. The course is mandatory for all CEES graduate students at the appropriate point in the degree plan.

Textbook(s) and/or other required material:
Alley, M., The Craft of Scientific Writing, Third Edition. 1996, Springer-Verlag, New York.

Course Objectives: This course is focused on enabling students to improve their oral and written communications skills. The course will examine the appropriate formats (structure, style, referencing) for various technical publications, including detailed discussions of the content of the specific sections of a technical publication. Discussions will also focus on proper word usage and sentence structures for technical documents. The course will also examine methods and practices for developing effective oral presentations, including the use of visual aids and multimedia technology. Each student will identify a "written communications project" for the semester (i.e., special topics, thesis or dissertation prospectus). The course will have intermediate milestones (e.g., outlines, first draft, revised drafts) designed to track progress toward achieving the goal. Each student will also be responsible for developing an oral presentation about his/her written product.

Coordinator: Dr. Robert C. Knox, John A. Myers Professor and Director, School of Civil Engineering and Environmental Science

Topics:

Week 1: Student orientation and discussion of course
Week 2: Outlines
Week 3: Prospectus Outline; Dealing With Data; Compilation of data
Illustration of data
Week 4: Analysis and interpretation of data
Week 5: Language - Choosing the right word; Choosing the right level of detail; Avoiding needless complexity; Avoiding ambiguity; Technical Writing
Week 6: Language - Controlling tone; Strong nouns and verbs; Avoid unfamiliar terms:

Incorporating examples and analogies
Week 7: Language -Eliminating redundancies; Reducing sentences to simplest form; Eliminating discontinuities; Effective Visual Aids
Week 8: Effective oral presentations
Week 9-14: Oral presentations

Class/laboratory schedule: One 70-minute lecture per week.

Computer Usage:
1. Extensive use of word processing and spreadsheets in developing reports
2. Specialized programs for completing various aspects of project, e.g., AUTOCAD, and developing presentations, e.g., PowerPoint, Harvard Graphics, etc.

Design Projects:
Each student must identify a CEES faculty member to work with on their "written communications project." The professor will read the final product and provide an evaluation of "satisfactory" or "unsatisfactory".

Laboratory Projects: None

Written and/or Oral Communications:
Each student is responsible for developing an oral presentation regarding his/her written project. The oral presentations must utilize available multimedia technology. The oral presentations will be made before the class and CEES faculty. The oral presentations will be evaluated by the CEES faculty in attendance

Assessment Methods Used:
6. Standard course evaluation

Contribution to Professional Component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science – 0 credit hours or 0%
Engineering Design – 0 credit hours or 0%

Relationship of Course to Program Outcomes
1.1:iv
2.1:iv

Relationship of Course to ABET Criterion 3 (a – k):
g

Prepared by: Robert C. Knox **Date:** May 15, 2005

CE 5244: Water and Waste Treatment
Spring 2004
Elective

2003 - 2006 Catalog Data: **5244 Water and Waste Treatment.** Corequisite: CE 5114. Analysis and design of physical and chemical treatment operations and processes used for environmental quality control. Solids and liquids separation, heat transfer, gas transfer, sludge treatment, advanced water and wastewater processes and operations. (F)

Prerequisites: CE/ES 5114 (corequisite)
(Note, course is now taught in spring semester only)

Textbook(s) and/or other required material:
American Water Works Association, *Water Quality & Treatment: A Handbook of Community Water Supplies,* 5th edition, Raymond D. Letterman, Ed., McGraw-Hill, Inc., New York.

Course Objectives: To understand and design physical/chemical unit processes for water and wastewater treatment and ground water remediation.

Coordinator: Dr. Elizabeth C. Butler, Associate Professor, School of Civil Engineering & Environmental Science

Prerequisites by Topic:
1. Introductory chemistry
2. Materials balance
3. Introductory physics
4. Calculus

Topics by Week:

Week 1	Regulations; overview of water quality concerns
Week 2	Chemical kinetics and reaction engineering
Week 3	Coagulation/flocculation
Week 4	Sedimentation
Week 5	Porous media filtration
Weeks 6-7	Disinfection; field trip to Norman water treatment plant
Weeks 8-9	Adsorption
Week 10	Spring break: no class
Week 11	Demineralization: precipitation
Week 12	Demineralization: ion exchange; Field trip to Norman wastewater treatment plant
Week 13	Demineralization: membrane processes
Weeks 14-15	Gas transfer/air stripping
Week 16	Residuals disposal; final project presentations

Class/laboratory schedule: Three 50-minute lectures per week and one 50-minute mandatory group project activity period.

Computer Usage: Spreadsheets for data analysis and graphing, word processing for writing project reports.

Design Projects: Semester-long group design project.
Homework assignments require design of various unit processes to achieve water treatment goals, e.g., filtration, flocculation, reactor sizing, and disinfectant dose.

Assessment Methods Used:
1. Standard course evaluation.

Contribution to Professional Component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science - 3 credit hours or 75%
Engineering Design - 1 credit hours or 25%

Relationship of Course to Program Outcomes:
1.1: iv
2.1: iv

Relationship of Course to ABET Criterion 3 (a – k)
a, c, e, g, j

Prepared by: Elizabeth C. Butler **Date:** February 10, 2005

CE 5343 - Advanced Soil Mechanics
Fall 2004
Elective

2003 - 2006 Catalog Data: **G5343: Advanced Soil Mechanics.** Prerequisite: 3363, Mathematics 3113. Advanced treatment of theories and principles of shearing strength, stress distribution and settlement analysis. (F)

Prerequisites: CE 3363, MATH 3113

Textbook and/or other required material:
None

Course Objectives: To provide students with an understanding of advanced theories of soil mechanics and their applications in geotechnical engineering.

Coordinator: Dr. Gerald A. Miller, Ph.D., P.E., Associate Professor, School of Civil Engineering and Environmental Science

Prerequisites by Topic:
1. Soil mechanics
2. Differential equations

Topics:
1. Introduction
2. The Nature of Soil Constituents
3. Stresses in a Soil Mass
4. Stress-Strain Behavior of Soils
5. Drained and Undrained Soil Behavior
6. Steady-State and Transient Flow of Water Through Soil
7. Consolidation in Saturated Soils
8. Compressibility and Settlement
9. Shear Strength and Stability
10. Unsaturated Soil Mechanics
11. Constitutive Modeling

Class/laboratory schedule: Two 75-minute classes per week

Computer Usage: Excel spreadsheet used on various homework assignments.

Design Projects: None

Laboratory Projects: None

Assessment Methods Used:
7. Standard course evaluation

Contribution to Professional Component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science – 2 credit hours or 67%
Engineering Design – 1 credit hours or 33%

Relationship of Course to Program Outcomes
1.1:iv
2.1:iv

Relationship of Course to ABET Criterion 3 (a – k):
a, c, e, j, k

Prepared by: Keith A. Strevett **Date**: June 14, 2005

CE 5423 - Environmental Geotechnology
Spring 2005
Elective

2003-2006 Catalog Data: **5423 Environmental Geotechnology**. Prerequisite 3234 and 3363, or permission of instructor. Covers geotechnical issues in environmental problems and solutions. Site characterization; laboratory and in situ testing for environmental applications; soil mineralogy and fabric; design and construction of contaminant barriers and landfill liners. (Sp)

Prerequisites: CE 3243, 3364
(Note: CE 3363 was replaced by course number CE 3364)

Textbook(s) and other required material:
None

Coordinator: Dr. K.K. Muraleetharan, Professor, School of Civil Engineering and Environmental Science

Course Objectives: Geotechnical engineering is an integral part of solving environmental problems. This course will attempt to provide a broad understanding of geotechnical issues in environmental problems and solutions.

Prerequisites by Topic:
1. Soil mechanics
2. Basic understanding of ground water quality management

Topics:
1. Introduction
2. Basic definitions and phase relationships for soils
3. Site characterization- Health and safety plan (general); Geophysical methods; Cone Penetration Tests; Drilling and soil sampling; Monitoring well installation, well development and water sampling; Hydropunch™ water sampling; BAT™ testing; Double ring infiltrometer permeability testing
4. Laboratory testing- Behavior of unsaturated soils; Permeability testing on saturated and unsaturated soils; Geosynthetic testing including interface properties
5. Soil Composition and fabric and their influence on soil behavior- Clay mineralogy; Pore fluid chemistry; Soil particle surface - pore fluid interaction; Arrangement of soil particles; Compaction; Conduction phenomena; Retention of pollutants
6. Design and Construction of Landfill covers and bottom liners- Regulations; Static and seismic design; Construction aspects and QA/QC
7. Design and construction of slurry walls
8. Physical and numerical modeling of pollution transport processes- Physics of the problem; Available computer codes; Bench tests vs. Centrifuge model tests

Class/laboratory schedule: Two 75-minute lectures per week

Computer Usage: Spreadsheet

Design Projects: Students analyze field and laboratory data from a Phase II environmental assessment at various sites of concern along a subway tunnel segment and write a report summarizing the findings. The report includes environmental concerns, investigation and findings, extent of contamination, and recommendations.

Laboratory Projects: Demonstration of unsaturated soil testing equipment

Assessment Methods Used:
1. Standard course evaluation

Contribution to Professional Component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science - 2.0 credit hours or 67%
Engineering Design - 1.0 credit hours or 33%

Relationship of Course to Program Outcomes:
1.1: iv

Relationship of Course to ABET Criterion 3 (a – k)
a, c, e, j, k

Prepared by: K. K. Muraleetharan **Date**: February 14, 2005

CE 5624 - Biological Waste Treatment
Fall 2003
Elective

2003-2006 Catalog Data: **5624 Biological Waste Treatment.** Treatment of waste using biological processes; emphasis on treatment kinetics, municipal wastewater treatment processes, and design of municipal wastewater unit processes; application of biological treatment concepts to other wastes including industrial wastes, groundwater, and solid or hazardous wastes. **Laboratory** (F)

Prerequisites: Graduate standing in Civil Engineering or Environmental Science or permission

Textbook(s) and/or other required material:
Rittmann, Bruce and McCarty, Perry, "Environmental Biotechnology: Principles and Applications", 2001, McGraw-Hill

Course Objectives: To develop an understanding of the major biochemical reactions relevant to environmental engineering. To develop an understanding of how these processes in ideal biochemical reactors respond to environmental and operational factors. To develop a knowledge base regarding the applications and limitations of these biochemical operations. To develop the ability to construct, use, and interpret process design for the major biochemical operations.

Coordinator: Dr. Keith A. Strevett, Assistant Professor, School of Civil Engineering and Environmental Science

Prerequisite by Topic:
1. Environmental Engineering Basic Processes.
2. Applied Environmental Engineering Background of Processes.

Topics:
By week:
1. Introduction; Stoichiometry and Kinetics
2. Stoichiometry and Kinetics, Fundamentals
3. Fundamentals; Modeling of Ideal Suspended Growth Systems; Aerobic Growth in a Single CSTR: COD Oxidation
4. Aerobic Growth in a Single CSTR: COD Oxidation; Multiple Activities in a Single CSTR
5. Nitrification and Denitrification; Evaluating Kinetic and Stoichiometric Parameters
6. Exam One; Continuous Stirred Tank Reactors
7. Continuous Stirred Tank Reactors with Cell Recycle; Design of Suspended Growth Reactors; Activated Sludge for COD Removal
8. Aerobic Digestion; Biological Nitrogen Removal
9. Spring Break
10. Enhanced Phosphorous Removal; Anaerobic Digestion
11. Anaerobic Digestion; Reactor Staging to Improve Sludge Settleability; Exam Two Recitation/Lecture Make-up

12. Exam Two; Modeling of Attached Growth Systems; Mass Transfer and Reactions
13. Boundary-Layer Theory; Design of Attached Growth Reactors; Loading Curves Approach; Trickling Filters and Fluidized Bed Reactors
14. Rotating Biological Contactors; Treatment of Gas-Phase Pollutants; *In Situ* Bioremediation
15. Principles of Bioremediation; Bioremediation Process Design; Techniques for Field Demonstration
16. Case Studies; Review; Final Exam

Class/laboratory schedule: Three 50-minute lectures and one 120-minute laboratory session per week

Computer Usage: Six homework assignments require the use of spreadsheets to solve specific problems in topics of stoichiometry and kinetics. Laboratory analyses require spreadsheets.

Design Projects:
Treatability of Industrial Wastewater
1. Objectives: Determination of activated sludge kinetic parameters of some industrial wastewater by laboratory batch systems.
2. Goals: Determination of treatability of the waste. Determination of kinetic parameters for design of activated sludge systems.
3. Introduction: The experiment consists of developing acclimated sludge for a particular industrial wastewater at four different loading rates. Four phases have to be completed:
   a. Phase 1: Acclimation of the activated sludge units to a particular synthetic wastewater.
   b. Phase 2: Acclimation of the activated sludge units to the actual industrial waste.
   c. Phase 3: Steady state application.

Laboratory Projects: Development of independent laboratories to define the parameters needed to complete design project.

Assessment Methods Used:
1. Standard course evaluation.

Contribution to Professional Component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science - 0 credit hours or 0%
Engineering Design – 4 credit hours or 100%

Relationship of Course to Program Outcomes:
1.1: vi
2.1: iv

Relationship of Course to ABET Criterion 3 (a – k)
a ,b ,c, e, j, k

Prepared by: Keith A. Strevett Date: June 19, 2005

CE 5833 - Ground Water Quality Protection
Spring 2005
Elective

2003-2006 Catalog Data: **5833 Ground Water Quality Protection.** Prerequisite: graduate standing or permission. Introduction to ground water quality protection. Covers sources of ground water, ground water hydrology, ground water information sources, ground water pollution sources, subsurface transport and fate processes and monitoring of ground water systems. (Sp)

Prerequisites: Graduate standing or permission

Textbook(s) and/or other required material:
1. Bedient, P. B., Rifai, H. S., and Newell, C. J. (1997), *Ground Water Contamination*, 2nd Ed., Prentice Hall, NJ.
2. Course pack of required supplemental reading.

Course Objectives: To identify and quantify the processes contributing to the fate, ransport, and remediation of pollutants in ground water

Coordinator: Dr. Elizabeth C. Butler, Associate Professor, School of Civil Engineering and Environmental Science

Prerequisites by Topic:
1. Materials balance
2. Introductory chemistry
3. Organic chemistry nomenclature
4. Calculus
5. Introductory physics

Topics by week:
Week 1: Introduction and overview
Weeks 2-3: Hydrodynamic processes (advection, dispersion, and diffusion)
Week 4: Sorption
Week 5: Hydrolysis
Week 6: Abiotic redox reactions
Week 7: Biodegradation
Week 8: Volatilization
Week 9: Spring break: no class
Week 10: Non-aqueous phase liquids
Weeks 11-12: Ground water remediation
Weeks 12-14: Natural attenuation
Week 15: Colloid facilitated transport; problem solving
Week 16: Oral presentations

Class/laboratory schedule: Two 75-minute lecture periods per week

Computer Usage: Word processing, spreadsheets, and public domain ground water software such as BIOSCREEN (U.S. EPA) and the University of Illinois Interactive Models for Groundwater Flow and Solute Transport (http://www.cee.uiuc.edu/transport/).

Design Projects: Homeworks, exams, and in-class problems require students to evaluate and/or propose ground water remediation strategies for contaminated sites. Assignments also require students to determine if different ground water contaminant transport scenarios will result in contaminant concentrations above regulatory levels. This analysis is one part of remedial design.

Laboratory Projects: None

Assessment Methods Used:
1. Standard course evaluation

Contribution to Professional Component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science - 2 credit hours or 67%
Engineering Design - 1 credit hour or 33%

Relationship of Course to Program Outcomes:
1.1: iv
2.1: iv

Relationship of Course to ABET Criterion 3 (a – k):
a, c, e, j, k

Prepared by: Elizabeth C. Butler **Date:** February 10, 2005

CE 5843 - Hydrology
Spring 2005
Elective

2003-2006 Catalog Data: **5843 Hydrology.** Prerequisite: graduate standing in civil engineering, environmental science or geology, or permission. An applied course on hydrology dealing with environmental water problems; principles of hydrologic systems, their structure and components; methods of analysis and their application to various purposes of water resources planning and development. (Sp)

Prerequisite: Graduate standing or permission

Textbook(s) and/or other required material:
Hydrology and Floodplain Management, Third Edition, Bedient and Huber, Prentice Hall.

Course Objectives: Hydrology is the science of water on or near the surface of the earth. Engineering hydrology deals with hydrologic analysis and prediction with the aim of achieving a useful result. Examples are sizing a reservoir to provide adequate water supply with acceptable risk, designing drainage infrastructure for a given frequency of exceedance, or prediction of short or long term response of a watershed. Modeling hydrologic processes has historically been done by lumped methods. Computational and data constraints have limited the development and acceptance of distributed parameter modeling until recent times. The advent of computer aided mapping software called geographic information systems (GIS) and new data sources has prompted the development of models capable of using the information content found in digital datasets. The modules comprising this course are designed to:

1. Acquaint the student with basic principles of hydrology
2. Convey an understanding of hydrologic analysis, prediction, and design
3. Develop an understanding of hydrologic modeling and its use

Coordinator: Dr. Baxter E. Vieux, Professor, School of Civil Engineering and Environmental Science

Prerequisites by Topic:
1. Differential equations
2. Computer Skills in Excel and application modeling

Topics:
1. Hydrologic principles
    a. Precipitation
    b. Hydrologic abstractions and their importance

   c. Surface runoff
   d. Subsurface runoff (base flow)
2. Methods of analysis
   a. Storm analysis and design storms
   b. Quantitative treatment of Hydrologic Abstractions
   c. Hydrologic routing
   d. Distributed hydrologic modeling
   e. Synthetic Hydrograph and their development

Class/laboratory schedule: Three 50-minute lectures per week.

Computer Usage:
1. Students utilize Blackboard Online to access lecture notes, sample data, references, and course materials.
2. Spreadsheets and application software are required for use in homework preparation and term project.

Design Projects: None

Laboratory Projects: Term project
Kinematic wave routing is explored for river reach.
Students must select various parameters governing the hydraulics and assess the impact on hydrologic response, analyze and interpret.

Assessment Methods Used:
1. Standard course evaluation.

Contribution to Professional Component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science - 2.5 credit hours or 83%
Engineering Design - 0.5credit hour or 17%

Relationship of Course to Program Outcomes:
1.1: iv
2.1: iv

Relationship of Course to ABET Criterion 3 (a – k):
a, c, e, j, k

Prepared by: Baxter E. Vieux **Date:** February 11, 2005

CE/GEOL 5853 – Groundwater and Seepage
Fall 2004
Elective

2003-2006 Catalog Data: **G5853 Groundwater and Seepage (Crosslisted with Geology 5853).** Prerequisite: graduate standing in civil engineering, environmental science or geology or permission. An applied course dealing with properties of aquifers, modeling of groundwater flow, groundwater hydrology and its interrelation with surface water, well hydraulics, pumping tests and safe yield of aquifers. (F)

Prerequisites: Graduate standing or permission of instructor

Textbook(s) or other required material:
C. W. Fetter. *Applied Hydrogeology*, 4^{th} Ed., Prentice Hall: New Jersey, 2001

Course Objectives: To provide students with an understanding of the factors underlying subsurface flow, as well as a practical understanding of groundwater modeling techniques.

Coordinator: Dr. Tohren C. G. Kibbey, Associate Professor, School of Civil Engineering and Environmental Science

Prerequisites by Topic: None

Topics:
1. Introduction, Hydrologic Cycle, Aquifer Types and Materials, Fluid Statics Review (1 cl.)
2. Fluid Flow, Darcy's Law, Hydraulic Conductivity, Intrinsic Permeability (1cl.)
3. 1D groundwater flow equations: confined and unconfined, multiple dimensions/anisotropy, 2D and 3D groundwater flow equations (1cl.)
4. Radial flow: confined and unconfined, Thiem equation, Theis equation, Jacob-Cooper equation, superposition, image wells (1cl.)
5. Well tests: Thiem, Theis, Jacob, slug tests, special cases (1 cl.)
6. Numerical solution of groundwater flow equations (0.5 cl.)
7. Contaminant transport overview (0.5 cl)
8. Well placement strategies for remediation (0.5 cl)
9. Unsaturated flow: Surface tension/contact angle, Capillary pressure/saturation relationships (1 cl.)
10. Hysteresis in capillary pressure/saturation relationships, Parameterization of capillary pressure saturation relationships (0.5 cl.)
11. Darcy's Law in unsaturated systems, relative permeability (1 cl.)
12. Computer laboratory time (2 cl.)
13. Laboratory experiment (1cl)
14. Project Presentations (1 cl.)
15. Exams (2 cl.)

Class/laboratory schedule: One 180-minute lecture per week.

Computer Usage: Visual MODFLOW, spreadsheets, presentation software

Design Projects: Remediation system design project

Laboratory Projects: Unsaturated soil drainage/imbibition behavior laboratory

Assessment Methods Used:
1. Standard course evaluation

Contribution to Professional Component:
Math and Basic Sciences - 0 credit hours or 0%
Engineering Science - 2 credit hours or 67%
Engineering Design - 1 credit hour or 33%

Relationship of Course to Program Outcomes:
1.1.: iv
2.1: iv

Relationship of Course to ABET Criterion 3 (a – k)
a, c, e, j, k

Prepared by: Tohren Kibbey **Date:** March 2, 2005

CE 5873 - Water Quality Management
Fall 2004
Elective

2003-2006 Catalog Data: **5873 Water Quality Management.** Prerequisite: senior or graduate standing. Water quality in lakes, rivers, estuaries; chemical, physical and biological aspects of marine and fresh waters; waste assimilation; system modeling; water quality management, waste load allocation, and engineer controls. (Sp)

Prerequisite: Senior or graduate standing

Textbook(s) and/or other required material:
Principles of Water Quality Modeling and Control. Thomman and MuellerHarper Collins Publishers, Inc. ISBN 0-06-046677-4. 1987

Course Objectives: Introduce the student to basic principles of water quality modeling and control. The course will emphasize the processes affecting water quality in diverse water bodies (rivers, lakes, and estuaries) as well as provide some simple tools to assess the impacts of discharges and engineering controls. These topics are at the heart of the waste load allocation process, which is used to assign allowable discharges to meet a designated standard through engineering controls.

Coordinator: Dr. Baxter E. Vieux, Professor, School of Civil Engineering and Environmental Science

Prerequisites by Topic:
1. Introduction to Environmental Biology and Chemistry
2. Fluid flow concepts
3. Calculus/statistics/differential equation
4. Computer operations and programming

Topics:
1. Environmental laws
2. Water characteristics—physical, chemical, biological
3. Types and sources of pollution
4. Process fundamentals
5. Transport mechanisms
6. Phosphorus and Eutrophication
7. BOD-NO systems and models
8. 2-dimensional models
9. Water quality management models
10. Engineering Controls

Class/laboratory schedule: Two 75-minute lectures per week

Computer Usage: Various personal computer software packages are demonstrated to students and made available for use. Students develop analytical computer solutions using spreadsheets.

Design Projects: None

Laboratory Projects: None

Assessment Methods Used:

1. Standard course evaluation.

Contribution to Professional Component:
Math and Basic Sciences 0 credit hours or 0%
Engineering Science - 2 credit hours or 67%
Engineering Design - 1 credit hour or 33%

Relationship of Course to Program Outcomes:
1.1: iv
2.1: iv

Relationship of Course to ABET Criterion 3 (a – k):
a, c, e, j, k

Prepared by: Baxter E. Vieux **Date:** February 11, 2005

CHEM 1315 – General Chemistry
Fall 2004
Required

2003-2006 Catalog Data: **1315 General Chemistry.** Prerequisite: Mathematics 1503 or 1643, or math ACT equal to or greater than 23. First of a two-semester sequence in general chemistry. Topics covered: basic measurement, gas laws and changes in state, stoichiometry, atomic theory, electron configuration, periodicity, bonding, molecular structure and thermochemistry. **Laboratory** (F, Sp, Su) [II-LAB]

Prerequisite(s): MATH 1503, or high school chemistry and MATH 0123, or a satisfactory score on the mathematics placement test.

Textbook(s) and/or other required material:
McMurry and Fay, "Chemistry" 2nd edition, Prentice Hall, 1998

Course Objectives: First semester of two-semester sequence introducing general chemical concepts and procedures

Coordinator: Dr. M. R. Abraham, Department of Chemistry and Biochemistry

Prerequisites by Topic: Basic Algebra

Topics: Basic concepts in general chemistry; stoichiometry; thermochemsitry; atomic structure; molecular structure; gases liquids; solids; solutions; organic chemistry.

Class/laboratory schedule: 3 periods of 50 minutes lecture with 3 hours of laboratory and 50 minutes of recitation per week

Computer Usage: None

Design Projects: None

Laboratory Projects: General experiments in in general chemistry; stoichiometry; thermochemsitry; atomic structure; molecular structure; gases liquids; solids; solutions; organic chemistry.

Assessment Methods Used:
1. Standard course evaluation

Contribution to Professional Component:
Math and Basic Sciences – 5 credit hours or 100%
Engineering Science – 0 credit hours or 0%
Engineering Design – 0 credit hours or 0%

Relationship of Course to Program Outcomes:
1.1: iii, v
1.2: i, iii

Relationship of Course to ABET Criterion 3 (a – k):
a, b

Prepared by: K.A. Strevett **Date**: May 14, 2005

CHEM 1415 - General Chemistry
Spring 2004
Required

2003-2006 Catalog Data: **CHEM 1415: General Chemistry.** Prerequisite: CHEM 1315, or a satisfactory score on the chemistry placement examination. Topics covered include nature of solutions, equilibrium, thermodynamics, acid and base properties, kinetics and electrochemistry. **Laboratory** (F, Sp, Su)

Prerequisite: CHEM 1315, or a satisfactory score on the chemistry placement examination.

Textbook(s) and/or other required material:
McMurry and Fay, "Chemistry" 2nd edition, Prentice Hall, 1998

Course Objectives: First semester of two-semester sequence introducing general chemical concepts and procedures

Coordinator: Various Instructors, Department of Chemistry and Biochemistry

Prerequisites by Topic: General Chemistry I

Topics: Basic concepts in kinetics; equilibrium; acids and bases; aqueous equilibrium; chemical thermodynamics; electrochemistry; nuclear chemistry; coordination chemistry..

Class/laboratory schedule: Three 50-minute lectures, one 120-minute laboratory sessions and one 50-minute period of recitation per week.

Computer Usage: None

Design Projects: None

Laboratory Projects: General experiments in kinetics; equilibrium; acids and bases; aqueous equilibrium; chemical thermodynamics; electrochemistry; nuclear chemistry; coordination chemistry.

Assessment Methods Used:
1. Standard course evaluation

Contribution to Professional Component
Math and Basic Sciences – 5 credit hours or 100%
Engineering Science – 0 credit hours or 0%
Engineering Design – 0 credit hours or 0%

Relationship of Course to Program Outcomes:
1.1: iii, v
1.2: i, iii

Relationship of Course to ABET Criterion (a – k)
a, b

Prepared by: K.A. Strevett **Date**: May 14, 2005

CHEM 3053 - Organic Chemistry
Fall 2004
Required

2003-2006 Catalog Data: **CHEM 3053: Organic Chemistry.** Prerequisite: CHEM 1415 or 1425 Covers the fundamental concepts of organic structure and reactions of the principal functional groups. Reaction mechanisms. (F)

Prerequisite: CHEM 1415.

Textbook(s) and/or other required material:
Joseph Hornback "Organic Chemistry" & "Solutions Manual & Study Guide." Prentice Hall, 1998

Course Objectives: First semester of two-semester sequence introducing general chemical concepts and procedures

Coordinator: Dr. Donna Nelson, Associate Professor, Department of Chemistry and Biochemistry

Prerequisites by Topic: General chemistry II

Topics: Fundamental concepts of organic structure and reactions.
1. Important parts that review general chemistry
2. Orbitals and Bonding
3. Proton Transfer
4. Functional Groups and Nomenclature
5. Stereochemistry
6. Nucleophilic Substitution Reactions
7. Elimination Reactions
8. Synthetic Uses of Substitution and EliminationND ELIMINATION

Schedule: 3 periods of 50 minutes lecture with 50 minutes of recitation per week

Computer Usage: None

Design Projects: None

Laboratory Projects: None

Assessment Methods Used:
1. Standard course evaluation

Contribution to Professional Component:
Math and Basic Sciences – 3 credit hours or 100%
Engineering Science – 0 credit hours or 0%
Engineering Design – 0 credit hours or 0%

Relationship of Course to Program Outcomes:
1.1: iii

Relationship of Course to ABET Criterion 3 (a – k):
a, b, d

Prepared by: K.A. Strevett **Date**: May 14, 2005

CHEM 3423 - Physical Chemistry I
Fall 2004
Required

2003-2006 Catalog Data: **CHEM 3423: Physical Chemistry I.** Prerequisite: CHEM 1415 or 1425, Physics 2424 or 2524, MATH 2423. States of matter, chemical thermodynamics, equilibria, etc. (F)

Prerequisite: CHEM 1415 or 1425, Physics 2424 or 2524, MATH 2423

Textbook(s) and/or other required material:
Barrow, Physical Chemistry, 6th Ed., McGraw Hill, 1996.

References: None

Course Objectives: First of two-semester sequence introducing physical chemical concepts and procedures.

Coordinator: Dr. R. Wheeler, Professor, Department of Chemistry and Biochemistry

Prerequisites by Topic:
1. General chemistry II
2. Linear algebra
3. Basic physics

Topics:
1. Gases
2. first law of thermodynamics
3. entropy
4. free energy and equilibrium
5. non-electrolyte solutions
6. phase equilibrium.

Class/laboratory schedule: 3- 50 minutes lecture with 50 minutes of recitation per week

Computer Usage: None

Design Projects: None

Laboratory Projects: None

Assessment Methods Used:
1. Standard course evaluation

Contribution to Professional Component:
Math and Basic Sciences – 3 credit hours or 100%
Engineering Science – 0 credit hours or 0%
Engineering Design – 0 credit hours or 0%

Relationship of Course to Program Outcomes:
1.1: iii

Relationship of Course to ABET Criterion 3 (a – k):
a

Prepared by: K.A. Strevett **Date**: May 14, 2005

ENGR 1410 Freshman Engineering Orientation I
Fall 2004
Required

2003-2006 Catalog Data: **1410 Freshman Engineering Orientation I.** Prerequisite: declared major in engineering. All entering freshmen with a declared engineering major are required to enroll. One hour of this seminar a week is in a large group setting where all students meet and cover details on all engineering disciplines. Additional topics would be continuums of majors, success in the College of Engineering, success at the University of Oklahoma, study abroad programs, advising issues, graduate school opportunities, career planning, and information related to technical/honor societies and participation. A second hour a week is a required small group session with an upper-class mentor from the College of Engineering Dean's Leadership Council. This second hour will focus on basic enrollment and retention strategies such as adding and dropping classes and choosing electives in addition to a weekly topic area. (F)

Prerequisites: declared major in engineering.

Textbook: The University of Oklahoma Class of 2008 Graduation Planner. Please note that *additional inserts to the planner specific to the College of Engineering will be provided. Readings may be placed in the engineering library when appropriate course content is being covered.*

References:

1. Donaldson, Krista (2002). The Engineering Student Survival Guide (B.E.S.T. Series). McGraw-Hill.

2. Schiavone, Peter (2002). Engineering Success, Second Edition, Prentice Hall.

3. King, Joe (2002). Exploring Engineering, Second Edition, Prentice Hall.

Course Objectives: The objectives of this course are to provide the student with an opportunity to acquire fundamental knowledge of the University of Oklahoma, the College of Engineering and the field of engineering. One hour of this seminar a week is in a large group setting where all students meet and cover details on all engineering disciplines. Additional topics would be continuums of majors, success in the CoE, success at the University of Oklahoma, study abroad programs, advising issues, graduate school opportunities, career planning, and information related to technical/honor societies and participation. A second hour a week is a required small group session with an upper-class mentor from the College of Engineering Dean’s Leadership Council. This second hour will focus on basic enrollment and retention strategies such as adding and dropping classes and choosing electives in addition to a weekly topic area.

Topics Covered:
1. Leadership
2. Careers in engineering
3. Engineering disciplines
4. Time management
5. Note taking skills
6. Student honor code
7. Advising

Computer Usage: None

Schedule: One session per week divided into one hour of lecture/presentation and one hour of mentoring with an upperclassman (Dean's Leadership Council Mentor).

Laboratory Projects: None

Assessment Methods Used:
1. Standard course evaluation

Contribution of course to meeting the professional component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science – 0 credit hours or 0%
Engineering Design – 0 credit hours or 0%

Relationship of Course to Program Outcomes:
2.1:ii

Relationship of Course to ABET Criterion 3 (a – k):
f, g, h, i, j

Prepared by: Teri Reed Rhoads **Date:** June, 2005

ENGR 1420 Freshman Engineering Orientation II
Spring 2005
Core Required

2003-2006 Catalog Data: **1420 Freshman Engineering Orientation II.** Prequisite: declared major in engineering. All entering freshmen with a declared engineering major are required to enroll in this spring continuation course. One hour of this seminar a week is in a large group setting where all students meet and cover details on all engineering disciplines. Additional topics would be continuums of majors, success in the College of Engineering, success at the University of Oklahoma, study abroad programs, advising issues, graduate school opportunities, career planning, and information related to technical/honor societies and participation. A second hour a week is a required small group session with an upper-class mentor from the College of Engineering Dean's Leadership Council. This second hour will focus on basic enrollment and retention strategies such as adding and dropping classes and choosing electives in addition to a weekly topic area. (Sp)

Prerequisites: Declared major in engineering.

Required Materials: The University of Oklahoma Class of 2008 Graduation Planner. Please note that *additional inserts to the planner specific to the College of Engineering will be provided. Readings may be placed in the engineering library when appropriate course content is being covered.*

The objectives of this course are to provide the student with an opportunity to acquire fundamental knowledge of the University of Oklahoma, the College of Engineering and the field of engineering. One hour of this seminar a week is in a large group setting where all students meet and cover details on all engineering disciplines. Additional topics will be success in the CoE, success at the University of Oklahoma, study abroad programs, advising issues, graduate school opportunities, career planning, teaming, ethics, globalization, diversity, and information related to technical/honor societies and participation.

Topics:

8. Learning Styles
9. Minors, Graduate School, REU
10. Advising
11. The Engineering Curriculum – What lies ahead
12. Interviewing Skills/Resumes/Corporate Panel Discussions
13. Teaming
14. Ethics
15. Engineering Resources (Library, ECS)
16. Globalization/Diversity

Computer Usage: None

Class/Laboratory Schedule: One 55-minute lecture/presentation per week with additional outside participation points required.

Laboratory Projects: None

Assessment Methods Used:

2. Standard course evaluation

Contribution of course to meeting the professional component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science – 0 credit hours or 0%
Engineering Design – 0 credit hours or 0%

Relationship of Course to Program Outcomes:
2.1:ii

Relationship of Course to ABET Criterion 3 (a – k):
f, g, h, i, j

Prepared by: Teri Reed Rhoads **Date:** June, 2005

ENGR 2003 – ENGINEERING PRACTICE I
Spring 2004
Required

2003-2006 Catalog Data: **2003 Engineering Practice 1.** Prerequisite: 1410, 1420, and English 1213. Introduction to basic principles of successful engineering enterprise. (Sp)

Prerequisites: ENGR 1410, ENGR 1420 or ENGR 3410 ***and*** ENGL 1213

Textbook(s) and/or other required material:

1. Oakes, William C.; Leone, Les L.; Gunn, Craig J. (2004). **Engineering Your Future**, Great Lakes Press, Inc.
2. Holloway, Brian (2005). **Technical Writing Basics** Pearson Prentice Hall.
3. Smith, Karl A. (2004)**. Teamwork and Project Management (B.E.S.T. Series).** McGraw-Hill.

Other required reading include selected chapters from the following (OU Library Electronic Reserve):

4. Stanley, Andy (1999); **Visioneering**.
5. Kouzes, James M.; Posner, Barry Z. (2002). **The Leadership Challenge**.
6. Collins, Jim (2001). **Good to Great**.
7. Kotter, John P. (1996). **Leading Change.**
8. Zimmer, Thomas W.; Scarborough, Norman M. (2005). **Essentials of Entrepreneurship and Small Business Management**.
9. Dorf, Richard C.; Byers, Thomas H (2005). **Technology Ventures from Ideas to Enterprise.**

Course Objectives: **Inspire personal vision** within each class member to **picture what could be** and introduce professional topics and the engineering design and problem solving process via an engaging, interactive class experience for students to **develop a context and framework for successfully *Engineering Their Future(s)*.**

Coordinator: Matthew B. Green, Instructor, College of Engineering

Prerequisites by Topic: Freshman Orientation I and Freshman Orientation II or Engineering Economics and Principles of English Composition

Topics:

17. Vision
18. Communication
19. Team Building
20. Project Management
21. Leadership
22. Creative Problem Solving
23. Engineering Design
24. Entrepreneurship / Intrpreneurship
25. Engineering Economics
26. Technology Development

Computer Usage:	Individual assignments and Team Case Studies are typically submitted electronically via email as PDF files. Assignments are typical created utilizing MS Office.
Class/laboratory schedule:	Two 75-minutes lectures per week
Laboratory Projects:	None

Assessment Methods Used:
3. Standard course evaluation

Contribution of course to meeting the professional component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science – 3 credit hours or 100%
Engineering Design – 0 credit hours or 0%

Relationship of Course to Program Outcomes:
1.2: i, ii, iii; 1.3: ii
2.1: ii; 2.2: ii; 2.3: i, iii

Relationship of Course to ABET Criterion 3 (a – k):
c, f, g, h, j

Prepared by: Matthew B. Green, Instructor **Date:** June, 2005

ES 2313 – Introduction to Mass Balance and Fate Processes
Fall 2004
Required

2003-2006 Catalog Data: **ES 2313: Introduction to Mass Balance and Fate Processes.** Prerequisite: Chemistry 1415, Mathematics 2423. Introduction to environmental mass balance and fate processes. Studies of mass and energy transfer, introductory environmental chemistry, water quality parameters, mathematics of growth, statistics and data analysis, introduction to environmental laws and regulations. (F)

Prerequisites: Chemistry 1415, Mathematics 2423

Textbook(s) and/or other required material:
Mihelcic, J. R. (1999), *Fundamentals of Environmental Engineering*, John Wiley and Sons, New York, 335 pp.
Course pack of supplemental required reading.

Course Objectives:
(1) Solve basic mass and energy balance problems in environmental science and engineering
(2) Apply fundamental chemistry concepts to environmental problems
(3) Understand basic water quality parameters and their impacts on streams and lakes
(4) Assess trends and uncertainties in environmental measurements using fundamental statistical techniques

Coordinator: Dr. Elizabeth C. Butler, Associate Professor, School of Civil Engineering and Environmental Science

Prerequisites by Topic:
1. Introductory chemistry
2. Calculus
3. Introductory physics

Topics:
Week 1: Units of concentration for air, water, soil, and biota
Weeks 2-3: Mass balances
Week 4: Energy balances
Week 5: Clean Air Act/chemical thermodynamics
Week 6: Chemical equilibrium problems
Week 7: Air/liquid equilibria
Week 8: Water quality field sampling trip
Week 9: Air/water equilibria
Week 10: Chemical kinetics
Week 11: Clean Water Act; Safe Drinking Water Act
Week 12: Suspended and dissolved solids: oxygen demanding wastes
Week 13: BOD kinetics; impact of BOD on streams and rivers

Week 14: Nutrients/eutrophication
Week 15: Data uncertainty/statistics
Week 16: Problem solving

Class/laboratory schedule: Two 75 minute lectures per week

Computer Usage: Word processing for writing and spreadsheets for graphics and statistical calculations.

Design Projects: None

Laboratory Projects: No laboratory projects, but there is a field trip in which students use test kits to assess the water quality of a local pond.

Assessment Methods Used:
1. Standard course evaluation
2. Review of course written submittals

Contribution to Professional Component:
Math and Basic Sciences - 2 credit hours or 67%
Engineering Science – 1 credit hour or 33%
Engineering Design – 0 credit hours or 0%

Relationship of Course to Program Outcomes:
1.1: ii; 1.2: i, iii
2.3: i

Relationship of Course to ABET Criterion 3 (a – k)
a, d, e, g

Prepared by: Elizabeth C. Butler **Date:** February 11, 2005

ES 2323 – Environmental Transport and Fate Process
Spring 2005
Required

2003-2006 Catalog Data: **ES 2323 Environmental Transport and Fate Process.** Prerequisites: 2313. Physicochemical and biological processes controlling contaminant distribution and fate; hydrological processes controlling contaminant transport; sources, prevention and remediation of environmental pollutants. (Sp)

Prerequisites: ES 2313

Textbook(s) and/or other required material:

1. Pepper, I.L., G.P. Gerba and M.L. Brusseau, 1996. *Pollution Science*, Academic Press, San Diego, CA
2. Harte, J., 1988. *Consider a Spherical Cow: A Course in Environmental Problem Solving*, University Science Books, Sausalito, CA

Course Objectives: Promote the development of critical thinking with respect to environmental pollution. Develop analytical and quantitative problem solving abilities with respect to the complex task of addressing environmental pollution. Foster oral and written communication skills for the expression of ideas, dissemination of information and fundamental conveyance of knowledge. Cultivate group discourse and interpersonal communication for use in future environmental problem solving in the private or public sector.

Coordinator: Dr. Geoff Canty, Instructor, School of Civil Engineering and Environmental Science

Prerequisites by Topic:

1. Introduction to Mass Balance
2. Introduction to Fate Processes

Topics:

1. Introduction aspects of environmental processes
2. Fate anthropogenic material
3. Transport of natural and anthropogenic materials
4. Interactions of anthropogenic material in the environment
5. Complex influences of humankind on the biosphere

Class/laboratory schedule: Two 75-minute lecture per week

Computer Usage: None

Design Projects: None

Laboratory Projects: None

Assessment Methods Used:

8. Standard course evaluation.

Contribution to Professional Component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science – 3 credit hours or 100%
Engineering Design – 0 credit hours or 0%

Relationship of Course to Program Outcomes:
1.1:ii
2.3:i

Relationship of Course to ABET Criterion 3 (a – k):
a, e, h, j

Prepared by: K.A. Strevett **Date**: May 14, 2005

ES 4473G – Soil Science
Spring 2005
Elective

2003-2006 Catalog Data: **4473G Soil Science.** Prerequisite: senior standing, graduate option. Discusses basic physical, chemical, and biological properties of soils. Soil formation, clay mineralogy, organic matter and cation exchange capacity are included. Current environmental problems of soil pollution are also covered. **Laboratory** (F)

Prerequisites: Senior standing, graduate option

Textbook(s) and/or other required material:
The Nature and Properties of Soils, Nyle C. Brady & Ray R. Weil, 13th edition, Prentice Hall

Course Objectives: To provide the student with an understanding of soil formation processes, as well as the physical, chemical, and biological processes that are present in soil. These concepts are placed within the context of soil quality, nutrient cycling, erosion, contamination, and remediation strategies.

Coordinator: Dr. Mark A. Nanny, Associate Professor, School of Civil Engineering and Environmental Science

Prerequisites by Topic: None

Topics:
1. Soil: Structure, Formation, and Classification
2. Soil: Physical Properties
3. Clays, Acidity, Alkalinity, and Salts
4. Organic Matter, Nutrients, and Pollutants

Course/laboratory schedule: Two 75-minute lectures per week

Computer Usage: Minimal; spreadsheets for some homework problems

Design Projects: None

Laboratory Projects: Laboratory used for demonstrations only

Assessment Methods Used:
1. Standard course evaluation

Contribution to Professional Component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science – 0 credit hours or 0%
Engineering Design – 0 credit hours or 0%

Relationship of Course to Program Outcomes:
1.1: iv
2.1: iv

Criterion 3 Contents:
a

Prepared by: K.A. Strevett **Date**: May 14, 2005

ES 4493 – Environmental Evaluation and Management
Spring 2005
Elective

2003-2006 Catalog Data: **4493 Environmental Evaluation and Management (Slashlisted with 5493).** Prerequisite: senior standing. Broad overview of natural resources management with attention to techniques used in decision making and analysis. Class discussion and readings include a review of measures used to value natural systems (e.g. benefit-cost analysis) and the role of private and public institutions in management. No student may earn credit for both 4493 and 5493.

Prerequisite: Senior standing/graduate standing

Textbook(s) and/or other required material:
Lance H. Gunderson, C. S. Holling, & Stephen S. Light (eds.), *Barriers and Bridges to the Renewal of Ecosystems and Institutions*, Columbia University Press, New York, NY, 1995

Course Objectives: This course is designed to provide the upper class or graduate environmental science student with an understanding of the interdisciplinary elements and perspectives associated with evaluating environmental issues in decision making and ecosystem management. The goal of the course is to provide students with the understanding and skills needed to engage ecosystem and environmental management in a positive and constructive manner.

Coordinator: Dr. Mark Meo, Professor, School of Civil Engineering and Environmental Science, and Science and Public Policy Fellow

Topics:
1. *Barriers and Bridges* (B&B), Chapter 1- What Barriers? What Bridges?
2. *B&B*, Chapter 2- The Forestry Problem: Adaptive Lurches of Renewal.
3. *B&B*, Chapter 3- The Everglades: Evolution of Management in a Turbulent Ecosystem
4. *B&B*, Chapter 4- The Chesapeake Bay and Its Watershed: A Model for Sustainable Ecosystem Management?
5. Student Discussions and Reports.
6. *B&B*, Chapter 5- Deliberately Seeking Sustainability in the Columbia River Basin.
7. Student Discussions and Reports.
8. *B&B*, Chapter 6- Barriers and Bridges to the Restoration of the Great Lakes Basin Ecosystem.
9. Student Discussions and Reports.
10. *B&B*, Chapter 7- The Baltic: The Sea of Surprises.
11. Student Discussions and Reports.
12. *B&B*, Chapter 9- Governing Design: The Management of Social Systems and Ecosystems Management
13. *B&B*, Chapter 10- Sustainable Development and Social Learning: Theoretical Perspectives and Practical Challenges for the Design of a Research Program.
14. *B&B*, Chapter 11- Barriers and Bridges to Learning in a Turbulent Human

Ecology.

15. *B&B*, Chapter 11- Barriers and Bridges to Learning in a Turbulent Human Ecology.
16. *B&B*, Chapter 12- Barriers Broken and Bridges Built: A Synthesis
17. City of Tulsa Case

Class/laboratory schedule: Three sixty-minute lectures per week

Computer Usage: None

Design Projects: None

Laboratory Projects: None

Assessment Methods Used:

1. Standard course evaluation

Contribution to Professional Component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science – 0 credit hours or 0%
Engineering Design – 0 credit hours or 0%

Program Objectives and Related Strategy Actions:
1.1:iv
2.1:iv

Criterion 3 Contents:
d, j

Prepared by: K.A. Strevett **Date**: May 14, 2005

ES 4813 – Environmental Science and Environmental Engineering Professional Practice
Fall 2004
Required

2003-2006 Catalog Data: **ES 4813: Environmental Science and Environmental Engineering Professional Practice.** Prerequisite: senior standing in environmental science or environmental engineering, 3603 or Civil Engineering 3213, and Civil Engineering 3334. Nature of profession, duties and administrative responsibilities. Organization and management of operating divisions with emphasis on role of environmental professional. Functional approach to planning and implementing public works needs with emphasis on role of environmental professional. (F)

Prerequisites: CE 3213, CE 3334, CE 3603

Textbook(s) and/or other required material:
1. McBean, E and Rovers, F. Statistical Procedures for Analysis of Environmental Monitoring Data and Risk Assessment, PTR New Jersey, 1998
2. Rast, R. Environmental Remediation Estimating Methods, RS Means Company, MA, 1997

Course Objectives: This course introduces students to technical and non-traditional issues related to professional practice. Emphases are placed on the nature of professional practice related to organization, management and planning of environmental science/engineering projects.

Coordinator: Dr. Robert C. Knox, John A. Myers Professor and Director, School of Civil Engineering and Environmental Science

Topics:
1. Team Building (2 weeks): Personality Tests; Resumes Development; Team Assignments; Lego Communications
2. Project Management (2 weeks): Organizational Management; Project Documents;
3. Decision-making
4. Economics (2 weeks) Engineering Economics; Time Value of Money; Cost estimating
5. Ethics (2 weeks) Professional Societies; Code of Ethics; Professional registration; Rules of Conduct for PE's
6. Professional Communications (3 weeks): Data Reduction and Presentation; Oral Presentations; Written Communication Skills
7. Design Codes (2 weeks): Guest Lecture
8. Introduction of Capstone Project (2 weeks)

Schedule: One 170-minute lecture per week

Computer Usage:
1. Extensive use of word processing and spreadsheets in developing reports
2. Specialized programs for completing various aspects of project, e.g., AUTOCAD, and

developing presentations, e.g., PowerPoint, Harvard Graphics, etc.

Design Projects: Student teams will be given a general problem statement and a list of minimum deliverables for the ensuing spring capstone project. The teams will be responsible for developing a detailed scope of work for the spring project. The scope of work will include a management structure, a detailed list of project deliverables and a proposed schedule for completing work tasks associated with each major aspect of the project. Each team will also deliver an oral presentation regarding their proposed scope of work. The oral presentations can include select members of the team but must use available multimedia technology and should be well-rehearsed. All team members should be in attendance at the final oral presentations.

Laboratory Projects: None

Written and/or Oral Communications:
1. Each student is expected to contribute equitably to the team assignments including written submittals and group oral presentations.
2. Students also do individual submittals (e.g., resumes) and homework assignments.

Assessment Methods Used:
1. Standard course evaluation with supplemental questions.
2. Peer/self evaluations
4. Practitioner evaluation of ethics interpretations, major design effort, written report and oral presentation

Contribution to Professional Component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science – 0 credit hours or 0%
Engineering Design – 3 credit hours or 100%

Relationship of Course to Program Outcomes:
1.2:i, ii, iii, iv; 1.3:ii
2.1:ii, iii, v; 2.2:ii, vi; 2.3.i, ii, iii

Relationship of Course to ABET Criterion 3 (a – k):
d, g, h, i, j, k

Prepared by: Robert C. Knox **Date**: February 10, 2005

ES 5253 – Environmental Administration and Law
Fall 2003
Elective

2003-2006 Catalog Data: **ES 5253: Environmental Administration and Law**. Prerequisite: senior or graduate standing or permission of instructor. An introduction to the political, legal, and administrative aspects of environmental management. A study of the processes involved in environmental policy development and promulgation. Overview of major environmental laws and regulations. (F)

Prerequisite: Senior or graduate standing or permission of instructor.

Textbook(s) and/or other required material:
1. Susan J. Buck, *Understanding Environmental Administration and Law*, 2nd Ed., Island Press, 1996
2. Richard L. Revesz, *Foundations of Environmental Law and Policy*, Foundation Press, 1997
3. Pew Oceans Commission, *America's Living Oceans: Charting a Course for Sea Change*. CD-ROM, 2003 (Handout)

Course Objectives: This course examines the relationships between environmental administration and law in a 2-part process. In the first part of the course, attention will be focused on the general process of environmental administration and the legal structure that empowers it. In the second part, the student will be exposed to the core knowledge and logic that serve as the foundation for environmental administration and the principles that are central to the development and modification of the legal framework in current use.

Coordinator: Dr. Mark Meo, Professor, School of Civil Engineering and Environmental Science, and Science and Public Policy Fellow

Topics:
1. The American Legal System
2. Environmentalism in the United States
3. The Public Policy Process
4. Legal Concepts in Environmental Law
5. Pollution Control and Hazardous and Toxic Substances
6. Managing Wildlife and Public Lands
7. International Environmental Policy and Law
8. The Economic Perspective on Environmental Degradation
9. Noneconomic Perspectives on Environmental Degradation
10. The Scientific Predicate for Environmental Regulation: Risk Assessment
11. The Objectives of Environmental Regulation: Risk Management
12. Distributional Consequences of Environmental Policy
13. The Choice of Regulatory Tools
14. Federalism and Environmental Regulation
15. Environmental Law and Public Choice

16. Control of Air Pollution
17. Liability for the Cleanup of Hazardous Waste Sites
18. Environmental Regulation and International Trade
19. International Environmental Law

Schedule: Three fifty-minute lecture per week

Computer usage: None

Design Projects: None

Laboratory Projects: None

Assessment Methods Used:
1. Standard course evaluation

Contributing to Professional Component:
Math and Basic Sciences – 0 credit hours or 0%
Engineering Science – 0 credit hours or 0%
Engineering Design – 0 credit hours or 0%

Relationship of Course to Program Outcomes:
1.1:iv
2.1:iv

Relationship of Course to ABET Criterion 3 (a – k):
d, j

Prepared by: K.A. Strevett **Date**: May 14, 2005

ES 5673 – Colloid and Surface Science
Spring 2005
Elective

2003-2006 Catalog Data: **G5673 – Colloid and Surface Science (Crosslisted with Chemical Engineering 5673)** Prerequisite: graduate standing or permission of instructor. Capillarity, surface thermodynamics, adsorption from vapor and liquid phases, contact angles, micelle formation, solubilization, emulsions and foams. Applications to be discussed include detergency, enhanced oil recovery and adsorption for pollution control. (Irreg.)

Prerequisite: Graduate standing or permission of instructor

Textbook(s) and/or other required material:

M. J. Rosen, *Surfactants and Interfacial Phenomena*. 3rd ed. Wiley, 2004. ISBN 0-471-47818-0

Course Objectives: Gain a fundamental and quantitative understanding of the physcicochemical processes active in colloid and surface science, develop an intuitive understanding of how to use these concepts in formulation and application, and evaluate their use in a range of industrial and environmental applications.

Coordinators: Dr. David A. Sabatini, Professor, School of Civil Engineering and Environmental Science and Dr. John F. Scamehorn, Professor, School of Chemical, Biological and Materials Engineering

Prerequisites by Topic:
1. Calculus
2. General chemistry
3. General physics
4. Fluid mechanics
5. Material Balance
6. Physical Chemistry

Topics:
9. Introduction to Surfactant Science and Technology
10. Micelles
11. Solubilization in Micelles
12. Surface Tension and Capillarity
13. Adsorption as a Surface Excess - General Discussion
14. Adsorption of Surfactants at Vapor-Liquid Interface
15. Adsorption of Surfactants at Solid-Liquid Interface
16. Wetting
17. Phases and Phase Diagrams
18. Surfactant Precipitation
19. Foaming
20. Emulsions/Microemulsions
21. Electrical Double Layer Theory
22. Dispersions

23. Detergency
24. Surfactant-based Separations
25. Environmental and Health Factors

Class/laboratory schedule: Three fifty-minute lectures per week

Computer Usage: Spreadsheets and word processing used on various homework assignments

Design Projects: None

Assessment Methods Used:

9. Standard course evaluation
10. Readiness Assessment Tests (RATs) – individual quizzes on a reading assignment followed by taking the same quiz in the group – promotes self-learning, peer-teaching and group dynamics
11. Peer evaluations

Contribution to Professional Component:

Math and Basic Sciences – 0 credit hours or 0%
Engineering Science - 3 credit hours or 100%
Engineering Design - 0 credit hours or 0%

Relationship of Course to Program Outcomes:

1.1: iv
2.1: iv

Relationship of Course to ABET Criterion 3 (a – k)

a, d, h, j

Prepared by: David A. Sabatini **Date**: February 14, 2005

MATH 1823 Calculus and Analytic Geometry I
Fall 2005
Required

2003-2006 Catalog Data: **1823 Calculus and Analytic Geometry I.** Prerequisite: 1523 at OU, or satisfactory score on the placement test, or satisfactory score on the ACT/SAT. Topics covered include equations of straight lines; conic sections; functions, limits and continuity; differentiation; maximum-minimum theory and curve sketching. A student may not receive credit for this course and 1743. (F, Sp, Su) [I-M]

Prerequisite: MATH 1523 at OU or satisfactory score on the placement test or satisfactory score on the ACT/SAT

Textbook(s) and/or other required material:
Calculus (5th ed.) by James Stewart, Brooks/Cole, 1999

Course Objectives: Students will learn the basic concepts of single-variable, differential calculus, as well as its applications to curve sketching and maximum/minimum problems.

Coordinator: Dr. E. Cline, Professor of Mathematics

Prerequisites by Topic: College algebra, trigonometry, elementary analytic geometry

Topics:
1. Functions and their graphs
2. Limits and continuity of functions
3. Tangent lines and the derivative
4. Differentiation formulae, chain rule, implicit differentiation
5. The derivative as a rate of change, related rate problems
6. Newton's method
7. Curve sketching using the derivative (including concavity, inflection points, asymptotes)
8. Applied max-min problems

Class/laboratory schedule: Three 50-minute lectures per week; one 50-minute discussion section per week

Computer Usage: TI-85 graphing calculator

Design Projects: None

Laboratory Projects: None

Assessment Methods Used:
1. Standard course evaluation

Contribution to Professional Component:
Math and Basic Sciences - 3 credit hours or 100%
Engineering Science – 0 credit hours or 0%
Engineering Design – 0 credit hours or 0%

Relationship of Course to Program Outcomes:
1.1: iii

Relationship of Course to ABET Criterion 3 (a – k):
a

Prepared by: K.A. Strevett **Date**: May 14, 2005

MATH 2423 - Calculus and Analytic Geometry II
Spring 2005
Required

2003-2006 Catalog Data: **2423 Calculus and Analytic Geometry II.** Prerequisite: 1823. Integration and its applications; the calculus of transcendental functions; techniques of integration; and the introduction to differential equations. A student may not receive credit for this course and 2123. (F, Sp, Su) [I-M]

Prerequisite(s): MATH 1823

Textbook(s) and/or other required material:
Calculus (5th ed.) by James Stewart, Brooks/Cole, 1999

Course Objectives: Students will learn the basic concepts of single-variable, integral calculus, as well its applications to area, work, centers of mass, etc.

Coordinator: Dr. E. Cline, Professor of Mathematics

Prerequisites by Topic: See topics for MATH 1823

Topics:
2. The area problem and the definition of the definite integral
3. The fundamental theorem of calculus and the substitution rule
4. Applications to areas and volumes, work, and the average value of a function
5. Exponential and logarithmic functions, applications to growth and decay models
6. Indeterminate forms and l'Hospital's rule
7. Techniques of integration (parts, trig substitutions, etc.)
8. Numerical integration
9. Improper integrals
10. Elementary differential equations
11. Arc length and other applications

Class/laboratory schedule: Three 50 minute lectures per week; one 50 minute discussion section per week

Computer Usage: TI-85 graphing calculator

Design Projects: None

Laboratory Projects: None

Assessment Methods Used:
1. Standard course evaluation

Contribution to Professional Component:
Math and Basic Sciences - 3 credit hours or 100%
Engineering Science – 0 credit hours or 0%
Engineering Design – 0 credit hours or 0%

Relationship of Course to Program Outcomes:
1.1: iii

Relationship of Course to ABET Criterion 3 (a – k):
a

Prepared by: K.A. Strevett **Date**: May 14, 2005

MATH 2433 - Calculus and Analytic Geometry III
Fall 2004
Required

2003-2006 Catalog Data: **2433 Calculus and Analytic Geometry III.** Prerequisite: 2423. Polar coordinates, parametric equations, sequences, infinite series, vector analysis. (F, Sp, Su)

Prerequisite(s): MATH 2423

Textbook(s) and/or other required material:
Calculus (5th ed.) by James Stewart, Brooks/Cole, 1999

Course Objectives: This course serves as a bridge between single and multivariable calculus. Students will learn the basic concepts concerning parametric equations, sequences and infinite series, three-dimensional coordinate systems and vectors

Coordinator: Dr. T.J. Murphy, Associate Professor, Department of Mathematics

Prerequisites by Topic: See topics for MATH 2423

Topics:
2. Curves defined by parametric equations
3. Tangents to and areas enclosed by parametric curves
4. Polar coordinates
5. Sequences and series
6. Tests for convergence of series (integral test, comparison test, root/ratio test, etc.)
7. Power series, Taylor and MacLaurin series
8. Three-dimensional coordinate systems and vectors
9. Vector dot and cross products, equations of lines and planes
10. Quadric surfaces
11. Vector functions, arc length, space curves (velocity and acceleration)
12. Cylindrical and spherical coordinates

Class/laboratory schedule: Three 50 minute lectures per week

Computer Usage: None

Design Projects: None

Laboratory Projects: None

Assessment Methods Used:
1. Standard course evaluation

Contribution to Professional Component:
Math and Basic Sciences - 3 credit hours
Engineering Science – 0 credit hours or 0%
Engineering Design – 0 credit hours or 0%

Relationship of Course to Program Outcomes:
1.1: iii

Relationship of Course to ABET Criterion 3 (a – k):
a

Prepared by: K.A. Strevett **Date**: May 14, 2005

MATH 2443 - Calculus and Analytic Geometry IV
Spring 2005
Required

2003-2006 Catalog Data: **2443 Calculus and Analytic Geometry IV.** Prerequisite: 2433. Vector calculus; functions of several variables; partial derivatives; gradients, extreme values and differentials of multivariate functions; multiple integrals; line and surface integrals. (F, Sp, Su)

Prerequisite(s): MATH 2433

Textbook(s) and/or other required material:
Calculus (5th ed .) by James Stewart, Brooks/Cole, 1999

Course Objectives: Students will learn the basic concepts of multivariable differential and integral calculus

Coordinator: Dr. T.J. Murphy, Associate Professor, Department of Mathematics

Prerequisites by Topic: See topics for MATH 2433

<u>Topics:</u>

2. Functions of several variables, limits and continuity
3. Partial derivatives, tangent planes and differentials, the chain rule for partial derivatives
4. Directional derivatives and gradients
5. Max/min problems, Lagrange multiplier method
6. Double and triple integrals, surface area, volumes, and other applications
7. Double integrals in polar coordinates, triple integrals in cylindrical and spherical coordinates
8. Vector fields, line integrals, Green's theorem
9. Divergence and curl of a vector field
10. Parametric surfaces, surface integrals, and surface area
11. Stokes' theorem and the divergence theorem

Class/laboratory schedule: Three 50 minute lectures per week

Computer Usage: A software package is used in selected sections

Design Projects: None

Laboratory Projects: None

Assessment Methods Used:

1. Standard course evaluation

Contribution to Professional Component:
Math and Basic Sciences - 3 credit hours or 100%
Engineering Science – 0 credit hours or 0%
Engineering Design – 0 credit hours or 0%

Relationship of Course to Program Outcomes:
1.1: iii

Relationship of Course to ABET Criterion 3 (a – k):
a

Prepared by: K.A. Strevett **Date**: May 14, 2005

MATH 3113 – Introduction to Ordinary Differential Equations
Spring 2005
Required

2003-2006 Catalog Data: [†]**G3113: Introduction to Ordinary Differential Equations.** Prerequisite: 2443 or concurrent enrollment. Duplicates two hours of 3413. First order ordinary differential equations, linear differential equations with constant coefficients, Laplace transformations, power-series solutions of differential equations, Bessel functions. (F, Sp, Su)

Prerequisite(s): MATH 2443 or concurrent enrollment

Textbook(s) and/or other required material:
Differential Equations and Boundary Value Problems by C. H. Edwards and D. E. Penney, Prentice Hall, 1996

Course Objectives: Students will learn solution methods for the most common types of ordinary differential equations and will be exposed to modeling applications involving ordinary differential equations (ODEs)

Coordinator: Dr. S. Gutman, Professor, Department of Mathematics

Prerequisites by Topic: Single-variable differential and integral calculus, infinite series (see the topics for MATH 1823, 2423, 2433 for details)

<u>Topics:</u>

2. First-order differential equations
3. Introduction to mathematical models
4. Solution methods for linear ODEs of higher order (including variation of parameters and constants)
5. Mechanical vibrations
6. First-order systems of ODE’s including eigenvalue methods
7. Laplace-transform methods

Class/laboratory schedule: Three 50 minute lectures per week

Computer Usage: The software package *MathLab* or the TI-92 calculator are used in selected sections

Design Projects: None

Laboratory Projects: None

Assessment Methods Used:
1. Standard course evaluation

Contribution to Professional Component:
Math and Basic Sciences - 3 credit hours or 100%
Engineering Science – 0 credit hours or 0%
Engineering Design – 0 credit hours or 0%

Relationship of Course to Program Outcomes:
1.1: iii

Relationship of Course to ABET Criterion 3 (a – k):
a

Prepared by: K.A. Strevett **Date**: May 14, 2005

PHYS 2514 General Physics for Engineering and Science Majors

Spring 2005

Required

2003-2006 Catalog Data: **2514 General Physics for Engineering and Science Majors.** Prerequisite: Mathematics 1823. Not open to students with credit in 1205.Vectors, kinematics and dynamics of particles, work and energy systems of particles, rotational kinematics and dynamics, oscillations, gravitation, fluid mechanics, waves. (F, Sp, Su) [II-NL]

Prerequisites: Mathematics 1823, not open to students with credit in 1205.

Required Materials:

1) Physics for Scientists and Engineers, a Strategic Approach, Vol. 1, by Randall D. Knight
2) Student Workbook for Physics: A Strategic Approach, by Randall D. Knight
3) H-ITT transmitter

To introduce engineering students to the physical principles governing mechanical systems

Topics Covered:

27. Concepts of Motion
28. Kinematics: the Mathematics of Motion
29. Vectors and Coordinate Systems
30. Force and Motion
31. Dynamics I: Motion Along a Line
32. Dynamics II: Motion in a Plane
33. Dynamics III: Motion in a Circle
34. Newton's Third Law
35. Impulse and Momentum
36. Energy
37. Work
38. Newton's Theory of Gravity
39. Rotation of a Rigid Body
40. Oscillations
41. Fluids and Elasticity

Computer Usage:

1) The Hyper-Interactive Teaching Technology (H-ITT) system was used to assess students' knowledge. During lectures students asked questions to test their understanding. Their answers were submitting using H-ITT transmitters, and the results were used by the instructor to decide the pace of the class.
2) Quizzes, homework, solutions, notes, tutorials, and discussions all utilized the web.

Class/laboratory Schedule: Three 50-minute lectures per week

Laboratory Projects: None

Assessment Methods Used:
1. Standard course evaluation

Contribution of course to meeting the professional component:
Math and Basic Sciences - 4 credit hours or 100%
Engineering Science – 0 credit hours or 0%
Engineering Design – 0 credit hours or 0%

Relationship of Course to Program Outcomes:
1.1:iii

Relationship of Course to ABET Criterion 3 (a – k):
a, b

Prepared by: Bruce Mason, Associate Professor of Physics **Date:** June 2005

PHYS 2524 General Physics for Engineering and Science Majors

Fall 2004

Required

2003-2006 Catalog Data: **2524 General Physics for Engineering and Science Majors.** Prerequisite: 2514 and Mathematics 2423. Not open to students with credit in 1215. Temperature, heat, thermodynamics, electricity, magnetism, optics. (F, Sp, Su)

Prerequisites: PHYS 2514 and Mathematics 2423, not open to students with credit in 1215

Required Materials:

4) Physics for Scientists and Engineers, a Strategic Approach, Vol. 2 & 4, by Randall D. Knight
5) Student Workbook for Physics: A Strategic Approach, by Randall D. Knight
6) H-ITT transmitter

To introduce engineering students to the physical principles governing electromagnetic systems and radiation.

Topics Covered:

42. A Macroscopic Description of Matter
43. Work, Heat, and the First Law of Thermodynamics
44. The Micro/Macro Connection
45. Heat Engines and Refrigerators
46. Electric Charges and Forces
47. The Electric Field
48. Gausss's Law
49. Current and Conductivity
50. The Electric Potential
51. Potential and Field
52. Fundamentals of Circuits
53. The Magnetic Field
54. Electromagnetic Induction
55. Electromagnetic Fields and Waves
56. AC Circuits

Computer Usage:

3) The Hyper-Interactive Teaching Technology (H-ITT) system was used to assess students' knowledge. During lectures students asked questions to test their understanding. Their answers were submitting using H-ITT transmitters, and the results were used by the instructor to decide the pace of the class.
4) Quizzes, homework, solutions, notes, tutorials, and discussions all utilized the web.

Class/laboratory schedule: Three 50-minute lectures per week

Laboratory Projects: None

Assessment Methods Used:
1. Standard course evaluation

Contribution of course to meeting the professional component:
Math and Basic Sciences - 4 credit hours or 100%
Engineering Science – 0 credit hours or 0%
Engineering Design – 0 credit hours or 0%

Relationship of course to Program Outcomes:
1.1:iii

Relationship of Course to ABET Criterion 3 (a – k):
a, b

Prepared by: Bruce Mason, Associate Professor of Physics **Date:** June 2005