APPENDIX I

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</tr>
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<td>169</td>
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### Support Courses

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<td>ENGL 101</td>
<td>Composition I</td>
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</tr>
<tr>
<td>MATH 125</td>
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<td>197</td>
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<td>MATH 225</td>
<td>Calculus III</td>
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<td>MATH 321</td>
<td>Differential Equations</td>
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<td>PHYS 211/211A</td>
<td>University Physics I</td>
<td>203</td>
</tr>
<tr>
<td>PHYS 213/213A</td>
<td>University Physics II</td>
<td>205</td>
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</table>
CEE 117/117L – Computer Aided Design and Interpretation in Civil Engineering
Spring 2003

Course Description: Students will learn how to read and interpret construction design documents, the use of engineering and architectural scales, and introduction to computer aided drawing and design, and three-dimensional visualization using AutoCAD.


Instructor: Lois Arneson-Meyer, CM 121
Office Hours: open door

Teaching Assistants: Zhong Tan, Homework Grader
Jonathan Brinson, Lab Assistant

Course Objectives:

Students learn the principles of engineering graphics including orthographic projections, auxiliary views, section, dimensioning and working drawings. These concepts are illustrated using a variety of techniques including freehand sketching and computer aided design software.

Course Outcomes:

The students successfully completing this course will have the ability to:

1. Visualize objects and ideas
2. Use and understand engineering drawing terminology
3. Interpret technical drawings
4. Communicate ideas in a visual medium
5. Sketch multiviews, auxiliary views and sectional views of objects
6. Demonstrate proficiency in the basics of AutoCAD.

Class Schedule and Topics: Week Topic
1 Introduction
2 Basic technical drawing skills – lettering, scales, linetypes, geometric construction.
3 Introduction AutoCAD features
Starting and setting up drawings
Drawings, saving drawings
Drawing lines, erasing objects, using layers and making prints
4 AutoCAD – Drawing basic shapes
Object snap, geometric constructions, placing text on drawing
5 Freehand drawing – sketching, multiviews
6  Project 1
7  AutoCAD – multiviews
8  AutoCAD – arrays, working with drawing files, basic editing
9  Freehand sketching – isometric views, dimensioning
10  AutoCAD – draw and edit polylines
11  Freehand auxiliary view, AutoCAD auxiliary views
12  Freehand sectional views, AutoCAD sectional views
13  Project 2
14  Project 2
15  Project 2

Laboratory Projects: Students have two projects a semester. The first project will be the drawing of a cabin from the beginning sketches to a complete drawing in AutoCAD. The second project is a drawing that students come up with that utilizes most of the concepts learned in this class. The projects are first cleared through the instructor.

Professional Component: Engineering Topics:  
2 credits or 100%

Relationship Between Course Outcomes and ABET a-k Outcomes:

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>ABET Program Outcomes</th>
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Assessment and Evaluation: Independent Course Assessment (homework, exams, quizzes, design projects)
Student Self Assessment Survey
Institutional Student Course Evaluation

Prepared by: Lois Arneson-Meyer
Course Description: (2-2) 4 credits. Prerequisite: An acceptable score on the Trigonometry Placement Examination; or trigonometry completed with a grade of “C” or better; or permission of instructor. An orientation to the civil engineering profession including historical development, civil engineering careers, professional practice and ethics, and specialties in the profession. Mensuration with the application of surveying techniques; basic surveying computations and field practice; theory of error propagation and its analysis; fundamental concepts of horizontal; angular, and vertical measurements; control systems related to engineering-construction surveys; horizontal and vertical curves and traverse computations.

Textbook: Elementary Surveying, 10th edition, Wolf and Ghilani

Instructor: Dr. M. R. Hansen, CM 242 mr.hansen@sdsmt.edu

Office Hours:

Course Objectives: This course is designed to provide sophomores in Civil Engineering with an introduction to engineering surveying. Also included, since all of the sophomore students are together as a group, is an introduction to the various specialty fields in Civil Engineering through guest speakers. Basic surveying topics including distance, angular, and vertical measurements, bearings, traverse computations, map construction and reading, and horizontal and vertical curves are introduced. Basic statistical methods are introduced using the student's own field data. Practical applications and teamwork will be experienced through fieldwork in parties and drawing a portion of the campus map, on AutoCAD, from their own measurements and notes. Basic and modern equipment is used by the students hands-on in the field. Data analysis and surveying computations are introduced, first by hand and then by computer. Responsibility to society is introduced, through the discussion of property boundaries and invited guest speakers. The students must communicate effectively, develop clear and complete field note taking, and demonstrate professional problem formulation, solution, and presentation procedures for solving engineering problems.

Course Outcomes: To satisfactorily complete this course the student must demonstrate:

1. The ability to work in survey parties of three or four people (a, c, e, g)
2. The ability to record complete and accurate field notes (a, c, e, g).
3. The ability to make distance, angular, and vertical measurements in the field (a, c, e, g).
4. An understanding of the analysis field data (a, c, e, g).
5. An understanding of traverse, bearing, and leveling computations (a, c, e, g).
6. An understanding of horizontal and vertical curve calculations (a, c, e, g).
7. An understanding of practical applications and teamwork through fieldwork, calculations, and AutoCad drawing of a final project (a, b, c, e, g).
Class Schedule and Topics:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>Introduction, form parties, field notes,</td>
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<tr>
<td></td>
<td>teamwork</td>
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<tr>
<td>2</td>
<td>Theory of measurement, statistics</td>
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<td>3</td>
<td>Distance measurement</td>
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<td>4</td>
<td>Bearing measurement and calculation</td>
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<td>5</td>
<td>Traversing</td>
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<td>6</td>
<td>Total station</td>
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<tr>
<td>7</td>
<td>Leveling</td>
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<td>8</td>
<td>Field operations</td>
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<td>9</td>
<td>Radial surveying</td>
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<td>10</td>
<td>Traverse adjustments</td>
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<td>11</td>
<td>Traverse computations</td>
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<td>Horizontal curves</td>
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<td>13</td>
<td>Vertical curves</td>
</tr>
<tr>
<td>14</td>
<td>Guest lecturers</td>
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<tr>
<td>15</td>
<td>Guest lecturers</td>
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</tbody>
</table>

Laboratory Projects:

1. Layout traverse, measure traverse distances, bearings, and internal angles.
2. Level loop with building elevations, calculations, and map preparation.
3. Campus survey with map preparation on AutoCad.
4. Radial surveying including calculations and map preparation.

Professional Component: Engineering Topics: 4 credits or 100%

Relationship Between Course Outcomes and ABET a-k Outcomes:

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<th>ABET Program Outcomes</th>
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</table>

Assessment and Evaluation: Independent Course Assessment (homework, exams, quizzes, lab reports and design projects) FE Exam Topical Results Student Self Assessment Survey Institutional Student Course Evaluation

Prepared by: M. R. Hansen
CEE 284 - Digital Computation Applications in Civil Engineering
Fall 2003

Course Description: (3-1) 4 credits. Prerequisite: Math 123. A one-semester introductory course in programming with Visual Basic language, a spreadsheet (Excel), and MathCAD. Elementary numerical methods and their application to Civil Engineering problems will be illustrated by the programming technique.


Instructor: Dr. Thomas A. Fontaine, CM 315; 394-5173; Thomas.Fontaine@sdsmt.edu
Office Hours:

Teaching Assistants: Sirisha Muppala, Homework Grader. Justin Johnson, Steve Lipetzky, and Matt Sletten, Lab Assistants

Course Objectives:

1. Introduce sophomore students to computer skills and numerical methods used in Civil and Environmental Engineering.

2. Demonstrate computer programming using the Visual Basic language.

3. Demonstrate numerical and analytical techniques using Visual Basic programs, Excel and MathCAD.

Course Outcomes:

The students successfully completing this course will have the ability to:

1. Write computer programs in Visual Basic.
2. Find roots of equations using Visual Basic programs.
4. Develop and apply probability distributions.
6. Use interpolation algorithms to fit curves through data sets.
7. Apply numerical techniques for integration and differentiation.
8. Use MathCAD for integration and differentiation.
9. Estimate accuracy, precision, and uncertainty in results of numerical analyses.
Class Schedule and Topics:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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</thead>
<tbody>
<tr>
<td>1 to 5</td>
<td>Introduction to Visual Basic 6.0</td>
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<tr>
<td>6</td>
<td>Error analysis</td>
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<tr>
<td>7</td>
<td>Roots of Equations</td>
</tr>
<tr>
<td>8 to 9</td>
<td>Solving Systems of Equations</td>
</tr>
<tr>
<td>10 to 12</td>
<td>Statistics, regression, interpolation</td>
</tr>
<tr>
<td>13 to 15</td>
<td>Numerical Calculus</td>
</tr>
</tbody>
</table>

Laboratory Projects: A weekly 3 hour lab is used for students to develop solutions to engineering problems using Visual Basic programs, Excel, and Mathcad.

Professional Component:

<table>
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<tr>
<th>Engineering Topics:</th>
<th>2 credits or 50%</th>
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<tbody>
<tr>
<td>Basic Math:</td>
<td>2 credits or 50%</td>
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Relationship Between Course Outcomes and ABET a-k Outcomes:

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<tr>
<th>Course Outcomes</th>
<th>ABET Program Outcomes</th>
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<tr>
<td></td>
<td>a  b  c  D  e  f  G  h  I  j  k</td>
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<tr>
<td>1</td>
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<td>2</td>
<td>X    X</td>
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<td>8</td>
<td>X    X</td>
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<tr>
<td>9</td>
<td>X    X</td>
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</tbody>
</table>

Assessment and Evaluation:

Independent Course Assessment (homework, exams, and lab reports)
FE Exam Topical Results
Student Self Assessment Survey
Institutional Student Course Evaluation

Prepared by: Thomas A. Fontaine
Course Description: (2-1) 3 credits. Prerequisites: Preceded by or concurrent with EM 216 and CEE 284. Principles that govern physical and mechanical properties of ferrous and nonferrous metals, plastics, bituminous materials, Portland cement, aggregates, concrete, and timber. Laboratory exercises to demonstrate basic principles and standard laboratory tests (ASTM standards) of structural materials. Computer-aided graphics and word processing are required for the lab reports.


Instructor: Dr. M. R. Hansen, CM 242
mr.hansen@sdsmt.edu

Course Objectives:

The course is designed to give juniors in civil engineering a basic knowledge of the material properties and behavior of the most common civil engineering materials, and of the standard tests of materials as given by ASTM. The students will work on laboratory teams to conduct tests, interpret data, and present it in a written report.

Course Outcomes:

Satisfactory completion of this course will demonstrate that the students have:

1. An understanding of the material properties and behavior of common materials used by civil engineers, such as cement, aggregates, concrete, wood, metals, etc. (a, e, h, i, k);

2. An understanding of the laboratory techniques for testing materials and learn how to conduct in teams some standard laboratory tests (ASTM standards).
   a) From these tests the student will learn how to perform a sieve analysis and how to compute absorption, moisture content, and specific gravity of aggregates (b, e, k):
   b) The ability to design a concrete mix, make trial batches from that design and perform tests on the wet concrete; slump, air, and unit weight; and make test specimens (b, e, k):
   c) The ability to perform strength tests on the concrete specimens made in the laboratory (b, e, k):
   d) The ability to perform tensile testing on several metal specimens and determine the modulus of elasticity, ultimate strength, and percent elongation (b, e, k):
   e) The ability to perform bending and compression tests on timber specimens and determine moduli of elasticity (b, e, k):
   f) The ability to perform Charpy impact tests on standard steel specimens at various temperatures and determine the impact strength and estimate the carbon content (b, e, k);

3. And the ability to interpret and analyze the data from the laboratory tests and write reports on the laboratory exercises (g).
Class Schedule and Topics:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>Concrete, general</td>
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<tr>
<td>2</td>
<td>Aggregates, cement, statistics</td>
</tr>
<tr>
<td>3</td>
<td>Hydration products</td>
</tr>
<tr>
<td>4</td>
<td>Testing wet concrete</td>
</tr>
<tr>
<td>5</td>
<td>Testing hardened concrete</td>
</tr>
<tr>
<td>6</td>
<td>Durability of concrete</td>
</tr>
<tr>
<td>7</td>
<td>Transport, place, finish, cure concrete</td>
</tr>
<tr>
<td>8</td>
<td>Hot and cold weather concrete</td>
</tr>
<tr>
<td>9</td>
<td>Fracture, fatigue, and creep of materials</td>
</tr>
<tr>
<td>10</td>
<td>Metals</td>
</tr>
<tr>
<td>11</td>
<td>Steel</td>
</tr>
<tr>
<td>12</td>
<td>Wood</td>
</tr>
<tr>
<td>13</td>
<td>Asphalt</td>
</tr>
<tr>
<td>14</td>
<td>Masonry</td>
</tr>
<tr>
<td>15</td>
<td>Plastics</td>
</tr>
</tbody>
</table>

Laboratory Projects:

1. Lab safety and statistics of measurements
2. Cement tests
3. Aggregate tests
4. Mix concrete and test wet properties
5. Test properties of hard concrete
6. ACI certification testing
7. Field trips to cement plant, ready mix plant, block plant
8. Tension test steel
9. Wood tests
10. Charpy impact tests

Relationship Between Program Objectives and Course Objectives:

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>ABET Program Outcomes</th>
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</thead>
<tbody>
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Assessment and Evaluation:

Independent Course Assessment (homework, exams, quizzes, lab reports and design projects)
FE Exam Topical Results
Student Self Assessment Survey
Institutional Student Course Evaluation

Prepared by: M. R. Hansen
Course Description: The first course in the theory and practice of Environmental Engineering. Emphasis is on the mass balance approach to problem solving with consideration of water chemistry, environmental process kinetics, ideal reactors, and biological process fundamentals.


Instructor: Henry V. Mott, Ph.D., P.E Henry.Mott@sdsmt.edu CM 123; 394-5170
Office Hours:

Prerequisites: Chem. 114, EM 331 and CEE 284.

Course Objectives:

1. The student will acquire a competency in computations in the context of both natural and engineered environmental systems involving: distributions of soluble gases between air and water, acids and bases in aqueous solutions, process analysis for selected reaction types in selected ideal reactors and fundamental biological process analysis.

2. The student will enhanced his/her abilities to apply concepts from mathematics, the sciences and engineering in the formulation and solution of engineering problems.

Course Outcomes: Students completing CEE/EnvE 326 should develop the following competencies:

1. An ability to interconvert concentrations among the various sets of gas-, liquid- and solid-phase units commonly used in environmental engineering practice.

2. An ability to determine the distribution of soluble gases between vapor phases and water using Henry’s Law.

3. An ability to apply the fundamental acid-base equations used in computing speciation of common weak and strong acids in aqueous environmental systems.

4. An ability to apply the concept of alkalinity in computations of inorganic carbon speciation in natural and engineered aqueous systems.

5. An ability to perform both steady-state and transient mixing computation for systems that may be modeled as complete-mix reactors.

6. An ability to apply first order, pseudo first order and saturation-type reaction rate laws in ideal reactor (stirred batch, plug-flow, complete-mix) performance analysis in selected environmental engineering contexts.

7. An ability to apply first order, pseudo first order and saturation-type reaction rate laws in non-ideal reactor performance analysis using the N tanks in series model in selected environmental engineering contexts.
8. An ability to apply the concept of coupled biomass growth and utilization of organic carbon substrates in biological processes in quantitative analyses of biological processes carried out in ideal and non-ideal reactors.

Computer usage - low level, Excel worksheets and/or Visual Basic project required.

Class Schedule and Topics: Week Topic

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
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<tbody>
<tr>
<td>9/3, 9/5, 9/8, 9/10</td>
<td>Liquid, solid, gas Concentration units</td>
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<tr>
<td>9/12, 9/15</td>
<td>Water/gas distributions (Henry’s Law)</td>
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<tr>
<td>9/17, 9/19, 9/22, 9/24, 9/26</td>
<td>Acid/base concepts</td>
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<td>9/29, 10/1</td>
<td>Environmental system applications</td>
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<tr>
<td>10/3, 10/6, 10/8</td>
<td>Steady and unsteady-state Mixing</td>
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<tr>
<td>10/15, 10/17</td>
<td>Reactions in batch reactors</td>
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<tr>
<td>10/20, 10/22, 10/24</td>
<td>Reactions in Plug-flow reactors</td>
</tr>
<tr>
<td>10/27, 10/29</td>
<td>Reactions in complete-mix reactors</td>
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<tr>
<td>10/31, 11/3</td>
<td>Reactions in series reactors</td>
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<td>11/5, 11/7</td>
<td>Reaction stoichiometry</td>
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<td>11/10, 11/14, 11/17</td>
<td>Biological growth principles</td>
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<td>11/19, 11/21, 11/24</td>
<td>Biological growth in reactor systems</td>
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<td>11/26, 12/1, 12/3</td>
<td>Biochemical oxygen demand</td>
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<td>Environmental biological processes</td>
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<td>10/8, 11/12, 12/10</td>
<td>Midterm examinations</td>
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Professional Component: Engineering Topics: 3 credits or 100%

Relationship Between Course Outcomes and ABET a-k Outcomes:

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<th>Course Outcome</th>
<th>Program Outcome</th>
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Assessment and Evaluation: Independent Course Assessment (homework, exams, and lab reports)
FE Exam Topical Results
Student Self Assessment Survey
Institutional Student Course Evaluation

Prepared by: Henry V. Mott, 04/09/04

118
CEE/EnvE 327 - Introductory Environmental Engineering Design
Spring 2004

Course Description: Second course in theory and practice of environmental engineering. Emphases are on applications of environmental engineering principles of the design and analysis of municipal water and wastewater treatment systems.


Instructor: James J. Stone, Ph.D., P.E.
Office Hours:

Prerequisites: CEE/EnvE 326

Course Objectives:
1. Introduce unit operations and processes employed in the treatment of water and wastewater;
2. Develop an understanding of the characteristics of water and wastewater that must be considered during design of a treatment plant;
3. Determine rational used in treatment process selection;
4. Develop understanding of events governing the physical, chemical, and biological operations used for water and wastewater treatment;
5. Develop the ability to professionally convey engineering design calculations using both a written and computer format;
6. Design and conduct laboratory experiments directed toward the evaluation of process parameters.

Course Outcomes: After completion of this course, the student is expected to be able to:
1. Describe a bacterium and understand importance of bacteria to environmental engineers;
2. Determine factors that influence microbial growth, including temperature, molecular oxygen, pH, oxidizing agents, and heavy metals;
3. Understand typical variation in water demand and wastewater generation and describe what factors may influence these patterns;
4. Develop conceptual schematics required for the treatment of water and wastewater;
5. Evaluate raw water quality data in relation to appropriate regulations and identify required treatments processes;
6. Describe chemistry of coagulation, determine optimum coagulant dose, and understand how jar test is used to determine that dose;
7. Understand the theory and practice of sedimentation;
8. Describe elements of typical granular media filter;
9. List primary uses of activated carbon adsorption and understand methods of carbon application for those uses;
10. Explain how the oxygen transfer equation can be used to size aeration system;
11. List major elements required by microorganisms for growth and state expressions for biomass growth and reaction rate expressions for substrate and oxygen utilization;
12. Describe activated sludge process and define the following terms and explain their importance to design and control of activated sludge systems: HRT, SRT, F:M ratio, SVI, and sludge recycling ratio;
13. Evaluate removal mechanisms of phosphorous from water and wastewater;
14. Understand principles of biological nitrification and denitrification;
15. Define trickling filter operational parameters;
16. Understand major types of sludges in wastewater treatment plants and describe the desired outcome from their digestion.

Class Schedule and Topics:

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1/8</td>
<td>Water/Wastewater facts</td>
</tr>
<tr>
<td>1/13,15</td>
<td>Water quality and quantity</td>
</tr>
<tr>
<td>1/20,22</td>
<td>Wastewater quality and quantity</td>
</tr>
<tr>
<td>1/27,29</td>
<td>Layout, preliminary unit operations</td>
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<tr>
<td>2/3,5</td>
<td>Coagulation, rapid mix, flocculation</td>
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<tr>
<td>2/10,12</td>
<td>Flocculation, sedimentation</td>
</tr>
<tr>
<td>2/17,19</td>
<td>Filtration</td>
</tr>
<tr>
<td>2/24,26</td>
<td>Adsorption, Oxygen transfer</td>
</tr>
<tr>
<td>3/2,4</td>
<td>Disinfection, Biological principles</td>
</tr>
<tr>
<td>3/23,25</td>
<td>Activated sludge</td>
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<td>3/30,4/1</td>
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<tr>
<td>4/6,8</td>
<td>Nitrification, denitrification</td>
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<td>4/13,15</td>
<td>Phosphorous removal, fixed film</td>
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<tr>
<td>4/20,22</td>
<td>Anaerobic digestion, aerobic digestion</td>
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<tr>
<td>4/27,29</td>
<td>Solids handling</td>
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</table>

Professional Component:  Engineering Topics:  3 credits or 100%

Relationship Between Course Outcomes and ABET a-k Outcomes:

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>ABET Program Outcomes</th>
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Assessment and Evaluation: Independent course assessment (homework, examinations, and laboratory reports)
Institutional student course evaluation

Prepared by: James J. Stone
Course Description: Hydraulic analysis of flow in pipe systems, open channels, and measuring devices with design applications including water supply distribution systems, pump selection, wastewater and stormwater collection. Computer applications will be used.


Instructor: Dr. Scott J. Kenner, CM 122
Office Hours: Monday 10:00 to 12:00, Friday 8:00 to 10:00

Teaching Assistants: Homework Grader – B. Shurka
Lab Assistant – Dan Nebelsick

Course Objectives:
1. To develop student’s capability to apply the basic governing equations (continuity, energy and momentum) to analysis and design of hydraulic systems of pressure pipe flow, pumps and open channels.
2. Develop student’s capability to collect and analyze experimental data demonstrating fundamental hydraulic principles.
3. To develop student’s awareness of design guidelines for hydraulic systems and how the design of hydraulic systems affects the safety and welfare of the public.

Course Outcomes: Students successfully completing this course will have the ability to
1. Calculate friction and minor energy losses in pressure pipe systems
2. Calculate flow rates, water pressure and energy losses in pressure pipe network systems such as parallel, series and looped pipe networks.
3. Calculate system head curves and with pump characteristics curves, determine pump operating conditions (head, discharge, horse power, and efficiency) for single pumps or pumps operating in series and parallel.
4. Calculate net positive suction head to evaluate pump cavitation potential
5. Calculate hydraulic properties of flow in open channel flow systems (depth, hydraulic radius, velocity, discharge, conveyance)
6. Calculate backwater conditions based on gradually varied flow in open channels for determining effects of flooding
7. Calculate stable channel conditions using regime and critical velocity theory for loose boundary channels.
8. Calculate flow capacity through culverts under inlet and outlet control flow conditions.
9. Design sanitary and storm sewer systems according to standard criteria and guidelines.
Class Schedule and Topics:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>Introduction and Review (fluid properties, hydrostatics)</td>
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<tr>
<td>2</td>
<td>Pressure Flow Systems &amp; Friction Headloss</td>
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<td>3</td>
<td>Minor Losses - Equivalent Pipes</td>
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<td>4</td>
<td>Pipelines and Network Analysis</td>
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<td>5</td>
<td>Network Analysis &amp; Water Hammer</td>
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<td>6</td>
<td>Pumps (classification &amp; terms)</td>
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<td>7</td>
<td>Characteristic Curves &amp; NPSH</td>
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<td>8</td>
<td>Open Channel Flow (continuity, energy and momentum)</td>
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<td>9</td>
<td>Uniform Flow &amp; Rigid Boundary Analysis</td>
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<td>10</td>
<td>Loose Boundary Analysis &amp; Gradually Varied Flow</td>
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<td>11</td>
<td>Water Measurements using hydraulic devices</td>
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<td>12</td>
<td>Culvert Hydraulics</td>
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<td>13</td>
<td>Culvert Hydraulics &amp; Inverted Siphon</td>
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<tr>
<td>14</td>
<td>Sanitary Sewer Design</td>
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<tr>
<td>15</td>
<td>Storm Sewer Design</td>
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</tbody>
</table>

Laboratory Projects:

- **Wet Laboratories**
  - 1. Headloss in Pipe Networks
  - 2. Pump Characteristic Curves
  - 3. Pumps in series and parallel
  - 4. Hydraulic Jumps

- **Design Laboratories**
  - 1. Computer analysis of pipe networks
  - 2. Open Channel flow backwater conditions based on culvert headwater conditions
  - 3. Sanitary sewer design

Professional Component: Engineering Topics: 3 credits or 100%

**Relationship Between Course Outcomes and ABET a-k Outcomes:**

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<th>Course Outcomes</th>
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Assessment and Evaluation: Independent Course Assessment, (homework, exams, quizzes, lab reports and design projects), FE Exam Topical Results, Student Self Assessment Survey, Institutional Student Course Evaluation

Prepared by: Scott J. Kenner

122
CEE 337 - Engineering Hydrology
Spring 2004

Course Description: A quantification study of the components of the hydrologic cycle with emphasis on engineering applications involving the design of water supplies, reservoirs, spillways, floodways, and urban drainage with computer applications. Prerequisites: CEE 336 or EM 327 or consent of instructor


Instructor: Dr. Thomas A. Fontaine, CM 315; 394-5173; Thomas.Fontaine@sdsmt.edu. Office Hours: M,W 1:00, F 11:00

Teaching Assistants: Anna Padilla, Homework Grader

Course Objectives:

1. Understand the earth science processes involved in the hydrologic cycle, and the methods to quantify these processes for prediction and design.

2. Understand the importance of data for hydrologic analyses and design.

3. Understand probability and statistics concepts for hydrologic analyses and design.

Course Outcomes:

The students successfully completing this course will have the ability to:

1. Discuss several contemporary global water resources issues.
2. Describe the hydrologic cycle.
3. Describe rainfall runoff processes (precipitation, interception, evapotranspiration, infiltration, percolation, soil moisture storage, and generation of overland and subsurface flow).
4. Apply mathematical models of these rainfall runoff processes to hydrologic analysis and design.
5. Analyze streamflow hydrographs, and to develop and apply unit hydrographs.
6. Describe the common sources of hydrologic data and basic data collection techniques, and to know how to estimate the uncertainty associated with this data.
7. Apply probability and statistical concepts to flood frequency and risk-based design.
8. Explain and apply concepts of urban drainage and stormwater control.
10. Demonstrate the judgment required to make appropriate assumptions when the data is inadequate, or the hydrologic system is poorly defined.
I. Explain the concept of a hydrologic model and how to apply a model for a hydrologic analysis.

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<th>Class Schedule and Topics:</th>
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<td>Water Resources Development</td>
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<td>Hydrologic Cycle and Water Budget</td>
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<td>3 to 4</td>
<td>Precipitation</td>
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<td>Evaporation &amp; Transpiration</td>
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<td>Infiltration &amp; Runoff</td>
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<td>Hydrograph Analysis</td>
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<td>Unit Hydrograph</td>
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<td>Urban Drainage, Stormwater Control</td>
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<td>Rational Method</td>
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<td>12 to 13</td>
<td>Risk and Hydrologic Design</td>
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<td>14</td>
<td>Streamflow Routing</td>
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<td>Case Studies &amp; Hydrologic Modeling</td>
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Laboratory Projects: None.

Professional Component: Engineering Topics: 3 credits or 100%

Relationship Between Course Outcomes and ABET a-k Outcomes:

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Assessment and Evaluation: Independent Course Assessment (homework and exams)
FE Exam Topical Results
Student Self Assessment Survey
Institutional Student Course Evaluation

Prepared by: Thomas A. Fontaine
CEE 346 - Geotechnical Engineering I
Fall 2003

Course Description: Prerequisite: EM 216 and CEE 285 (GEOE 201 recommended). Composition, structure, index and engineering properties of soils, soil classification systems; introduction to soil engineering problems involving stability, settlement, seepage, consolidation and engineering properties of soils. Computer applications are required. Computer-aided graphics and word processing is required for laboratory.


Instructor: Dr. Terje Preber, CM 313
Office Hours: 13:00-15:00 MWF

Teaching Assistants: Kuchenbecker, Garret; Homework Grader Harris, Andy; Lyman, Brandt; Lab Assistants

Expectations:
Students should know how to use spreadsheets and Mathcad, be familiar with stresses, strain and Young’s modulus, know how to work with Mohr’s circle, be familiar with differentiation and integration, and should have been introduced to basic differential equations.

Course Objectives: This course is designed to provide:
1. Juniors in civil and geological engineering with a basic working knowledge of soil mechanics;
2. The building blocks required to calculate settlement of structures;
3. Knowledge of laboratory procedures by working on laboratory teams and to interpret and present the data in written laboratory report form.

Course Outcomes: The students successfully completing this course will have the ability to:
1. Basic understanding of the phase relationship of soils and an ability to derive basic expressions for soil density, degree of saturation, void ratio and porosity. The students should also be able to measure specific gravity and water content, and to calculate soil density of a soil sample;
2. An understanding of grain size distribution, including sieve and hydrometer analysis. In addition the students should be able to perform grain size (mechanical and hydrometer) analysis;
3. The ability to classify soils by their gradation and index properties, and to perform Atterberg limit tests;
4. To use soil permeability for seepage analysis and to draw basic flow nets. The students should be able to perform both constant and falling head permeability tests and to calculate hydraulic conductivity;
5. Understanding of the effective stress concept and be able to calculate effective stresses under static, upward and downward flow, and based on flow nets;
6. The ability to calculate stress distribution underneath any point on a loaded area using the basic Boussinesq equation and by numerical integration of an infinitesimal area using Mathcad;
7. Understanding of the mechanism of settlement and consolidation and be able to calculate settlements for foundations both on normally and over consolidated soils. They should
also be able to perform one dimensional compression (consolidation) tests and to
calculate the parameters needed for both settlements and time rate of settlements;
8. Understanding of the Mohr-Coulomb failure criteria and shear strength of soils. This
would include a basic understanding of drained and undrained strength parameters. This
would also include the effect of pore water pressure and buoyancy on shear strength. In
addition, the students should be able to perform direct shear tests and understand the
principles of the triaxial test.

Class Schedule and Topics:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>Soil composition and properties;</td>
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<tr>
<td>2</td>
<td>Clay minerals, specific gravity and mechanical analysis;</td>
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<tr>
<td>3</td>
<td>Phase relationships, relative density and soil consistency;</td>
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<tr>
<td>4</td>
<td>Plasticity and Atterberg limits;</td>
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<td>5</td>
<td>Soil Classification and Exam 1;</td>
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<td>6</td>
<td>Soil Classification and permeability;</td>
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<td>7</td>
<td>Laboratory procedures for measuring permeability;</td>
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<td>8</td>
<td>Directional permeability and two dimensional flow;</td>
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<td>Effective stresses;</td>
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<td>10</td>
<td>Effective Stresses and exam 2;</td>
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<td>Compressibility;</td>
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<td>Consolidation;</td>
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<td>Settlements and exam 3;</td>
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<td>14</td>
<td>Shear Strength of Sand;</td>
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<tr>
<td>15</td>
<td>Shear Strength of Clay</td>
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</table>

Laboratory Projects: Water content and specific gravity, mechanical and hydrometer analysis,
Atterberg limits, permeability, compaction, consolidation, unconfined compression, direct shear,
and vacuum triaxial tests.

Professional Component: Engineering Topics: 3 credits or 100%

Relationship Between Course Outcomes and ABET a-k Outcomes:

<table>
<thead>
<tr>
<th>Course Outcomes</th>
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Assessment and Evaluation: Independent Course Assessment (homework, exams,
quizzes, lab reports and design projects)
FE Exam Topical Results
Student Self Assessment Survey
Institutional Student Course Evaluation

Prepared by: Terje Preber

126
CEE 347 – Geotechnical Engineering II
Spring 2004

Course Description: (3-0) 3 credits. Composition of soils, origin and deposition, exploration, selection of samples for testing, frost problems, swelling of soils, erosion protection, soil improvement, groundwater flow and de-watering, slope stability, retaining structures, and introduction to foundation systems


Instructor: Dr. Terje Preber, CM 313
Office Hours: 13:00-15:00 MWF

Course Objectives:
This course is designed to give students a broader background in Geotechnical Engineering and to cover topics not included in CEE 346. The students will be provided with the working knowledge required to design field investigation programs, using appropriate drilling and sampling techniques, penetration devices and in bore-hole measuring devices, and also learn which type of sampling and testing to be performed for foundation systems, earth retaining structures and slope stability. The student will also be provided with the background to analyze and understand the workings of earth retaining structures and foundation systems.

Course Outcomes:
The students successfully completing this course will have the ability to:

1. Have a basic understanding of the geological processes of soil formation and the origin of soil, and recognize basic landforms on aerial photographs and their associated soil types;
2. Apply the principles of shear strength to lateral earth pressures and be able to calculate lateral earth pressures for retaining walls, bridge abutments and underground structures;
3. Know what type of drilling or exploratory equipment to use for different soil conditions and distinguish between undisturbed and disturbed samples. The students should also know how to determine the spacing between borings, depth of bore holes, and sample frequency. In addition the students should know where to find pre-field investigation information on geologic conditions and geotechnical data for a site;
4. Know what types of tests to run to obtain the correct soil properties for different types of geotechnical projects;
5. Know what factors which are important for both field and laboratory compaction. The students should also be able to understand field compaction control methods;
6. Know the basic principles of erosion and erosion protection;
7. Understand the principles behind frost and frost action in soil and be able to calculate frost depth from meteorological and soil thermal properties using the Modified Berggren formula;
8. Know how to calculate well capacity from soil hydraulic conductivity data and subsurface information;  
9. Make simple bearing capacity determinations for shallow and deep foundations.

Class Schedule and Topics:  

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<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1.</td>
<td>Review of shear strength;</td>
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<td>2.</td>
<td>Lateral earth pressures;</td>
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<tr>
<td>3.</td>
<td>Retaining walls, origin of soils and landforms;</td>
</tr>
<tr>
<td>4.</td>
<td>Recognition of landforms from aerial photographs and exam 1;</td>
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<tr>
<td>5.</td>
<td>Exploration methods, drilling and sampling;</td>
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<tr>
<td>6.</td>
<td>Exploration methods, in-situ measurements</td>
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<tr>
<td>7.</td>
<td>Geophysical methods and boring logs;</td>
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<tr>
<td>8.</td>
<td>Testing requirements, selection of samples and frost action;</td>
</tr>
<tr>
<td>9.</td>
<td>Exam 2 and spring break;</td>
</tr>
<tr>
<td>10.</td>
<td>Solutions to frost problems and expansive soils;</td>
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<tr>
<td>11.</td>
<td>Properties of compacted soils and field compaction equipment;</td>
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<tr>
<td>12.</td>
<td>Compaction control and erosion;</td>
</tr>
<tr>
<td>13.</td>
<td>Ground water flow and wells;</td>
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<td>14.</td>
<td>Shallow foundations;</td>
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<td>15.</td>
<td>Deep foundations</td>
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</table>

Laboratory Projects: None

Professional Component: Engineering Topics: 3 credit hours or 100%

Relationship Between Course Outcomes and ABET a-k Outcomes:

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<th>Course Outcomes</th>
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Assessment and Evaluation: Independent Course Assessment (homework, exams, quizzes, lab reports and design projects), FE Exam Topical Results, Student Self Assessment Survey, Institutional Student Course Evaluation

Prepared by: Terje Preber
Course Description: (3-0) 3 credits. Prerequisites: EM 321 and CEE 284. Basic concepts in the structural analysis of statically determinate beams, trusses, and frames; the construction and use of influence lines; and the determination of deflections using the virtual work principle. As time allows, an introduction to the application of slope-deflection and moment distribution to statically indeterminate structures. Computer applications will be used.


Instructor: Dr. Melvin Klasi, CM 241 mklasi@taz.sdsmt.edu
Office Hours: posted on my door

Teaching Assistants: Homework Grader – Dola K. Erla

Expectations:
The student is expected to have completed the sophomore year courses in calculus, statics, mechanics of materials, and numerical methods and programming.

Course Objectives: As a first course in structural analysis this course aims to
1. develop the student’s capability to use equations of equilibrium to determine the internal forces in beams, trusses, and frames, including the sketching of shear and moment diagrams and influence lines; and to develop the student’s capability to determine deflections of structures; and
2. to give the student an overall awareness of the behavior of various types of simple structures and an appreciation of the tools needed for their analysis.

Course Outcomes:
Students successfully completing this course will have the ability to
1. sketch proper free body diagrams from beams, trusses, and frames;
2. apply the method of joints and sections to trusses and to write a simple computer program for the analysis of determinate trusses;
3. solve for the internal forces at a point in beams or frames and to be able to write equations for the internal forces over the whole structure;
4. To be able to sketch shear and moment diagrams using basic relationships between load, shear, and moment;
5. To be able to construct influence lines for statically determinate structures using equations of equilibrium and the Muller-Breslau principle;
6. and determine deflections by either the conjugate-beam or the moment-area methods and by the method of virtual work (unit load method).
Class Schedule and Topics:

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<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>Introduction and review</td>
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<td>Introduction and review</td>
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<tr>
<td>3-4</td>
<td>Trusses</td>
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<tr>
<td>5-6</td>
<td>Internal loading in beams – shear and omen diagrams and equations</td>
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<tr>
<td>7-9</td>
<td>Influence lines for statically determinate structures</td>
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<td>10</td>
<td>Deflections by the conjugate-beam method (or moment-area method)</td>
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<tr>
<td>11-12</td>
<td>Deflections by the unit load method</td>
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<tr>
<td>13</td>
<td>Approximate analysis of structures</td>
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<tr>
<td>14-15</td>
<td>Other topics or review</td>
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</tbody>
</table>

Computer Project:
Write a program to analyze statically determinate trusses using the Gauss-Elimination solver learned in CEE 284.

Professional Component: Engineering Topics: 3 credit hours or 100%

Relationship Between Course Outcomes and ABET a-k Outcomes:

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Assessment and Evaluation: Independent Course Assessment – homework, quizzes, tests, programming project
FE Exam topical results
Student Self Assessment Survey
Institutional Student Course Evaluation

Prepared by: Melvin L. Klasi
Course Description: (2-1) 3 Credits. Prerequisite: CEE 356. Correlation of analysis and design using the current building code requirements for steel structures. Design techniques are formulated for axial, transverse and combined loading conditions, for individual members and for connections between components of a structure. Comparisons between design requirements of materials to illustrate relative benefits in structural systems.

Textbooks:

Instructor: Dr. Anil K. Patnaik, CM243
Office hours – posted on office door

Teaching Assistant: Chris Bauer

Expectations:

Students are expected to know how to draw free-body diagrams, and develop and solve equations of equilibrium for simple loading systems, draw shear force and bending moment diagrams for statically determinate structures, determine internal stresses such as axial, shear, and bending stresses in structural members, estimate dead and live loads for buildings.

Course Objectives:

1. This course is designed to introduce load and resistance factor design (LRFD) concepts applied to design of steel members such as tension members, compression members, and beams - with and without full lateral braces
2. To provide understanding of the behavior and design of simple welded and bolted connections, and base plates.
3. To introduce to the relevant AISC design specifications, charts and tables for design of steel members and simple connections.

Outcomes:

Students successfully completing this course will have the ability to:
1. Apply load and resistance factor design (LRFD) concepts to design of steel members and simple connections.
2. Analyze and design tension members, compression members, and beams.
3. Analyze and design simple welded and bolted connections, and base plates.
4. Use the relevant AISC specifications for design of steel members and simple connections.
5. Use relevant design charts and tables from the AISC design manual and to develop details.

Class Schedule and Topics:

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<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1.</td>
<td>Introduction, sections and steel properties</td>
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<td>2.</td>
<td>LRFD Philosophy</td>
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<td>3.</td>
<td>Tension Members</td>
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<td>5.</td>
<td>Bolted Connections</td>
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<td>Bolted Connections</td>
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<td>7.</td>
<td>Welded Connections</td>
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<td>8.</td>
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<td>9.</td>
<td>Compression Members</td>
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<td>Beams</td>
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<td>15.</td>
<td>Base plates and simple connections</td>
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Laboratory Projects:  None

Professional Component:  Engineering Topics:  3 credits or 100%

Relationship Between Course Outcomes and ABET a-k Outcomes:

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Assessment and Evaluation:  Independent course assessment (homework, exams, labs)
FE Exam topical results
Student self assessment survey
Institutional student course evaluation

Prepared by:  A. K. Patnaik
CEE 358 - Applied Structural Design
Spring 2003

Course Description: (3-0) 3 credits. Prerequisite: CEE 353 or permission of instructor. Elements of structural design utilizing concrete, steel, or wood. Applied methods emphasizing practical, conservative, and economical solutions will be emphasized. Intended for students who will take no other structural design courses.

“ACI Building Code and Commentary 2002”, American Concrete Institute.

Instructor: Dr. Melvin Klasi, CM 241 mklasi@taz.sdsmt.edu
Office Hours: posted on my door

Teaching Assistants: Homework Grader –

Expectations: Students are expected to have completed a first course in structural analysis and its necessary prerequisites, the first two semesters of calculus, and the departments sophomore course in programming and numerical methods or an equivalent.

Course Objectives:
1. To develop the student’s capability to analyze and design reinforced concrete beams, one-way slabs, footings, and retaining walls using the ACI code.
2. To develop the students capability to analyze and design steel tension members, bolted connections, and beams using the AISC code.
3. To give the student an introduction to the use of design codes and an awareness of what must be considered for structural design.

Course Outcomes: Students successfully completing this course will have the ability to
1. compute the cracking moment and the ultimate flexural moment in a reinforced concrete beam; and design reinforced concrete beams;
2. compute development length of steel reinforcement in beams;
3. design the shear reinforcement for concrete beams;
4. analyze and design wall footings and square footings;
5. analyze and design cantilever retaining walls;
6. analyze and design steel tension members with either bolted or welded connections;
7. and to analyze and design steel beams for flexure and shear.

Class Schedule and Topics: Week Topic
1 Introduction and review and the ACI code
2 Flexural analysis of beams
3-4 Design of beams and one-way slabs
5 Bond strength and development length
6-7 Shear and diagonal tension
8-9 Wall footings and square footings
10-11 Cantilever retaining walls
12-13 Steel – tension members and the AISC code
14-15 Steel beams

Computer Projects:
Several programs in Mathcad will be written to carry out design procedures.

Professional Component: Engineering Topics: 3 credits or 100%

Relationship Between Course Outcomes and ABET a-k Outcomes:

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Assessment and Evaluation: Independent Course Assessment – homework, quizzes, tests, programming project
FE Exam topical results
Student Self Assessment Survey
Institutional Student Course Evaluation

Prepared by: Melvin L. Klasi

134
Course Description: Prerequisite: Senior in Civil Engineering. Lecture and discussion with emphasis on professional, personal, and ethical development.

Textbook and Materials:
1. Modules used in this course were developed by the College of Engineering, University of Alabama. http://fc.eng.ua.edu/philosophy.htm

Instructor: Dr. Scott J. Kenner, CM 122
Office Hours:

Course Objective: Lecture and discussion on current engineering topics with emphasis on professional, personal and ethical development. The course will cover ethics, societal impacts, contemporary issues, lifelong learning and communications.

Course Outcomes:
1. Students completing the Oral Communication module should be able to do the following (outcome g):
   a. Write guidelines for effective presentation.
   b. Plan, prepare, and deliver a presentation.
   c. Critique a presentation.
2. Students completing the Engineering Ethics module should be able to do the following (outcome f):
   a. Discuss an engineer’s professional responsibilities.
   b. Discuss various engineering ethics codes.
   c. Discuss the importance of engineering ethics in the career of an engineer.
   d. Discuss the need for a professional code of ethics.
   e. Discuss what an engineer should do when the employer’s interest conflicts with the public.
   f. Discuss resources and contact points that would be helpful in dealing with ethical dilemmas.
   g. Given a scenario, identify ethical concerns, describe the appropriate behavior, and discuss the ethical basis for these choices.
3. Students completing the Societal Impact module should be able to do the following (outcome h):
   a. Identify global, societal, and environmental implications of various technological issues within their engineering discipline.
   b. Create a comprehensive list of questions concerning global, societal, and environmental impact of a particular engineering implementation within their engineering discipline.
   c. Identify (journals, websites, newspapers, etc.) where global, societal, and environmental issues of engineering are discussed.
   d. Find websites or other public domain material concerning global, societal, and environmental impact of a specific engineering solution within their discipline.
e. Prepare an oral or written report concerning global, societal, and environmental impact of a specific engineering implementation within their discipline.

f. Identify appropriate governmental regulatory bodies and appropriate general regulations concerning global, societal, and environmental impact of engineering within their specific discipline.

4. Students completing the Contemporary Issues module should be able to do the following (outcome f):
   a. Name 3 sources of breaking news in their discipline.
   b. Apply their search skills to find recent developments impacting their discipline.
   c. Make initial applications of breaking news items to the likely future development of their discipline.
   d. Suggest implications of these new developments into their engineering practice.
   e. Track some form of technical advance over a timeline, then predict developments 2 - 5 years into the future.

5. Students completing the Lifelong Learning module should be able to do the following (outcome i):
   a. Explain the importance of lifelong learning in an engineering or computer science career.
   b. Describe a process for learning new material.
   c. Identify what they need to learn for a given situation.
   d. Find appropriate resources in the library and on the web.
   e. List sources for continuing education opportunities.
   f. Assess their academic and professional development.

Course Requirements:
Each student is required to register for and take the Fundamentals of Engineering exam. Although it will vary with semester, presentations during the semester from outside speakers are required attendance. Times and places will be identified at the start of each semester.

Class Schedule and Topics
   Week 1 -   Introduction and Pre Course Survey
   Week 2-5   Engineering Ethics
   Week 6-9   Societal Impacts
   Week 10-13 Contemporary Issues
   Week 14-16 Life-long Learning

Professional Component: Engineering Topics: 1 credit or 100%

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Assessment and Evaluation: Independent Course Assessment (presentations, quizzes, team assignments, individual participation), FE Exam Topical Results, Student Self Assessment Survey, Institutional Student Course Evaluation

Prepared by: Scott J. Kenner

136
Course Description: Prerequisite: Senior in Civil Engineering. Content will include a major engineering design experience integrating fundamental concepts of mathematics, basic science, engineering science, engineering design, communication skills, humanities and social science.

Textbook and Materials: NA

Instructor: Dr. Dan Hoyer, CM 122

Teaching Assistants: NA

Course Objective: The undergraduate “design experience” is an ABET requirement and builds upon the fundamental concepts of mathematics, basic sciences, humanities and social sciences, engineering topics and communication skills. A meaningful major design experience focuses the student’s attention on professional practice and draws upon previous course work. The design experience is more than a project and must be considered a process. ABET characterizes the engineering design process as follows:

IV.C.3.d.(3)(c) Engineering design is the process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic sciences, mathematics and engineering sciences are applied to convert resources optimally to meet a stated objective. Among the fundamental elements of the design process are the establishment of objectives and criteria, synthesis, analysis, construction, testing, and evaluation. The engineering design component of a curriculum must include most of the following features: development of student creativity, use of open-ended problems, development and use of modern design theory and methodology, formulation of design problem statements and specifications, consideration of alternative solutions, feasibility considerations, production processes, concurrent engineering design, and detailed system descriptions. Further, it is essential to include a variety of realistic constraints, such as economic factors, safety, reliability, aesthetics, and social impact.

Course Outcomes:
1. Develop and improve teamwork skills
2. an ability to identify, formulate, and solve engineering problems
3. an understanding of professional and ethical responsibility
4. an ability to communicate effectively
5. an ability to use techniques, skills and modern engineering tools necessary for engineering practice
6. economics of business and project management
7. an understanding of professional practice issues such as procurement of work, bidding versus quality based selection processes, design/construction project management
Course Requirements: Each student will write an application paper describing an aspect of project management. The paper should be based on approximately ten references, of which at least five are journal articles. The paper should be approximately 2500 words. Each student will also make a management style presentation to the class of 10 minutes at the end of the semester.

Each student will prepare a project book CD based on a project that will be assigned in class. The project book will contain the project management concepts presented in the book applied to the assigned project. The project book will contain; early project estimate, economic analysis, project budget, work plan, organization, schedule, cash flow, labor hours/skills and work time relationship charts along with tracking proposals. The detailed content will be assigned as the class progresses.

Professional Component: Engineering Topics: 1 credit or 100%

Class Schedule and Topics

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<td>1</td>
<td>Organize 1 Credit students</td>
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<td>2 Credit Proposals Presentations</td>
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<td>3</td>
<td>1 Credit Teams Progress Presentation - Scope, Advisor</td>
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<td>4</td>
<td>Help Session</td>
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<td>5</td>
<td>Help Session</td>
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<td>6</td>
<td>2 Credit Design Progress Presentations</td>
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<td>7</td>
<td>1 Credit Proposal Presentations</td>
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<td>8</td>
<td>1 Credit Proposal Presentations</td>
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<td>9</td>
<td>1 Credit Proposal Presentations</td>
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<td>10</td>
<td>1 Credit Final Proposals Due, Field Trip</td>
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<td>11</td>
<td>1 Credit Progress</td>
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<tr>
<td>12</td>
<td>2 Credit Project Final Reports</td>
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<tr>
<td>13</td>
<td>Class Closeout</td>
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</table>

Assessment and Evaluation: Independent Course Assessment (Presentations, quizzes, team assignments, individual participation), FE Exam Topical Results, Student Self Assessment Survey, Institutional Student Course Evaluation

Prepared by: Scott J. Kenner/Daniel Hoyer
CEE 474 – Engineering Project Management

Course Description: Prerequisite: Senior in Civil Engineering. Study of owner, engineer, and contractor organizational structures, project work breakdown structures, resource and asset allocation, computer and non-computer scheduling by Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT). Students enrolling will be required to perform an engineering project with written and oral presentation.

Textbook and Materials:
Microsoft, Project for Windows on the network in CEE computer labs.
Homework assignments and study materials on WebCT. Files are also on F:/dept/CEE/CEE 474-574 for the last three classes.

Instructor: Dr. Dan Hoyer, CM 122

Teaching Assistants: NA

Course Objective: To provide students with knowledge and experience in practical application of principals and techniques for project management for engineering and construction projects.

Course Outcomes:

1. Develop and improve teamwork skills
2. an ability to identify, formulate, and solve engineering problems
3. an understanding of professional and ethical responsibility
4. an ability to communicate effectively
5. an ability to use techniques, skills and modern engineering tools necessary for engineering practice
6. economics of business and project management
7. an understanding of professional practice issues such as procurement of work, bidding versus quality based selection processes, design/construction project management

Course Requirements: Each student will write an application paper describing an aspect of project management. The paper should be based on approximately ten references, of which at least five are journal articles. The paper should be approximately 2500 words. Each student will also make a management style presentation to the class of 10 minutes at the end of the semester.

Each student will prepare a project book CD based on a project that will be assigned in class. The project book will contain the project management concepts presented in the book applied to the assigned project. The project book will contain; early project estimate, economic analysis, project budget, work plan, organization, schedule, cash
flow, labor hours/skills and work time relationship charts along with tracking proposals. The detailed content will be assigned as the class progresses.

Professional Component: Engineering Topics: 3 credits or 100%

Class Schedule and Topics

Relationship Between Course Outcomes and ABET a-k Outcomes:

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>ABET Program Outcomes</th>
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Assessment and Evaluation: Independent Course Assessment (Presentations, quizzes, team assignments, individual participation)
FE Exam Topical Results
Student Self Assessment Survey
Institutional Student Course Evaluation

Prepared by: Scott J. Kenner/Daniel Hoyer
CEE 456 - Theory and Design of Reinforced Concrete
Fall 2003

Course Description: (2-1) 3 credits. Prerequisite: CEE 356. Properties and behavior of concrete. Analysis and design of structural slabs, beams, girders, columns, and footings, with use of elastic and ultimate strength methods. Design of a structural frame-building system.

Textbook: Design of Reinforced Concrete, fifth edition, McCormac

Building Code Requirements for Structural Concrete, (ACI 318-02)

Instructor: Dr. M. R. Hansen, CM 242 mr.hansen@sdsmt.edu

Office Hours:

Course Objectives:

This course is designed to provide seniors in Civil Engineering with an understanding of the analysis and design of basic reinforced concrete components. Design of slabs, beams, girders, columns, and footings will be introduced. Engineering design concepts are integrated through a six-story building design final project. Practical applications and teamwork will be experienced through a second, experimental-type, final project. Responsibility to society is introduced, especially with respect to designing structures to prevent failure and use of the ACI building code. The students must communicate effectively and demonstrate professional problem formulation, solution, and presentation procedures for solving engineering problems.

Course Outcomes:

To satisfactorily complete this course the student must demonstrate:

1. An understanding of analysis and design of flexural members to resist bending moments and shear forces.
2. An understanding of and conformance to the ACI building code.
3. An understanding of the importance of detailing in reinforced concrete design, such as stirrups, ties, and development length.
4. An understanding of analysis and design of columns.
5. An understanding of analysis and design of footings.
6. An understanding of synthesis and integration through the design of a realistic six-story building.
7. An understanding of practical applications, construction, and teamwork through an experimental final project.
Class Schedule and Topics:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>16</td>
<td>Materials, concrete and steel</td>
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<tr>
<td>17</td>
<td>Load analysis</td>
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<td>18</td>
<td>Flexural analysis</td>
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<td>19</td>
<td>Design of rectangular sections</td>
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<td>20</td>
<td>Final projects</td>
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<tr>
<td>21</td>
<td>Design of slabs</td>
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<td>22</td>
<td>Design of floor beams</td>
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<td>Shear</td>
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<td>24</td>
<td>Design of girders</td>
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<td>25</td>
<td>Development length</td>
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<tr>
<td>26</td>
<td>Design of columns</td>
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<td>27</td>
<td>Design of footings</td>
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<td>28</td>
<td>Final designs</td>
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<tr>
<td>29</td>
<td>Deflections</td>
</tr>
<tr>
<td>30</td>
<td>Final designs</td>
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</table>

Laboratory Projects:

1. Theoretical design of a six-story building including load analysis, typical slab, beam, girder, column, and footing.

2. Design, fabrication, and testing of a Small Beam, including predicted strength, and final report.

Professional Component: Engineering Topics: 3 credits or 100%

Relationship Between Course Outcomes and ABET a-k Outcomes:

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Assessment and Evaluation: Independent Course Assessment (homework, exams, quizzes, lab reports and design projects)
FE Exam Topical Results
Student Self Assessment Survey
Institutional Student Course Evaluation

Prepared by: M. R. Hansen
CEE 457 - Indeterminate Structures  
Fall 2003

Course Description: (2-1) 3 credits. Prerequisite: CEE 353. Co requisite: CEE 457L. Analysis of indeterminate structures by classical and matrix methods. The classical methods are the force method, the slope-deflection equations, and the moment-distribution method. The classical methods are also used to determine influence lines for indeterminate structures. Stiffness matrices for truss and beam elements are derived and used to analyze trusses, beams, and frames.


Instructor: Dr. Melvin Klasi, CM 241  mklasi@taz.sdsmt.edu  
Office Hours: posted on my door

Teaching Assistants: Homework Grader -

Expectations:
The student is expected to have completed the sophomore year courses in calculus, statics and mechanics of materials, as well as a first course in the structural analysis of determinate structures.

Course Objectives:
This course is designed to follow a first course in the structural analysis of determinate structures and introduce the student to several of the classical methods of analyzing indeterminate structures and to the stiffness method of analysis with matrices.

Course Outcomes:
Students successfully completing this course will have the ability to
1. compute reactions for an indeterminate beam by the force method;
2. compute support moments for an indeterminate beam from the slope-deflection equations;
3. compute support moments for an indeterminate beam by the moment-distribution method;
4. compute member forces and joint deflections of trusses by the stiffness method;
5. and compute member forces and joint deflections of beams and frames by the stiffness method.
Class Schedule and Topics: Week Topic
1-2 Force Method
3-4 Slope-Deflection
5-7 Moment-Distribution
8 Review of Matrices
9-11 Truss Analysis Using the Stiffness Method
11-12 Beam Analysis Using the Stiffness Method
13-15 Frame Analysis Using the Stiffness Method

Professional Component: Engineering Topics: 3 credits or 100%

Relationship Between Course Outcomes and ABET a-k Outcomes:

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Assessment and Evaluation: Independent Course Assessment – homework, quizzes, tests, programming project
FE Exam topical results
Student Self Assessment Survey
Institutional Student Course Evaluation

Prepared by: Melvin L. Klasi
Course Description: CEE 447 – Foundations (3-0) 3 credits Prerequisite: CE346. Application of the fundamentals of soil behavior to the evaluation, selection and design of shallow and deep foundation systems. Related subjects such as subsurface investigations, temporary support systems for excavations, pile driving and retaining walls are also included. Computer applications are required.


Instructor: Dr. Terje Preber, CM 313
Office Hours: 13:00-15:00 MWF

Teaching Assistants: None

Expectations: Students entering this course should have understanding of shear strength of soil, settlement analysis, seepage and explorations techniques.

Course Objectives:

This course is designed to provide seniors in civil and geological engineering with a basic working knowledge of foundation engineering, including the design of shallow foundations, driven piles and drilled piers.

Course Outcomes:

Satisfactory completion of this course should demonstrate that the students have:

1. Basic understanding of foundations systems and their use;
2. The ability to design shallow foundations on all types of soil under vertical and inclined loads and for foundations under one and two way eccentricity;
3. The knowledge to design shallow foundations on layered soils and in sloped terrain;
4. The ability to calculate stress distributions under and settlements for shallow foundations, and view evaluate the results in conjunction with the calculated bearing capacity;
5. The understanding of the working and stress transfer mechanisms for piles and drilled piers;
6. The understanding of deep foundation systems and be able to design pile and drilled pier foundations applying the most commonly used methods of analysis, like Meyerhof, Vesic, Kulhawy, and Coyle and Castello;
7. An understanding of drilled pier and pile installation, and knowledge about the different tools used;
8. The knowledge to determine lateral pile capacity using the soil modulus of lateral subgrade reaction and the method developed by Broms.

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Class Schedule and Topics:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1.</td>
<td>Orientation and review of shear strength;</td>
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<td>2.</td>
<td>Bearing capacity of shallow foundations;</td>
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<td>3.</td>
<td>Bearing capacity of shallow foundations;</td>
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<td>4.</td>
<td>Stress distribution and settlement of shallow foundations;</td>
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<td>5.</td>
<td>Settlement of shallow foundations;</td>
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<td>6.</td>
<td>Settlement of shallow foundations and exam 1;</td>
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<td>7.</td>
<td>Deep foundations, piles;</td>
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<td>8.</td>
<td>Bearing capacity of piles;</td>
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<tr>
<td>9.</td>
<td>Negative skin friction and settlement of piles;</td>
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<tr>
<td>10.</td>
<td>Pile groups and lateral capacity of piles;</td>
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<tr>
<td>11.</td>
<td>Load testing, pile driving and exam 2;</td>
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<tr>
<td>12.</td>
<td>Pile driving and drilled piers;</td>
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<tr>
<td>13.</td>
<td>Bearing capacity of drilled piers;</td>
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<tr>
<td>14.</td>
<td>Settlement and uplift capacity of drilled piers;</td>
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<tr>
<td>15.</td>
<td>Installation of drilled piers.</td>
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</table>

Laboratory Projects: None

Professional Component: Engineering Topics: 3 credits or 100%

Relationship Between Course Outcomes and ABET a-k Outcomes:

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Assessment and Evaluation:

- Independent Course Assessment (homework, exams, quizzes, lab reports and design projects)
- FE Exam Topical Results
- Student Self Assessment Survey
- Institutional Student Course Evaluation

Prepared by: Terje Preber
Course Description: (3-0) 3cr. Prerequisites: CEE346. Contents will include the principles taught in CEE346 to practical geotechnical engineering problems in the Civil Engineering Profession, such as exploration, pavement design, geotechnical problems unique to the region, and dam design.

Instructor: Dr. Terje Preber, CM 313 Office Hours: 13:00-15:00

Expectations:
Students entering this course should have understanding of shear strength of soil, settlement analysis, seepage and explorations techniques.

Course Objectives:
This course is designed to give students an introduction to the application of geotechnical principles to design of retaining and geo-synthetics reinforced retaining walls, exploration for and design of small dams. The students will also be introduced to the use of geo-synthetics, highway design, building on fill, and introduction to the geotechnical problems associated with landfills, regional geotechnical challenges, and to emphasize the importance and interaction of Geotechnical Engineering with other Civil Engineering Disciplines.

Course Outcomes:

Following successful completion of this course, the students should have the knowledge of and the ability to:

1. Design and analyze, using their own software developed in Excel, classical retaining walls under static loading conditions, including the assessment of safety against sliding, overturning, bearing capacity and global stability;

2. The preparation, exploration, engineering design and interaction with other engineering disciplines that is part of dam design. The students will understand the difference between short term and long term stability, and understand the critical phases during and after construction. The students should, in addition, have an understanding of the importance of long term inspection and maintenance of dams;

3. The use of geo-synthetics and the type of materials available for Civil Engineering structures and construction. This should include applications in erosion protection, reinforced earth walls, pavement design, drainage, and separation;

4. Know the basics of slope stability, including infinite slopes with or without seepage, undrained analysis of embankments on clay, knowledge and understanding of the Simplified Bishop Method through design of a spreadsheet application, the use of PCSTABLE through STED;

5. Understand the complexity of the factors involved in the design of landfills, and the importance of soil compaction and moisture conditioning of the foundation soils. The student should also be able to understand the importance of drainage, the use of geo-synthetics and problems with bacterial clogging, capping and slope stability;

6. Recognize the need for ground improvement and have the basic knowledge of the material, equipment and methods available for ground stabilization;

7. Recognize and determine the existence of fill, and know about the dangers associated with building on fill, treatments available, and foundations systems suitable for structures located
on fill;
8. Recognize special regional subsurface factors and the special geotechnical problems associated with them

**Class Schedule and Topics:**

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<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1.</td>
<td>Review of earth pressures;</td>
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<td>2.</td>
<td>Traditional retaining walls;</td>
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<td>3.</td>
<td>Traditional retaining walls;</td>
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<td>4.</td>
<td>Reinforced earth walls;</td>
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<td>5.</td>
<td>Reinforced earth walls;</td>
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<tr>
<td>6.</td>
<td>Dam design, exploration, borrow study and construction materials;</td>
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<td>7.</td>
<td>Pertinent soil properties, modes of failure and stability analysis;</td>
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<tr>
<td>8.</td>
<td>Stability analysis, and inspection and maintenance;</td>
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<td>9.</td>
<td>Geotextiles and geogrids;</td>
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<tr>
<td>10.</td>
<td>Geotextiles and geogrids;</td>
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<tr>
<td>11.</td>
<td>Landfill and clay liners, exploration, and gas and leachate generation and movement;</td>
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<tr>
<td>12.</td>
<td>Clay and synthetic liners;</td>
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<tr>
<td>13.</td>
<td>Capillary transportation of solids and capping;</td>
</tr>
<tr>
<td>14.</td>
<td>Soil improvement and grouting, and building on fill;</td>
</tr>
<tr>
<td>15.</td>
<td>Regional problems and application of judgment in geotechnical engineering</td>
</tr>
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</table>

**Laboratory Projects:** None

**Professional Component:**

Design of retaining walls, dams and liners.

**Relationship Between Program Objectives and Course Objectives:**

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**Assessment and Evaluation:** Independent Course Assessment (homework, exams, quizzes, lab reports and design projects) FE Exam Topical Results Student Self Assessment Survey Institutional Student Course Evaluation

**Prepared by:** Terje Preber
CEE 433 - Open Channel Flow
Fall 2003

Course Description: Application of continuity, momentum, and energy principles to steady flow in open channels; flow in the laminar and transition ranges; specific energy and critical depth; energy losses; channel controls; gradually and rapidly varied flow; and high velocity flow. Prerequisites: CEE 336 or consent of instructor.


Instructor: Dr. Thomas A. Fontaine, CM 315; 394-5173; Thomas.Fontaine@sdsmt.edu.
Office Hours: M,W 12:00, T 11:00

Teaching Assistants: Anna Miller, Homework Grader

Course Objectives:

1. Apply the principles of conservation of mass, momentum, and energy to flow analyses in natural and constructed open channel conduits.
2. Analyze special flow conditions such as critical flow and depth, hydraulic jumps, uniform flow, and gradually varied flow
3. Apply the design methods for channel cross sections and hydraulic structures

Course Outcomes:

The students successfully completing this course will have the ability to:

1. Identify which of the fundamental conservation laws (mass, energy, or momentum) are required to analyze a specific flow condition.
2. Apply the appropriate conservation laws to flow analyses and design applications.
3. Calculate critical depth.
4. Calculate sequent depths, energy losses and length of hydraulic jumps.
5. Know when channel flow can be assumed to be uniform flow, and to calculate normal depth.
7. Develop and apply velocity distributions in open channel flow.
8. Apply the slope area method.
9. Complete the preliminary design of channel cross sections, culverts, and flow control structures.
10. Explain general concepts for flood routing, sediment transport and river geomorphology.
11. Explain the general concepts of the HEC RAS and HMS simulation programs.
Class Schedule and Topics:

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<th>Topic</th>
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<tr>
<td>1</td>
<td>Continuity</td>
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<td>2</td>
<td>Energy, critical flow</td>
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<td>3</td>
<td>Momentum, hydraulic jump</td>
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<td>4</td>
<td>Boundary layer concepts</td>
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<td>5</td>
<td>Uniform Flow Concepts</td>
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<td>6</td>
<td>Estimating Manning's n</td>
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<td>7</td>
<td>Uniform Flow Computations</td>
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<tr>
<td>8</td>
<td>Non-erodible channel design</td>
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<td>9</td>
<td>Erodible channel design</td>
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<tr>
<td>10</td>
<td>Gradually Varied Flow concepts</td>
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<td>11</td>
<td>Gradually Varied Flow computations</td>
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<td>12</td>
<td>HEC RAS program</td>
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<td>13</td>
<td>HEC HMS program</td>
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<td>14</td>
<td>Flow Measurement, streamflow gaging, culverts</td>
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<td>15</td>
<td>Sediment Transport, geomorphology</td>
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</tbody>
</table>

Laboratory Projects:

1. Field trip to observe open channel structures in Pennington County.
2. Demonstration of the U.S.G.S. in-stream flow measurement procedure.
4. Demonstration of the slope area method.
5. Demonstration of various flow conditions in the laboratory flume.

Professional Component: Engineering Topics: 3 credits or 100%

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Assessment and Evaluation: Independent Course Assessment (homework, exams, and term project)
FE Exam Topical Results
Student Self Assessment Survey
Institutional Student Course Evaluation

Prepared by: Thomas A. Fontaine
CEE 437 - Watershed and Floodplain Analysis
Spring 2004

Course Description: 3 credits, prerequisites: CEE 336 & CEE 337. This course will consist of the application of the HEC-HMS Hydrologic Modeling System and HEC-RAS River Analysis System computer programs. Each model is applied to an actual watershed and conveyance channel. The student is responsible for two project reports, one for each model application. Development of the model inputs will include review of hydrologic and hydraulic processes relating to the modeling options.


Instructor: Dr. Scott J. Kenner, CM 122
Office Hours: Monday 10:00 to 12:00, Friday 8:00 to 10:00

Teaching Assistants: NA

Course Objectives:
1. To strengthen student’s knowledge and understanding of hydrologic and hydraulic processes used for rainfall-runoff and floodplain modeling.
2. Develop student’s capability to collect compile and analyze data for development of hydrologic model parameter inputs.
3. Develop students understanding and knowledge of the proper application of hydrologic models.
4. Develop student’s skills for writing technical reports.

Course Outcomes:
The students successfully completing this course will have the ability to
1. delineate a watershed using a topographic map and using GIS techniques
2. develop a design rainstorm for hydrologic analysis
3. develop data inputs for hydrologic modeling
4. apply concepts and components of hydrologic modeling
5. evaluate and interpret the affects of parameter sensitivity on model results
6. apply hydraulic principles for floodplain analysis
7. delineate and understand floodplains and floodways
8. understand and apply hydraulic principles for modeling culverts and bridges
9. present technical results and write a technical report
10. understanding the importance of hydrologic and hydraulic modeling for the safety and well being of the public
Class Schedule and Topics:

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<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
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<td>Introduction to HEC-HMS</td>
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<td>2</td>
<td>Watershed delineation</td>
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<td>3</td>
<td>Data Entry, Data Structure, and Hydrologic Modeling, Control Specifications</td>
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<td>Infiltration Parameters &amp; Loss Models</td>
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<td>6</td>
<td>Unit Hydrograph Computations &amp; Transformation Models</td>
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<td>7</td>
<td>Stream Flow Routing</td>
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<td>8</td>
<td>Reservoir &amp; Detention Basin Analysis</td>
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<td>9</td>
<td>Introduction to HEC-RAS</td>
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<td>10</td>
<td>HEC-RAS Data Requirements</td>
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<td>11</td>
<td>Develop Valley X-Sections, Entering &amp; Editing Geographic Data</td>
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<td>12</td>
<td>Step Backwater Hydraulics</td>
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<td>13</td>
<td>Normal Bridge and Special Bridge</td>
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<td>14</td>
<td>Basic Culvert Analysis</td>
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<tr>
<td>15</td>
<td>FIS and Floodway Computations</td>
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</table>

Laboratory Projects:
1. Development of a watershed model for a local drainage basin and technical report
2. Hydraulic analysis and delineation of 100 yr floodplain and floodway with technical report

Professional Component: Engineering Topics: 3 credits or 100%

Relationship Between Course Outcomes and ABET a-k Outcomes:

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<th>Course Outcomes</th>
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Assessment and Evaluation: Independent Course Assessment, (2 semester projects and technical reports and 2 exams), FE Exam Topical Results, Student Self Assessment Survey, Institutional Student Course Evaluation

Prepared by: Scott J. Kenner
Course Description: Emphases are on the design and analysis of physical/chemical environmental engineering unit operations and processes. Students enrolling in CEE/EnvE 526 will be held to a higher standard than those enrolling in CEE/EnvE 426.

Textbook: Water Quality and Treatment, 5th Edition (AWWA)

Instructor: James J. Stone, Ph.D., P.E. James.Stone@sdsmt.edu
314 CM (inside room 316); 394-2443
Office Hours:

Prerequisites: CEE/EnvE 326 and CEE/EnvE 327, graduate standing or permission of instructor.

Course Objectives:

1. Demonstrate an understanding of the design guidelines for advanced physical and chemical processes commonly employed within the field of environmental engineering with emphasis on water and wastewater treatment;
2. Develop the ability to professionally convey engineering design calculations using both a written and computer format.

Course Outcomes: After completion of this course, the student is expected to be able to:

1. Evaluate raw water quality data in relation to appropriate drinking water regulations and identify required treatments processes;
2. Develop conceptual schematics required for the treatment of water for a potable use;
3. Determine chemical coagulants required for water treatment needs, and locate their point of application within the treatment plant;
4. Calculate power input and mixing requirements in rapid mix and flocculation basins;
5. Estimate requirements for mono and mixed media filtration beds;
6. Calculate chemical dosages for lime-soda ash softening systems;
7. Develop ion exchange technology for removal of selected inorganic contaminants and size ion exchange columns for appropriate treatment objectives;
8. Determine requirements for GAC adsorption system based upon treatment objectives;
9. Identify chemical oxidant requirements for disinfection.
Class Schedule and Topics:  

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<th>Week</th>
<th>Topic</th>
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<tr>
<td>9/3 – 9/8</td>
<td>Regulations</td>
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<td>9/10 – 9/15</td>
<td>Coagulation/Flocculation</td>
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<td>9/17 – 9/22</td>
<td>Sedimentation</td>
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<td>9/24 – 10/1</td>
<td>Filtration</td>
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<td>10/3 – 10/8</td>
<td>Chemical Precipitation</td>
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<td>10/10 – 10/17</td>
<td>Chemical Oxidation</td>
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<td>10/20 – 10/24</td>
<td>Disinfection</td>
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<td>10/27 – 11/10</td>
<td>Carbon Adsorption</td>
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<td>11/12 – 11/17</td>
<td>Ion Exchange</td>
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<td>11/19 – 11/26</td>
<td>Gas Transfer</td>
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<td>12/1 – 12/5</td>
<td>Waste Residuals</td>
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<tr>
<td>12/8 – 12/12</td>
<td>Other Selected Topics</td>
</tr>
</tbody>
</table>

Professional Component: Engineering Topics: 3 credits or 100%

Relationship Between Course Outcomes and ABET a-k Outcomes:

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<th>Course Outcomes</th>
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Assessment and Evaluation: Independent course assessment (homework, examinations, and design project)
Student self assessment survey
Institutional student course evaluation

Prepared by: James J. Stone
Course Description: Fourth course in the theory and practice of Environmental Engineering. Emphases are on the design and analysis of biological environmental unit operations and processes for the renovation of contaminated waters and soils. Students enrolling in CEE/EnvE 527 will be held to a higher standard than those enrolling in CEE/EnvE 427.


Instructor: James J. Stone, Ph.D., P.E James.Stone@sdsmt.edu 314 CM (inside room 316); 394-2443 Office Hours:

Prerequisites: CEE/EnvE 326 and CEE/EnvE 327, graduate standing or permission of instructor if enrolled in CEE/EnvE 527.

Course Objectives:

1. Demonstrate an understanding of the design guidelines for advanced biological processes commonly employed within the field of environmental engineering;
2. Develop the ability to professionally convey engineering design calculations using both a written and computer format.

Course Outcomes: After completion of this course, the student is expected to be able to:

1. Describe various unit processes used in the biological treatment of wastewater;
2. Explain how these unit processes work from a microbiological and process basis;
3. Develop conceptual schematics required for treatment of wastewater;
4. Design a biological wastewater treatment plant for treating municipal wastewater;
5. Evaluate existing data from biological unit processes and discern the function and performance of the unit;
6. Identify and implement design and operational parameters for the biological removal of selected organic contaminants within soil and groundwater;
Class Schedule and Topics:

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<tr>
<th>Week</th>
<th>Topic</th>
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<tr>
<td>1</td>
<td>Regulations</td>
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<td>2-4</td>
<td>Fundamentals of Biological Treatment</td>
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<td>Suspended Growth Biological Treatment</td>
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<td>Selected Topics in Biological Treatment</td>
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<td>Bioremediation</td>
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Professional Component: Engineering Topics: 3 credits or 100%

Relationship Between Course Outcomes and ABET a-k Outcomes:

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Assessment and Evaluation: Independent course assessment (homework, examinations, and design project)
Student self assessment survey
Institutional student course evaluation

Prepared by: James J. Stone
CEE/EnvE 421/521 - Environmental Systems Analysis
FALL 2003
Elective for BS Civil Engineering, required for BS Environmental Engineering

Course Description: Applications of fundamental physical and chemical principles in the examination of solution phase behavior of organic and inorganic substances in Environmental Engineering Systems. Analytical and computer solutions are performed. Students enrolling in CEE/EnvE 521 will be held to a higher standard than those enrolling in CEE/EnvE 421.


Instructor: Henry V. Mott, Ph.D., P.E. Henry.Mott@sdsmt.edu
CM 123; 394-5170
Office Hours:

Prerequisites: CEE/EnvE/MinE 326, graduate standing or permission of instructor

Course Objectives:
1. Students will advance their competency to formulate and solve problems involving applications of mass conservation and water chemistry (acid/base, complexation, dissolution/precipitation and oxidation/reduction).
2. Students will gain competency in computations addressing the distributions of organic compounds among phase compartments present in the environment.

Course Outcomes: Students completing CEE/EnvE 421/521 should develop the following competencies:

1. An ability to apply understandings of Gibbs Free energy and enthalpy of reaction concepts in evaluating equilibrium constants for environmentally important chemical reactions.
2. An ability to apply the ideal gas and Henry's laws in characterization of vapor phases and determination of the distribution of soluble gases between vapor and water.
3. An ability to apply acid-base principles in characterization of chemical speciation in aqueous systems.
4. An ability to apply concepts from coordination chemistry in the characterization of the speciation of metals in aqueous systems.
5. An ability to apply dissolution-precipitation chemical concepts to ascertain the dissolution or formation of solid phases in aqueous systems.
6. An ability to apply oxidation-reduction chemical concepts in characterization of speciation in environmental systems affected by redox phenomena.
7. An ability to apply vapor pressure, Henry's law, aqueous solubility and sorption principles in combination with the equation of partial fugacity to characterize distributions of organic compounds among the four (vapor,
aqueous liquid, non-aqueous liquid, solid) phases present in environmental systems.

8. An ability to employ computational software (MathCAD, Excel) in solution of formulated problems.

Computer usage: High level, MathCAD/Excel worksheets employed throughout course.

Class Schedule and Topics: Lecture Dates                     Topic

| 9/3, 9/5, 9/8, 9/10 | Gibbs free energy & enthalpy of reaction |
| 9/12, 9/15          | ionic strength and chemical equilibria   |
| 9/17, 9/19, 9/22,   |                                             |
| 9/24, 9/26, 9/29,   |                                             |
| 10/1                | Applications of Acid/base concepts        |
| 10/3, 10/6, 10/8    | Applications of complexation concepts     |
| 10/15, 10/17, 10/20,|                                             |
| 10/22, 10/24        | Applications of solubility/dissolution    |
| 10/27, 10/29        |                                             |
| 10/31, 11/3, 11/5   | Applications of Oxidation-Reduction       |
| 11/7                | Partial fugacity principles               |
| 11/10               | Vapor Pressure                            |
| 11/12, 11/17        | Aqueous solubility                        |
| 11/19               | Henry’s Law                               |
| 11/21, 11/24, 11/26 | Sorption on solids                        |
| 12/1, 12/3          | Activity coefficient, multi-component     |
|                    | systems                                    |
| 12/5, 12/8,         |                                             |
| 12/10, 12/12        | Applications in environmental systems      |
| 10/10, 11/14        | Midterm examinations                      |

Professional Component: Engineering Topics: 3 credits or 100%

Relationship Between Course Outcomes and ABET a-k Outcomes:

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Assessment and Evaluation: Independent Course Assessment – homework, quizzes, tests, programming project, FE Exam topical results, Student Self Assessment Survey, Institutional Student Course Evaluation

Prepared by: Henry V. Mott, 04/09/04

158
CEE 453 – Design of Metal Structures II
Fall 2003

Course Description: (2-1) 3 Credits. Prerequisite: CEE 357. Analysis and design of structural elements and connections for buildings, bridges and specialized structures that utilize structural metals. Behavior of structural systems under elastic and plastic design.

Patnaik, Comprehensive Lecture Notes

Instructor: Dr. Anil K. Patnaik, CM243
Office hours – posted on office door

Teaching Assistant: Nasir Kahin

Expectations:

Students are expected to know how to apply load and resistance factor design (LRFD) concepts to design of steel members and simple connections, analyze and design tension members, compression members, and beams with lateral braces, analyze and design simple welded and bolted connections, and base plates, use the relevant AISC specifications for steel members and simple connections, use relevant design charts and tables from the AISC design manual and to develop details.

Course Objectives:

1. This course is designed to teach load and resistance factor design (LRFD) concepts for steel members such as members subjected combined axial load and bending moment, plate girders and composite beams.
2. To design beam bearing plates, base plates, knee joints and splices.
3. To introduce to the relevant AISC design specifications, charts and tables for design of steel members and connections.
4. To introduce analysis and design of multistory steel buildings braced frames

Outcomes: Students successfully completing this course will have the ability to:

1. Apply load and resistance factor design (LRFD) concepts to design of members and to develop details, and design of simple braced multistory buildings
2. Analyze and design members subjected to combined axial load and bending moment, plate girders, and composite beams.
3. Analyze and develop details for beam bearing plates, base plates, knee joints and splices.
4. Use the relevant AISC specifications for design of steel members and details.
5. Use relevant design charts and tables of the AISC design manual.

Class Schedule and Topics: Week Topic
1. Introduction and review of beam design
2. Members subjected to flexure and tension
3. Members subjected to flexure & compression – braced
4. Members subjected to flexure & compression – unbraced
5. Beam bearing plates
6. Base plates
7. Knee joints
8. Splices
9. Plate girders
10. Plate girders
11. Plate girders
12. Composite beams
13. Composite beams
14. Multistory buildings – wind loads
15. Multistory buildings

Design (Laboratory) Projects: Complete design of a plate girder, complete design of a 7-story steel frame (braced) building

Professional Component: Engineering Topics: 3 credits or 100%

Relationship Between Course Outcomes and ABET a-k Outcomes:

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Assessment and Evaluation: Independent course assessment (homework, exams, labs)
Design projects
Student self-assessment survey
Institutional student course evaluation

Prepared by: A. K. Patnaik
CEE 475/575 – HIGWAY ENGINEERING
Spring 2004

Course Description: CEE 475/575 Highway Engineering (3-0) 3 credits. Prerequisite: Senior standing or permission of instructor. This course is an introduction to the principles of highway engineering. The course will cover the integration of various levels of government transportation systems along with aspects of safety and vehicle performance. Laboratory and lecture experiences will be provided in geometric design and materials selection, design and rehabilitation. Traffic planning methods and life cycle cost analysis in highway engineering will also be covered. Students enrolling in CEE 575 will be held to a higher standard than those enrolling in CEE 475.

Textbook: Fred L. Mannering and Walter P. Kilareski; Principles of Highway Engineering and Traffic Analysis, John Wiley &Sons, Inc

Instructors: Dr. Terje Preber, CM 313 SDDOT Staff Office Hours: 13:00-15:00

Teaching Assistants: None

Course Objectives:

To give seniors sufficient knowledge about highway engineering and traffic analysis such as to qualify them to work for DOT’s.

Course Outcomes:

The students successfully completing this course will:

1. Understand the workings of federal, state and local highway systems;
2. Have an understanding of the steps involved in highway design and construction from beginning to end;
3. Be familiar with functional classification, and corridor function, utilities, highway systems and their impact on the environment;
4. Be able to design a traffic study and analyze the data there from;
5. Understand the concepts of road design and route alignment;
6. Be able to perform geometric design;
7. Be able to design flexible and rigid pavements, and be familiar with rehabilitation procedures and design;
8. Understand the behavior and requirements of highway construction materials;
9. Be familiar with QA/QC.
Class Schedule and Topics:

Week  Topic
1. History of US transportation system, federal, state, and local classification systems, corridor function;
2. Access Management and Needs Assessment;
4. State Transportation Improvement Program and Design concepts;
5. Project Development, Road Design and Route Alignment, exam 1;
6. Geometric design and inroads and traffic analysis;
7. Traffic analysis and hydrology;
8. Structure design and function, material concepts, exam 2;
9. Geotechnical engineering and compaction;
10. Flexible and rigid pavement design;
11. Rigid pavement design and pavement rehabilitation, exam 3;
12. Pavement design in South Dakota, construction methods and QA/QC, asphalt properties and testing;
13. Asphalt properties and testing and construction management;
14. Roadway maintenance and ITS;
15. The future - materials – vehicles – ITS.

Laboratory Projects: None

Professional Component: Engineering Topics: 3 credits or 100%

Relationship Between Course Outcomes and ABET a-k Outcomes:

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<th>Course Outcomes</th>
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Assessment and Evaluation: Independent Course Assessment (homework, exams, quizzes, lab reports and design projects)
FE Exam Topical Results
Student Self Assessment Survey
Institutional Student Course Evaluation

Prepared by: Terje Preber
GEOE 475/475L Ground Water (Required Course)
Fall Semester 2003

GEOE 475/475L Ground Water (2-1) 3 credits. Prerequisites: GEOL 201 or GEOE 221, and MATH 225, or permission of instructor. Note: Engineering majors must complete the equivalent of Calculus III before registration. Geohydrologic principles, applications, and design considerations concerning ground-water occurrence, flow, and quality. Ground-water and surface-water relations; theory of aquifer tests; flow nets; head distribution by graphical, analytical, and digital models; and ground-water contamination. Laboratories include water budgets, chemistry of ground water, design of exploration programs and aquifer tests, computer solutions, and field trips to areas of geohydrologic interest. A design project with written and oral presentations is required. This course is cross-listed with ENVE 475/475L.


Driscol, F.G., Groundwater and Wells: Johnson Division.

Coordinator: Arden D. Davis, Professor of Geological Engineering

Prerequisites:
Differential calculus.
Physical geology, or geology for engineers.

Objectives: To give training, practice, and independent experience in the use of techniques for evaluation and solution of ground-water flow problems.

Topics:
1. Basic definitions and principles (5 classes).
2. Hydrologic cycle; infiltration/runoff (3 classes).
3. Ground-water flow description (2 classes).
4. Flow nets (3 classes).
5. Pumping tests; analytical and numerical models (6 classes).
6. Geochemistry (2 classes).
7. Safe yield; legal aspects; well construction (5 classes).
8. Project design considerations (4 classes).

Computer Usage:
1. Homework assignment requiring the use of curve-matching program in the design of a pumping test.
2. Use of program to calculate drawdown vs. time.
3. Demonstration of the use of a finite-difference model on a PC to determine potentiometric contours and flow lines in simulation of flow in sand-tank model.
4. Demonstration of the use of an analytic element model to determine optimum design for a well field.

Laboratory Projects:
1. Pumping-test analysis and design; use of pump and water-level measuring equipment (4 classes).
2. Specific capacity (1 class).
3. Flow-net design; use of PC and finite-difference model (2 classes).
4. Laboratory determinations and design of experiments; use of permeameters (2 classes).
5. Field trips, and ground-water exploration (6 classes).

Professional Component: Engineering science: 2 credits or 67%
Engineering design: 1 credit or 33%
Outcomes:

Upon completion of this course, students should demonstrate the ability to:

1. Understand and apply Darcy's law in the solution of ground-water problems (meets program outcome 1 and ABET outcome a).
2. Understand basic aquifer properties (meets program outcome 2 and ABET outcome a).
3. Run a laboratory experiment with a permeameter to determine hydraulic conductivity (meets program outcomes 2 and 4, and ABET outcome b).
4. Conduct a field piezometer test and analyze the data to determine hydraulic conductivity (meets program outcomes 2 and 4, and ABET outcome b).
5. Conduct a field pumping test and analyze the data with the Theis equation to determine transmissivity and storage coefficient of an aquifer (meets program outcomes 2 and 4, and ABET outcome b).
6. Use a flow net to analyze and understand a ground-water flow problem (meets program outcome 2 and ABET outcome b).
7. Describe two-dimensional ground-water flow with a partial differential equation (meets program outcome 1 and ABET outcome a).
8. Design a reasonable solution for a basic ground-water problem (meets program outcomes 3, 4, 5, 7, 8, 9, 10, and 11, and ABET outcomes c, e, f, g, h, i, and k).
9. Effectively communicate a ground-water design report in written form (meets program outcome 5 and ABET outcome g).

Relationship of Course to Program Outcomes:

GEOE 475, Ground Water, meets ten of the twelve outcomes for the geological engineering program (below), and nine of the eleven ABET a-k outcomes (see table below):

- Ability to apply basic knowledge in mathematics, science, and engineering;
- Field, laboratory, technical, and computer competence;
- Knowledge of contemporary issues;
- Critical thinking and research skills;
- Ability to communicate effectively;
- Broad, general knowledge of the role of engineering solutions in society;
- An understanding of professional and ethical responsibility;
- Ability to identify, formulate, and solve engineering problems;
- Ability to design a system or process to meet desired needs; and
- Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

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Prepared by: Arden D. Davis  May, 2004
GEOL 416 GIS I: Introduction to GIS (Required Course)
Spring Semester 2004

GEOL 416/416L/516/516L GIS I: Introduction to GIS (2-1) 3 credits. Introduction to principles and application of geographic information systems, with emphasis on GIS analysis techniques. Laboratory work will involve introduction to PC-based GIS software, and data sets. A semester project and presentation is required. Students are expected to have basic computer system, word processing, and spreadsheet skills prior to taking this class. Students enrolling in GEOL 516 will be held to a higher standard than those enrolling in GEOL 416.


References: Using ArcMap, Using ArcCatalog, Understanding Map Projections, ESRI Press, digital books/reference documents available at f:\programs\dept\geo\gis_lib\Digital Books. Students may make ONE copy of these books to a CD for personal use only.

Coordinator: Maribeth H. Price, Associate Professor of Geology

Course Objectives:
1) To teach the basic principles of GIS systems and their applications.
2) To give students practical experience in doing GIS analysis using ArcGIS.
3) To give students practice in implementing and presenting a GIS research project.
4) To prepare students for further work with GIS in school or the workplace.

Prerequisites: No formal course prerequisites. Good computer skills including word processing, spreadsheets, and basic file management strongly recommended.

Topics:
Each topic is one week (two lectures / one lab) unless otherwise indicated.
1. Introduction to GIS.
2. Working with maps in GIS.
3. Map projections and coordinate systems.
4. Drawing and symbolizing map features.
5. Working with tabular data.
6. Creating maps and map layouts.
7. Working with attribute queries on tables.
8. Working with spatial queries.
10. Address geocoding.
12. GIS professionalism and ethics.
13. Working on independent semester projects (3 weeks).

Computer Usage:
Every week includes a three-hour computer lab with hands-on use of ArcGIS Desktop software, plus a set of lab exercises that take most students an addition one to three hours to complete.

Laboratory Projects:
Students complete an independent GIS analysis project, in which they choose a topic, locate the data they need, perform an analysis, and present the results orally and in written form.

Professional Component: Engineering topics: 1 credit or 33%
Basic science: 2 credits or 67%
Outcomes

Upon completion of this course, students should demonstrate the ability to:
1. Carry out basic GIS cartographic and analytic functions using ArcGIS Desktop.
2. Create aesthetically pleasing and communicative maps using a variety of map styles and classification schemes.
3. Manage coordinate systems and projections of digital spatial data.
4. Perform basic queries and calculations using tabular data.
5. Solve spatial problems using a variety of analytic functions including queries, overlay, geocoding, and raster analysis.
6. Develop a project objective and identify the appropriate data and methods needed to complete it.
7. Present the results of a project orally and in written form.

Relationship of Course to Program Outcomes:

GEOL 416, GIS I, meets six of the twelve outcomes for the geological engineering program (below), and five of the ABET a-k outcomes (see table below):

- Ability to apply basic knowledge in mathematics, science, and engineering;
- Field, laboratory, technical, and computer competence;
- Knowledge of contemporary issues;
- Ability to communicate effectively;
- Ability to design a system or process to meet desired needs; and
- Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

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Prepared by: Maribeth H. Price May, 2004
GE 115/115L-Professionalism in Engineering and Science

Course Description: A course based upon professional issues pertinent to engineers and scientists along with an overview of the various engineering and science disciplines. Case studies based upon actual technical problems will be presented by practicing engineers and scientists. These case studies will involve both societal and professional questions. The format for a particular case study will involve an overview of a particular engineering or science discipline, and introduction to an actual technical problem, and a discussion of the societal implications of decisions that result.

Textbook:
Student Manual (CD available at the Tech Bookstore. Supplements online)
References: Engineering Success, Peter Schiavone, Prentice Hall, 1999
Engineering Ethics, Charles Fleddermann, Prentice Hall, 1999
Introduction to Excel, David Kuncicky, Prentice Hall, 2001
Introduction to Engineering Analysis, Kirk Hagen, Prentice Hall, 2001
Design Concepts for Engineers, Mark Horenstein, Prentice Hall, 1999

Instructor: Dr. Stetler, Dr. Kellar, Dr. Dixon, Dr. Stone, Dr. Simonson, Dr. Hladysz, Mr. Ash, Ms. Sieverding,
Chemistry Building, Room C-218
Office hours: M, W 11:00-11:50; Tu 14:00-14:50 - Or by appointment

Course Objectives: To make the most of this course, it is recommended that students adopt the following five learning objectives to guide their priorities and actions during this term.

- Be able to use technology tools (World Wide Web, Excel, PowerPoint, analysis software) to analyze, solve, and present solutions to engineering problems.
- Become an effective team member.
- Develop the communication skills necessary to package acquired technical and professional abilities that are required to succeed in engineering practice.
- Understand the engineering profession enough to commit to a major and create an education/career plan.
- Develop motivation for self-responsibility, lifelong learning, and self-development of a person of good character.

Course Outcomes: Upon completion of the course, students will be able to:
1. Document a rational for selection in their chosen major.
2. Author a web page and post to the Internet.
3. Incorporate the rules of significant digits when solving problems and check for dimensional consistency.
4. Incorporate the 7-step approach to solving engineering problems.
5. Utilize Excel to solve fundamental problems in engineering.
6. Use a data acquisition system to collect experimental data.
7. Utilize Excel to analyze data and conduct a trend analysis on experimental data.
8. Utilize the fundamental principles of engineering design and team problem solving to design a rudimentary engineering system.
9. Utilize fundamental principles of technical writing to prepare a technical report, resume, and technical memorandum.

10. Utilize ethical principles in professional engineering decision making

Class Schedule and topics: M, W, & F, 2 pm – 2:50 pm
The course will cover the following engineering related topics:
- Technical Library Orientation
- Teams and Teaming
- Webpage Development and Publishing
- Professional Engineering Ethics
- Dimensions, Units and Significant Figures
- Technical Writing Overview
- Analytical Methods for Engineering
- Problem Solving and Chart Creation Using Excel
- Experimental Lab and Data Analysis
- Final Teaming Project

Laboratory: The students will utilize the Lab Pro data acquisition devices to measure the temperature in a coffee pot as a function of time from when the coffee pot is turned on. This data will be collected and analyzed by the students and then placed into a technical report. In addition, extensive lab work is used during the final team project.

Computer Usage: Microsoft FrontPage, Microsoft Excel, Microsoft Word, Microsoft PowerPoint, Logger Pro

Professional Component: Engineering Topics: 2 credits or 100%

Relationship Between Course Outcomes and CE Program Outcomes:

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Assessment and evaluation: Homework, Laboratory Project, Writing reports, presentation
Professionalism/Attendance Portfolio and Exit Exam

Prepared By: David Dixon, Fall 2003
Course Description: Prerequisite Math 124 completed with a grade of “C” or better. The study of the effects of external forces acting on stationary rigid bodies in equilibrium. Vector algebra is used to study two and three-dimensional systems of forces. Trusses, frames and machines, shear and moment in beams. Friction, centroids, moments of inertia and mass moments of inertia are discussed.


Instructor: Lois Arneson-Meyer, CM 121
Office Hours: Open door

Teaching Assistants: Homework Grader

Expectations:

Students should know all trigonometric functions associated with right angles. Sine and cosine law, algebra skill: solving linear equations, exponents, factoring, solving systems of equations, similar triangles and fundamental calculus skills (integration, differentiation)

Course Objectives:

This course is designed to provide students with a basic knowledge in the study of the effects of external forces acting on stationary rigid bodies in equilibrium.

Course Outcomes:

The students successfully completing this course will have the ability to:

2. Determine the components of a force in rectangular coordinates.
3. Draw complete and correct free-body diagrams and write the appropriate equilibrium equations from the free-body diagrams.
4. Evaluate forces acting on static bodies including determining resultants and 3D components.
5. Calculate moments in 2D and 3D about a point and an axis utilizing cross products and dot products.
6. Determine the support reactions on a structure.
7. Determine the connection forces in trusses and in general frame structures.
8. Given standard shapes and corresponding centroids and or moment of inertia be able to compute centroids and or moment of inertia for composite bodies
9. Determine how to identify and solve problems involving dry friction, wedges and belt friction.
10. Determine the internal reactions in a beam, draw correct shear force and bending moment diagrams.

Class Schedule and Topics:

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<td>Review fundamental concepts</td>
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<td>Particles – equilibrium in 2D and 3D</td>
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<td>Rigid bodies moments – 2D and 3D and couples</td>
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<td>Rigid bodies moments – 2D and 3D and couples</td>
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<td>Rigid bodies – equilibrium 2D and 3D and 2 and 3 force members</td>
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<td>Equilibrium 3D, centroids – areas and lines, and centroids by integration</td>
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<td>Distributed loads on beams, submerged surfaces</td>
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<td>Trusses – method of joints and sections</td>
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<td>Frames and machines</td>
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<td>Internal forces in members, shear and bending moment diagrams</td>
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<td>Shear and bending moment diagrams for beams</td>
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<td>12</td>
<td>Friction, belt friction</td>
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<td>13</td>
<td>Moment of inertia, arc and composite areas</td>
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<td>14</td>
<td>Mass moment of inertia</td>
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<td>Semester review</td>
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Laboratory Projects:

Professional Component: Engineering Topics: 3 credits or 100%

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Assessment and Evaluation:

Independent Course Assessment (homework, exams, quizzes)
FE Exam Topical Results
Student Self Assessment Survey
Institutional Student Course Evaluation

Prepared by: Lois Arneson-Meyer
EM 321 - Mechanics of Materials  
Spring 2003

Course Description: Basic concepts of stress and strain that result from axial, transverse, and torsional loads on bodies loaded within the elastic range. Shear and moment equations and diagrams; combined stresses; Mohr’s circle; beam deflections; and column action and equations.


Instructor: Dr. M. R. Hansen, CM 242  
Office Hours:

Teaching Assistants: Munkhzul Distabazar

Course Objectives:

1. This course is designed to provide sophomores in Civil, Mechanical, and other engineering majors with a basic understanding of stress, strain, and deformation analysis due to axial, torsional, flexural, and combined loads.
2. Design of torsional, flexural, and compression members will be introduced. Basic engineering design concepts are integrated.
3. Responsibility to society is introduced, especially with respect to designing structures to prevent failure.
4. The students must communicate effectively and demonstrate problem formulation and solution procedures for solving basic engineering problems.

Course Outcomes:

The students successfully completing this course will have the ability to:

1. Apply concepts for axial stress and strain, axial deflection, and the application to solve simple indeterminate problems (a, b, c, e, g).
2. Apply concepts for torsional stress and strain, torsional deflection, and the application to solve simple indeterminate problems (a, c, e, g).
3. Apply concepts for shear and moment diagrams, and equations, and the ability to construct these for complex loading combinations on beams (a, c, e, g).
4. Apply concepts for flexural stress and strain and the ability to apply these principles in elementary design of beams (a, c, e, g).
5. Apply concepts for horizontal shear stress in beams and the ability to apply these principles in elementary design of nails, bolts, glue, or welding (a, c, e, g).
6. Apply concepts for two-dimensional combined stress and the ability to demonstrate this through construction and labeling of Mohr’s circle (a, c, e, g).
7. Apply concepts for beam deflection and the ability to demonstrate this by double integration and superposition methods (a, b, c, e, g).
8. Apply concepts for basic column analysis and design (a, c, e, g).
Class Schedule and Topics:

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<td>Flexural stress</td>
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<td>Horizontal shear stress</td>
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Laboratory Projects: None

Professional Component: Engineering Topics: 3 credits or 100%

Relationship Between Course Outcomes and ABET a-k Outcomes:

$(1 = \text{min.} \ 2 = \text{avg.} \ 3 = \text{max})$

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Assessment and Evaluation:

1. One or two short quizzes will be given in class each week. Regular examinations will be designed to demonstrate mastery of the basic concepts and the ability to solve basic problems.

2. Students will compete one “mini-lab report” to present and analyze deflection data obtained in class. Students will also complete several spreadsheet exercises, using given data, to present and analyze stress and strain data. Students will participate in the West Point Bridge Design contest, which emphasizes efficiency of truss bridge design.

3. A comprehensive final examination will be designed to demonstrate the student’s ability to solve basic problems and to integrate concepts presented during the course. The students must achieve a minimum score of 60 percent to pass the course.

Prepared by: M. R. Hansen
Course Description: (3-0) 3 Credits. An introduction to the static and dynamic properties of real and ideal fluids; application of continuity, energy, and momentum principles to laminar, turbulent, compressible, and incompressible flows; laminar and turbulent flow of fluids in closed conduits and around immersed bodies; and flow measurement. Prerequisites: EM321 or concurrent registration, or consent of instructor.


Instructor: Dr. Thomas A. Fontaine, CM 315; 394-5173; Thomas.Fontaine@sdsmt.edu.
Office Hours:

Teaching Assistants: Fanuel Banda, Homework Grader

Course Objectives:

1. Understand fluid pressure and forces due to pressure.
2. Understand conservation of mass, energy and momentum in fluid systems.
3. Understand fluid flow in pipes and around immersed bodies.

Course Outcomes:

The students successfully completing this course will have the ability to:

1. Explain fluid properties.
2. Analyze hydrostatic pressure.
3. Calculate hydrostatic pressure forces on surfaces.
4. Identify and analyze steady vs unsteady flow, uniform vs varied flow, laminar vs turbulent flow, and compressible vs incompressible flow.
5. Evaluate a given flow condition, identify which of the main concepts are involved (e.g., continuity, momentum, forces, and energy), and formulate a solution approach.
6. Apply the basic principles of fluid mechanics to flow analysis, including continuity, momentum, forces, and energy.
7. Explain dimensional analysis and similitude in experimental design.
8. Analyze pipe flow using the Darcy Weisbach equation and Moody Diagram.
9. Calculate energy losses in pipelines due to fittings.
10. Apply principles of fluid mechanics to flow measurement, open channel flow, drag forces, and hydromachinery.
Class Schedule and Topics:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>Fluid properties</td>
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<td>2</td>
<td>Hydrostatic pressure</td>
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<tr>
<td>3 to 4</td>
<td>Forces on plane areas</td>
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<tr>
<td>5 to 6</td>
<td>Forces on curved surfaces</td>
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<tr>
<td>7</td>
<td>Buoyant force, characteristics of fluid flow</td>
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<tr>
<td>8</td>
<td>Continuity equation</td>
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<tr>
<td>9</td>
<td>Energy equation, hydromachinery</td>
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<tr>
<td>10</td>
<td>Momentum equation</td>
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<tr>
<td>11</td>
<td>Dimensional analysis &amp; similitude</td>
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<tr>
<td>12</td>
<td>Laminar and turbulent flow</td>
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<tr>
<td>13</td>
<td>Darcy-Weisbach equation, Moody diagram</td>
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<tr>
<td>14</td>
<td>Minor losses, open channel flow</td>
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<tr>
<td>15</td>
<td>Flow measurement, drag forces</td>
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</tbody>
</table>

Laboratory Projects: Team project to develop a water wheel with a specified power output (done in 2003).

Professional Component: Engineering Topics: 3 credits or 100%

Relationship Between Course Outcomes and ABET a-k Outcomes:

<table>
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<tr>
<th>Course Outcomes</th>
<th>ABET Program Outcomes</th>
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Assessment and Evaluation:
Independent Course Assessment (homework, exams, and team design project)
FE Exam Topical Results
Student Self Assessment Survey
Institutional Student Course Evaluation

Prepared by: Thomas A. Fontaine
IENG 301 Basic Engineering Economics (Required Course)

IENG 301 Basic Engineering Economics (2-0) 2 credits. Prerequisite: Junior or higher standing preferred. Introduces the concepts of economic evaluation regarding capital investments, including the time value of money and income tax effects. Graduation credit cannot be given for both IENG 301 and IENG 302


Instructor: Jennifer Karlin
Office hours: M, W: 10-11 AM; M, F:1-2 PM, or by appointment

Class Schedule: Lecture: 3 hours per week, M, W, F 12 - 12:50 PM, CB 204W

Topics:
1. Time Value of Money
2. Nominal and Effective Interest Rates
3. Present Worth Analysis
4. Annual Worth Analysis
5. Rate of Return Analysis
6. Benefit / Cost Analysis
7. Replacement and Retention Decisions

Computer Usage:
Application of Microsoft Excel to spreadsheet based problems.

Course Objectives:

After completing this course, students should be able to:
1. Identify how time and interest affect cash flows.
2. Identify the best engineering economy tool for evaluating alternatives.
3. Utilize present worth analysis, annual worth analysis, rate of return analysis, and benefit/cost analysis for evaluating alternatives.

Course Outcomes:

Engineering Economy Fundamentals
1. Be able to move various cash flows across time while accounting for discrete or continuous compound interest, e.g., single payment factors, uniform-series factors, and arithmetic and geometric gradient factors.
2. Apply the concept of minimum attractive rate of return in economic decision-making.

Tools for Evaluating Alternatives
3. Be able to identify the best engineering economy tool for evaluating alternatives.
4. Be able to evaluate asset alternatives using present worth analysis, annual worth analysis, rate of return analysis, benefit / cost analysis.
5. Be able to utilize computer spreadsheets and their functions to solve engineering economy problems.

Making Decisions on Real-World Projects
6. Be able to determine the economic service life of an asset that minimizes the total annual worth of costs.
7. Be able to perform an asset replacement study between the defender and the best challenger.
Relationship of Course to Geological Engineering Program Outcomes:

IENG 301, Basic Engineering Economics, meets four of the twelve outcomes for the geological engineering program (below), and three of the eleven ABET a-k outcomes (see table below):

- Ability to apply basic knowledge in mathematics, science, and engineering;
- Field, laboratory, technical, and computer competence;
- An understanding of professional and ethical responsibility; and
- Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

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<tr>
<th>Course Outcomes</th>
<th>ABET Outcomes</th>
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Course Assessment:

Course assessment will involve embedded assessments. Sample problems from student exams will be collected and scored by the instructor against a proficiency rubric. Problems will be saved for IE faculty review. Course results will be compared to weighted average results on FE in engineering economy.

Prepared by: Jennifer Karlin  May, 2004
ME 221: DYNAMICS OF MECHANISMS

CATALOG DATA:
ME 221 – Dynamics of Mechanisms: (3-0) 3 Credits

Prerequisite: PHYS 211, EM 214, MATH 125. Brief review of dynamics of a particle. Kinetics and
kinematics of two and three-dimensional mechanisms. Emphasis will include free body diagrams, vector
methods, and various coordinate systems. Newton’s law and energy methods will both be used.

TEXTBOOK:
Engineering Mechanics – Dynamics by R.C. Hibbeler

INSTRUCTOR:
Dr. Vojislav D. Kalanovic, MWF 10-12 p.m.

EXPECTATIONS:
Upon entering this course, the student will be expected to:
1. Have basic knowledge of mechanics from the stand-point of PHYS 211
2. Be able to form Free Body Diagrams
3. Be able to integrate and differentiate with ease
4. Proficient in vector algebra

COURSE OBJECTIVES:
The objective of this course is to provide the working knowledge required to formulate and analyze
engineering problems related to bodies in motion. The course will also provide a series of
methodologies enabling the flexibility in the process of solution forming.

CLASS SCHEDULE:
Lecture 3 hours per week 9 – 10 a.m. MWF

PROFESSIONAL COMPONENT:
Engineering Science: 2.5 credit or 83%; Engineering Design: 0.5 credit or 17%

TOPICS:
The course will cover the traditional elements of kinematics and kinetics and will include
the following:

- Kinetics of Particle: Force and Acceleration
- Kinetics of Particle: Work and Energy
- Kinetics of Particle: Impulse and Momentum
- Planar Kinematics of a Rigid Body
- Planar Kinematics of a Rigid Body: Force and Acceleration
- Planar Kinematics of a Rigid Body: Work and Energy

COMPUTER USAGE:
This course does not require specific computer usage.

COURSE OUTCOMES:
Upon the completion of this course, the students will be able to:
1. Form kinetic diagrams
2. Correctly set-up coordinate frames
3. Form differential equations of motion
4. Use principle of Work and Energy
5. Use principle of Impulse and Momentum
**RELATION OF COURSE OUTCOMES TO PROGRAM OUTCOMES:**

<table>
<thead>
<tr>
<th>ME 221</th>
<th>ME Program Outcomes</th>
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<tr>
<td></td>
<td>Objective 1</td>
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<td>Program Outcome</td>
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* (For a list of Program Objectives and Program Outcomes, please go to [http://www.hpcnet.org/assessment](http://www.hpcnet.org/assessment))

**LABORATORY:**

There is no laboratory component for this course. However, students are required to run parametric studies thus being exposed to a virtual laboratory environment.

**ASSESSMENT AND EVALUATION:**

The course objectives will be evaluated from the input supplied by: FE exam, Exit exam, ME 311, ME 316, ME 331, ME 352, and ME 385. In addition, course outcomes will be evaluated from in-class testing and other instruments deemed suitable.

**GRADING**

The grade for this course will be formed based on the test and quiz scores.

**PREPARED BY:**

Dr. Vojislov D. Kalanovic, January 2, 2003
CHEM 112 GENERAL CHEMISTRY I
(Required Course)

CATALOG DATA:
CHEM 112 GENERAL CHEMISTRY I
(3-0) 3 credits. Prerequisites Prerequisite or corequisite MATH 102. An introduction to the basic principles of chemistry for students needing an extensive background in chemistry (including chemistry majors, science majors, and pre-professional students). Completion of a high school course in chemistry is recommended. Duplicate credit for CHEM 106 and 112 not allowed.

TEXTBOOK:
2. Arrington, D. E., *"General Chemistry I CD."* This CD contains self-tests for this course. You will need an IBM-compatible computer, equipped with a CD-ROM drive, and Windows 9x or NT variants as the operating system.

INSTRUCTOR:
Dr. Dale Arrington, C-313 (394-1236)
E-mail: dale.arrington@sdsmte.edu
Office Hours: 10 a.m. MWF

EXPECTATIONS:
Students are expected to have a fundamental understanding of:
- Algebra
- Prior course in chemistry

COURSE OBJECTIVES:
Students will obtain a foundation in the fundamental principles and models of chemistry necessary for an understanding of the composition, structure, and properties of matter and the changes that matter undergoes.

CLASS SCHEDULE:
C-228 (sec. 1) Monday-Wednesday-Friday; 8:00 – 8:50 a.m.
C-228 (sec. 2) Monday-Wednesday-Friday; 9:00-9:50 a.m.

PROFESSIONAL COMPONENT:
Basic Science: 3 credits or 100%

TOPICS:
- Properties of matter
- Atomic structure
- Stoichiometry
- Reactions in aqueous solution
- Thermochemistry
- Electronic structure
- Periodic properties
- Bonding
- States of matter
- Intermolecular forces
- Properties of solutions
COMPUTER USAGE:
None

COURSE OUTCOMES:
Each student successfully completing Chem112 is expected to have the following abilities:

- Understand, and use correctly, the symbolic representations, chemical notation, formulas, and systematic rules of nomenclature that characterize the language of chemistry.
- Understand and apply the mole concept in a variety of chemical calculations, including calculating the number of particles in a given mass of substance (and vice versa), and the quantitative relationships between reactants and products in a chemical reaction.
- Recognize the different types of chemical transformations: acid-base, precipitation, combination, decomposition, single-replacement, oxidation-reduction, double replacement, and combustion.
- Understand the basic principles of energy transfer involving chemical systems, including the transfer of heat and work between system and surroundings, the qualitative and quantitative interpretation of thermochemical equations, and the application of Hess’s Law.
- Understand the various models of atomic structure, the basic principles of quantum theory, and the experiments that led to those principles.
- Write ground-state electron configurations for atoms and ions of any representative element and the 3d transition series elements.
- Understand the fundamental aspects of chemical bonding, including writing Lewis structures, describing the bonding in molecules by simple valence-bond theory, and using Valence Shell Electron Pair Repulsion Theory to predict the geometries of molecules and ions.
- Use modern atomic theory to understand and predict the properties of different elements.
- Recognize, and account for, in terms of the underlying electronic factors involved, the characteristic properties of the different groups in the periodic table.
- Understand the properties of the different states of matter.
- Qualitatively and quantitatively describe the properties of the gaseous state and the fundamental laws governing the behavior of gases.
- Understand, qualitatively and quantitatively, the behavior of solutions and their colligative properties.
- Understand how fundamental intermolecular interactions among particles determine the physical and chemical properties of a system.
- Understand the fundamental postulates of kinetic-molecular theory and use them to explain the physical behavior of the three states of matter.

RELATIONSHIP OF COURSE TO PROGRAM OUTCOMES:
CHEM 112, General Chemistry I, meets part of ABET Criterion 3, outcome (a):
(a) Ability to apply knowledge of mathematics, science, and engineering.

LABORATORY:
None

ASSESSMENT AND EVALUATION:
Cumulative percent average on the five hour exams is the sole determinant of the grade in this course.

PREPARED BY:
Dale Arrington, Fall 2003
CHEM 112L GENERAL CHEMISTRY I LAB
(Required Course)

CATALOG DATA:
CHEM 112L GENERAL CHEMISTRY I LAB
(0-1) 1 credit. Prerequisite or corequisite: CHEM 112. Laboratory designed to accompany CHEM 112.

TEXTBOOK:
1. Prepackaged set of experiments from the Modular Laboratory Program in Chemistry (Chemical Education Resources, Palmyra, PA). A complete set consists of the following numbered experiments: 368, 387, 388, 389, 394, 395, 399, 451, 455, 460, 484, and 498.
2. Approved safety goggles, which must be worn at all times while in the laboratory. Goggles may be purchased in the bookstore or at the first and second lab meetings.
3. Roll of paper towels. A roll of paper towels should be purchased by you and kept in your lab locker. Any budget brand will do.

INSTRUCTOR:
Dr. Dale Arrington, C-313 (394-1236)
E-mail: dale.arrington@sdsmte.edu
Office Hours: 10 a.m. MWF

EXPECTATIONS:
Students are expected to have a fundamental understanding of:
- Algebra
- Prior course in chemistry

COURSE OBJECTIVES:
Students will gain familiarity with common chemical laboratory safety practices and the apparatus and experimental methods used in analyzing and investigating the properties and behavior of matter.

CLASS SCHEDULE:
C-204/201 (sec. 51 & 52) Tuesday; 8:00 – 9:50 a.m.
C-201/204 (sec 55 & 56) Thursday; 8:00 – 9:50 a.m.
C-204/201 (sec. 53 & 54) Tuesday 1:00-3:50 p.m.
C-201/204 (sec. 57 & 58) Thursday 1:00-3:50 p.m.

TOPICS:
- Safety Video. Locker check-out.
- Relating Mass and Volume (bring a metric ruler to lab).
- Detecting Signs of Chemical Change.
- Separating and Isolating the Components of a Binary Mixture of Solids.
- Empirical Formula of an Oxide.
- Single Replacement Reactions and Relative Reactivity.
- Percent Water in a Hydrate.
- Heat of Neutralization (partners; bring a watch with a second hand).
- Paper Chromatography of Selected Transition-metal Cations (bring a ruler to lab).
- Separating and Determining the Mass of Calcium Ion in a Calcium-Enriched Tablet.
- Paper Chromatography of Selected Transition-metal Cations (bring a ruler to lab).
- Determining the Molar Concentration of a Sodium Hydroxide Solution.
- Titrating Vinegar and locker check-in.

COMPUTER USAGE:
None
COURSE OUTCOMES:
Each student successfully completing Chem112L is expected to have the following abilities:

- Understand the distinction between qualitative and quantitative chemical analysis.
- Understand the fundamental and operational principles upon which common methods of separation and purification of chemical substances are based.
- Identify sources of error in chemical experiments.
- Interpret experimental results and draw reasonable conclusions.
- Analyze data in terms of the precision and accuracy of results.
- Learn and understand laboratory safety procedures.
- Anticipate, recognize, and respond to hazards of chemical materials and manipulations.
- Learn the importance of performing accurate and precise quantitative measurements.
- Keep legible and complete experimental records.
- Collaborate with peers in obtaining and interpreting data.
- Understand the concept of standardization.

LABORATORY:
100%  

ASSESSMENT AND EVALUATION:
Pre-lab questions
Lab Reports

PREPARED BY:
Dale Arrington, Fall 2003
CHEM 114 GENERAL CHEMISTRY II  
(Required Course)

CATALOG DATA:
CHEM 114 GENERAL CHEMISTRY II  
(3-0) 3 credits. Prerequisite: CHEM 112 and MATH 102. Prerequisite or corequisite CHEM 114L. A continuation of CHEM 112. An introduction to the basic principles of chemistry for students needing an extensive background in chemistry.

TEXTBOOK:

INSTRUCTOR:
Dale Arrington, C 313 (394-1236)  
Email: Dale.Arrington@sdsmt.edu

TOPICS:
Chemistry 114, General Chemistry II, is the second semester of a two-semester sequence that surveys the important concepts, principles, and models of chemistry. The main emphasis in the second semester is on the macroscopic properties of matter. The course content includes: chemical kinetics; chemical equilibrium; acids and bases; acid-base and solubility equilibria; chemical thermodynamics; and electrochemistry. The course is organized around Learning Guides that are written for each chapter. Each guide consists of two main parts:

1. A specific reading assignment that clearly specifies not only what you must read, but also what material, if any, should be omitted from the readings. The number of class periods devoted to each chapter is clearly indicated on each Learning Guide.
2. A set of carefully prepared learning objectives that describe the specific tasks that it is desirable to be able to do upon completion of each reading assignment. These learning objectives are the most important part of each guide and you should refer to them as you read the assigned material, do homework and prepare for examinations. Examinations will emphasize the most important of these objectives.

OBJECTIVES:
Students will obtain a foundation in the fundamental principles governing chemical reactivity: chemical kinetics, equilibrium (gas-phase, acid-base, and solubility equilibria), thermodynamics, and electrochemistry.

PROFESSIONAL COMPONENT:
Basic Science: 3 credits or 100%

COURSE OUTCOMES:(more specific "outcomes" are indicated on the Learning Guides and are referred to by their correct name: learning objectives).
- Understand rates of reaction and the conditions affecting rates.
- Derive the rate equation, rate constant, and reaction order from experimental data.
- Use integrated rate laws.
- Understand the collision theory of reaction rates and the role of activation energy.
- Understand the nature and characteristics of chemical equilibria.
- Understand the significance of the equilibrium constant, K.
- Understand how to use the equilibrium constant in quantitative studies of chemical equilibria.
- Understand and use Le Châtelier’s Principle in predicting the effects of stresses on equilibrium systems.
- Use the Bronsted-Lowry and Lewis concepts of acids and bases.
• Apply the principles of chemical equilibrium to acids and bases in aqueous solution.
• Understand the control of pH in aqueous solutions with buffers.
• Evaluate the pH in the course of acid-base titrations.
• Apply chemical equilibrium concepts to the solubility of ionic compounds.
• Understand the concept of entropy and how it relates to spontaneity.
• Use tables of data in thermodynamic calculations.
• Define and use free energy in predicting the spontaneity of chemical processes.
• Balance net ionic equations for oxidation-reduction reactions.
• Understand the principles of voltaic and electrolytic cells.
• Understand how to use electrochemical potentials.

RELATIONSHIP OF COURSE TO PROGRAM OUTCOMES:
CHEM 114, General Chemistry II, meets part of ABET Criterion 3, outcome (a):
(a) Ability to apply knowledge of mathematics, science, and engineering.

Prepared by: Dale Arrington and Arden Davis May, 2004
ENG 101 COMPOSITION I

CATALOG DATA:
ENGL 101 COMPOSITION I
(3-0) 3 credits. Appropriate student placement based on entry level assessment or completion of (or concurrent enrollment in) ENGL 031, 032, or 033. Practice in the skills, research, and documentation needed for effective academic writing. Analysis of a variety of academic and non-academic texts, rhetorical structures, critical thinking, and audience will be included.

TEXTBOOK:
Mims and Nollen, Mirror on America: Short Essays and Images, 2nd Edition
Raimes, Keys for Writers, third edition.

INSTRUCTOR:
Palmer, Morgan, Antonen, and Neumann
Humanities office phone: 394-1243. Leave a message if no one answers.

EXPECTATIONS:
None

COURSE OBJECTIVES:
At the conclusion of English 101, students should be able to:
- understand the basic principles of organization and development necessary to write an essay
- understanding writing as a process that requires analysis, interpretation, drafting and revision
- master basics of expository prose and use of rhetorical strategies to write effectively and critically for a variety of audiences
- know techniques of basic research in order to communicate knowledge and ideas professionally and ethically of the composition, structure, and properties of matter and the changes that matter undergoes.

PROFESSIONAL COMPONENT:
English: 3 credits or 100%

TOPICS:
- Critical Reading
- Argumentation
- Logical Fallacies
- Peer Review
- Brainstorming, Freewriting
- Titles, Topic Sentences, Thesis Statements
- Using & Citing Sources
- Textual Analysis
- Using the Library
- Research Writing, MLA Style
- Documentation
- Sentences, Punctuation, Analyzing Texts
- Portfolio Consultations

COMPUTER USAGE:
Word Processing
**COURSE OUTCOMES:**
In English 101 students will demonstrate effective communication by:
- designing and producing writing adapted to various audiences and purposes
- composing clear, effective sentences and combining them into focused, coherent paragraphs that support the purpose of their essays
- using basic research skills and appropriate documentation of sources
- exhibiting awareness of ethical standards by accurately using sources and formulating text
- practicing a prose style based on conciseness, clarity, and fluency
- using standard English grammar, punctuation, and other mechanical aspects

**RELATIONSHIP OF COURSE TO PROGRAM OUTCOMES:**
ENGL 101, Composition I, meets part of ABET Criterion 3, outcome (g):
(g) Ability to communicate effectively.

**LABORATORY:**
None

**ASSESSMENT AND EVALUATION:**
- Papers
- Quizzes & Assignments
- Oral Presentation
- Portfolio

**PREPARED BY:**
Sally Palmer, Spring 2004
ENG 279 TECHNICAL COMMUNICATIONS I
(Required Course)

CATALOG DATA:
ENGL 279 TECHNICAL COMMUNICATIONS I
(3-0) 3 credits. Prerequisites: ENGL 101 or equivalent and sophomore standing. Introductory written and oral technical communications with emphasis on research and explanations of scientific and engineering topics.

TEXTBOOK:
Companion Website to text: http://www.ablongman.com/lannontechcomm

Class WebCT Site: http://webct.sdsmt.edu:8900/

Other Materials: Computer disk for storing writing & videotape for recording speeches

INSTRUCTORS:
Sneller, Hudgens, Palmer, and Boysen,
Humanities office phone: 394-1243. Leave a message if no one answers.

EXPECTATIONS:
Students will have completed English 101, or equivalency.

COURSE OBJECTIVES:
At the conclusion of English 279, students should be able to
• understand the principles of organization and development that are required to produce a variety of short, basic technical documents,
• understand technical writing as a process requiring analysis, interpretation of data, drafting and revision;
• understand the basic components of planning and preparing effective oral presentation of technical and professional material;
• conduct basic technical research using both traditional and electronic methods to communicate in an ethical manner; and
• improve communication and problem solving skills by working on speaking and writing projects in teams.

PROFESSIONAL COMPONENT:
English: 3 credits or 100%

TOPICS:
• What is “technical communication” and what does it entail?
• Audience Analysis
• The “How To’s” of speaking in public
• “Students Take Charge” presentations
• Peer Review
• Summary Writing
• Research / Identifying Sources
• Ethics and/in technical communication
• Visual Aids
• Job Search
• Resumes
• Definitions & Descriptions
• Persuasive Speaking
COMPUTER USAGE:
- Word Processing
- PowerPoint

COURSE OUTCOMES:
Students will demonstrate effective technical communication by
- producing well organized and effectively designed short, basic technical documents;
- employing drafting, revision, and analytical skills to take a document from initial conception to final product;
- producing individual and collaborative documents and oral presentations for a variety of technical, professional, and general audiences;
- recognizing and using appropriate conventional formats and visuals for a variety of basic technical/professional documents;
- the basic research skills and documentation techniques necessary to produce effective written and oral technical communications;
- exhibiting awareness of ethical standards by accurately using sources and formulating text; and
- practicing a technical communication style based on conciseness, clarity, fluency; and using standard English grammar, punctuation, and other mechanical aspects.

RELATIONSHIP OF COURSE TO PROGRAM OUTCOMES:
ENGL 279, Technical Communication I, meets part of ABET Criterion 3, outcome (d), (f), (g):
  (d) Ability to function on multi-disciplinary teams
  (f) Understanding of professional and ethical responsibility
  (g) Ability to communicate effectively

LABORATORY:
None

ASSESSMENT AND EVALUATION:
- Formal writing assignments
- Formal speeches
- Quizzes
- Attendance & participation

PREPARED BY:
Judy Sneller, Spring 2004
ENG 289/289L TECHNICAL COMMUNICATIONS II  
(Required Course)

CATALOG DATA:
ENGL 289/289L TECHNICAL COMMUNICATIONS II  
(2-1) 3 credits. Prerequisites: ENGL 279 or equivalent and sophomore standing. Advanced written and oral technical communications with emphasis on the research, preparation, and delivery of complex technical documents.

TEXTBOOK:

INSTRUCTORS:
Rice, Boysen, Lee, Westergaard, and Antonen  
Humanities office phone: 394-1243. Leave a message if no one answers.

EXPECTATIONS:
Students will have completed ENGL 279 or equivalent.

COURSE OBJECTIVES:
At the conclusion of English 289, students should be able to
- Understand the advanced principles of organization and development that are required to produce different types of complex technical documents,
- Understand technical writing as a process requiring analysis, interpretation of data, drafting and revision;
- Understand the advanced principles of planning and preparing effective oral presentations of technical and professional material;
- Conduct advanced technical research using a variety of traditional and electronic methods to communicate in an ethical manner;
- Improve communication and problem solving skills by working on speaking and writing projects in teams; and
- Use writing, speaking, researching, and networking skills to compete effectively in the job market.

PROFESSIONAL COMPONENT:
English: 3 credits or 100%

TOPICS:
- Elements of the proposal
- Formal reports: preliminary guidelines
- Style review
- Style: clarity
- Style: conciseness
- Summaries and abstracts
- Writing evaluations
- Proposal briefing
- Communication issues in professional writing
- Communication issues workshop
- Team communication problems
- Peer review
- Oral presentations
**COMPUTER USAGE:**
- Word Processing
- PowerPoint

**COURSE OUTCOMES:**
In English 289 students will demonstrate effective technical communication by:
- Producing well organized and effectively designed complex technical documents;
- Producing well organized and effectively designed resumes and other job application documents;
- Employing drafting, revision, and analytical skills to take a document from initial conception to final product;
- Producing individual and collaborative documents and oral presentations for a variety of technical, professional, and general audiences;
- Recognizing and using appropriate formats and elements of document design applicable to a variety of complex technical documents;
- Using appropriate, effective graphics in speaking and writing projects;
- Using the advanced research skills and documentation techniques necessary to produce effective written and oral technical communications;
- Exhibiting awareness of ethical standards by accurately using sources and formulating text;
- Adopting a technical communication style based on conciseness, clarity, fluency, and consistency;
- Using standard English grammar, punctuation, and other mechanical aspects.

**RELATIONSHIP OF COURSE TO PROGRAM OUTCOMES:**
ENGL 289289L, Technical Communication II, meets part of ABET Criterion 3, outcome (d), (f), (g):
- (d) Ability to function on multi-disciplinary teams
- (f) Understanding of professional and ethical responsibility
- (g) Ability to communicate effectively

**LABORATORY:**
None

**ASSESSMENT AND EVALUATION:**
- Written Assignments
- Presentations
- Attendance & Participation

**PREPARED BY:**
Rodney Rice, Spring 2004
GEOE 221 Geology for Engineers

GEOE 221/221L Geology for Engineers (2-1) 3 credits: Basic concepts in the study of earth, with emphasis on geological processes acting on earth's surface. Topics include rock forming processes and identification, mass wasting, ground water, streams, glaciers, coastal erosion, and earthquakes. Emphasis is given to engineering significance of processes and their resulting deposits.

Prerequisites: None.
Instructor: L.D. Stetler Office: MI 310 Phone: 394-2464 e-mail: larry.stetler@sdsmt.edu
Webpage: http://www.hpcnet.org/geoe221

Course Objectives: Geology for Engineers is a 3 credit introductory engineering geology course intended for engineers. The course has the following objectives:

1) To attain a thorough understanding of the internal and external composition of Earth
2) To understand its basic geologic history
3) To understand and assess fundamental geologic and engineering processes which have shaped the world on which we live
4) To learn how engineering principles are used to assess and analyze problems that are founded in or upon geologic media

Course Outcomes: Students successfully completing the course will have the ability to:

1) Define physical and chemical aspects of rock-forming environments
2) Visualize the internal structure of Earth including plate tectonic processes
3) Use basic geologic data to interpret surficial processes
4) Interpret topographic and simple geologic maps and structures
5) Use geologic concepts to describe and interpret engineering processes related to earth materials

Topics:
1. Origin of the universe, and age dating
2. Geologic Time Scale
3. Maps I: scale, contours, cross sections
4. Minerals
5. Maps II
6. Igneous rocks
7. Sedimentary rocks
8. Igneous rocks
9. Metamorphic rocks
10. Weathering and soils
11. Maps III -- folds and faults
12. Rock and soil mechanics
13. Structural geology
14. Plate tectonics and mountain building
15. Surface water
16. Field trip -- stream gaging
17. Ground water
18. Field trip -- pumping wells
19. Geomorphology
20. Glaciers
21. Mass wasting
22. Field trip -- landslides
23. Oceans and deserts
24. Earthquakes and environmental geology
Professional Component: Basic science: 3 credits or 100%

The course has a conventional lecture-based format: two 1-hour lectures per week and one 3-hour laboratory period per week.

Relationship of Course to Program Outcomes

GEOE 221, Geology for Engineers, fulfills five of the twelve outcomes for the geological engineering program (below), and four of the ABET a-k outcomes (see table below):

- Ability to apply basic knowledge in mathematics, science, and engineering
- Field, laboratory, technical, and computer competence
- Knowledge of contemporary issues
- Critical thinking and research skills, including the ability to design and conduct experiments as well as interpret data
- Broad based knowledge of the role of engineering solution in societal and in a global context

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<th>Course Outcomes</th>
<th>ABET Outcomes</th>
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Assessment and Evaluation: Independent course assessment (homework, exams, quizzes, laboratory projects)
Institutional Student Course Evaluation

Prepared by: Larry D. Stetler May, 2004
GEOL 201-Physical Geology

Course Description: Basic concepts in the study of the Earth and its history. Brief introduction to the Earth’s place in the universe and solar system and the evolution, composition and structure of the Earth. Introduction to minerals, and igneous, sedimentary, and metamorphic rocks. Survey of geological processes acting at the surface of the Earth such as wind, rivers, glaciers, ground water and the sea; introduction to internal processes regarding plate tectonics theory and growth of mountains. Societal implications of geological processes are emphasized throughout the course.


Instructor: Dr. Colin J. Paterson, Room MI 314

Course Objectives:

1. Understand fundamental aspects of the Earth as seen during trips across SD, the U.S.A., or the world -- based upon presentations in class.
2. Know the fundamental mineralogical and rock compositions of the Earth’s crust and the general processes by which these rocks formed.
3. Know the general architecture of the Earth’s interior and the effect of internal processes upon development of the Earth’s surface, including volcanism, seismic activity, and the formation of mountains.
4. Know the processes and results of the interaction of water, wind, and ice in forming soils and in carving the Earth’s surface.
5. Have a fundamental awareness of the impact of humans upon the Earth and its natural resources.

Outcomes:

1. Understand basic concepts and principles of earth science (level of science).
2. Identify and classify basic geologic materials, structures, and landforms (Identify and classify landforms).

Topics:

Introduction (applications of geology, solar system, plate tectonics theory)
Minerals
Rocks: Igneous - intrusive and extrusive
Rocks: Sedimentary
Rocks: Metamorphic
Geologic Time
Age of the Earth
Structural Geology
Earthquakes
Plate Tectonics
Surface Processes, Weathering and Soils
Mass Movement
Streams and Floods
Ground Water
Glaciers
Deserts and Wind Action
Shores and Coastal Processes
Earth's Resources

Professional Component: Basic Science: 3 credits or 100%

Relationship Between Course Outcomes and ABET a-k Outcomes:

GEOL 201, Physical Geology, meets two of the twelve outcomes for the geological engineering program:
- Ability to apply basic knowledge in mathematics, science, and engineering;
- Field, laboratory, technical, and computer competence.

Prepared by: Colin J. Paterson and Arden D. Davis Date: March, 2004
MATH 123 Calculus I  
(Required Course)

CATALOG DATA:
MATH 123 CALCULUS I  
(4-0) 4 credits. Prerequisite: MATH 115 or appropriate mathematics placement or permission of instructor. Prerequisite: MATH 115 completed with a minimum grade of "C." The study of limits, continuity, derivatives, applications of the derivative, antiderivatives, the definite and indefinite integral, and the fundamental theorem of calculus.

Prerequisite: Pre-calculus.

INSTRUCTORS:  
Math office phone: 394-2471. Leave a message if no one answers.

TEXT:  
Calculus 2nd edition Smith and Minton.

TOPICS:  
1) Functions  
2) Limits and continuity  
3) Derivatives of polynomial and trigonometric functions  
4) Derivatives of logarithmic and exponential functions  
5) Applications of derivatives  
   i) Curve sketching  
   ii) Related rates  
   iii) Newton’s method  
   iv) Velocity and acceleration  
6) Applications of derivatives  
   i) Optimization  
7) Antiderivatives  
8) Integration using u-substitution  
9) Topics for Exam 4  
10) Definite integrals  
11) Applications of integration  
   i) Area  
   ii) Volume using disks, shells, and washers

COURSE OBJECTIVE:  
This course is intended for students majoring in mathematics, physics, chemistry, engineering and related fields. Students will apply the concepts of limits, derivatives and integrals in solving problems in their respective disciplines. They will be able to identify, graph, integrate, and differentiate polynomial, trigonometric, logarithmic, exponential and algebraic functions.
PROFESSIONAL COMPONENT:
Mathematics 4 credits or 100%

OUTCOMES.
A student who successfully completes this should, at a minimum, be able to:

1. Understand functions.
2. Be able to use functional notation in manipulating mathematical expressions.
3. Understand the concept of a limit and how it applies to calculus.
4. Be able to compute limits using various methods.
5. Be able to determine where a function is continuous.
6. Understand the concept of the derivative.
7. Be able to compute derivatives using the power rule, product rule, quotient rule and chain rule.
8. Be able to use the concept of the derivatives in applications such as related rates, linear approximations, Newton’s Method, curve sketching, optimization, velocity and acceleration.
9. Understand the concept of an antiderivative.
10. Be able to manipulate expressions using sigma notation.
11. Be able to integrate using substitution and the power rule.
12. Understand and be able to apply the Fundamental Theorem of Calculus.
13. Be able to use the concept of the integral in applications such as area, volume, velocity and acceleration.
14. Understand the use of numerical integration techniques such as Trapezoidal and Simpson’s rules.

RELATIONSHIP OF COURSE TO PROGRAM OUTCOMES:
MATH 123, Calculus I, meets part of ABET Criterion 3, outcome (a):
(a) Ability to apply knowledge of mathematics, science, and engineering.

PREPARED BY: Laura Geary and Arden Davis May, 2004
MATH 125 Calculus II
(Required Course)

CATALOG DATA:
MATH 125 CALCULUS II
(4-0) 4 credits. Prerequisite: MATH 120 completed with a minimum grade of "C" or appropriate score on departmental Trigonometry Placement Examination and MATH 123 completed with a minimum grade of "C." A continuation of the study of calculus, including the study of sequences, series, polar coordinates, parametric equations, techniques of integration, applications of integration, indeterminate forms, and improper integrals.

Prerequisite: Calculus I.

INSTRUCTORS:
Math office phone: 394-2471. Leave a message if no one answers.

TEXT:
Calculus (Smith, Minton 2nd ed.) We will cover Chapters 5-9.

OBJECTIVES:
1) The student will continue to learn differentiation and integration techniques, building on the skills learned in Calculus I.
2) The student will learn basic concepts dealing with infinite sequences and series.
3) The student will learn how to work with parametric equations and polar coordinates.

TOPICS:
1. Further applications of the definite integral
   a. Arc length
   b. Surface area
   c. Work
   d. Moments and center of mass
2. Properties of logarithms, exponentials, trig and inverse trig functions Derivatives and antiderivatives
   of exponential, logarithms, trig and inverse trig functions.
3. Evaluation of antiderivatives using:
   a. Trig integrals
   b. Trig substitutions
   c. Parts
   d. Partial fractions
4. L’Hôpital’s rule and improper integrals
5. Infinite series and convergence using:
   a. Definition
   b. Integral test
   c. Ratio test
d. Comparison test
e. n-th term test
f. Alternating series, conditional and absolute convergence

6. Interval of convergence of power series
7. Taylor series expansions
8. Fourier series expansions
9. Parametric and polar graphs and equations, derivatives and integrals

PROFESSIONAL COMPONENT:
Mathematics  4 credits or 100%

OUTCOMES:
A student who successfully completes this course should, at a minimum:

1. Know how to differentiate exponential and logarithmic functions and integrate the corresponding functions.
2. Know how to differentiate inverse trigonometric functions and integrate the corresponding functions.
3. Know how and when to use various integration techniques, including integration by parts and partial fractions.
4. Know how to evaluate limits of infinite sequences, including how and when to use L'Hopital's Rule.
5. Know how to evaluate improper integrals.
6. Recognize common infinite series, including the geometric and harmonic series.
7. Know how and when to use various tests for convergence of infinite series, including the Ratio Test, the Alternating Series Test, and Comparison Tests.
8. Know how to determine the interval of convergence for a power series.
9. Know how to use infinite series such as the Taylor Series or Fourier Series to approximate functions.
10. Know how to convert between rectangular and parametric form, graph parametric curves, find derivatives, and do other calculus applications using parametric functions.
11. Know how to convert between rectangular and polar coordinates, graph polar curves, and do calculus applications using polar coordinates.

RELATIONSHIP OF COURSE TO PROGRAM OUTCOMES:
MATH 125, Calculus II, meets part of ABET Criterion 3, outcome (a):
(a) Ability to apply knowledge of mathematics, science, and engineering.

PREPARED BY:  Don Teets, Harold Carda, and Arden Davis  May, 2004
MATH 225 Calculus III
(Required Course)

CATALOG DATA:
MATH 225 CALCULUS III
(4-0) 4 credits. Prerequisite: MATH 125 completed with a grade of “C.” A continuation of the study of calculus, including an introduction to vectors, vector calculus, partial derivatives, and multiple integrals.

Prerequisite: Calculus II.

INSTRUCTORS:
Teets, Burgoyne, Carda, Dahl, and Riley.
Math office phone: 394-2471. Leave a message if no one answers.

TEXT:
Calculus (Smith, Minton 2nd ed.) We will cover Chapters 10-14 with some omissions.

TOPICS:
- Vector and vector functions.
- Functions of several variables.
- Partial derivatives.
- Multiple and line integrals.
- Vector analysis.

OBJECTIVES:
1) The student will learn the basic tools and methods of multivariate calculus.
2) The student will understand applications of multivariate calculus.

PROFESSIONAL COMPONENT:
Mathematics: 4 credits or 100%

OUTCOMES:
A student who successfully completes this course should, at a minimum:
1. Know basic vector operations.
2. Know how to work with lines and planes in space.
4. Be able to compute position, velocity, and acceleration vectors.
5. Understand functions of several variables.
6. Be able to compute partial derivatives and gradients using multivariate chain rules
7. Be able to find extremals of constrained and unconstrained functions.
8. Understand iterated integrals.
9. Be able to set up and evaluate double and triple integrals in various coordinate systems.
10. Understand field vectors.
11. Be able to compute line integrals.
12. Understand the basic integral theorems of vector analysis.

RELATIONSHIP OF COURSE TO PROGRAM OUTCOMES:
MATH 225, Calculus III, meets part of ABET Criterion 3, outcome (a):
(a) Ability to apply knowledge of mathematics, science, and engineering.

PREPARED BY: Don Teets, Kyle Riley, and Arden Davis May, 2004
MATH 321 Differential Equations
(Required Course)

CATALOG DATA:
MATH 321 DIFFERENTIAL EQUATIONS
(4-0) 4 credits! Prerequisites: MATH 125 with a minimum grade of "C." Selected topics from ordinary differential equations including development and applications of first order, higher order linear and systems of linear equations, general solutions and solutions to initial-value problems using matrices. Additional topics may include Laplace transforms and power series solutions. MATH 225 and 321 may be taken concurrently or in either order. In addition to analytical methods this course will also provide an introduction to numerical solution techniques.

Prerequisite: Calculus II.

INSTRUCTORS:
Geary, Burgoyne, Carda, and Dahl
Math office phone: 394-2471. Leave a message if no one answers.

TEXT:

TOPICS:
1) Basic definitions and terminology
2) Direction fields and solution curves
3) First order differential equations and their applications
   a) Separable
   b) Linear
   c) Exact
   d) Bernoulli
   e) Numerical Methods
4) Higher order differential equations...homogeneous and nonhomogeneous
5) Method of undetermined coefficients
6) Method of variation of parameters
7) Applications of higher order differential equations
   a) Simple harmonic motion
   b) Damped motion
   c) Forced motion
   d) Electric circuits and analogous systems
8) Basic LaPlace transforms and their inverses
9) Laplace transforms
10) Inverse Laplace transforms
11) Operational Properties
12) Applications
13) Systems of linear first order equations
14) Matrices
15) Gauss elimination
16) Systems of ordinary differential equations
17) Eigenvalues
18) Variation of parameters
PROFESSIONAL COMPONENT:
Mathematics  4 credits or 100%

COURSE OBJECTIVES:

1) The student will learn how to apply basic techniques to solve ordinary differential equations.
2) The student will understand how to determine whether a function is a solution to a given ordinary differential equation or initial value problem.

STUDENT OUTCOMES:

A student who successfully completes this should, at a minimum, be able to:

1) Know how to use separation of variables.
2) Be able to solve first order ordinary differential equations.
3) Be able to solve second order linear ordinary differential equations.
4) Understand the difference between homogeneous and non-homogeneous linear systems.
5) Be familiar with at least one science or engineering application of differential equations.
6) Be able to compute the Laplace transform and inverse Laplace transform for simple functions.
7) Understand the basic process of how to use the Laplace transform to solve an initial value problem.
8) Be familiar with a numerical technique for solving an initial value problem, such as Euler's Method or the Runge Kutta method.
9) Be able to carry out basic matrix addition and matrix multiplication.
10) Be able to solve a linear system in matrix form.
11) Be able to use matrices to solve simple linear first order systems of ordinary differential equations.

RELATIONSHIP OF COURSE TO PROGRAM OUTCOMES:
MATH 321, Differential Equations, meets part of ABET Criterion 3, outcome (a):
(a) Ability to apply knowledge of mathematics, science, and engineering.

PREPARED BY: Laura Geary and Arden Davis May, 2004
PHYS 211/211A UNIVERSITY PHYSICS I
(Required Course)

CATALOG DATA:
PHYS 211/211A UNIVERSITY PHYSICS I
(3-0) 3 credits. Prerequisite: MATH 123 or permission of instructor. This is the first course in a two (2) semester calculus-level sequence, covering fundamental concepts of physics. This is the preferred sequence for students majoring in physical science or engineering. Topics include classical mechanics and thermodynamics. Credit will not be allowed in both Phys 111-113 and Phys 211-213

TEXTBOOK:
University Physics by Halliday and Resnick

INSTRUCTOR:
Dr. M. Foygel, EEP 219 (394-1227)
E-mail: michael.foygel@sdsmu.edu
Office Hours: 2:00 – 4:00 p.m. MW

EXPECTATIONS:
Students are expected to have a fundamental understanding of:
- Areas and volumes of simple geometric figures (example: circle, triangle, cylinder and sphere).
- Pythagorean Theorem.
- Solution of quadratic equations.
- Solution of simultaneous linear equations.
- Finding x and y components of a given vector.
- Find the magnitude and direction of a vector from the x and y component.
- Vector addition and subtraction.
- Scalar and vector products of two vectors.
- Integration and differentiation of linear equations.
Generally, most material from algebra, geometry, trigonometry, and calculus should be known thoroughly.

COURSE OBJECTIVES:
1. To present the basic concepts and principles of mechanics;
2. To strengthen an understanding of the concepts and principles through a broad range of interesting applications in the real world.

To meet these objectives, emphasis is placed on sound physical arguments and problem-solving methodology.

CLASS SCHEDULE:
C-228 Monday & Wednesday, 11:00 – 11:50 a.m.

PROFESSIONAL COMPONENT:
Basic Science: 3 credits or 100%

TOPICS:
The basic physical principles of Newton’s laws of motion.
The conservation laws concerning momentum, energy and angular momentum are applied to the linear and curvilinear motion of particles, simple harmonic motion and the rotation of rigid bodies.

COMPUTER USAGE:
None

COURSE OUTCOMES:
Upon completion of this course, students should demonstrate the ability to:
1. Use SI units and convert units from one system to another.
2. Perform basic operations on vectors such as adding and subtracting vectors geometrically and by components in the unit-vector notation; converting components into polar coordinates; multiplying a vector by a scalar and performing the dot and cross multiplication of vectors.
3. Given a position vector of a particle calculate its displacement, average and instantaneous velocity and acceleration; describe projectile motion and uniform circular motion; relate velocities in different frames of reference.
4. Use the free-body diagrams in solving dynamics problems; apply Newton's laws to a system of several interacting bodies in order to find their accelerations.
5. Calculate work done by a constant or general variable force; calculate power given the force and instant velocity; use the work-energy theorem to relate a change in kinetic energy to the net work done on a system.
6. Calculate gravitational and elastic potential energy; apply energy conservation principle to systems involving gravity, springs, and friction.
7. Find the center of mass of a system of several particles; apply Newton's second law to a system of particles in order to relate the net external force and the acceleration of the system's center of mass.
8. Use conservation of linear momentum and of energy to relate velocities of colliding bodies before and after collision for the cases of elastic and purely inelastic collisions in one and two dimensions.
9. Calculate angular displacement, velocity and acceleration; relate angular and linear variables; calculate rotational kinetic energy; use the parallel-axis theorem to find the rotational inertia of a body; calculate torque; apply the Newton's second law in angular form to relate the net torque and the angular acceleration

RELATIONSHIP OF COURSE TO PROGRAM OUTCOMES:
PHYS 211/211A University Physics I, meets part of ABET Criterion 3, outcome (a):
(a) Ability to apply knowledge of mathematics, science, and engineering.

LABORATORY:
None

ASSESSMENT AND EVALUATION:
Quizzes
Homework
Special Projects
Exams

PREPARED BY:
Michael Foygel, Fall 2003
PHYS 213/213A UNIVERSITY PHYSICS II
(Required Course)

CATALOG DATA:
PHYS 213/213A UNIVERSITY PHYSICS II
(3-0) 3 credits. Prerequisite: PHYS 211. This course is the second course in a two (2) semester calculus-level sequence, covering fundamental concepts of physics. This is the preferred sequence for students majoring in physical science or engineering. Topics include electricity and magnetism, sound, light, and optics.

TEXTBOOK:

INSTRUCTOR:
Dr. Vladimir Sobolev, EEP 220 (394-1225)
E-mail: vladimir.sobolev@sdsmt.edu
Office Hours: open

EXPECTATIONS:
Students are expected to have a fundamental understanding of:
• Areas and volumes of simple geometric figures (example: circle, triangle, cylinder and sphere).
• Pythagorean Theorem.
• Solution of quadratic equations.
• Solution of simultaneous linear equations.
• Finding x and y components of a given vector.
• Find the magnitude and direction of a vector from the x and y component.
• Vector addition and subtraction.
• Scalar and vector products of two vectors.
• Integration and differentiation of linear equations.
• Knowledge of polar coordinate systems and its relation to Cartesian coordinate system.
• Ability to calculate indefinite and definite integrals of power and rational functions, and ability to use table of integrals.

Generally, most material from algebra, geometry, trigonometry, and calculus should be known thoroughly.

COURSE OBJECTIVES:
As a result of this course students will be familiar with basic terminology, processes and fundamental laws in electricity and magnetism. Students will have an understanding of how the mathematical techniques of complex numbers, vector analysis, differentiation and integration can assist in formulating and solving physical problems and will then be able to use these techniques when studying other more-advanced courses in Physics. Student will have also further developed generic problem-solving skills, and scientific world-view.

CLASS SCHEDULE:
EP 252 Monday & Wednesday, 11:00 – 11:50 a.m.

PROFESSIONAL COMPONENT:
Basic Science: 3 credits or 100%

TOPICS:
• Electric Charge
• Electric Fields
• Gauss’ Law
• Electric Potential
• Capacitance
• Current and Resistance

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• Circuits
• Magnetic Fields
• Magnetic Fields Due to Currents
• Induction and Inductance
• Magnetism of Matter; Maxwell's Equations
• Electromagnetic Oscillations and Alternating Current

**Computer Usage:**
None

**Course Outcomes:**
Upon completion of this course, students should demonstrate the ability to:
• *use SI units for electric and magnetic physical quantities; know non-system units used in electricity and magnetism;*
• understand the basic concepts and laws of classical electrostatics and electrodynamics;
• quantitatively describe the forces between point charges; know major application of electrostatics and electrodynamics in modern technology;
• calculate the electric fields and electric potentials due to point charges and simple continuous charge distributions;
• understand the notions of capacitance and resistance, to find equivalent capacitances and resistances for capacitors and resistors connected in series and in parallel; know major application of capacitors and resistors in electric circuits;
• to apply the Kirchhoff's laws for calculations of multi-loop circuits;
• understand the phenomena taking place in circuits contain resistor and capacitor and how these phenomena are described by corresponding equations;
• calculate magnetic fields due to electric currents;
• understand the laws of motion of charged particles in uniform electric and magnetic fields or combined electric and magnetic fields and applications of these phenomena in modern science and technology;
• understand the laws of electromagnetic induction and their role in modern technology;
• improve ability to use mathematics and problem solving skills

**Relationship of Course to Program Outcomes:**
PHYS 213/213A University Physics II, meets part of ABET Criterion 3, outcome (a):
(a) Ability to apply knowledge of mathematics, science, and engineering.

**Laboratory:**
None

**Assessment and Evaluation:**
Quizzes
Homework
Exams

**Prepared By:**
Vladimir Sobolev, Fall 2003