B. Course Syllabus

Course Syllabus

1. **Department:** Civil and Environmental Engineering

2. **Course number and title:** 180:216 Introductory Computer-Aided Design and Drafting (3 cr.)

3. **Course (catalog) description:**
Principles of computer-aided design and drafting (CADD); graphic entities, hatch patterns, layering, part file creation and information extraction. Two-dimensional drafting and pictorial drawings using a CADD system. Introduction to three-dimensional modeling and surface revolution. CADD application in civil engineering.

4. **Prerequisite(s):**

440:127 Introduction to Computers for Engineers

5. **Text books and other required material:**

Required: R.S. Sahai, *Teach Yourself Microstation J,* Alpha Press, 2000
Optional: G.R. Bertoline, *Fundamentals of Graphic Communication,* The Irwin Graphic Series.

Course objectives:

To provide the students with an understanding of the roll of the engineer on a design team and the importance of the standards. To provide the knowledge and hands-on practice of computer-aided design and drafting, and to use CADD software in civil engineering design.

7. **Topics covered:**

Graphic language and design
Introduction to CADD
Lettering
Geometric construction
Multi-view projection
Sectional views
Dimensioning
Design and working drawings

8. **Class/Laboratory schedule:** (number of sessions each week and duration of each session)

Lecture 1 hr., lab 3 hrs., recitation 1 hr. per week

9. **Contribution of course to meeting the professional component:** (mathematics, basic science, engineering science, engineering design, or general education)

Engineering science and design.

10. **Relationship of course to program objectives:**

The course provides the students with a design experience using modern engineering tools and techniques.

11. **Person(s) who prepared this description and date of preparation:**

Name(s): S. Antoljak **Date:** 4/10/00

Course Syllabus

1. **Department:** Civil and Environmental Engineering

2. **Course number and title:** 180:243 Mechanics of Solids (3 cr.)

3. **Course (catalog) description:**

Axial force, shear, moment, and torque in structural members; stress, strain, and stress-strain relations; principal stresses and strains; torsion of circular shafts; bending of singly symmetric beams; compound loading; buckling of columns; statically indeterminate systems.

4. **Prerequisite(s):**

Math:251 Multi variable Calculus; 440:221 Statics. Corequisite Math:244 Diff. Equations

5. **Text books and other required material:**

Gere, J.M., Timeshinko, S.P., (1997) *Mechanics of Materials*, 4th Ed., PWS Publishing Co.

6. **Course objectives:**

The objective of this course is to give the student an in-depth understanding of the effect of external loads on the behavior of members, which they will use in subsequent design courses.

Topics covered:

- *Preliminaries*--Statics, force & stress, units, normal-, shearing-, and bearing stresses, allowable stress
- *Axial*--axial strain, stress-strain relationship, Hooke's Law, elastic vs. plastic, axial deformation
- *Assorted*--statically indeterminate problems, superposition, temperature effects, stress on an arbitrary plane, general 3-D stress state, Poisson's effect, shearing strain, generalized Hooke's Law, plane Stress, plain Strain, relation between E, ν, and G, St. Venant's principle, problems involving plastic deformation
- *Torsion*--torsion stresses, torsion deformations, angle of twist, torsion of non-circular members
- *Flexure*--stresses, strains, and deformations in pure bending, composite sections
- *Combined Stresses*--stresses due to eccentric loads, shear and bending moment diagrams, relationship between load, shear, and moment, transverse loading on prismatic beams, horizontal shear stress, vertical shear stress, superposition of stresses
- *Stress Transformation*--transformation of stresses, principal stresses, Mohr's circles, Mohr's circles for 3-D analysis of stress, thin walled pressure vessels, principal stresses in beams, stresses near applied loads

8. **Class/Laboratory schedule:** (number of sessions each week and duration of each session)
   2/wk – 75 minutes each.

9. **Contribution of course to meeting the professional component:**
   It satisfies the engineering science and design component required by Criteria 4.

10. **Relationship of course to program objectives:**
    This is the first course for students entering the civil engineering curriculum. It is a pre-requisite for all analysis and design courses that follow in the curriculum.

11. **Person(s) who prepared this description and date of preparation:**
    Name(s): Hani H. Nassif **Date:** 3/18/00

Course Syllabus

1. **Department:** Civil and Environmental Engineering

2. **Course number and title:** 180:305 Construction Engineering (3 cr.)

3. **Course (catalog) description:**
Construction Planning and Practices. Utilization of heavy construction equipment. Economic and operational considerations in selection of construction equipment. Use of computer spreadsheets for cost recording and economic decisions. Quality and productivity control

4. **Prerequisite(s):**
180:243 Mechanics of Solids

5. **Text books and other required material:**
Daniel W. Halpin, and Ronald Woodhead, Construction Management, Second Edition, 1998

6. **Course objectives:**
Provide an introduction to construction engineering and management. Introduce students to the legal aspects of construction and the organization of the construction company. Provide students with an understanding of the basic techniques to plan, manage and estimate construction projects.

7. **Topics covered:**
   - Competitive Bidding
   - Legal issues during construction
   - Types of Construction Contracts
   - Legal Structure of the construction firm.
   - Scheduling and Planning
   - Critical Path Method
   - Project cash flow and financing
   - Equipment costs
   - Equipment productivity
   - Estimating
   - Labor Relations
   - Construction Safety

8. **Class/Laboratory schedule:** (number of sessions each week and duration of each session)
Two 1.5 hour sessions per week

9. **Contribution of course to meeting the professional component:** (mathematics, basic science, engineering science, engineering design, or general education)

The main contribution of this course is in the area of engineering science. It provides an introduction to quantitative management techniques used in construction. It also contributes to the engineering design component by providing information about how to plan and schedule construction. It also provides an introduction to techniques for designing construction operations.

10. **Relationship of course to program objectives:**

The course provides an introduction to construction. It also shows the relationship of the construction process to design activities, which is one of the program criteria..

11. **Person(s) who prepared this description and date of preparation:**

Name(s): Trefor P. Williams **Date:** 4/4/2000

Course Syllabus

1. Department: Civil and Environmental Engineering

2. Course number and title: 180:318 Elements of Structural Analysis (3 cr.)

3. Course (catalog) description:
Structural analysis of statically determinate trusses, frames, cables, and arches. Computation of deflections in trusses and plane frames. Influence lines for beams and trusses. Introduction to indeterminate structures.

4. Prerequisite(s):

CE243 Mechanics of Solids; GE222 Dynamics

5. Text books and other required material:

Structural Analysis, 4th edition, R.C. Hibbeler, Prentice Hall, 1999.

6. Course objectives: This is the first required course on structural analysis for civil engineers. The course will provide the necessary analytical foundation and engineering insight on the behavior of determinate structures. The course will also make the connection between the design of structures and its analysis.

7. Topics covered:

Types of structures and loads.

Analysis of statically determinate structures.

Analysis of statically determinate trusses.

Internal loadings developed in structural members.

Cables and arches. Influence lines.

Approximate analysis of statically indeterminate structures.

Deflections. Distribution of loads within a structure

Class/Laboratory schedule:
Two times a week for 80 minutes

Contribution of course to meeting the professional component:
90% to engineering science, 10% to engineering design.

10. Relationship of course to program objectives: The course will ensure that the graduates are well versed in structures, which is one of the program outcomes .

11. Person(s) who prepared this description and date of preparation:

Name(s): Yook-Kong Yong **Date: April 5, 2000**

Course Syllabus

1. **Department:** Civil and Environmental Engineering

2. **Course number and title:** 180:320 Elements of Structural Design (3 cr.)

3. **Course (catalog) description:**
   Design of bolted and welded connections; design of components of structural systems in tension compression, bending, and combined axial and bending loads. Use of computer in design and detailing
4. **Prerequisite(s):**

   180:243 Mechanics of Solids

5. **Text books and other required material:**

   LRFD Steel Design, 3nd Edition , 2001 by William Segui
   AISC Manual of Steel Construction, 3rd edition, 2001

6. **Course objectives:**

   The course objective to teach design of steel structures according to the LFRD design code.
   Make the students familiar with the AISC LRFD Manual
   Introduce students to real life design problems and how to approach the design process

7. **Topics covered:**

   Introduction (loads, codes,etc..)
   Steel Materials
   Design for Tension Members
   Design for Compression Members
   Beam Design
   Beam-Column Design
   Design for Simple bolted and welded Connections
   Design for Eccentric bolted and welded Connections

8. **Class/Laboratory schedule:** (number of sessions each week and duration of each session)

   Two sessions each week (1hr 20 min each)

9. **Contribution of course to meeting the professional component:** (mathematics, basic science, engineering science, engineering design, or general education)

   The course is a very important professional component, and satisfies the engineering design component required by Criteria 4.

10. **Relationship of course to program objectives:**

    This is an important course in the program and it provides the students with fundamental of the design process in general an steel design in particular and it prepares the students for the professional practice.

11. **Person(s) who prepared this description and date of preparation:**

    Name(s): Husam S. Najm **Date:** 1/15/2006

Course Syllabus

1. **Department:** Civil and Environmental Engineering

2. **Course number and title:** 180:331 Elements of Environmental Engineering

3. **Course (catalog) description:**

Engineering management of the environment with particular emphasis on water and wastewater, air and noise pollution, and solid wastes. Hazardous substances and risk analysis.

4. **Prerequisite(s):** Basic math, basic chemistry.

5. **Text books and other required material:**

Primary test: *Introduction to Environmental Engineering and Science*, 2nd Edition, by Gilbert M. Masters, Publisher: Prentice Hall.

Supplemental text*: Environmental Engineering* by Peavy, Rowe, and Tchobanoglous. *Introduction to Environmental Engineering* by Mackenzie L. Davis and David A. Cornwell.

6. **Course objectives:**

The main objective of the course is to give the student a basic understanding of environmental issues and how engineering helps to provide solutions to these issues.

6. **Topics covered:**

Review of basic math used in environmental engineering
Review of environmental chemistry
Mathematics of growth
Population and the environment
Water Pollution, BOD
Groundwater basics, Darcy's Law
Water Purification
Water Quality Control
Risk Assessment
Wastewater Treatment
Sewer Systems
Hazardous Wastes
Disposal Options, NJ Radioactive
Air pollution, Clean Air Act
Indoor air quality
Global Atm Change; Greenhouse effects
Carbon cycle
Solid Waste Management

8. **Class/Laboratory schedule:** (number of sessions each week and duration of each session)

Two lectures per week, each 1 hour and 20 min. One field trip

9. **Contribution of course to meeting the professional component:** (mathematics, basic science, engineering science, engineering design, or general education)

Engineering science, engineering design

10. Relationship of course to program objectives:

This course is offered primarily to accomplish the objective of ensuring that the graduates are well versed in several areas of civil engineering. This course is a core course in the water resources and environmental engineering area.

11. Person(s) who prepared this description and date of preparation:

Name(s): Joseph R. Stencel **Date:** April 24, 2000

Course Syllabus

1. Department: Civil and Environmental Engineering

2. Course Number and Title: 180:345 Properties of Materials Lab (1 credit)

3. Course description:

Mechanical testing of wood, concrete, plastics, and numerous metals in tension, compression, and flexure. Approximate analysis of indeterminate beams using experimental methods. Experimental study of stress-strain transformations. Hardness testing. Elastic and inelastic column buckling. Structural efficiency.

4. Pre-requisite: 180:243 Mechanics of Solids

5. Text books and other required materials:

Properties of Materials Lab Manual by Stephen Kurtz, Rutgers Department of Civil and Environmental Engineering, 2000.

6. Course objectives:

To learn the mechanical properties of engineering materials through first-hand testing. To study selected topics from solid mechanics, structural analysis and structural design through experimentation.

7. Topics covered:

1. Introduction
2. Ultimate compressive and flexural strengths of engineering materials
3. Mohr's circle and the elastic properties of 6061 Aluminum Alloy
4. Optimum wooden bridge construction (student competition)
5. Approximate analysis of indeterminate structures
6. Stress-strain curves of engineering materials in compression
7. Stress-strain curves of engineering materials in tension
8. Optimum highway bridge design (student competition)
9. Elastic and Inelastic buckling of steel columns
10. The principle of superposition
11. Hardness testing

All topics are covered in groups of 2, 3, or 4 students.

8. Class/laboratory schedule: (number of sessions each week and duration of each session)

One laboratory meeting of 3 hours. 11 weeks. No final exam.

9. Contribution of course to meeting the professional component:

Engineering Science
Engineering Design

10. Relationship of course to program objectives

To train students in experimental design and analysis and interpretation of data.

11. Person(s) who prepared this description and date of preparation:

Name(s) Dr. Husam S. Najm **Date:** March 4, 2006
Instructor: Joseph Davis

Course Syllabus

1. **Department:** Civil and Environmental Engineering

2. **Course number and title:** 180:372 Soil Mechanics (3 cr.)

3. **Course (catalog) description:**

Elements of engineering geology; mechanical and hydraulical properties of soils; soil-water systems and fluid flow; stresses in soils; compressibility, consolidation and settlement; shearing resistance; lateral earth-pressure; slope stability; bearing capacity; numerical methods and computer applications.

4. **Prerequisite(s):** CE 243 Mechanics of Solids, CE 387 Fluid Mechanics

5. **Text books and other required material:**

Das, B. J. (1997), *Principles of Geotechnical Engineering* - 4th Edition, PWS-Kent Publishing Company, Boston, Massachusetts, 712 pp.

Reference: Bowles, J.E. (1996), *Foundation Analysis and Design*, - 5th Edition, McGraw-Hill, Inc., 1004 pp.

6. **Course objectives:**

1) To develop understanding of basic principles and methods in identification and characterization of soils with respect to their engineering properties.
2) To develop understanding of most important aspects of soil behavior.
3) To develop understanding of behavior of soil masses under various types of loading conditions and teach methods for analysis and design of various soil and soil-structure systems.
4) To teach fundamentals and application of computers and geotechnical computer programs in the analysis of varies types of problems of soil mechanics and geotechnical engineering.

7. **Topics covered:**

1. Introduction to Soil Mechanics
2. Soil Constituents
3. Weight-Volume Relationships
4. Index Properties
5. Soil Classification
6. Permeability of Soil - Theory and Field and Laboratory Evaluation
7. Seepage and Flow Nets
8. Capillarity and Frost Action
9. Effective Stress Concept
10. Seepage Forces
11. Review of the Stress Tensor
12. Stresses in Soils
13. Stresses Beneath Loaded Areas
14. Compressibility of Soil and Soil Compaction
15. Consolidation and Settlement Estimates
16. Time Rate of Consolidation
17. Soil Failure Criteria
18. Shear Strength Tests
19. Shear Strength of Sands and Clays
20. Bearing Capacity Equations

21. Lateral Earth Pressure
22. Lateral Pressure on Retaining Walls

8. Class/Laboratory schedule: 2 sessions of 1 hour and 20 minutes a week, for 15 weeks

9. Contribution of course to meeting the professional component: (mathematics, basic science, engineering science, engineering design, or general education)

The course has both the engineering science and engineering decomponents. The engineering science component is in teaching of basic principles and methods (algorithms) used in soil characterization and analysis of soil-structure systems. The engineering design component is in a discussion of advantages and disadvantages in the foundation design process (foundation type selection, soil improvement, foundation placement, etc.), and application of computer programs in exploration of alternative solutions to problems of seepage under hydraulic structures and design of shallow foundations.

10. Relationship of course to program objectives:

The course enables students to identify, formulate and analyze problems associated with behavior of soil masses, foundations of structures, and fluid flow in soil systems. Thus, it is contributing to the versatility in several areas of civil engineering, in particular geotechnical, structural, transportation and water resources. The students are educated in the use of modern engineering analysis and design tools.

11. Person(s) who prepared this description and date of preparation:

Name(s): Nenad Gucunski **Date:** 3/28/2000

Course Syllabus

1. **Department:** Civil and Environmental Engineering

2. **Course number and title:** 180:374 Soil Mechanics Laboratory (1 cr.)

3. **Course (catalog) description:**

Engineering classification of soils and rocks. Laboratory studies of physical properties and shear strength of soils such as Atterberg limits, compaction, permeability, unconfined compression, and direct shear tests.

4. **Corequisite(s):** CE 372 Soil Mechanics

5. **Text books and other required material:**

Bowles, J. (1992), *Engineering Properties of Soils and their Measurement, 4th. Edition* , McGraw-Hill

6. **Course objectives:**

    1) To introduce students to the ASTM and AASHTO methods of laboratory soil and field testing procedures.
    2) To develop understanding of the determination of soil properties and their relevance to engineering design and construction.

7. **Topics covered:**

    1. Water Content determination
    2. Atterberg Limits
    3. Particle –Size Analysis by Mechanical Method
    4. Particle-Size Analysis by Hydrometer Method
    5. Specific Gravity of Soil Solids
    6. Classification of Soils
    7. Permeability
    8. Unconfined Compression
    9. Triaxial Test without Pore Pressure Measurement
    10. Triaxial Test with Pore Pressure Measurement
    11. Compaction Test
    12. California Bearing Ratio (CBR) Test
    13. Direct Shear Test
    14. Vane Shear Test
    15. Consolidation Test

8. **Class/Laboratory schedule:** 3 separate sections of about 15 students
    Each section consists of one 3 hrs session a week for 15 weeks

9. **Contribution of course to meeting the professional component:** (mathematics, basic science, engineering science, engineering design, or general education)

The engineering science and engineering design components of the course entails the application of basic engineering principles in the characterization of soils and determination of their engineering properties relevant in the design and construction of foundations, highways and other engineering structures.

10. Relationship of course to program objectives: It relates to the program outcome of "ability to run laboratory experiments and to analyze and interpret data. This course provides students with the knowledge required to accurately determine engineering soil properties. It enables students to properly assess soil properties and make an engineering judgment with respect to their recommendation about the suitability of tested materials in design and construction.

11. Person(s) who prepared this description and date of preparation:

Name(s): Nenad Gucunski **Date:** 4/12/00

Course Syllabus

1. **Department:** Civil and Environmental Engineering

2. **Course number and title:** 180:387 Fluid Mechanics (3 cr.)

3. **Course (catalog) description:**

Fluid properties, Statics and kinematics; Concepts of system and control volume; mass, momentum, and energy conservation principles; Laminar and turbulent flows in conduits and channels; Boundary layer theory; drag and lift; ideal fluid flow.

4. **Prerequisite(s):**

GE 222 Engineering Mechanics: Dynamics
Math 244 Differential Equations for Engineering

5. **Text books and other required material:**

Fluid Mechanics, an Interactive Text, by Liggett and Caughey (CD-ROM and text)

6. **Course objectives:**

To familiarize junior-level civil & environmental engineering students with basic knowledge of fluid mechanics.

7. **Topics covered:**

Fluid statics,
Integral and differential descriptions,
Incompressible pipe flow,
Flow past bodies,
Open channel flow,
EGL & HGL, and subsurface flow.

8. **Class/Laboratory schedule:** (number of sessions each week and duration of each session)

2 sessions per week, 80 minutes per session.

9. **Contribution of course to meeting the professional component:** (mathematics, basic science, engineering science, engineering design, or general education)

It satisfies the engineering science component required by Criteria 4..

10. **Relationship of course to program objectives:**

Fluid mechanics is a prerequisite for a number of junior and senior level courses, and provides some of the program objectives and outcomes as prescribed in Section B.

11. **Person(s) who prepared this description and date of preparation:**

Name(s):	**Date:**
Kenneth Y. Lee	03-15-2000

Course Syllabus

1. **Department:** Civil and Environmental Engineering

2. **Course number and title:** 180:389 Fluid Mechanics Laboratory (1 cr.)

1. **Course (catalog) description:**

Experimental applications and demonstrations; measurement of fluid properties; applications of mass, energy, and momentum principles; energy losses; forces on immersed bodies; flow measurement devices.

4. **Prerequisite(s):**

CE 387 Fluid Mechanics (Co-requisite)

5. **Text books and other required material:**

Laboratory manual provided by the Civil and Environmental Engineering Department.

6. **Course objectives:**

To provide junior-level civil & environmental engineering students with hands-on learning experiments of the various topics covered in fluid mechanics.

7. **Topics covered:**

Basic report writing
Principles of measurement
Statistical methods
Graphical data display
Fluid properties, pressure and velocity measurements
Discharge over weirs and through orifices, pipe friction.

8. **Class/Laboratory schedule:** (number of sessions each week and duration of each session)

1 session per week, 120 minutes per session.

9. **Contribution of course to meeting the professional component:** (mathematics, basic science, engineering science, engineering design, or general education)

It satisfies the engineering science component required by Criteria 4..

10. **Relationship of course to program objectives:**

Provides students with hands-on laboratory experience.

11. **Person(s) who prepared this description and date of preparation:**

Name(s): Kenneth Y. Lee **Date:** 03-15-2000

Course Syllabus

1. **Department:** Civil and Environmental Engineering

2. **Course number and title:** 180:406 Construction Management (3 cr.)

3. **Course (catalog) description:**

Construction planning, scheduling, and control. Use of computer-based information systems for project management. Value engineering. Critical path method and PERT scheduling techniques. Computer drawn scheduling networks. Schedule compression. Resource allocation leveling and optimization. Project organization and financial control. Decision making.

4. **Prerequisite(s):** CE 305 Construction Engineering

5. **Text books and other required material:**
   CPM in Construction Management by J. O'Brien, McGraw- Hill
   Professional Construction Management by D.S.Barrie and B.C.Paulson, McGraw-Hill
   Journal of Construction Division, ASCE

6. **Course objectives:**
   To educate the students on the importance of time and cost management, ethical standards, professional integrity and construction practice. Both planning and progress management are emphasized.

7. **Topics covered:**
   Introduction
   Bar charts
   Network logic and development
   CPM – Basic computation
   Time-cost trade-off procedures
   Resource leveling and resource allocation
   Time and cost control
   Project evaluation and review techniques
   Aids for decision making
   Introduction to value engineering

   Computer usage using the latest programs and coding language is emphasized for each topic.

8. **Class/Laboratory schedule:** (number of sessions each week and duration of each session)

   Two lectures, 80 minutes each, per week for 14 weeks plus a final examination.

9. **Contribution of course to meeting the professional component:** (mathematics, basic science, engineering science, engineering design, or general education)
   Engineering science
   General education

10. **Relationship of course to program objectives:**
    The course is related to the first three objectives and the Program Criteria dealing with learning engineering and economic principles, time and cost management, construction practice, professional integrity and ethical responsibility.

11. **Person(s) who prepared this description and date of preparation:**

    Name(s): P. Balaguru **Date:** 3/24/06

Course Syllabus

1. **Department:** Civil and Environmental Engineering

2. **Course number and title:** 180:407 Construction Projects (3 cr.)

Course (catalog) description:
Application of skills and theories of construction engineering management to actual projects. Students are assigned to a project and work with managers to budget, schedule, and control operations. Topics include project staffing, cost control and documentation, safety and health and labor relations.

4. **Prerequisite(s):**
180:305, 180:406

5. **Text books and other required material:**
Daniel Halpin and Leland Riggs, Design of Construction and Process Operations, 2nd ed. John Wiley and Sons, 1993.

6. **Course objectives:**
To provide students with the opportunity to apply computer modeling techniques to actual construction projects. To provide an introduction to computer simulation as a technique for designing construction operations.

7. **Topics covered:**
   - Line of Balance
   - Queueing Systems
   - Work Sampling Methods
   - Process Modeling Concepts
   - Building Process Models
   - CYCLONE Functions
   - Mid Term Exam
   - Modeling Work Task Durations
   - Discrete Simulation
   - Life Cycle Costing
   - Project Control
   - Sensitivity Analysis

8. **Class/Laboratory schedule:** (number of sessions each week and duration of each session)
Two 1.5 hour sessions per week.
Additional time in the field observing construction

9. **Contribution of course to meeting the professional component:** (mathematics, basic science, engineering science, engineering design, or general education)
The course provides a contribution in both engineering design and science. In the course students learn how to design construction processes and operations in an optimum manner. The engineering science component consists of an introduction to the use of computer simulation as a problem-solving tool.

10. **Relationship of course to program objectives:**
The course provides exposure to some advanced construction management techniques for students contemplating a career in construction. It provides an introduction to computer simulation.

11. **Person(s) who prepared this description and date of preparation:**

Name(s): Trefor Williams **Date:** 4/4/00

Course Syllabus

1. **Department:** Civil and Environmental Engineering

2. **Course number and title:** 180:411 Reinforced Concrete (3 cr.)

3. **Course (catalog description):**
   Strength theories for the analysis and design of beams, slabs, columns, and floor systems in flexure, diagonal tension, torsion, serviceability, and load factors, including computer applications.

4. **Prerequisite (s):**
   14:180:318, 320

5. **Text books and other required material:**
   - Reinforced Concrete-A Fundamental Approach, by Edward G. Nawy, 4th. Edition, 2000, Publ. Prentice Hall.
   - Building Code Requirements for Structural Concrete (318-99) and Commentary (318R-99), Publ. American Concrete Institute.

6. **Course objectives:**
   This professional course is intended to acquaint the senior year civil engineering student with the fundamentals of design of concrete structures and the behavior of the structural members and the constituent materials so that the designed elements and system are durable with appropriate long-term serviceability performance.

7. **Topics covered:**
   a. Fundamentals of concrete behavior. The Compressive Stress Block
   b. Flexural design of singly-reinforced, doubly-reinforced and flanged beams.
   c. Shear and torsional behavior of concrete sections and design of web reinforcement.
   d. Design of non-slender reinforced concrete columns.
   e. Stability design of slender columns and first order analysis; second-order behavior.
   f. Computer use and programming for analysis of sections.
   g. Design of two-way slabs and plates by the Direct Design Method. Shear-Moment Transfer.
   h. Yield line theory for two-way action plates.

8. **Class/Laboratory schedule:** (number of sessions each week and duration of each session)
   The class meets twice a week. The duration of each session is 1 hr. 20 min.

9. **Contribution of course to meeting the professional component:** (mathematics, basic science, engineering science, engineering design, or general education)
   It meets the engineering design component of the curriculum as a pre-capstone fundamental course for professional engineering.

10. **Relationship of course to program objectives:**
    The objectives of the program is to prepare the graduating senior to handle engineering analysis and design problems in several areas of discipline, including the major area of structural engineering. The design of concrete structures is one such major area required of all civil engineering graduates.

11. **Person(s) who prepared this description and date of preparation:**
    Name(s): Dr. Edward G. Nawy **Date:** March 20, 2000

Course Syllabus

1. **Department:** Civil and Environmental Engineering

2. **Course number and title:** 180:413 Theory of Indeterminate Structures (3 cr.)

3. **Course (catalog) description:**

The force method for solving simple indeterminate structures. Classical methods of slope-deflection and moment distribution. Formulation and algorithms for matrix methods. Application of computers for analyzing indeterminate trusses and frames.

4. **Prerequisite(s):** CE 318 Elements of Structural Analysis

5. **Text books and other required material:**

West, H. H., *Fundamentals of Structural Analysis*, John Wiley & Sons, Inc., New York, N.Y., 1993.

Reference: Wilson, E. L. and Habibullah, A., *SAP90 - A Series of Computer Programs for the Finite Element Analysis of Structures,* Computers & Structures Inc., 1993.

Ghali, A. and Neville, A. M., *Structural Analysis - A Unified Classical and Matrix Approach,* Chapman and Hall, London, UK, 1988, 779 pp.

Sack, R. L., *Matrix Structural Analysis*, PWS-Kent, Boston, 1989, 329 pp.

Au, T. and Christiano, P., *Fundamentals of Structural Analysis*, Prentice Hall, Englewood Cliffs, NJ, 1993, 510 pp.

6. **Course objectives:**

1) To develop understanding of basic principles used in the analysis of indeterminate structures.
2)To develop understanding of mechanisms of functioning of indeterminate structures, and to those related advantages and disadvantages in comparison to statically determinate ones.
3) To teach methods that can be used in the analysis of indeterminate structures.
4)To teach fundamentals and application of computer based structural analysis programs in the analysis of indeterminate structures.

7. **Topics covered:**

1) Introduction. Basic concepts. Fundamental energy and work principles.
2) Statical determinacy and stability for planar and space structures.
3) General formulation for analysis of statically determined trusses/space framework
4) Influence lines.
5) Elastic deflections by complementary virtual work.
6) Elastic deflections by energy methods.
7) Static and kinematic indeterminacy.
8) Compatibility (force or flexibility) methods for statically indeterminate systems.
9) Equilibrium methods for statically indeterminate systems.
10) Member stiffness and flexibility matrices.
11) Stiffness method of analysis (matrix approach).
12) Introduction to SAP90-Plus structural analysis program.
13) Flexibility method of analysis (matrix approach).

8. Class/Laboratory schedule:

2 sessions of 1 hour and 20 minutes a week, for 15 weeks

9. Contribution of course to meeting the professional component: (mathematics, basic science, engineering science, engineering design, or general education)

The course has both the engineering science and engineering design components. The engineering science component is in teaching of basic principles and methods of analysis (algorithms) used for indeterminate structures. The engineering design component is in a discussion of advantages and disadvantages in the selection of indeterminate structures in the design process, application of structural analysis programs for design purposes (exploration of alternative solutions), and discussion of design capabilities of computer structural analysis programs.

10. Relationship of course to program objectives:

The course enables students to identify, formulate and analyze a broad range of structures, thus it is contributing to the versatility in several areas of civil engineering. The students are educated in the use of modern engineering analysis and design tools.

11. Person(s) who prepared this description and date of preparation:

Name(s): Nenad Gucunski **Date:** 8/28/1999

Course Syllabus

1. Department: Civil and Environmental Engineering

2. Course Number and Title: 180:421 Reinforced Concrete Lab (1 credit)

3. Course description:

Conventional and high-performance concrete mix design. The effect of mix design on the mechanical properties of concrete. Design, construction, and testing of a large-scale reinforced concrete structural component.

4. Co-requisite: 180:411 Reinforced Concrete

5. Text books and other required materials:

Reinforced Concrete Lab Manual by Stephen Kurtz, Rutgers Department of Civil and Environmental Engineering, 2000.

6. Course objectives:

To learn standard principles and procedures of concrete mix design. To learn the field test methods for fresh concrete. To learn the materials and methods of designing high-performance concrete mixes. To study the effects of mix design on the mechanical properties of plain concrete. To evaluate the accuracy of building codes and the assumptions of design methods by comparison with large-scale structural tests.

7. Topics covered:

1. Introduction
2. Mix design using the ACI procedure
3. The effect of water-cement ratio on mechanical properties in compression
4. The effect of water-cement ratio on concrete tensile strength
5. High-performance concrete mix design
6. Large-scale structural project

All topics are covered in groups of 3 or 4 students.

8. Class/laboratory schedule: (number of sessions each week and duration of each session)

One laboratory meeting of 3 hours. 11 weeks. No final exam.

9. Contribution of course to meeting the professional component:

Engineering Science
Engineering Design

10. Relationship of course to program objectives

To train students in experimental design. analysis and interpretation of data

11. Person(s) who prepared this description and date of preparation:

Name(s) Stephen Kurtz **Date:** April 12, 2000
Perumalsamy N. Balaguru

Course Syllabus

1. **Department:** Civil and Environmental Engineering

2. **Course number and title**: 14:180:426 Structural Design (4 cr.)

3. **Course (catalog) description:**

14:180:426. Structural Design lec. 3 hrs. lab. 3 hrs. prerequisits:14:180:318, 320, 411, 421.
Design of steel or concrete structures; prestressed concrete design of beams and slabs. Design project with working drawings for a bridge or high-rise building. Economic and ethical considerations. A comprehensive report.

Prerequisite(s):

CE318 Elements of Structures, CE 320 Elements of Structural Design, CE 411, 421 Reinforced Concrete, and Reinforced Concrete Laboratory.

Text books and other required material:

" Prestressed Concrete", by E. G. Nawy, Prentice Hall, Third Edition, 1999.

Course objectives:

The objective of this course is to give the student an in-depth understanding of the design and analysis process as performed in a practical manner and advise the students in completing a group design project.

Topics covered:

Theory and analysis of prestressed concrete members by various methods of prestresing; design of simple beams and slabs; prestressed concrete bridge design using LRFD-AASHTO specifications.

8. **Class/Laboratory schedule:** (number of sessions each week and duration of each session)

   3 Hrs. lec. and 3 Hrs. Lab.

9. **Contribution of course to meeting the professional component:** (mathematics, basic science, engineering science, engineering design, or general education)

   It satisfies the engineering design component required by Criteria 4.

10. **Relationship of course to program objectives:**

This course represents the senior design project in the structures area. It is a culmination of the student knowledge in analysis and design.

11. **Person(s) who prepared this description and date of preparation:**

    Name(s): Hani H. Nassif **Date:** 3/25/00

Course Syllabus

1. **Department:** Civil and Environmental Engineering

2. **Course number and title:** 180:430 Water and Wastewater Engineering (3 cr.)

3. **Course (catalog) description: (new course effective with Class of 2002)**

Design principles for various water and wastewater engineering systems including water supply and distribution, wastewater collection and disposal, water treatment, and wastewater treatment. Design practice.

4. **Prerequisite(s):**

14:180:331 Elem of Environ. Engg;, 387 Fluid Mechanics , 389 Fluid Mech. Lab..

5. **Text books and other required material:**

Water Supply and Sewage, by Terence J. McGhee, McGraw-Hill, Inc., 1991.

Wastewater Engineering: Collection and Pumping of Wastewater by Metcalf & Eddy, Inc., McGraw-Hill, Inc., 1981.

Wastewater Engineering: Treatment, Disposal, and Reuse, McGraw-Hill, Inc., 1991.

6. **Course objectives:**

There is a need for one or more courses between 180:331 Elements of Environmental Engineering and 180:431 Design of Environmental Engineering Facilities. 180:331 gives an overview of different aspects of the environmental engineering field, such as, water quality, air pollution, and solid and hazardous wastes. 180:431 is for a comprehensive design of a chosen environmental facility, which varies from student to student. To prepare the students for a comprehensive design in 180:431, an in-depth course on a certain area of the environmental area should be taken beforehand. The proposed course Water and Wastewater Engineering is to serve such a purpose.

7. **Topics covered:**

Quantity of Water and Sewage
Sources of Water (Reservoirs and Aquifers)
Water Transmission
Quality of Water Supplies
Water Purification
Distribution of Water (Pipe Networks)
Stormwater
Sanitary and Combined Sewers
Storm Sewers
Characteristics of Wastewater
Wastewater Treatment
Sewage Disposal
Receiving Water Quality
Innovative Water and Wastewater Treatment Techniques

8. Class/Laboratory schedule: (number of sessions each week and duration of each session)

Two lecture sessions each week, 1 hour and 20 minutes per session.

9. Contribution of course to meeting the professional component: (mathematics, basic science, engineering science, engineering design, or general education)

Engineering science, engineering design

10. Relationship of course to program objectives:

This course is offered primarily to accomplish the objective of ensuring that the graduates are well versed in several areas of civil engineering. This course is a core course in the water resources and environmental engineering area.

11. Person(s) who prepared this description and date of preparation:

Name(s): Qizhong Guo **Date:** April 24, 2000

Course Syllabus

1. **Department:** Civil and Environmental Engineering

2. **Course number and title:** 180:431 Design of Environmental Engineering Facilities (4 cr.)

3. **Course (catalog) description:**

Analysis and design considerations for environmental engineering facilities such as water supply and wastewater treatment plants; physical engineering management of solid and hazardous waste; resource recovery; economic and ethical considerations. A comprehensive report.

4. **Prerequisite(s):**

CE:331 Elements of Environmental Engineering, CE 387 Fluid Mechanics, CE 389 Fluid Mechanics Laboratory.

5. **Text books and other required material:**

Wastewater Engineering: Collection and Pumping of Wastewater by Metcalf & Eddy, Inc., McGraw-Hill, Inc., 1981.

Wastewater Engineering: Treatment, Disposal, and Reuse, McGraw-Hill, Inc., 1991.

Stormwater and Nonpoint Source Pollution Best Management Practices Manual, NJDEP, 1994.

Rules and Regulations Governing Treatment Works Approvals, Sewer Bans, etc., NJDEP, 1994

6. **Course objectives:**

Provide students with an opportunity for a comprehensive engineering design experience. Enhance students' ability in putting civil engineering fundamentals into practical applications. Enhance students' skills in evaluating alternatives with due considerations of costs and environmental constraints.

7. **Topics covered:**

Surface Water Quality and Watershed Approach: Biochemical Oxygen Demand (BOD) and Dissolved Oxygen (DO). Pathogens. Nutrients and Eutrophication. Toxic Substances.

Design of Sanitary Sewer Systems: Hydraulic Computation. Estimation of Peak Flow. Infiltration/Inflow. Pump Hydraulics. Performance Characteristics of Pumps. Selection of Pumps. Pumping Stations.

Design of Wastewater Treatment Systems: Wastewater Characteristics. Grit Removal. Primary Sedimentation. Activated Sludge Reactors, Aerators, and Secondary Clarifiers. Trickling Filters. Ponds and Lagoons. Disinfection of Effluent. Advanced Treatment Methods. Sludge Treatment and Disposal.

Design of Best Management Practices for Nonpoint Source Pollution Control

8. **Class/Laboratory schedule:** (number of sessions each week and duration of each session)

Two lecture sessions each week, 1 hour and 20 minutes each session. Two lab sessions each week, one hour each session.

9. Contribution of course to meeting the professional component: (mathematics, basic science, engineering science, engineering design, or general education)

It satisfies the engineering design component required by Criteria 4.

10. Relationship of course to program objectives:

This course is offered primarily to accomplish the objective of providing students with a major design experience.

11. Person(s) who prepared this description and date of preparation:

Name(s): Qizhong Guo **Date:** April 7, 2000

Course Syllabus

1. **Department:** Civil and Environmental Engineering

2. **Course number and title:** 180:437 Transportation Engineering (3 credits).

3. **Course (catalog) description:**

Principles of transportation engineering with applications to various modes; planning, selection, formulation Economic, environmental, and political constraints; land use studies; applications; administration of transportation systems; term project to include proposal and analysis to meet a specific transportation requirement

4. **Prerequisite(s):**

None

5. **Text books and other required material:**

Transportation Engineering and Planning" by C.S. Papacostas and P.D.Prevedouros, Prentice Hall, 1993
Class Notes prepared by the Instructor

6. **Course objectives:**

The goal of this course is to provide the student with some of the tools and methods to understand, analyze, plan, operate, and control complex transportation systems. In order to achieve this goal, different transportation systems or components of these systems will be studied using available transportation modeling techniques.

7. **Topics covered:**

Introduction: Transportation as a System
Vehicle Motion & Geometric Design
Pavement Design
Vehicular Flow Models
Urban Mass Transit
Traffic Signal Analysis and Design + SYNCHRO
Highway Capacity Analysis +HCS
Transportation System Planning
Intelligent Transportation Systems
Air Quality, Noise and Energy Impacts

8. **Class/Laboratory schedule:** (number of sessions each week and duration of each session)

2 Sessions per week – 80 minutes each

9. **Contribution of course to meeting the professional component:** (mathematics, basic science, engineering science, engineering design, or general education)

The course satisfies the engineering science and engineering design components required by Criteria 4.

10. Relationship of course to program objectives:

The course enables the students to identify, formulate and analyze a broad range of problems in transportation engineering. The students are trained in the use of modern engineering tools and techniques.

11. Person(s) who prepared this description and date of preparation:

Name(s): Kaan Ozbay **Date:** April 7, 2000

Course Syllabus

Department: Civil and Environmental Engineering

2. Course number and title: 180:438 Transportation Engineering II (4 credits).

3. Course (catalog) description:

Studies in the design of transportation facilities, with emphasis on streets, highways, airports. Earthworks, construction, pavement and roadway design based on economic, stability, and durability considerations, and interface with the environment.

4. Prerequisite(s):

14:180:437 Transportation Engineering I

5. Text books and other required material:

Traffic Engineering by W. R. McShane, R. P. Roess, and E. S. Prassas, Second Edition, Prentice Hall
Transportation Engineering and Planning by C.S. Papacostas and P.D.Prevedouros, Prentice Hall, 1993
Class Notes prepared by the Instructor
Software Manuals for INTERGRATION, HCS, QRS 2

6. Course objectives:

The goal of this course is to provide the student with state-of-the art tools and methods to understand, analyze, plan, operate, and control complex transportation systems. In order to achieve this goal, widely used transportation planning and management techniques and transportation related software packages will be studied. Students will be introduced to the latest transportation planning, operations, and management methods adopted by the transportation professionals. The material thought in class will be supplemented by real-world examples and assignments, which might require the use of computer software provided by the instructor.

7. Topics covered:

Introduction & Emerging Issues
Traffic Studies (Data Collection & Analysis)
Transportation System Analysis, Planning, Evaluation and QRS II
(Traffic Impact Studies and Economic Analysis)
QRS II
Capacity Analysis and Highway Capacity Software (HCS)

Transportation System Simulation and Simulation Software
Packages - INTEGRATION
Traffic Control and Management
Intersection Signalization Applications and SYNCHRO Signal
Design Software

8. Class/Laboratory schedule: (number of sessions each week and duration of each session)

2 Sessions per week – 80 minutes each
Lab 3 hours (computer lab)

9. Contribution of course to meeting the professional component: (mathematics, basic science, engineering science, engineering design, or general education)

It satisfies the engineering design component required by Criteria 4.

10. Relationship of course to program objectives:

The course represents the senior design project in the transportation area to prepare the students for solving the real-world problems and system design in the transportation field.

11. Person(s) who prepared this description and date of preparation:

Name(s): Kaan Ozbay **Date:** April 7, 2000

Course Syllabus

1. **Department:** Civil and Environmental Engineering

2. **Course number and title:** 180:473 Foundation Engineering (3 cr.)

3. **Course (catalog) description:**

Subsurface exploration; bearing capacity, settlement, and design of shallow foundations; design of rigid and flexible retaining structures; bearing capacity, settlement, and design of deep foundations.

4. **Prerequisite(s):**

180:372 Soil Mechanics
180:374 Soil Mechanics Laboratory

5. **Text books and other required material:**

Das, B.J. (1998) *Principles of Foundation Engineering,* Fourth Ed., PWS-Kent Pub. Co.

6. **Course objectives:**

This course is designed to provide the student with the basic tools and experience for analysis and design of foundations.

7. **Topics covered:**

Review of soil mechanics
Subsurface exploration
Analysis and design of shallow foundations (footings and mat)
Lateral earth pressures
Analysis and design of earth retaining structures (rigid and flexible)
Braced cuts
Analysis and design of deep foundations (pile and drilled shaft)

8. **Class/Laboratory schedule:** (number of sessions each week and duration of each session)

Two hour lectures and one three-hour lab. per week

9. **Contribution of course to meeting the professional component:** (mathematics, basic science, engineering science, engineering design, or general education)

This course satisfies the engineering design component as required by Criteria 4

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10. **Relationship of course to program objectives:**

This course meets the program objective of providing students with basic tools and techniques necessary for analyzing and solving engineering problems, and design experience to prepare for real world practice.

11. **Person(s) who prepared this description and date of preparation:**

Name(s): M.H. Maher **Date:** 4/1/00

Course Syllabus

1. **Department:** Civil and Environmental Engineering

2. **Course number and title:** 180:474 Geotechnical Engineering Design (4 cr.)

3. **Course (catalog) description:**
   Subsurface investigation; construction dewatering; design concepts and procedures for shallow and deep foundations; application of numerical methods; safety and economy, a comprehensive report.

4. **Prerequisite(s):**

   CE 372 Soil Mechanics
   CE 473 Foundation Engineering

5. **Text books and other required material:**
   No textbooks required.
   References: Das, B.J. (1998) *Principles of Foundation Engineering,* PWS-Kent Pub. Co.
   Bowles, J.E. (1996) *Foundation Analysis and Design,* McGraw-Hill, Inc.

6. **Course objectives:**
   This course is designed to provide the senior students with a design experience of a major geotechnical and foundation project involving team work , alternate solutions, and decision making, and incorporating engineering standards and realistic constraints that include economic, environmental, ethical, safety, and social considerations.

7. **Topics covered:**
   Project assignment
   Subsurface investigation
   Construction dewatering
   Analysis and design of foundations of different kinds
   Comparison of different foundation types
   Consideration of realistic constraints
   Cost analysis
   Final recommendation

Submission of a final report, and an oral presentation required.

8. **Class/Laboratory schedule:** (number of sessions each week and duration of each session)

   A two- hour lectures, a three-hour design laboratory, and one-hour discussion per week.

9. **Contribution of course to meeting the professional component:** (mathematics, basic science, engineering science, engineering design, or general education)
   Engineering design.

10. **Relationship of course to program objectives:**
    The course prepares the students for engineering practice in design. The course meets all of the program objectives and many of the program outcomes including the specific ABET civil engineering program criteria.

11. **Person(s) who prepared this description and date of preparation:**
    Name(s): M.H. Maher **Date:** 4/1/00

Course Syllabus

1. **Department:** Civil and Environmental Engineering

2. **Course number and title:** 180:482 Professional Issues in Civil Engineering (1 cr.)

3. **Course (catalog) description:**

Principles of design of civil engineering projects from the view point of the whole; interaction between individual parts (subsystems) and the effect of each on the overall system; overview of design process, quality of design, risk and liability, ethics, and economic considerations; report writing.

4. **Prerequisite(s):**

Completion of all required courses through fall term of senior year.

5. **Text books and other required material:**
   Book:
   Reference: *Journal of Professional Issues in Civil Engineering*

6. **Course objectives:**

To educate the students on the importance of personal and professional integrity and ethical responsibility in the practice of civil engineering, and other professional practice issues such as team work, economic considerations, and effective communication.

7. **Topics covered:**

Different disciplines of civil engineering
Opportunity and responsibilities
Risk and liability considerations
Ethics in civil engineering practice
Impact of civil engineering

Guest lectures by practicing engineers from industry and government agencies.

8. **Class/Laboratory schedule:** (number of sessions each week and duration of each session)

One lecture, 55 minutes, per week for 14 weeks, and a final exam or term paper.

9. **Contribution of course to meeting the professional component:** (mathematics, basic science, engineering science, engineering design, or general education)
   Engineering design
   General education

10. **Relationship of course to program objectives:**

This course is related to four of the five prescribed objectives and the program outcomes (6) through (9).

11. **Person(s) who prepared this description and date of preparation:**

Name(s): P.N.Balaguru **Date:** March 24, 2006

Course Syllabus

1. **Department:** Civil and Environmental Engineering

2. **Course number and title:** CE 491/492 Special Problems in Civil Engineering (Fall/Spring-Credit by arrangement)

3. **Course (catalog) description:**

Individual investigation of a topic in a branch of civil engineering of particular interest to the student.

4. **Prerequisite(s):**

Senior standing
GPA of 2.8 or better
Approval of a supervising professor

5. **Text books and other required material:**

As assigned by the supervising professor

6. **Course objectives:**

The course is designed to give the seniors a research experience and/or independent study in civil engineering.

7. **Topics covered:**

Vary – as assigned by supervising professor.

8. **Class/Laboratory schedule:** (number of sessions each week and duration of each session)

Vary – as arranged with supervising professor.

9. **Contribution of course to meeting the professional component:** (mathematics, basic science, engineering science, engineering design, or general education)

Engineering science and/or design

10. **Relationship of course to program objectives:**

Depending on the special problem topic, it satisfies a number of the prescribed program objectives and outcomes.

11. **Person(s) who prepared this description and date of preparation:**

Name(s): Husam Najm **Date:** 4/1/06

Course Syllabus

1. **Department:** Civil and Environmental Engineering

2. **Course number and title:** CE 493/494 Special Problems in Environmental Engineering (Fall/Spring-Credit by arrangement)

3. **Course (catalog) description:**

Individual investigation of a topic in a branch of environmental engineering of particular interest to the student.

4. **Prerequisite(s):**

Senior standing
GPA of 2.8 or better
Approval of a supervising professor

5. **Text books and other required material:**

As assigned by the supervising professor

6. **Course objectives:**

The course is designed to give the seniors a research experience and/or independent study in water resources and environmental engineering.

7. **Topics covered:**

Vary – as assigned by supervising professor.

8. **Class/Laboratory schedule:** (number of sessions each week and duration of each session)

Vary – as arranged with supervising professor.

9. **Contribution of course to meeting the professional component:** (mathematics, basic science, engineering science, engineering design, or general education)

Engineering science and/or design

10. **Relationship of course to program objectives:**

Depending on the special problem topic, it satisfies a number of the prescribed program objectives and outcomes.

11. **Person(s) who prepared this description and date of preparation:**

Name(s): Husam Najm **Date:** 4/1/06

Course Syllabus

School of Engineering

General Engineering

SCHOOL OF ENGINEERING
14:440:100 ENGINEERING ORIENTATION LECTURES
FALL 1999

Catalog Data: 14:440:100. Engineering Orientation Lectures (1credit). A brief overview of each of the specific fields of engineering offered as degree programs at the college. Describes the major fields of study, as well as the engineering profession in general. Graded on a Pass/No Credit basis.

Prerequisites: None.

Textbook: None.

Additional Materials:

INFOWEB and other online services provided by the Rutgers University Library. Hand-outs provided by presenters representing each engineering discipline.

Objectives: The lectures are designed to provide general knowledge of the activities of professional engineers in each of the fields represented by departmental instruction and research at Rutgers University. This is perhaps the best way to gather information that will serve as the basis for the declaration of major prior to beginning the second year of the program. Professors involved in this course may also be viewed as a resource outside the bounds of this course for more information or advice about their specific engineering disciplines.

The course is also a vehicle for communication between new college professional students and their faculty. The monthly reports particularly provide a personal avenue to ask questions, express opinions, and receive advice and assistance for this challenging engineering curriculum.

Schedule: One lecture (80 minutes) for 9 weeks and one library session (1credit).

Requirements: Each first-year student must register for and complete the Engineering Orientation Lecture series. The course is graded on attendance, using the following guidelines:

Personal Monthly Reports	3 submissions required
Dean's Overview Lecture	Attendance required
Other Departmental Lectures	Must attend any 6 of the 8 offered
Library Assignment	Completion required

Lectures Over the course of 9 weeks following the opening Dean's Lecture, students in 4 different sections will be presented 80 minute lectures by the following programs: Biomedical Engineering, Bioresource Engineering, Ceramic Engineering, Chemical Engineering, Civil Engineering, Electrical&Computer Engineering, Industrial Engineering, and Mechanical Engineering.

Contribution of course to meeting the professional component: 1 credit general education.

SCHOOL OF ENGINEERING

14:440:127 INTRODUCTION TO COMPUTERS FOR ENGINEERS

SPRING 2000

Catalog Data: 14:440:127. Introduction to Computers for Engineers (3 credits). Use of higher level languages such as FORTRAN 90 to solve engineering related problems. Emphasis on problem solving skills and mathematical tools of importance in engineering.

Prerequisites: One year of computer programming in high school or 14:440:125 or equivalent.

Textbook: Chapman, Stephen J., *Fortran 90-95 for Scientists and Engineers,* McGraw Hill (1999). Includes Lahey Fortran 90 Editor and Compiler.

Additional Materials:

Intro to Computing Website: http://www.rci.rutgers.edu/~fortweb
Primary source of information regarding the course, including syllabus, Assignments, and other general information.

Objectives: To have first year engineering students develop some facility in programming in a high level language, such as Fortran 90, to provide a foundation for other programming courses or for application in other courses in their chosen engineering disciplines. Also, as one of the first courses in engineering along with Engineering Mechanics (14:440:221), to develop problem-solving skills which can be used and enhanced throughout the curriculum.

Schedule: One lecture (80 minutes) and one recitation (80 minutes) per week (3 credits)

Topics:

WEEK 1 Lahey Fortran 90 and the Windows PC environment, Sunsoft Fortran 90 and the Eden Unix/Emacs environment.

WEEK 2 Basic elements of Fortran 90: Statement structure, variables and constants, assignment statements.

WEEK 3 Control structures, algorithms and program design.

WEEK 4 Input, output, and formatting.

WEEK 5 Arrays

WEEK 6 Subprograms

WEEK 7 Advanced topics: DO exit and cycle, array as object, dynamic data structures and Pointers.

WEEK 8 Pointers

WEEK 9 Midterm Exam

WEEK 10 Error analysis and data reduction.

WEEK 11 Numerical integration

14:440:127 (continued)

WEEK 12 Curve fitting I

WEEK 13 Curve fitting II

WEEK 14 Roots of equations

Contribution of course to meeting the professional component: 1 credit engineering topics, 2 credits math/basic science (computer science).

14:440:221 ENGINEERING MECHANICS: STATICS (3 CREDITS)

CATALOG DESCRIPTION

The classification of systems of forces and their resultants; geometrical and analytical conditions for the equilibrium of force systems; frames and trusses; friction; centers of gravity.

PREREQUISITES

01:640:151, 01:750:123

TEXTBOOK

Engineering Mechanics: Statics, second edition, by A. Bedford and W. Fowler, Addison Wesley, 1999.

COORDINATOR

Mitsunori Denda, Associate Professor of MAE

COURSE OBJECTIVES

This is the first course where students are expected to apply engineering science concepts to engineering problems. The objective is to present students with basic skills for 2-D and 3-D vectors and concept of force, moment and equilibrium. Emphasis is placed on the development of visualization, analytical and independent thinking skills through problem solving. To introduce students to engineering design by examples of trusses, frames, machines and beams.

TOPICS COVERED

Vectors in 2-D and 3-D, vector products, free body diagrams, 2-D and 3-D force systems, moments, moment vector, moment about a line, couples, equivalent systems, 2-D and 3-D equilibrium, 2-D trusses, frame and machines, centroids for areas, lines and volumes, distributed loads, moments of inertia, beams.

TOPICS

Vectors: 2-D, Vectors, 3-D, Products
F-B D. and Force Systems
Moment Vector
Couples
Equivalent Systems
2-D Equilibrium
3-D Equilibrium
Trusses
Frames and Machines
Centroids, Composite Areas
Distributed Loads, Volumes & lines
Area, Moments of Inertia
Beams

CLASS SCHEDULE

Fourteen weeks, two lectures and one recitation, each 55 minutes long.

CONTRIBUTION TO PROGRAM OBJECTIVES

This course provides students with basic knowledge and tools in mechanics and with problem solving skills. It gives students an ability to formulate and solve elementary engineering problems, in preparation for more advanced applications in the engineering program. The knowledge and skills acquired will form the basis for students to perform competent and independent study in all fields of engineering.

14:440:222 ENGINEERING MECHANICS – DYNAMICS (3 CREDITS)

CATALOG DESCRIPTION

Kinematics of particles and rigid bodies; rectangular, path, and polar descriptions. Relative motion. Kinetics of particles, particle systems, and rigid bodies; equations of motion, principles of work and energy, linear and angular impulse and momentum. Impact.

PREREQUISITES

14:440:221, 01:640:152, 01:750:124

COREQUISITE

01:640:251

TEXTBOOK

Engineering Mechanics Vol. 2 - Dynamics, Fourth Edition, by J.L. Meriam and L.G. Kraige, Wiley, 1997.

COORDINATOR

William J. Bottega, Associate Professor of MAE

COURSE OBJECTIVES

To provide students with a basic understanding of forces and motion, and thus to give students a fundamental understanding and background in introductory (planar) dynamics at the second year university level. To provide the requisite background for further study at the junior and senior level in the MAE curriculum, as well as to prepare students for further study in the subject area. To provide students in other engineering curricula with a background in this fundamental engineering science.

TOPICS COVERED

Kinematics of a Particle: Cartesian Reference Frame
Path Coordinates
Polar Coordinates, Relative Motion
Constrained Relative Motion
Kinetics of a Particle: Newton's Laws of Motion
Work and Energy
Impulse and Momentum
Impact
Dynamics of Particle Systems: Equations of Motion, Linear Impulse-Momentum
Work and Energy, Angular Impulse-Momentum
Kinematics of Rigid Bodies: Plane Motion, Relative Velocity
Instantaneous Center, Relative Acceleration
Mass Measures for Continuous Systems
Rigid Body Kinetics: Angular Momentum, Equations of Motion
Work and Energy
Impulse and Momentum
Free Vibrations of Undamped 1-DOF Systems.

CLASS SCHEDULE

Two 55 minute lectures and one 55 minute recitation per week for 14 weeks.

CONTRIBUTION TO PROGRAM OBJECTIVES

The material covered provides the requisite background in the subject area required of students in several engineering disciplines. Students learn to apply the material from first year calculus, statics and physics to more applied engineering problems. In addition, it provides the foundations for further study and prerequisites for more advanced courses within the engineering program.

Course Syllabus

1. Department: Industrial Engineering

2. Course Number and Title: 14:540:343 Engineering Economics (3 credits)

3. Course (catalog) description:

Economic decisions involving engineering alternatives; annual cost, present worth, rate of return, and benefit-to-cost; before and after tax replacement economy; organizational financing; break-even charts; unit and minimum-cost public sector studies.

4. Prerequisites

5. Textbook and other required material

W.G. Sullivan, J.A. Bontadelli, E.M. Wicks, *Engineering Economy, 11th ed.*, Prentice Hall, 2000.

6. Course objectives

This course introduces the students to the economics of design, single variable tradeoff analysis, fundamental cost concepts and present economy studies. It is intended that students will use the principles of engineering economy to develop good alternatives and focus on differences. Other objectives include a student understanding of equivalence and determining unknown quantities, obtaining the estimates for making an engineering economic analysis, comparison of mutually exclusive alternatives, using "good" data and correct measures of profitability, breakeven analysis and sensitivity analysis, and depreciation and taxes.

7. Topics covered

Week	Topics
1	Introduction and Basic Principles. Economics of Engineering Design
2	Cost Concepts, Single Variable Tradeoff Analysis
3	Present Economy Studies
4	Money-Time Relationships
5	Developing Cash Flows/Cost Estimating.
6	Developing Cash Flows/Cost Estimating (cont'd)
7	Applications of Money-Time Relationships
8	Comparing Alternatives
9	Comparing Alternatives (cont'd)
10	Dealing With Uncertainty
11	Depreciation and Income Taxes
12	Evaluating Projects with the Benefit/Cost Ratio Method
13	Class Presentations of Interdisclipinary Team Projects
11	Class Presentations of Interdisclipinary Team Projects

PROJECTS

The design economics project is an interdisciplinary group project that involves the application of engineering economy principles. Students will work on the project in groups of three to five members. A

project progress report is submitted within a month after the semester has started. A project presentation is made in class and a final written report is submitted at the end of the semester. Many of the projects involve on-site studies.

8. Class/Laboratory schedule

Lectures: 2 times a week (80 min. long each)

9. Contribution of course to meeting the professional component

General education

10. Relationship of course to the program objectives

The course meets the program outcomes (1), (3), and (9)

11. Person who prepared this description and date of preparation

Name: James Luxhoj **Date:** 4/1/00

Course Syllabus

Faculty of Arts and Sciences

Chemistry

Mathematics

Physics

Economics

English

DEPARTMENT OF CHEMISTRY
01:160:159-160 GENERAL CHEMISTRY FOR ENGINEERS
FALL 1999 – SPRING 2000

Catalog Data: 01:160:159-160. General Chemistry for Engineers (3,3 credits). Introduction to chemical principles and their application. Includes stoichiometry, states of matter, atomic and molecular structure, solutions, thermodynamics, equilibrium, oxidation-reduction, kinetics, nonmetals, metals and coordination compounds, and nuclear chemistry.

Prerequisites: Intermediate Algebra, 01:640:026. Corequisite: Introduction to Experimentation, 01:160:171.

Textbook: Hill, J.W. and R. Petrucci, *General Chemistry, An Integrated Approach,* 2nd edition (1999), Prentice-Hall.

Objectives: To provide a thorough introduction to the basic principles of chemistry to engineering students in order to prepare them for further study in chemistry and to support their understanding and design of practical applications in their fields.

Schedule: Two lectures (55 minutes) and one recitation (55 minutes) per week (3 credits).

Topics: **FALL 1999, 01:160:159**

WEEK 1 Introduction, scientific measurements, precision and accuracy. Laws of chemical combination; Dalton and the Atomic Theory of Matter; atomic masses, Periodic Table; molecules and molecular compounds, ions and ionic compounds; acids, bases, and salts.

WEEK 2 Molecular masses and formula masses; the mole and Avogadro's Number; mass percent composition and chemical formulas; elemental analysis; writing and balancing chemical equations.

WEEK 3 Stoichiometric equivalence and reaction stoichiometry; limiting reactants; yields of chemical reactions; solutions and solution stoichiometry. Aqueous solutions, electrical properties, acid-base reactions, reactions that form precipitates.

WEEK 4 Oxidation-reduction, oxidizing and reducing agents, applications. Gases, Kinetic-Molecular Theory, gas pressure, Boyle's Law, Charles's Law.

WEEK 5 Avogodro's Law, Combined Gas Law, Ideal Gas Law, gases in reaction stoichiometry, gas mixtures, Dalton's Law, real gases.

WEEK 6 First exam. Thermochemistry, internal energy, state functions, First Law of Thermodynamics, heats of reaction, enthalpy change.

WEEK 7 Calorimetry, Hess's Law, standard enthalpies of formation, combustion and respiration.

WEEK 8 Protons and neutrons, positive ions and mass spectrometry, the wave nature of light, photons, Bohr's hydrogen atom, wave mechanics, quantum numbers and atomic orbitals.

WEEK 9	Electron configurations: The Aufbau Principle, periodic relationships, magnetic properties.
WEEK 10	Periodic atomic properties of the elements; metals, nonmetals, metalloids, and noble gases. Chemical bonds, The Lewis Theory of Chemical Bonding.
WEEK 11	Second exam. Ionic bonds and ionic crystals; Lewis Structures; polar covalent bonds and electronegativity.
WEEK 12	Bond lengths and bond energies; alkenes and alkynes. Bonding theory and molecular structure: VSEPR Method; polar molecules and dipole moments; atomic orbital overlap.
WEEK 13	Hybridization of atomic orbitals; hybrid orbitals and multiple covalent bonds; characteristics of molecular orbitals.
WEEK 14	Homonuclear diatomic molecules of the second-period elements; bonding in benzene, aromatic compounds.

Topics: **SPRING 2000, 01: 160:160**

WEEK 1	States of matter and intermolecular forces: vaporization and vapor pressure; phase changes involving solids; phase diagrams; van der Waals forces; hydrogen bonds; inter molecular forces and two liquid properties; network covalent solids; ionic bonds as “intermolecular forces”.
WEEK 2	Structure of crystals. Physical properties of solutions: types, concentration, energetics of formation, equilibrium, solubilities of gases, vapor pressure, freezing point depression and boiling point elevation.
WEEK 3	Osmotic pressure, electrolytes, colloids. Chemical kinetics: reaction rates, measuring reaction rates, The Rate Law, first-order reactions, ractions of other orders.
WEEK 4	Theories of chemical kinetics, temperature effects, reaction mechanisms, catalysis, enzyme catalysis. Chemical equilibrium; dynamic nature, equilibrium constant, modifying equilibrium constant expressions.
WEEK 5	Le Chatelier’s Principle. Intro to Acid-Base Equilibria: The Bronsted-Lowry Theory; molecular structure and strength. First exam.
WEEK 6	Acid-Base Equilibria (continued): self-ionization of water, pH, equilibrium in solutions of weak acids and weak bases, polyprotic acids, ions as acids and bases, The Common Ion Effect.
WEEK 7	Buffer solutions, acid-base indicators, neutralization reactions and titration curves, Lewis Acids and Bases. The solubility product constant, relationship with molar solubility; The Common Ion Effect in solubility equilibria.

01:160:159-160 (continued)

WEEK 8	Precipitation, effect of pH on solubility, complex ions, qualitative inorganic analysis. Introduction to Thermodynamics, spontaneous change.
WEEK 9	Entropy, free energy, standard free energy change, equilibrium, effect of temperature.
WEEK 10	Electrochemistry: half-reactions, redox equations, voltaic cells. Second exam.
WEEK 11	Standard electrode potentials; electrode potentials, spontaneous change, and equilibrium; effect of concentrations on cell voltage; batteries; corrosion; electrolysis reactions, applications.
WEEK 12	Nuclear chemistry: radioactivity and nuclear equations, radioactivedecay rates, synthetic nuclides.
WEEK 13	Transuranium elements, nuclear stability, energetics of nuclear reactions.
WEEK 14	Nuclear fission and fusion, effect of radiation on matter, applications of radioactive nuclides.

Contribution of course to meeting the professional component: 3 credits basic science per semester (total of 6 credits basic science).

DEPARTMENT OF CHEMISTRY
01:160:171 INTRODUCTION TO EXPERIMENTATION
FALL 1999 or SPRING 2000

Catalog Data: 01:160:171. Introduction to Experimentation (1 credit). Laboratory illustrating basic chemical methods.

Prerequisites: General Chemistry for Engineers, 01:160:159, is a pre- or corequisite.

Textbook: Hill, J.W. and R. Petrucci, *General Chemistry, An Integrated Approach,* 2nd edition (1999), Prentice-Hall.

Objectives: To provide a hands-on experience to support the learning of basic chemical principles and to learn and develop good experimental techniques for use throughout the curriculum.

Schedule: One three-hour session per week for 14 weeks (1 credit).

Experiments:

WEEK 1	Skills test, safety rules, significant digits.
WEEK 2	Safety quiz. Check-in.
WEEK 3	Determination of the Density of a Solid.
WEEK 4	Empirical Formula of Copper Chloride.
WEEK 5	Writing Chemical Equations and Identifying Unknown Solutions Using Microscale Techniques.
WEEK 6	Separation and Identification of a Ternary Mixture, Part I.
WEEK 7	Separation and Identification of a Ternary Mixture, Part II.
WEEK 8	Determining Molar Volume of Carbon Dioxide.
WEEK 9	Reactivity of Metals With Hydrochloric Acid.
WEEK 10	Standardization of NaOH Solution and Determination of Concentration of HCl Solution by Titration Against the Standard NaOH Solution.
WEEK 11	Evaluations of Commercial Antacids.
WEEK 12	Enthalpy of Formation of Ammonium Salts.
WEEK 13	Chemical Kinetics: Methylene Glycol Clock Reaction.
WEEK 14	Check out. Final exam.

Contribution of course to meeting the professional component: 1 credit basic science.

DEPARTMENT OF MATHEMATICS
01:640:151 CALCULUS FOR MATHEMATICAL AND PHYSICAL SCIENCES
FALL 1999

Catalog Data: 01:640:151. Calculus For Mathematical and Physical Sciences (4 credits). For mathematics, physics, computer science, statistics, chemistry, or engineering majors. Analytic geometry, differential calculus, applications, introduction to integral calculus.

Prerequisites: Precalculus, 01:640:112 or 115.

Textbook: Stewart, James, *Calculus (Early Transcendentals)*, 4th ed. (1999), Brooks/Cole Publishing Co.

Calculator: A graphing calculator is required for this course. A TI-82 is recommended, but any equivalent calculator, such as the TI-83, 85, or 86, may be used. Calculators may be required for use on certain exams. Therefore, calculators or portable computers with a QWERTY keyboard or with symbolic manipulation abilities (such as the TI-89 or 92) should be avoided, as they are not permitted on exams.

Objectives: To introduce students in mathematics, sciences, and engineering to fundamental principles of calculus in order to prepare them for further study in mathematics and for applications in their disciplines.

Schedule: Two lectures (80 minutes) and one recitation (55 minutes) per week (4 credit hrs)

Topics:

WEEK 1 Review of real numbers, absolute value, inequalities, lines, functions, exponential and trig functions. Inverse functions, logs and inverse trig functions.

WEEK 2 Tangents and velocity, limits; limit laws and definition of a limit.

WEEK 3 Continuity, intermediate value theorem, infinity, asymptotes.

WEEK 4 Rates of change, derivatives, differential formulas, derivatives of exponential functions.

WEEK 5 Rates of change, derivatives of trig functions; the chain rule, implicit differentiation.

WEEK 6 First exam. Derivatives of logs and inverse trig functions, higher derivatives.

WEEK 7 Related rates, linear approximation, Newton's Method.

WEEK 8 L'H\^opital's Rule; max and min, the Mean Value Theorem.

WEEK 9 f'(x), f''(x) and the graph of f; sketching graphs.

WEEK 10 Applied max/min; antiderivatives.

WEEK 11 Area, distance, sigma notation. Second exam.

WEEK 12 The definite integral; the Fundamental Theorem of Calculus.

01:640:151 (continued)

WEEK 13 Substitution rule; computation of areas.

WEEK 14 Logarithm defined as an integral. Review for final exam.

Contribution of course to meeting the professional component: 4 credits mathematics.

DEPARTMENT OF MATHEMATICS

01:640:152 CALCULUS FOR MATHEMATICAL AND PHYSICAL SCIENCES

SPRING 2000

Catalog Data: 01:640:152. Calculus For Mathematical and Physical Sciences (4 credits). For mathematics, physics, computer science, statistics, chemistry, or engineering majors. Transcendental functions, techniques of integration, polar coordinates, and series.

Prerequisites: Calculus I for Mathematical and Physical Sciences, 01:640:151.

Textbook: Stewart, James, *Calculus (Early Transcendentals)*, 4th ed. (1999), Brooks/Cole Publishing Co.

Calculator: A graphing calculator is required for this course. A TI-82 is recommended, but any equivalent calculator, such as the TI-83, 85, or 86, may be used. Calculators may be required for use on certain exams. Therefore, calculators or portable computers with a QWERTY keyboard or with symbolic manipulation abilities (such as the TI-89 or 92) should be avoided, as they are not permitted on exams.

Objectives: To introduce students in mathematics, sciences, and engineering to fundamental principles of calculus in order to prepare them for further study in mathematics and for applications in their disciplines.

Schedule: Two lectures (80 minutes) and one recitation (55 minutes) per week (4 credit hrs)

Topics:

WEEK 1 Areas (review), volumes.

WEEK 2 Work, average values, integration by parts.

WEEK 3 Trigonometric integrals, trigonometric substitution, partial fractions, integration strategies.

WEEK 4 Approximation for integrals, improper integrals.

WEEK 5 Arc length, surface area; differential equations, direction fields, separable Equations.

WEEK 6 Review. First exam.

WEEK 7 Separable equations; exponential growth; sequence, series.

WEEK 8 Integral tests, estimates, comparison tests.

WEEK 9 Alternating series, absolute convergence; ratio and root tests, strategies.

WEEK 10 Power series; representation of functions by power series.

WEEK 11 Taylor and Maclaurin series; binomial series.

WEEK 12 Review. Second exam.

WEEK 13 Applications of Taylor series; parametric equations, tangent lines, arc length.

01:640:152 (continued)

WEEK 14 Calculus in polar coordinates. Review for final exam.

Contribution of course to meeting the professional component: 4 credits mathematics.

DEPARTMENT OF MATHEMATICS
01:640:251 MULTIVARIABLE CALCULUS
FALL 1999

Catalog Data: 01:640:251. Multivariable Calculus (4 credits). Analytic geometry of three dimensions, partial derivatives, optimization techniques, multiple integrals, vectors in Euclidean space, and vector analysis.

Prerequisites: Calculus II for Mathematical and Physical Sciences, 01:640:152.

Textbook: Stewart, James, *Calculus (Early Transcendentals)*, 3rd ed. (1995), Brooks/Cole Publishing Co.

Calculator: A graphing calculator is required for this course. A TI-82 is recommended, but any equivalent calculator, such as the TI-83, 85, or 86, may be used. Calculators may be required for use on certain exams. Therefore, calculators or portable computers with a QWERTY keyboard or with symbolic manipulation abilities (such as the TI-89 or 92) should be avoided, as they are not permitted on exams.

Objectives: To introduce students in mathematics, sciences, and engineering to fundamental principles of calculus in order to prepare them for further study in mathematics and for applications in their disciplines.

Schedule: Two lectures (80 minutes) and one recitation (55 minutes) per week (4 credit hrs)

Topics:

WEEK 1 Three-dimensional coordinate systems; vectors, dot product, cross product.

WEEK 2 Equations of lines and planes; vector functions and space curves, arc length and curvature.

WEEK 3 Motion in space; velocity and acceleration; functions of several variables, limits and continuity.

WEEK 4 Partial derivatives, tangent planes and differentials, The Chain Rule.

WEEK 5 Directional derivatives and the gradient vector; maximum and minimum values.

WEEK 6 First exam. Lagrange multipliers.

WEEK 7 Double integrals over rectangles, iterated integrals, double integrals over general regions.

WEEK 8 Double integrals in polar coordinates; change invariables in multiple integrals; triple integrals.

WEEK 9 Cylindrical and spherical coordinates (review); triple integrals in cylindrical and spherical coordinates; vector fields, line integrals.

WEEK 10 Line integrals, The Fundamental Theorem for Line Integrals.

WEEK 11 Green's Theorem. Second exam.

WEEK 12 Curl and divergence, surface area, parametric surfaces and their areas.

01:640:251 (continued)

WEEK 13 Surface integrals, Stokes' Theorem.

WEEK 14 The Divergence Theorem. Review.

Laboratory: Use of the Maple Symbolic Manipulation System is part of this course. One class early in the semester will be held in a computer laboratory rather than a regular classroom to provide an orientation. Five Maple labs will be assigned:

Introduction to Maple
Vector Calculus
Quadric Surfaces
Maximum and Minimum Values
Triple Integrals

Contribution of course to meeting the professional component: 4 credits mathematics.

DEPARTMENT OF MATHEMATICS

01:640:244 DIFFERENTIAL EQUATIONS FOR ENGINEERING & PHYSICS
SPRING 2000

Catalog Data: 01:640:244. Differential Equations for Engineering & Physics. First- and second-order differential equations; introduction to linear algebra and to systems of ordinary differential equations.

Prerequisites: Multivariable Calculus, 01:640:251.

Textbook: Boyce, William E. and DiPrima, Richard C., *Elementary Differential Equations, 6th edition.*

Objectives: To introduce students in mathematics, sciences, and engineering to fundamental principles of calculus in order to prepare them for further study in mathematics and for applications in their disciplines.

Schedule: Two lectures (80 minutes) and one recitation (55 minutes) per week (4 credit hrs)

Topics:

WEEK 1 Classification of differential equations; linear equations, separable equations.

WEEK 2 Differences between linear and nonlinear equations; modeling with linear equations; population dynamics and other related problems.

WEEK 3 Some problems in mechanics; exact equations and integrating factors. The Euler Method; errors in numerical procedures.

WEEK 4 The Runge-Kutta Method. Homogeneous equations with constant coefficients; Fundamental solutions of linear homogeneous equations.

WEEK 5 Linear independence and the Wronskian; complex roots of the characteristic equation, repeated roots, reduction of order.

WEEK 6 First exam. Nonhomogeneous equations; method of undetermined coefficients; Variation of parameters.

WEEK 7 Mechanical and electrical vibrations, forced vibrations.

WEEK 8 General theory of nth order linear equations; homogeneous equations with constant coefficients; Euler equations.

WEEK 9 Review of matrices; systems of linear algebraic equations; linear independence; Eigenvalues, eigenvectors.

WEEK 10 Homogeneous linear systems with constant coefficients; complex eigenvalues, repeated eigenvalues.

WEEK 11 Second exam. Nonlinear differential equations and stability; the phase plain; linear systems.

WEEK 12 Autonomous systems and stability; almost linear systems; competing species.

01:640:244 (continued)

WEEK 13 Predator-Prey Equations; series solutions of second-order linear equations.

WEEK 14 Series solutions near an ordinary point. Review for final exam.

Laboratory: Use of the Maple Symbolic Manipulation System is part of this course. One class early in the semester will be held in a computer laboratory rather than a regular classroom to provide an orientation. Six Maple labs will be assigned:

Introduction to Maple for Differential Equations
Exact solutions of differential equations
Direction fields and numerical methods
Second order differential equations
Systems of first order linear differential equations
Trajectories in the phase plane

Contribution of course to meeting the professional component: 4 credits mathematics.

DEPARTMENT OF PHYSICS AND ASTRONOMY

01:750:123-124 Analytical Physics I
FALL 1999 – Spring 2000

Catalog Data:	01:750:123-124. Analytical Physics I (2,2credits). Primarily for engineering and physics majors. This course should be followed up by 01:750:227-228. Forms a thorough introductory sequence together with 01:750:227-228. Kinematics, dynamics, energy, momentum, angular momentum, heat, and kinetic theory.
Prerequisites:	Precalculus, 01:640:112 or 115. Corequisites: Calculus I & II, 01:640:151-152.
Textbook:	Serway and Beichner, *Physics for Scientists and Engineers,* 5th edition (1999) Saunders College Publishing.
Objectives:	To provide a thorough introduction to the basic principles of physics to physics and engineering students in order to prepare them for further study in physics and to support their understanding and design of practical applications in their fields.
Schedule:	One lecture (80 minutes) and one recitation (80 minutes) per week (2 credits per semester).
Topics:	Fall 1999, 01:750:123
WEEK 1	Introduction; physics and measurement; one-dimensional motion.
WEEK 2	One dimensional motion (continued).
WEEK 3	Vectors.
WEEK 4	Two-dimensional motion.
WEEK 5	Two-dimensional motion (continued); laws of motion.
WEEK 6	Laws of motion (continued).
WEEK 7	Circular motion.
WEEK 8	Resistive forces; work and kinetic energy.
WEEK 9	Work and kinetic energy (continued).
WEEK 10	Potential energy.
WEEK 11	Linear momentum.
WEEK 12	Collisions and center-of-mass.
WEEK 13	Rotation of a rigid body.
WEEK 14	Torque and angular momentum.

01:750:123-124 (continued)

Topics:	Spring 2000, 01:750:124
WEEK 1	Torque, angular momentum.
WEEK 2	Conservation of angular momentum; static equilibrium.
WEEK 3	Static Equilibrium (continued).
WEEK 4	Oscillatory motion.
WEEK 5	Oscillatory motion (continued); gravity.
WEEK 6	Gravity (continued); satellite motion.
WEEK 7	Fluid dynamics.
WEEK 8	Wave motion.
WEEK 9	Sound waves.
WEEK 10	Standing waves.
WEEK 11	Temperature, heat.
WEEK 12	Heat and the First Law of Thermodynamics
WEEK 13	Kinetic Theory of Gases
WEEK 14	Heat Engines; entropy; Second Law of Thermodynamics.

Recitation: Each 80 minute recitation (workshop) consist of three parts: discussion of homework problems (problems will be collected and graded); a brief quiz; and a mini-lab experiment. Written instructions will be provided each week when the lab begins. Students will work in groups and submit a group report at the end of the session. Experiments parallel lecture topics.

Contribution of course to meeting the professional component: 4 credits basic science.

DEPARTMENT OF PHYSICS AND ASTRONOMY

01:750:227 ANALYTICAL PHYSICS IIA
FALL 1999

Catalog Data: 01:750:227. Analytical Physics IIA (3 credits). Primarily for engineering and physics majors. Electrostatics, particles in electric and magnetic fields, electromagnetism, circuits, Maxwell's equations, electromagnetic radiation.

Prerequisites: Analytical Physics I, 01:750:123-124. Corequisites: Analytical Physics IIA Lab, 01:750:229.

Textbook: Serway and Beichner, *Physics for Scientists and Engineers,* 5th edition (1999) Saunders College Publishing.

Objectives: To provide a thorough introduction to the basic principles of physics to physics and engineering students in order to prepare them for further study in physics and to support their understanding and design of practical applications in their fields.

Schedule: Two lectures (55 minutes) and one recitation (55 minutes) per week (3 credits).

Topics:

WEEK 1 Electric charges, insulators, conductors, Coulomb's Law. Electric field, field lines, charge motion in uniform field.

WEEK 2 Electric flux, Gauss' Law. Applications of Gauss' Law: insulators, conductors.

WEEK 3 Electric potential, potential difference, E-field from ptential. Potential from continuous charge distribution, conductor, applications.

WEEK 4 Capacitance, combinations of capacitances, stored energy. Capacitance with dielectrics, electric dipoles, atomic description.

WEEK 5 Electric current, resistance, Ohm's Law. Micro modeling, R(T),superconductivity, energy and power.

WEEK 6 EMR, resistor combinations, Kirchoff's Law. Review for first exam.

WEEK 7 RC circuits, electrical instruments. Magnetic field, magnetic force on current, q in uniform B.

WEEK 8 Torque, magnetic devices, Hall Effect. Bio-Savart Law, magnetic force between parallel conductors.

WEEK 9 Ampere's Law, Magnetic Flux, Gauss' Law. Displacement current, magnetic materials, earth's B-field.

WEEK 10 Faraday's Law of Induction, motional EMF, Lenz's Law. Induced EMF, E-fields, motors, generators, Maxwell's Equations.

WEEK 11 Self-inductance, RL circuits, energy in B. Review for second exam.

WEEK 12 Mutual inductance, LC oscillations, RLC circuits. AC sources, phasors; R, L, and C in AC circuits.

01:750:227 (continued)

WEEK 13 RLC circuit, power, resonance, transformer, transmission. Maxwell's Equations, Hertz, plane electromagnetic waves.

WEEK 14 Energy, pressure, momentum, sources, spectrum of EM waves.

Contribution of course to meeting the professional component: 3 credits basic science.

DEPARTMENT OF PHYSICS AND ASTRONOMY

01:750:228 ANALYTICAL PHYSICS IIA
SPRING 2000

Catalog Data: 01:750:228. Analytical Physics IIB (3 credits). Primarily for engineering and physics majors. Waves and optics, relativity, quantum properties of electrons and photons, wave mechanics, atomic, solid state, nuclear, and elementary particle physics.

Prerequisites: Analytical Physics IIA, 01:750:227. Corequisites: Analytical Physics IIB Lab, 01:750:230.

Textbook: Serway and Beichner, *Physics for Scientists and Engineers,* 5th edition (1999) Saunders College Publishing.

Objectives: To provide a thorough introduction to the basic principles of physics to physics and engineering students in order to prepare them for further study in physics and to support their understanding and design of practical applications in their fields.

Schedule: Two lectures (55 minutes) and one recitation (55 minutes) per week (3 credits).

Topics:

WEEK 1 Light; Geom. Optics, mirrors.

WEEK 2 Geom. Optics: lenses; interference of light waves.

WEEK 3 2-slit interference, phasors. Diffraction.

WEEK 4 Single-slit diffraction, gratings. Michelson-Morley Experiment. Relativity.

WEEK 5 Lorentz Transformation, Energy-Momentum. Breakdown of classical mechanics, key experiments.

WEEK 6 Review for first exam. Bohr Atom; Wave-particle duality.

WEEK 7 Uncertainty principle; The Schrodinger Equation.

WEEK 8 The hydrogen atom; spin. Exclusion Principle, atomic structure and transitions.

WEEK 9 Molecules, solids, metals, insulators, semiconductors.

WEEK 10 Nuclei properties and models. Radioactivity; nuclear reactions.

WEEK 11 Review for second exam. Nuclear fission.

WEEK 12 Nuclear fusion, radiation detectors. Elementary particles and forces.

WEEK 13 Quarks; The Standard Model. Cosmology.

WEEK 14 Cosmology. Review for final exam.

Contribution of course to meeting the professional component: 3 credits basic science.

DEPARTMENT OF PHYSICS AND ASTRONOMY
01:750:229-230 ANALYTICAL PHYSICS II LABORATORY
FALL 1999 – SPRING 2000

Catalog Data: 01:750:229-230. Analytical Physics II Laboratory (1,1 credit). Primarily for engineering and physics majors. Laboratory to complement 01:750:227-228.

Prerequisites: Analytical Physics I, 01:750:123-124. Corequisites: Analytical Physics IIA and IIB, 01:750:227-228.

Textbook: Serway and Beichner, *Physics for Scientists and Engineers,* 5th edition (1999) Saunders College Publishing, and associated Lab Manual.

Objectives: To provide a hands-on experience to support the learning of the basic principles of physics, and to learn and develop good experimental techniques for use throughout the curriculum.

Schedule: Three hours per week for 14 weeks per semester (1,1 credit)

Experiments: FALL 1999, 01:750:229

1. Analysis of Data Errors
2. Review of Torques
3. Analyzing Standing Waves
4. Ohm's Law, Resistive Networks
5. Capacitance
6. Electric Potential and Field Maps
7. Magnetic Fields and Currents
8. LRC
9. Electric and Magnetic forces

SPRING 2000, 01:750:230

1. Sound Wave Interference
2. Normal Modes I: Coupled Oscillation and FFT
3. Electric Pulse Response
4. Normal Modes II: Springy, Pendulum
5. Geometrical Optics
6. FFT: Forced Mechanical Oscillator
7. Radioactive Decay
8. Light Wave Interference
9. Atomic Spectra
10. Beta and Gamma Absorption

Contribution of course to meeting the professional component: 1 credit basic science per semester (total of 2 credits of basic sciences).

DEPARTMENT OF ECONOMICS
01:220:200 ECONOMIC PRINCIPLES AND PROBLEMS
SPRING 2000

Catalog Data: 01:220:200. Economic Principles and Problems (3 credits). Open only to Engineering students. Equivalent to the combination of Macroeconomics and Microeconomics, 01:220:102 and 103. Economic principles and their application to current problems.

Prerequisites: None. Not open to first-year students.

Textbook: William McEachern, *Economics – A Contemporary Introduction,* 5th edition, South Western.

Objectives: To provide a thorough introduction to the basic principles of economics to engineering students in order to prepare them for further study in economics and related areas, and to support the application of economics in their professional courses and activities. This is a required course in the program's humanities/ social sciences component.

Schedule: Two lectures (55 minutes) and one recitation (55 minutes) per week (3 credits).

Topics:

Part I Microeconomics

1. Introduction
2. Demand and Supply
3. Economic Decision Makers
4. Elasticity
5. Consumer Choice
6. Costs and Production
7. Profit Maximization
8. Monopoly
9. Monopolistic Competition, etc.
10. Markets for Inputs/Resources
11. Labor markets and Capital

Part II Macroeconomics

1. Productivity and Economic Growth
2. Unemployment and Inflation
3. Measuring Economic Aggregates and Consumption
4. Aggregate Demand
5. Aggregate Supply
6. Fiscal Policy
7. Money
8. Money Supply and Banking
9. Monetary Policy
10. Active or Passive Policy
11. Public Policy

Contribution of course to meeting the professional component: 3 credits humanities/social sciences.

DEPARTMENT OF ENGLISH
01:355:101 EXPOSITORY WRITING
FALL 1999

Catalog Data: 01:355:101. Expository Writing (3 credits). The development of competence in reading, thinking, and writing through the analysis and composition of expository prose.

Prerequisites: By required placement test or Basic Composition, 01:355:100.

Textbook: Bartholomae, D. and A. Petrosky, *Ways of Reading, An Anthology for Writers,* 5th edition.

Objectives: At the end of the semester students should be able to compose an expository essay that reflects their own point of view and that demonstrates thoughtful engagement with complex readings of some length. This is a required course in the engineering program's humanities/social sciences component and serves as an initial step in the development of reading, analysis, and writing skills which will be encouraged throughout the curriculum. Students are encouraged to complete this course by the end of the first year.

Schedule: Two lectures (80 minutes) per week (3 credit hours).

Course Requirements:

- 25 pages of typed (6 out-of-class) essays.
- Final draft should be typed. Rough drafts should be typed or written legibly in ink.
- A final exam (essay format, graded pass or fail). The final exam must be passed to pass the course.
- The final grade will reflect the level of achievement that the student can sustain at the end of the semester. It will not be based on an average of all grades.

Philosophy: The course encourages students to see themselves as participants in a collaborative process of questioning, at times working with, and at other times working against, the voices they will encounter in the assigned readings and in the class. This conversational model of writing assumes the notion of community that includes the authors of the assigned texts, the instructor, and other students.

The course helps students learn to work with discursive prose in the form of texts that approximate the scholarly approaches and the levels of difficulty that they will encounter in other disciplines. The text, *Ways of Reading,* was adopted because it provides lengthy, challenging readings that are not easily mastered the first few times through. To help students test their own voices within the discourses of the academy, the course asks them to engage in conversations with essays that are resistant, complex, and sometimes elusive. We want students to see for themselves that a text's meaning, no matter what the discipline, is not simply contained in words on the page, but also exists through their active participation.

Contribution of course to meeting the professional component: 1.5 credits college writing, 1.5 credits humanities/social sciences.