CE 1301 – Introduction to Civil Engineering
Part A-Course Outline

Required course in the Civil Engineering program

Catalog description:
(1-0) 1 hour credit.
Engineering as a career, engineering ethics, and approaches to engineering problem formulation and solution using principles of design and decision making. (Formerly EGR 1301. Credit cannot be earned for both CE 1301 and EGR 1301.)

Prerequisites:
None

Textbooks(s) and/or required material
No textbook

Topics covered:
1. Professional engineering organizations (1 week)
2. College of engineering advising resources (1 week)
3. Academic career planning and recommended programs of study (1 week)
4. Contemporary issues in engineering (1 week)
5. Career opportunities in civil engineering (1 week)
6. Professional registration as an engineer (1 week)
7. Research and library resources (1 week)
8. Career service resources (1 week)
9. Professional and ethical behavior related to engineering (2 week)
10. Introductory problem solving skills (1 week)
11. Basic written presentation skills for engineering (1 week)
12. Foundational verbal and graphical presentation skills in engineering (1 week)
13. Use of computer-based tools in engineering (1 week)
14. Working in teams (1 week)

Some lectures are offered by guest speakers describing their careers in engineering.

Course outcomes:
The outcomes of this course are to:
1. Describe the student's understanding of career opportunities in civil engineering [contributes to PO e, f, h].
2. Provide opportunities to clarify educational and career goals [contributes to PO a, e, i].
3. Gain an awareness of professional engineering organizations (TSPE, NSPE, and ASCE, etc) and professional engineering (PE) registration [contributes to PO f, h, i].
4. Provide opportunities to explore professional and ethical responsibilities of engineers and how fundamentally important integrity is in society [contributes to PO f, j].
5. Expose students to some of the contemporary issues facing engineers [contributes to PO j].
6. Learn basic engineering problem solving procedures [contributes to PO a, d, m].
7. Learn how to use computer-based tools used in engineering [contributes to PO a, k, m].
8. Learn effective written communication skills [contributes to PO k, g].

Overall, it is expected that the students will learn the skills, develop the motivation, and understand the effort needed to successfully complete an engineering degree.

Relationship to Civil Engineering program outcomes (PO):
This course contributes to the following program outcomes:

a. an ability to apply knowledge of mathematics, science, and engineering. (I)

d. an ability to function on multi-disciplinary teams. (I)
e. an ability to identify, formulate, and solve engineering problems. (I)
f. an understanding of professional and ethical responsibility. (I)
g. an ability to communicate effectively. (I)
h. the broad education necessary to understand the impact of engineering solutions in a global and societal context. (I)
i. a recognition of the need for, and an ability to engage in life-long learning. (I)
j. a knowledge of contemporary issues. (I)
k. an ability to understand the techniques, skills and modern engineering tools necessary for engineering practice. (I)
m. An understanding of the elements of project management, construction, and asset management. (I)

Class/laboratory schedule:

- One 50 minute lecture per week

Contribution of course to professional education:

This course provides a brief introduction of the profesisonal role of civil enginners in solving technical problems and the societal context in which these problems are solved.

Evaluation methods:

1. Homework assignments and quizzes
2. One mid-term exam and
3. One final exam

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance criteria:

Course outcomes 1 to 6 are evaluated by methods 2 and 3.
Course outcomes 7 and 8 are evaluated by method 1.

Course Content:

Engineering Science: 0 credits
Engineering Design: 1 credit

Coordinator:

Dr. H. Sharif, Assistant Professor of CEE

Persons who prepared this description:

Dr. T.Papagiannakis, Professor of CEE

CE 1403 - Engineering Communication
Part A-Course Outline

Required course in the Civil Engineering program

Catalog description:
(2-3) 3 hours credit.
Technical communication: oral, written and graphic; introduction to engineering analysis, design and synthesis; and computer-aided graphics. (Formerly EGR 1402. Credit cannot be earned for both CE 1403 and EGR 1402.)

Prerequisites:
None

Textbook(s) and/or required material:
- Madsen, Shumaker, and Madsen Civil Drafting Technology, Pearson/Prentice 6th Ed. ISBN 9780131711990.

Major prerequisites by topic:
1. Algebra, Geometry, and Trigonometry
2. Fundamental units, dimensions, and conversions
3. Spatial measurement in two dimensions

Topics covered:
1. Introduction (½ week)
2. 3-D visualization -- ability to visualize 3-D representation of a two-dimensional object (1 week)
3. Creation of 2D orthographic drawings of 3-D objects. standard views, six view layouts, three view layout with model view (1 ½ weeks)
4. Dimensioning practices –general (1 week)
5. Specification mentioning with feature identification (1 week)
6. AutoCAD 2D deconstruction (2 week)
7. AutoCAD 2D editing (2 weeks)
8. AutoCAD 3-D construction (2 weeks)
9. AutoCAD 3-D editing (2 week)
10. Writen and oral communcation, inlcuding technical writing and public technical speaking (2 weeks)

Course outcomes:
At the conclusion of the course:
1. The student will be familiar with the practices and procedures used to produce working engineering drawings [contributes to PO f, k].
2. The student will be familiar with the computer from an historical, software and hardware prospective as they are used to aid in the production of engineering drawings [contributes to PO f, k].
3. The student will be familiar with the general principles of computer-aided corporate design and drafting (CADD), and be unreasonably proficient in the use of one modern CADD software package package -- AutoCAD for Windows [contributes to PO d, f].
4. The student will demonstrate entry-level expertise in doing civil engineering drawing layouts using civil engineering drafting sets and CADD drafting technology [contributes to PO k].
5. The student witll learn how to communiate in writing and orally [contributes to PO g, o].

Relationship to Civil Engineering program outcomes (PO):
This course contributes to the following program outcomes:

a. an ability to function on multi-disciplinary teams. (I)

b. an understanding of professional and ethical responsibility. (I)

c. an ability to communicate effectively. (I)

d. an ability to understand the techniques, skills and modern engineering tools necessary for engineering practice. (I)

e. An understanding of the role of the leader and leadership principles and aptitudes. (I)

Class/laboratory schedule:

- Two 50 minute lectures per week
- One laboratory consisting of 2 hours and 45 minutes of supervised and guided classworks

Contribution of course to professional education:

This course provides the basic tools for oral and graphical engineering communication.

Evaluation methods:

1. Homework assignments, quizzes
2. Mid-term exams 2
3. Final exam
4. Sketches, drawings and graphs
5. Engineering project write-up and presentation

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance criteria:

Course outcomes 1 and 2 are evaluated by methods 1, 2, 3 and 4.
Course outcomes 3 and 4 is evaluated by methods 1 through 4
Course outcome 5 is evaluated by method 5.

Course content:

Engineering Science: 0 credits
Engineering Design: 3 credits

Coordinator:

Dr. A. Arroyo, Professor of CEE

Persons who prepared this description:

J. Strybos, Lecturer II

CE 2103 - Civil Engineering Measurements
Part A-Course Outline

Required course in the Civil Engineering program

Catalog description:
(2-3) 3 hours credit. Corequisite: MAT 1214 and CE 1301
Principles of measurement and error analysis; Applications of equipment to acquire, analyze, and control data in civil engineering systems; and introduction to plane surveying.

Prerequisites:
None

Corequisites:
1. MAT 1214 – Calculus I
2. CE1301 - Intro. to Civil Engineering

Textbook(s) and/or required material:
- B. F. Kavanagh, Surveying principles and applications Pearson/Prentice Hall, 8th Ed. ISBN 013236512X.

Supplies:
1. National Field/Transit Book (one of the following field books):
    - #416 (hard cover, approximately 60 sheets)
    - #430 (soft cover, approximately 30 sheets)
    - #425 (spiral, soft cover, approximately 30 sheets)
2. Engineer's computation pad
3. Engineer's scale (Hearlily P232 EES -recommended)
4. 6" Protractor
5. Calculator approved by NCEES for the FE exam (recommended)
6. Clipboard (recommended)
7. Two 0.5 mm or 0.7 mm mechanical pencils with 2H lead.
8. One inch - three ring binder with divider sheets

Major prerequisites by topic:
1. Algebra, Geometry, and Trigonometry
2. Fundamental units, dimensions, and conversions
3. Statistics.

Topics covered:
1. Survey equipment Introduction (1/2 week)
2. Automatic Level & Laser Level Instruments (1/4 week)
3. Measurement history, theory, and systems (1/2 week)
4. Basics of Surveying (1/4 week)
5. Distance Measurement (1/2 week)
6. Instrument and data collection field practice (1/4 week)
7. Leveling (3/4 week)
8. Angles and Directions (1/3 week)
9. Theodolite (1 week)
10. Locating point principles (1/3 week)
11. Transit & Theodolite Instruments (1/3 week)
12. Traverse Surveys (1 1/2 weeks)
13. Electronic Surveying Measurement (1/2 week)
14. Global Positioning Systems (1/2 week)

15. Total Station Instruments (1 1/2 weeks)
16. Topographic Surveying and Mapping (1 week)
17. Construction Surveys (2 weeks)
18. Land Surveying (1 week)
19. Geographic Information Systems GIS (1 week)

Course outcomes:

For students to:

1. Learn about basics of surveying and measurements [contributes to PO a, b, e, i, k].
2. Study the main elements of surveying and surveying equipment [contributes to PO f, k].
3. Study principles of measurement and error analysis [contributes to PO a, b, e, i].
4. Study equipment to acquire, analyze, and control data in civil engineering systems [contributes to PO b, k].
5. Experience a field hands-on introduction to plane surveying [contributes to PO d, e].

Relationship to Civil Engineering program outcomes (PO):

This course contributes to the following program outcomes:

a. an ability to apply knowledge of mathematics, science, and engineering. (I)
b. an ability to design and conduct experiments, as well as analyze and interpret data. (I)
d. an ability to function on multi-disciplinary teams. (I)
e. an ability to identify, formulate, and solve engineering problems. (I)
f. an understanding of professional and ethical responsibility. (I)
i. a recognition of the need for, and an ability to engage in life-long learning. (I)
k.an ability to understand the techniques, skills and modern engineering tools necessary for engineering practice. (I)
o. An understanding of the role of the leader and leadership principles and aptitudes. (I)

Class/laboratory schedule:

- 110 minutes of lectures per week
- 2 hours and 50 minutes of laboratory per week

Contribution of course to professional education:

This course provides the basic tools for performing land survying and often allows students to intern as field engineering perosnel during their engineering program.

Evaluation methods:

1. Midterm Exam
2. Field Exam
3. Field Books & Homework
4. Final Exam

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance criteria:

Course outcomes 1 through 5 are evaluated by all methods 1 through 4. In addition, Senior Design (CE 4813). projects that involve surveying are evaluated by the CEE Advisory Board.

Course content:

Engineering Science: 1 credit
Engineering Design: 2 credits

Coordinator:

Dr. J. Weissmann, Professor of CEE

Persons who prepared this description:

Dr. José Weissmann, Professor of CEE, and P. Santamaria, Teaching Assistant II

CE 2633 - Environmental Engineering
Part A-Course Outline

Required course in the Civil Engineering program

Catalog description:
(3-0) 3 hours credit. Prerequisites: CHE 1103 and CE 1301.
Principles, analysis, and design related to environmental monitoring, protection, and remediation systems. Topics include environmental quality and legislation, modeling, water treatment, wastewater treatment, solid and hazardous waste management, air and noise pollution, and radioactive waste management.

Prerequisites:
1. CHE 1103 - General Chemistry
2. CE 1301 – Introduction to Engineering

Textbook(s) and/or required material:
- M. Davis, S. Masten, Principles of Environmental Engineering and Science, McGraw-Hill, 2nd Ed. ISBN 9780073122359.

Major prerequisites by topic:
1. Inorganic and organic chemistry basics
2. Reactions (acid-base, precipitation, oxidation-reduction) and reaction mechanisms
3. Stoichiometry
4. Conservation of energy and momentum principles
5. Projectile motion

Topics covered:
1. Environmental Legislation (1 week)
2. Risk and Environmental Impact Assessments (1 week)
3. Materials Balance1 (1 week)
4. Air pollution concerns (greenhouse gases, stratospheric versus ground level ozone, acid rain, and particulates) (1 week)
5. Air pollution control and detection mechanisms (1 week)
6. Fate and Transport Modeling (1 week)
7. Solid and Hazardous Waste Management (landfilling, composting, incineration, waste collection and recycling) (1 week)
8. Hazard Classifications (1 week)
9. Stream Pollution Modeling (Streeter Phelps DO Sag Curve) (2 weeks)
10. Ground and Surface Water Pollution Sources/Concerns (1 week)
11. Water and Wastewater Overall Treatment Processes (3 weeks)
12. Introduction to Sizing of Process Units (Basic design) (1 week)

Course outcomes:
To provide an opportunity for students to:
1. Become familiar with environmental laws and regulations [contributes to PO h, i, j, n].
2. Identify environmental concerns for air, land, and water [contributes to PO h, i, j].
3. Understand the science behind environmental problems and solutions [contributes to PO a, c, e, k].
4. Practice basic environmental engineering design [contributes to PO a, c, e, k].
5. Evaluate pollution control strategies [contributes to PO a, c, e, j, k, n].

Relationship to Civil Engineering program outcomes (PO):
This course contributes to the following program outcomes:
a. an ability to apply knowledge of mathematics, science, and engineering. (E)

c. an ability to design a system, component, or process to meet desired needs. (I)
e. an ability to identify, formulate, and solve engineering problems. (E)
h. the broad education necessary to understand the impact of engineering solutions in a global and societal context. (E)
i. a recognition of the need for, and an ability to engage in life-long learning. (I)
j. a knowledge of contemporary issues. (E)
k. an ability to understand the techniques, skills and modern engineering tools necessary for engineering practice. (I)
n. an understanding of business and public policy and administration fundamentals. (I)

Class/laboratory schedule:

- 150 minutes of lectures per week

Contribution of course to professional education:

This course teaches the principles, analytical tools, design elements of environmental engineering practice, as well as the legislative and ethical framework essential for their solution.

Evaluation methods:

1. Homework assignments
2. Quizzes
3. Section Exams (3)
4. Notebooks
5. Group presentation
6. Final Comprehensive Examination

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance criteria:

Course outcomes 1, 2 and 3 are evaluated using evaluation methods [1, 2, 3 and 6].
Course outcome 2 is also evaluated using evaluation method [5].
Course outcome 4 is evaluated using evaluation methods [1, 2, 4 and 6].
Course outcome 5 is evaluated using evaluation methods [3, 5 and 6].

Course content:

Engineering Science: 2 credits
Engineering Design: 1 credits

Coordinator:

Dr. D. Johnson, Assistant Professor of CEE

Persons who prepared this description:

Dr. D. Johnson, Assistant Professor of CEE

CE 3103 - Mechanics of Solids
Part A-Course Outline

Required course in the Civil Engineering program

Catalog description:
(2-3) 3 hours credit. Prerequisites: EGR 2103 and EGR 2323.
Internal forces and deformations in solids; stress, strain, and their relations; stresses and deflections in beams, column, theory, and analysis; and engineering applications. (Formerly EGR 3213. Credit cannot be earned for both CE 3103 and EGR 3213.)

Prerequisites:
1. EGR 2103 - Statics (requires a grade of C or better)
2. EGR 2323 - Applied Engineering Analysis I (requires a grade of C or better)

Textbook(s) and/or required material:
- R. C. Hibbeler, Mechanics of Materials, Pearson/Prentice Hall, 7th Ed. ISBN 0132209918.

Major prerequisites by topic:
1. First order differential equations
2. Equilibrium of forces
3. Forces and free body diagrams
4. Units of force and dimensions (SI and USCS)
5. Centroids and moments of inertia

Topics covered:
1. Analysis of internal forces (2 weeks)
2. Axial and shear stresses (1 week)
3. Stress/strain relationships (1 week)
4. Computer applications to force analysis (1 week)
5. Shear and moment diagrams (1 week)
6. Torsion and shear stresses due to torsion (2 weeks)
7. Bending stress and shear stress in beams (1 week)
8. Stress transformation and Mohr's circle (1 week)
9. Column design and buckling of compression members (2 weeks)
10. Deflection of beams (2 weeks)
11. Combined stresses (1 week)

Course outcomes:
At the conclusion of the course, the student will be able to:
1. Learn the relationships between external forces acting on a body and the stresses in the body to resist deformation [contributes to PO a, e].
2. Understand the relationship between stress and strain [contributes to PO a, k].
3. Construct shear and moment diagrams [contributes to PO e, k].
4. Determine the effect of bending stress and shear stress [contributes to PO c, e, k].
5. Understand torsion and its effects on a member [contributes to PO a, k].
6. Understand the principles of stress transformation [contributes to PO a, e, k].
7. Use computer software to solve shear and moment problems [contributes to PO a, k].
8. Be able to calculate deflections of simple beams [contributes to PO a, e, k].
9. Differentiate between material failure and buckling failure of columns [contributes to PO b, k].

Relatiohnsip to Civil Engineering program outcomes (PO):
This course contributes to the following program outcomes:
a. an ability to apply knowledge of mathematics, science, and engineering. (E)

b. an ability to design and conduct experiments, as well as analyze and interpret data. (I)
c. an ability to design a system, component, or process to meet desired needs. (I)
e. an ability to identify, formulate, and solve engineering problems. (E)
k. an ability to understand the techniques, skills and modern engineering tools necessary for engineering practice. (I)

Class/laboratory schedule:

- 100 minutes of lectures per week
- 165 minutes of problem solving session per week

Contribution of course to professional education:

This course prepares students to work professionally in the area of structural design.

Evaluation methods:

1. Homework assignments
2. Quizzes
3. Midterm exams (2)
4. Final exam (comprehensive)

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance criteria:

Course outcomes 1 to 9 are evaluated using evaluation methods [1, 2, 3, and 4].

Course content:

Engineering Science: 3 credits
Engineering Design: 0 credits

Coordinator:

Dr. M. Diaz, Associate Professor of CEE

Persons who prepared this description:

Dr. M. Diaz, Associate Professor of CEE and Dr. A. Arroyo, Professor of CEE

CE 3113 - Structural Analysis
Part A-Course Outline

Required course in the Civil Engineering program

Catalog description:
(3-0) 3 hours credit. Prerequisite: CE 3103.
Forces and deflections in structural systems; considers stationary and moving loads and exact and approximate methods.

Prerequisites:
1. CE 3103 – Mechanics of Solids

Textbook(s) and/or required material:
- R.C. Hibbeler, Structural Analysis, Pearson/Prentice Hall, 7th Ed. ISBN 0131976419.

Major prerequisites by topic:
1. Static equilibrium
2. Moment and shear diagrams
3. Free-body diagrams
4. Shearing and flexural stresses

Topics covered:
1. Structural Loads**;** Wind loads, snow loads, other (1/2 week)
2. System loading and behavior (1/2 week)
3. Reactions for cantilever and arch type construction (1 week)
4. Shear and moment diagrams; Constructing shearing force and bending moment diagrams (1 week)
5. Common types of bridge trusses (1/2week)
6. Truss analysis by method of joints (1/2week)
7. Truss analysis by method of sections, simple trusses, compound trusses, computer analysis (1 week)
8. Influence lines for beams (1 week)
9. Qualitative influence lines (1/2 week)
10. Determining maximum loading effects; Maximum values for moving loads (1/2 week)
11. Deflections; The moment area (1 week)
12. Energy methods; Deflections of beams and frames (1 week)
13. Virtual Work (1/2 week)
14. Statically indeterminate structures; Slope deflection (1 week)
15. Slope deflection for beams (1 week)
16. Slope deflection for frames (1 week)
17. Frames with sidesway (1/2 week)
18. Moment distribution for beams (1 week)
19. Moment distribution for frames (1/2 week)
20. Frames with sidesway (1/2week)

Course outcomes:
At the conclusion of the course the student will be able to:
1. Construct shear and moment diagrams for determinate/indeterminate beam and frame structures [contributes to PO a, e, k].
2. Determine axial forces for truss type structures [contributes to PO a, c].
3. Determine deformations (deflections and rotations) of determinate structures using various classical and modern methods of analysis [contributes to PO a, e, k].
4. Construct influence lines for determinate structures and subsequently position dead and live loads to cause the maximum forces [contributes to PO a, e, k].
5. Apply theoretical concepts to practical problems in structural engineering [contributes to PO c, k].

6. Understand concepts of stiffness and energy as it relates to structural mechanics [contributes to PO a, e, k].
7. Analyze different types of determinate/indeterminate structures using a computer program and interpret the results [contributes to PO c, k].

Relatiohnsip to Civil Engineering program outcomes (PO):

This course contributes to the following program outcomes:

a. an ability to apply knowledge of mathematics, science, and engineering. (R)
c. an ability to design a system, component, or process to meet desired needs. (E)
e. an ability to identify, formulate, and solve engineering problems. (E)
k. an ability to understand the techniques, skills and modern engineering tools necessary for engineering practice. (E)

Class/laboratory schedule:

150 minutes of lectures per week

Contribution of course to professional education:

This course prepares students to work professionally in the area of structural analysis.

Evaluation methods:

1. Homework assignments
2. Midterm exams (3)
3. Final exam

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance criteria:

Course outcomes 1 through 7 are evaluated using evaluation methods [1, 2, and 3].

Course content:

Engineering Science: 2 credits
Engineering Design: 1 credit

Coordinator:

Dr. A Arroyo,Professor of CEE

Persons who prepared this description:

Dr. M. Diaz, Associate Professor of CEE and Dr. J. Weissmann, Associate Professor of CEE

CE 3173 Numerical Methods
Part A-Course Outline

Required course in the Civil Engineering program

Catalog description:
(3-0) 3 hours credit. Prerequisite: EGR 2323.
An introduction to numerical and analytical methods applied to civil and environmental engineering. Techniques for computer solution of linear and non-linear simultaneous equations; eigenvalue analysis; finite differences; numerical integration; numerical solutions to ordinary differential equations. Introduction to Visual Basic in Excel applications. Case studies in the various branches of civil engineering.

Prerequisites:
1. EGR 2323 - Applied Engineering Analysis I

Textbook(s) and/or required material:
- C. Chapra, and R. Canale, Numerical Methods for Engineers, McGraw Hill, 5th Ed. ISBN 007291873-X

Major prerequisites by topic:
1. First-Order Differential Equations
2. Linear Differential Equations of Second and Higher Order
3. Linear Algebra: Matrices, Vectors, Determinants, Linear Systems of Equations, Matrix Inversion
4. Linear Algebra: Matrix Eigenvalue Problems
5. Laplace Transforms

Topics covered:
1. Numerical differentiation and integration (3 weeks)
2. Numerical interpolation-splines (2 weeks)
3. Solution of ordinary linear differential equations and error propagation (Taylor, Euler, Runge-Kutta, Adams-Moulton) (3 weeks)
4. Solution of simultaneous linear differential equations (2 weeks)
5. Solution of elliptic, parabolic and hyberbolic partial differential equations (3 weeks)
6. Finite Difference method (2weeks)

Course outcomes:
At the conclusion of the course, the student will be able to:
1. Understand numerical techniques in solving differential equations [contributes to PO a, e, k].
2. Use computer tools (Visual Basic, Matlab and Mathcad) in applying these techniques [contributes to PO a, k].
3. Understand the relevance of these techniques in solving practical Civil Engineering problems [contributes to PO e, k].

Relationship to Civil Engineering program outcomes (PO):
This course contributes to the following program outcomes:

a. an ability to apply knowledge of mathematics, science, and engineering. (E)
e. an ability to identify, formulate, and solve engineering problems. (E)
k. an ability to understand the techniques, skills and modern engineering tools necessary for engineering practice. (E)

Class/laboratory schedule:
- 150 minutes of lectures per week

Contribution of course to professional education:

This course prepares students to apply computer techniques in solving a multitude of practical Civil Engineering problems.

Evaluation methods:

1. Homework assignments
2. Quizzes
3. Midterm exams (2)
4. Final exam (comprehensive)

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance criteria:

Outcomes 1 and 3 are evaluated by methods [1, 2, 3 and 4].
Outcome 2 is evaluated by method [1].
In addition, the student ability to use these techniques in other junior/senior courses is evaluated by means of exit surveys conducted for selected CEE courses (CE 3213, CE 3413, CE 4123, CE 4603) as well as an external evaluation conducted by the CEE Advisory Board during the Senior Design Project (CE 4813) review.

Course content:

Engineering Science: 2 credits
Engineering Design: 1 credit

Coordinator:

Dr. A. Chowdhury, Adjunct Associate Professor of CEE

Persons who prepared this description:

Dr. T. Papagiannakis, Professor of CEE

CE 3213 – Reinforced Concrete Design
Part A-Course Outline

Required course in the Civil Engineering program

Catalog description:
(2-3) 3 hours credit. Prerequisite: Completion of or concurrent enrollment in CE 3113 and CE 3243.
Ultimate strength theory and design for reinforced concrete members.

Coerequisites:
1. CE 3113 – Structural Analysis
2. CE 3243 – Properties and Behavior of Engineering Materials

Textbook(s) and/or required material:
- J. Wight, J. MacGregor, Reinforced Concrete: Mechanics and Design, Pearson/Prentice Hall, 5th Ed. ISBN 0132281414.

Major prerequisites by topic:
1. Static equilibrium
2. Moment and shear diagrams
3. Free-body diagrams
4. Shearing and flexural stresses
5. Deflections
6. Buckling of compression elements

Topics covered:
1. Basic loads on reinforced concrete structures (1 1/2 weeks)
2. Mechanical properties of reinforced concrete (1 week)
3. Design methods (1 week)
4. Flexure strength and flexural reinforcement (2 weeks)
5. One-way floor systems (1 1/2 weeks)
6. Shear strength and shear reinforcement (2 weeks)
7. Serviceability of beams and one-way slabs (1 week)
8. Development of reinforcement (1 week)
9. Combine compression and bending (2 weeks)
10. Spread footings (2 weeks)

Course outcomes:
At the conclusion of the course, the student will be able to:
1. Design reinforced concrete beams, columns, one-way floor systems and footings in accordance with ACI 318-02 [contributes to PO a, c, h, j, k].
2. Understand the construction process of reinforced concrete structures [contributes to PO f, h, k].
3. Write a report and make an oral presentation of a reinforced concrete construction project [contributes to PO d, f, g, h, o].
4. Design a low-rise reinforced concrete structure [contributes to PO a, c, e, j, k].

Relationship to Civil Engineering program outcomes (PO):
This course contributes to the following program outcomes:

a. an ability to apply knowledge of mathematics, science, and engineering. (R)
c. an ability to design a system, component, or process to meet desired needs. (E)
d. an ability to function on multi-disciplinary teams. (E)
e. an ability to identify, formulate, and solve engineering problems. (E)
f. an understanding of professional and ethical responsibility. (E)

g. an ability to communicate effectively. (E)
h. the broad education necessary to understand the impact of engineering solutions in a global and societal context. (I)
j. a knowledge of contemporary issues. (E)
k. an ability to understand the techniques, skills and modern engineering tools necessary for engineering practice. (E)
o. An understanding of the role of the leader and leadership principles and aptitudes. (E)

Class/laboratory schedule:

- 100 minutes of lectures per week
- 165 minutes of problem solving session per week

Contribution of course to professional education:

This course prepares students to apply state-of the-art techniques in designing reinforced concrete elements.

Evaluation methods:

1. Homework assignments
2. Quizzes
3. Midterm exams (2)
4. Final exam (comprehensive)
5. Written report and oral presentation
6. Design project

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance criteria:

Course outcomes 1 through 4 is evaluated using evaluation methods [1, 2, 3 and 4].
Course outcomes 2 and 3 is evaluated using evaluation method [5].
Course outcome 4 is evaluated using method [6].
In addition, their performance is evaluated by means of a course-specific exit survey. Furthermore, Senior Design (CE 4813) projects that involve reinforced concrete design are evaluated by the CEE Advisory Board .

Course content:

Engineering Science: 1 credit
Engineering Design: 2 credits

Coordinator:

Dr. M. Diaz, Associate Professor of CEE

Persons who prepared this description:

Dr. M. Diaz, Associate Professor of CEE and Dr. M. Yang, Assistant Professor of CEE

CE 3233 - Steel Design
Part A-Course Outline

Required course in the Civil Engineering program

Catalog description:
(2-3) 3 hours credit. Prerequisite: Completion of or concurrent enrollment in CE 3113.
Analysis and design of tension members, beams, columns, and bolted or welded connections.

Corequisites:
1. CE 3113 – Structural Analysis

Textbook(s) and/or required material:
- Salmon, Johnson, Mathias, Steel Structures: Design and Behavior, Pearson/Prentice Hall, 5th Ed. ISBN 0131885561.

Major prerequisites by topic:
1. Static equilibrium
2. Moment and shear diagrams
3. Free-body diagrams
4. Shearing and flexural stresses
5. Deflections
6. Mechanical Properties of Steel
7. Buckling of compression elements
8. Testing methods

Topics covered:
1. Steels and properties (1/2 week)
2. Tension members (1/2 week)
3. Staggered holes (1/2 week)
4. Effective net area (1/2 week)
5. Load transfer at connections (1/2 week)
6. Structural fasteners, high strength bolts, and installation procedures (1/2 week)
7. Bearing type connections (1/2 week)
8. Slip critical connections (1/2 week)
9. Eccentric shear (1 week)
10. Type of welds, possible defects, and inspection and control (1/2 week)
11. Economics of welded members, fillet welds, nominal strength of welds (1 week)
12. Eccentric shear connections (1 week)
13. Columns, Euler elastic buckling, and basic column strength (1 week)
14. Residual stresses (1/2 week)
15. Column design (1 week)
16. Laterally supported beams (1 week)
17. Shear on rolled beams (1/2 week)
18. Lateral torsional buckling of beams (1/2 week)
19. I beams subjected to strong axis bending (1 week)
20. Combined bending and axial load (1 week)
21. Instability in the plane of bending, interaction equations (1 week)

Course outcomes:
At the conclusion of the course the student will be able to:
1. Become proficient in the basic LRFD design of steel members [contributes to PO a, c, e].
2. Design steel tension, compression, and flexural members along with connections using the LRFD specifications [contributes to PO a, c, e, k].

3. Become familiar with the construction of steel structures [contributes to PO d, f, g, j, k].
4. Oral and writing presentation of a steel construction project [contributes to PO d, f, g, j, o].
5. Design a small steel structure [contributes to PO c, h, k].

Relatiohnsip to Civil Engineering program outcomes (PO):

This course contributes to the following program outcomes:

a. an ability to apply knowledge of mathematics, science, and engineering. (R)
c. an ability to design a system, component, or process to meet desired needs. (E)
d. an ability to function on multi-disciplinary teams. (E)
e. an ability to identify, formulate, and solve engineering problems. (E)
f. an understanding of professional and ethical responsibility. (E)
g. an ability to communicate effectively. (E)
h. the broad education necessary to understand the impact of engineering solutions in a global and societal context. (I)
i. a recognition of the need for, and an ability to engage in life-long learning. (I)
j. a knowledge of contemporary issues. (E)
k. an ability to understand the techniques, skills and modern engineering tools necessary for engineering practice. (E)
o. An understanding of the role of the leader and leadership principles and aptitudes. (E)

Class/laboratory schedule:

- 100 minutes of lectures per week
- 165 minutes of problem solving laboratory per week

Contribution of course to professional education:

This course prepares students for the design of steel structures.

Evaluation methods:

1. Homework assignments
2. Midterm exams (2)
3. Final exam
4. Presentations
5. Design project

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance criteria:

Course outcomes 1 through 5 are evaluated using evaluation methods [1 through 5].

Course content:

Engineering Science: 1 credit
Engineering Design: 2 credits

Coordinator:

Dr. M. Diaz, Associate Professor of CEE

Persons who prepared this description:

Dr. M. Diaz Associate Professor of CEE, Dr. A. Arroyo, Professor of CEE and Dr. M. Yang Assistant Professor of CEE

CE 3243 - Properties and Behavior of Engineering Materials
Part A-Course Outline

Required course in the Civil Engineering program

Catalog description:
(2-3) 3 hours credit. Prerequisites: CE 3103 and STA 2303.
Structure, properties, and behavior of engineering materials; measurement and analysis of material properties and behavior. Laboratory exercises illustrate typical material behavior and selected principles of mechanics.

Prerequisites:
1. CE 3103 - Mechanics of Solids
2. STA 2303 - Applied Probability and Statistics for Engineers

Textbook(s) and/or required material:
- Portland Cement Assoc., Design and Control of Concrete Mixtures, 14th Ed. ISBN 0893122173.
- Mamlouk and Zaniewsky, Materials for Civil and Construction Engineers, Pearson/Prentice Hall 2nd Ed. ISBN 0131477145.

Major prerequisites by topic:
1. Mechanic of Solids
2. Statistics
3. Static equilibrium
4. Force free-body diagram
5. Fundamental units and dimensions

Topics covered:
1. Aggregates classification (1 week)
2. Aggregates properties and testing (1 week)
3. Introduction to portland concrete Cement (1 week)
4. Proportioning of portland concrete (2 weeks)
5. Concrete mixing and testing (compression, splitting and beam bending) (1 week)
6. Properties of fresh and hardened concrete (1 week)
7. Placing and finishing/ curing (1 week)
8. Asphalt bitumen classification and testing (1 week)
9. Asphalt mixes design and testing (1 week)
10. Wood structural and physical properties (1 week)
11. Wood mechanical properties and testing (1 week)
12. Introduction to Steel (1 week)
13. Mechanical properties of steel (1 week)
14. Introduction to Masonry (1 week)

Course outcomes:
At the conclusion of this course students will be able to:
1. Understand materials properties and visualize structural behavior and response [contributes to PO a, e].
2. operate testing equipment and material testing specifications for [contributes to PO b]:
   - Metals
   - Portland and Asphaltic Concrete
   - Wood
3. Understand material behavior under stress [contributes to PO e].
4. Use tables, equations, and charts, for summarizing lab results [contributes to PO a, b].
5. Write laboratory reports [contributes to PO g, b].
6. Carry out data acquisition in the lab environment [contributes to PO b].
7. Better define engineering problems and the properties necessary to solve them [contributes to PO e, k].

Relationship to Civil Engineering program outcomes (PO):

This course contributes to the following program outcomes:

a. an ability to apply knowledge of mathematics, science, and engineering. (R)
b. an ability to design and conduct experiments, as well as analyze and interpret data. (R)
d. an ability to function on multi-disciplinary teams. (E)
e. an ability to identify, formulate, and solve engineering problems. (E)
g. an ability to communicate effectively. (E)
k.an ability to understand the techniques, skills and modern engineering tools necessary for engineering practice. (E)
o. An understanding of the role of the leader and leadership principles and aptitudes. (E)

Class/laboratory schedule:

- 100 minutes of lectures per week
- 3 hours of laboratory session per week

Contribution of course to professional education:

This course provides the basic concepts of civil engineering materials testing and mechanical behavior of materials. It is the foundation for other structure analysis and design courses in the CE curriculum.

Evaluation methods:

1. Laboratory reports
2. Midterm exams (2)
3. Final exam (comprehensive)
4. Term Project

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance criteria:

Course outcomes 1 through 7 will be evaluated using evaluation methods [1, 2, 3, and 4].

Course content:

Engineering Science: 2 credits
Engineering Design: 1 credit

Coordinator:

Dr. J. Weissmann, Professor of CEE

Persons who prepared this description:

Dr. S. Dessouky, Assistant Professor of CEE

CE 3253 – Introduction to Masonry and Timber Design
Part A-Course Outline

Technical elective course in the Civil Engineering Program

Catalog Description:
(3-0) 3 hours credit. Prerequisites: Completion of or concurrent enrollment in CE 3113 and CE 3243. Design philosophy and methodology for masonry and timber structures. Flexure design, axial load design, and shear design of basic masonry and timber components.

Corequisites:
1. CE 3113 – Structural Analysis
2. CE 3243 – Properties and Behavior of Engineering Materials

Textbook:
- Design of Wood structures-ASD/LRFD, D. Breyer, 6th Ed,, McGraw Hill, ISBN 0071455396

Major Prerequisites by Topic:
1. Static Equilibrium
2. Moment and Shear Diagrams
3. Free–body diagrams
4. Shearing and flexural stresses
5. Deflections
6. Buckling of compression members

Topics covered:
1. Basic loads on masonry/timber structures (2 weeks)
2. Mechanical properties of masonry and timber (2 weeks)
3. Design methods (2 weeks)
4. Flexure strength of masonry and timber (2 weeks)
5. Timber floor/roof systems (2 weeks)
6. Shear strength of masonry and timber (3 weeks)
7. Combine compression and bending (2 weeks)

Course Outcomes:
At the conclusion of the course the students will be able to:
1. Design masonry and timber beams, columns, and shear and gravity walls, and timber florr/roof systems in accordance with ACI 530-05 and AF&PA NDS-2005 [contributes to PO a, c, h, j, k].
2. Understand the construction process of masonry and timber structures [contributes to PO f, h, k].
3. Work in a group and effectively communicate in writing and orally in relation to a masonry/timber construction project [contributes to PO d, f, g, h, o].
4. Design a one-story masonry/timber structure [contributes to PO a, c, e, j, k].

Relationship of course to program outcomes:
This course contributes to the following program outcomes:
a. an ability to apply knowledge of mathematics, science, and engineering. (R)
c. an ability to design a system, component, or process to meet desired needs. (E)
d. an ability to function on multi-disciplinary teams. (E)
e. an ability to identify, formulate, and solve engineering problems. (E)
f. an understanding of professional and ethical responsibility. (E)
g. an ability to communicate effectively. (E)

h. the broad education necessary to understand the impact of engineering solutions in a global and societal context. (I)
j. a knowledge of contemporary issues. (E)
k. an ability to understand the techniques, skills and modern engineering tools necessary for engineering practice. (E)
o. An understanding of the role of the leader and leadership principles and aptitudes. (E)

Class schedule:

2-65 minutes lectures/week

Contribution of course to meet the professional component:

This course builds the necessary skills for preparing students to work professionally in the area of masonry and timber design.

Evaluation Methods:

1. Homework assignments
2. Quizzes
3. Exams (2)
4. Final exam (comprehensive)
5. Written report and oral presentation
6. Design project

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance Criteria:

Course outcomes 1 through 4 will be evaluated using evaluation methods [1, 2, 3 and 4]
Course outcomes 2 and 3 will be evaluated using evaluation method [5]
Course outcome 4 will be evaluated using evaluation method [6]

Course Content:

Engineering Science:	1 credit
Engineering Design:	2 credits

Coordinator:

Dr. M. Diaz, Associate Professor of CEE

Persons who prepared and reviewed this description:

Dr. M. Diaz, Associate Professor of CEE

CE 3413 - Geotechnical Engineering and Applications
Part A-Course Outline

Required course in the Civil Engineering program

Catalog description:
(2-3) 3 hours credit. Prerequisite: CE 3103; Corequisites: CE 3173 and GEO 4023.
Exploration, sampling, and in-situ measurements; laboratory testing; review of fundamental properties of soil and rock; flow through porous media; the effective stress principle and computation of in-situ stress distributions; shear strength of soils and one-dimensional consolidation settlement; introduction to slope stability.

Prerequisites:
1. CE 3103 – Mechanics of Solids

Corequisites:
1. GEO 4023 – Engineering Geology
2. CE 3173 – Numerical Methods

Textbook(s) and/or required material:
- B.M. Das, Principles of Geotechnical Engineering, Thomson, 6th Ed. ISBN 053438742X.

Major prerequisites by topic:
1. Analysis of internal forces
2. Axial and shear stresses
3. Stress/strain relationships
4. Computer applications to force analysis
5. Shear and moment diagrams
6. Torsion and shear stresses due to torsion
7. Bending stress and shear stress in beams
8. Stress transformation and Mohr's circle
9. Column design and buckling of compression members
10. Deflection of beams
11. Combined stresses

Topics covered:
1. Soil exploration (1/2 week)
2. Weight/Volume relationships (2 weeks)
3. Atterberg limits (1 week)
4. Engineering classification of soil (1 week)
5. Soil compaction (1 1/2 weeks)
6. Stress distribution in soil (2 weeks)
7. Seepage (2 weeks)
8. Consolidation of soil and settlement of structures (2 weeks)
9. Shear strength of soil (2 1/2 weeks)
10. Retaining walls (1/2 week)

Course outcomes:
At the conclusion of the course the students will be able to:
1. Obtain gravimetric and volumetric soil properties [contributes to PO a, b, e, g].
2. Classify a soil sample according to AASHTO and USC systems [contributes to PO a, b, d, e, k].
3. Make compaction calculations and recommendations [contributes to PO a, b, e, k].
4. Determine vertical and lateral stresses on a soil mass from applied loads [contributes to PO a, b, c, e, g].
5. Calculate the amount of settlement and the settlement rate [contributes to PO a, b, c, e, g].

6. Construct flow nets and determine seepage forces [contributes to PO a, b, c, e, g].
7. Determine the shear strength of soil [contributes to PO a, c, h, j, k].
8. Apply the principles of soil mechanics to the analysis and design of basic geotechnical systems [contributes to PO a, b, c, e, d, e, k].
9. Write reports and make oral presentations [contributes to PO d, e, g, k, o].

Relationship to Civil Engineering program outcomes (PO):

This course contributes to the following program outcomes:

a. an ability to apply knowledge of mathematics, science, and engineering. (R)
b. an ability to design and conduct experiments, as well as analyze and interpret data. (R)
c. an ability to design a system, component, or process to meet desired needs. (R)
d. an ability to function on multi-disciplinary teams. (E)
e. an ability to identify, formulate, and solve engineering problems. (R)
g. an ability to communicate effectively. (E)
k. an ability to understand the techniques, skills and modern engineering tools necessary for engineering practice. (E)
o. An understanding of the role of the leader and leadership principles and aptitudes. (E)

Class/laboratory schedule:

- 100 minutes of lectures per week
- 165 minutes of laboratory per week

Contribution of course to professional education:

This course prepares students to work professionally in the area of geotechnical engineering.

Evaluation methods:

1. Homework assignments
2. Quizzes
3. Laboratory reports
4. Midterm exams (2)
5. Final exam

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance criteria:

Course outcomes 1 through 8 are evaluated using evaluation methods [1, 2, 4 and 5].
Course outcome 9 is evaluated using method [3].
In addition, their performance is evaluated by means of a course-specific exit survey. Furthermore, Senior Design (CE 4813) projects that involve geotechnical design are evaluated by the CEE Advisory Board.

Course content:

Engineering Science: 2 credits
Engineering Design: 1 credit

Coordinator:

Dr. M. Diaz, Associate Professor of CEE

Persons who prepared this description:

Dr. S. Bin-Shafique, Assistant Professor of CEE

CE 3543 – Project Design and Construction Management
Part A-Course Outline

Required course in the Civil Engineering program

Catalog description:
(3-0) 3 hours credit. Prerequisites: CE 2103 and EGR 3713.

Civil Engineering design process, project specifications, construction management. Topics covered include design process/practices, project proposals, pricing, specifications, bidding strategies, project management/scheduling and project financing. Course concludes by forming the student teams for CE 4813 Civil Engineering Design and identifying their projects.

Prerequisites:
1. CE 2103 - Civil Engineering Measurements
2. EGR 3713 - Engineering Economic Analysis

Course must be taken one semester prior to CE 4813

Textbook(s) and/or required material:
No textbook

Major prerequisites by topic:
1. Spreadsheets and word processing
2. Technical writing
3. Engineering economics
4. Computer aided design
5. Surveying
6. Geotechnical engineering
7. Properties/Behavior of engineering materials
8. Steel design
9. Concrete design

Topics covered:
1. Planning and scheduling using Primavera P6 (1 week)
2. Concepts of work breakdown structure (1 week)
3. Task logical relationships (1 week)
4. Project resources (2 weeks)
5. Project calendars (1 weeks)
6. Construction planning and scheduling (2 weeks)
7. Project planning and scheduling (2 weeks)
8. Technical writing (1 week)
9. Request for proposals writing (1 week)
10. Proposal writing and presentation (2 weeks)

Course outcomes:
At the conclusion of the course the students will be able to:
1. Model and track project development using Primavera P6 [contributes to PO a, g, m, k, r, o].
2. Write Requests for Proposals [contributes to PO a, f, g, j, k, m, n].
3. Write proposals [contributes to PO f, g, j, k, n, o].
4. Present proposals to owners [contributes to PO g, j, o].
5. Form and function in project teams [contributes to PO g, m, o].

Relationship to Civil Engineering program outcomes (PO):

This course contributes to the following program outcomes:

a. an ability to apply knowledge of mathematics, science, and engineering. (R)
f. an understanding of professional and ethical responsibility. (R)
g. an ability to communicate effectively. (R)
i. a recognition of the need for, and an ability to engage in life-long learning. (R)
j. a knowledge of contemporary issues. (R)
k. an ability to understand the techniques, skills and modern engineering tools necessary for engineering practice. (R)
m. An understanding of the elements of project management, construction, and asset management. (I)
n. An understanding of business and public policy and administration fundamentals. (E)
o. An understanding of the role of the leader and leadership principles and aptitudes. (I)

Class/laboratory schedule:

- 75 minutes of lectures per week
- 75 minutes of laboratory per week

Contribution of course to professional education:

This course prepares students to work professionally in the area of construction and project management. It also trains students in proposal writing and presentation.

Evaluation methods:

1. Homework assignments
2. Interim reports
3. Project and proposal review by a panel of professionals

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance criteria:

Course outcomes 1 through 5 are evaluated using evaluation methods [1, 2, and 3].
In addition, their performance is evaluated by means of a course-specific exit survey. Furthermore, Senior Design project proposals that are the outcome of this course are evaluated by the CEE Advisory Board .

Course content:

1. Engineering Science: 1 credits
2. Engineering Design: 2 credit

Coordinator:

Dr. José Weissmann, Professor of CEE

Persons who prepared this description:

Dr. José Weissmann, Professor of CEE

CE 3603 - Fluid Mechanics
Part A-Course Outline

Required course in the Civil Engineering program

Catalog description:
(2-3) 3 hours credit. Prerequisites: EGR 2103 and EGR 2513.
Fluid properties, fluid statics concepts, equations of fluid flow in pipes and open channels, and flow through porous media.

Prerequisites:
1. EGR 2103 –Statics (requires a grade of C or better)
2. EGR 2513 –Dynamics (requires a grade of C or better)

Textbook(s) and/or required material:
- E. Finnemore, J. Franzini, Fluid Mechanics with Engineering Applications, 10th Ed., McGraw-Hill, ISBN 0072432020.

Major prerequisites by topic:
1. Fundamental of statics (free-body diagrams, equilibrium)
2. Kinetic of particles and solids, work and energy, impulse and momentum, equations of motion).

Topics covered:
1. Definitions, Standard Units & Conversion Factors (1/2 week)
2. Fluid Properties (1/2 week)
3. Ideal Fluids, Fluid Statics (1 1/2 weeks)
4. Pressure Forces (1 1/2 weeks)
5. Fluid Flow and Continuity Equation (1 week)
6. Fluid Flow and Energy (Bernoulli Equation) (1 week)
7. Application of Bernoulli Equation (1 week)
8. Total Energy Line & Hydraulic Line (1/2 week)
9. The Fluid Momentum Principle (1 week)
10. Application of the Momentum Principle to Fluids (1 week)
11. Incompressible Flow (1 week)
12. Laminar and Turbulent Flow in Pipe System (1/2 week)
13. Darcy-Weisbach Equation, Moody Diagram (1/2 week)
14. Friction and Local Losses in Pipe Systems (1 week)
15. Open Channel Uniform Flow, Manning's Equation (1 week)
16. Forces on Immersed Bodies (1/2 week)

Course outcomes:
To provide an opportunity for students to:
1. learn about basic fluid properties [contributes to PO a, e].
2. learn about fluid static principles [contributes to PO a, e].
3. gain understanding of steady state flow-rate conservation of mass and conservation of energy equations [contributes to PO a, b, c, d].
4. gain understanding of mass-rate impulse-momentum methods [contributes to PO a, e].
5. learn about friction losses in pipes [contributes to PO a, b].
6. see and measure fluid flow phenomena [contributes to PO a, b].
7. enhance student problem solving skills [contributes to PO b, c, e].

Relationship to Civil Engineering program outcomes (PO):
This course contributes to the following program outcomes:
a. an ability to apply knowledge of mathematics, science, and engineering. (R)

b. an ability to design and conduct experiments, as well as analyze and interpret data. (E)
c. an ability to design a system, component, or process to meet desired needs. (E)
d. an ability to function on multi-disciplinary teams. (E)
e. an ability to identify, formulate, and solve engineering problems. (E)
g. an ability to communicate effectively. (E)
k. an ability to understand the techniques, skills and modern engineering tools necessary for engineering practice. (E)
o. An understanding of the role of the leader and leadership principles and aptitudes. (E)

Class/laboratory schedule:

- 100 minutes of lectures per week
- 2 hours and 50 minutes of laboratory per week

Contribution of course to professional education:

This course prepares students to work professionally in the area of fluid mechanics.

Evaluation methods:

1. Homework assignments & laboratory reports
2. Midterm exams (3)
3. Comprehensive final exam

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance criteria:

1. Course outcomes 1 through 6 and objective 8 will be evaluated using evaluation methods [1, 2, and 3].
2. Course outcome 7 will be evaluated using evaluation method [1].

Course content:

Engineering Science: 2 credits
Engineering Design: 1 credit

Coordinator:

Dr. R French, Professor of CEE

Persons who prepared this description:

Dr. R. French, Professor of CEE

CE 3633 - Water and Wastewater Treatment
Part A-Course Outline

Required course in the Civil Engineering program

Catalog description:
(2-3) 3 hours credit. Prerequisites: CE 2633 and completion of or concurrent enrollment in CE 3603.
The application of chemical, biochemical, and physical processes to water treatment, wastewater treatment, and pollution control. (Formerly CE 4633. Credit cannot be earned for both CE 3633 and CE 4633.)

Prerequisites:
1. CE 2633 - Environmental Engineering

Corequisites:
1. CE 3603 - Fluid Mechanics

Textbook(s) and/or required material:
- R. Droste, Theory and Practice of Water and Wastewater Treatment, Wiley, 1st Ed. ISBN 0471124443

Major prerequisites by topic:
1. Familiarity with environmental issues, laws and regulations
2. Understanding of the science behind environmental problems and solutions
3. Understanding the principles of environmental design.

Topics covered:
1. Water-related Legislation (1 week)
2. Coagulation/Softening (1 week)
3. Flocculation (1 week)
4. Sedimentation (types of settling) (2 weeks)
5. Filtration (1 week)
6. Sludge handling/dewatering (1 week)
7. Disinfection (chemical addition, storage, and residual) (1 week)
8. Hardness versus Alkalinity (1 week)
9. Water distribution and wastewater collection (2 weeks)
10. Activated sludge unit processes: aeration basin, oxidation ditch, rotating biological contactor, trickling filter/biotower (2 weeks)
11. Sludge digestion (2 weeks)

Course outcomes:
To provide an opportunity for students to:
1. Become familiar with various types of water and wastewater treatment processes [contributes to PO a, c].
2. Learn about design of water and wastewater treatment processes [contributes to PO a, c, e].
3. Identify the different process units of treatment [contributes to PO a, c, e, k].
4. Analyze typical water quality parameters [contributes to PO a, b, d, k].
5. Investigate a local treatment facility [contributes to PO a, e, k, o].
6. Present the results of their investigation [contributes to PO a, b, d, e, k, o].

Relatiohnsip to Civil Engineering program outcomes (PO):
This course contributes to the following program outcomes:
a. an ability to apply knowledge of mathematics, science, and engineering. (R)
b. an ability to design and conduct experiments, as well as analyze and interpret data. (E)
c. an ability to design a system, component, or process to meet desired needs. (E)
d. an ability to function on multi-disciplinary teams. (E)

e. an ability to identify, formulate, and solve engineering problems. (E)
k. an ability to understand the techniques, skills and modern engineering tools necessary for engineering practice. (E)
o. An understanding of the role of the leader and leadership principles and aptitudes. (E)

Class/laboratory schedule:

- 100 minutes of lectures per week
- 165 minutes of laboratory/field work per week

Contribution of course to professional education:

This course is designed for students to become familiar with the size and scale as well as the design and operational aspects of water treatment processes.

Evaluation methods:

1. Homework assignments
2. Quizzes
3. Design Projects (2)
4. Progress Reports (Laboratory and Field Trip Write ups)
5. Group Evaluations
6. Final Comprehensive Report (Semester-long Treatment Facility Investigation)
7. Final Oral Examination

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance criteria:

Course outcomes 1 and 3 are evaluated using evaluation methods [1, 2, 3, and 7].
Course outcome 2 is evaluated using evaluation methods [1, 3, 5, and 7].
Course outcome 4 is evaluated using evaluation methods [1, 4, and 7].
Course outcome 5 is evaluated using evaluation methods [1, 2, 5, 6, and 7].
Course outcome 6 is evaluated using evaluation methods [4, 5, 6, and 7].

Course content:

Engineering Science: 2 credits
Engineering Design: 1 credit

Coordinator:

Dr. D. Johnson, Assistant Professor of CEE

Persons who prepared this description:

Dr. D. Johnson, Assistant Professor of CEE

CE 3723 - Applied Hydrology
Part A-Course Outline

Technical Elective course in the Civil Engineering program

Catalog description:
(3-0) 3 hours credit. Prerequisite: CE 3603.
Hydrologic cycle, precipitation, hydrologic abstractions, surface runoff; unit hydrographs; synthetic hydrographs; peak discharge relationships; flood frequency analysis; flood and reservoir routing; and groundwater hydrology.

Prerequisites:
1. CE 3603 – Fluid Mechanics

Textbook(s) and/or required material:
- Lewis Viessman, Introduction to Hydrology, Pearson/Prentice Hall, 5th Ed., ISBN 067399337X

Major prerequisites by topic:
1. Understanding of basic fluid properties
2. Understanding of fluid static principles
3. Understanding of steady state flow-rate conservation of mass and conservation of energy equations
4. Understanding of mass-rate impulse-momentum phenomena
5. Ability to calculate friction losses in pipes

Topics covered:
1. Introduction, Standard Units & Conversion Factors (1/2 week)
2. History of Hydrology, Hydrologic Cycle (1 week)
3. Precipitation (1 week)
4. Evaporation, Transpiration (1 week)
5. Infiltration and Stream-flow (1 week)
6. Watershed & Catchment (1 week)
7. Rainfall-Runoff & Hydrographs (1 week)
8. Unit Hydrographs (1 week)
9. Synthetic Unit Hydrographs and Hydrograph Application (1 week)
10. Flood Routing (1/2 week)
11. Kinematic Wave Routing (1/2 week)
12. Ground-Water Hydrology (1/2 week)
13. Flow to Wells, Intrusion and Contamination (1 week)
14. Flood Frequency Analysis (1/2 week)
15. Hydrologic Modeling (1/2 week)
16. Urban Hydrology (1/2 week)

Course outcomes:
1. Learn about the elements of the hydrologic cycle [contributes to PO a, e, k].
2. Use unit hydrograph analyses to predict rainfall/runoff from watersheds [contributes to PO a, c, e, k].
3. Use routing methods to predict flood wave attenuation [contributes to PO c, e, h].
4. Learn about groundwater flow, well hydraulics, and groundwater modeling [contributes to PO a, c, k].
5. Perform calculations associated with flood frequency analysis [contributes to PO a, e, k].
6. Use various standard hydrologic models [contributes to PO a, c, e].
7. Learn about urban hydrology and floodplain management [contributes to PO a, j, k].

Relationship to Civil Engineering program outcomes (PO):
This course contributes to the following program outcomes:

a. an ability to apply knowledge of mathematics, science, and engineering. (R)

b. an ability to design and conduct experiments, as well as analyze and interpret data. (R)
c. an ability to design a system, component, or process to meet desired needs. (R)
e. an ability to identify, formulate, and solve engineering problems. (R)
h. the broad education necessary to understand the impact of engineering solutions in a global and societal context. (E)
j. a knowledge of contemporary issues. (E)
k. an ability to understand the techniques, skills and modern engineering tools necessary for engineering practice. (R)

Class/laboratory schedule:
150 minutes of lectures per week

Contribution of course to professional education:
This course prepares students to work professionally in the area of hydrology.

Evaluation methods:
1. Homework assignments
2. Midterm exams (4)
3. Comprehensive Final Exam

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance criteria:
Outcomes 1 through 5 and outcome 7 are evaluated using evaluation methods [1, 2, and 3].
Outcome 6 is evaluated using evaluation method [1].

Course content:
Engineering Science: 3 credits
Engineering Design: 0 credits

Coordinator:
Dr. R. French, Professor of CEE

Persons who prepared this description:
Dr. R. French, Professor of CEE

CE 4123- Highway Engineering
Part A- Course Outline

Required course in the Civil Engineering program

Catalog Description:
(3-0) 3 hours credit. Prerequisite: CE103 and STA 2303
General characteristics of highway design; horizontal and vertical alignment, cross-sections, earthwork, drainage, and pavement; and economic analysis.

Prerequisites:
1. CE 103 – Civil Engineering Measurements
2. STA 303 – Applied Probability and Statistics for Engineers

Textbook(s) and/or required material:
- Highway Engineering, Wright, Dixon, Wiley, 7th Ed., ISBN 047126461X

Major Prerequisites by Topic:
1. Surveying principles
2. Probability and statistical concepts and data analysis

Topics covered:
1. Introduction (1/2 week)
2. Transportation Planning (1/2 week)
3. Highway Economic Evaluation (1/2 week)
4. Driver Pedestrian and Vehicle Characteristics. (1/2 week)
5. Traffic Characteristics (1 week)
6. Geometric Design (2 weeks)
7. Roadside Design (1 week)
8. Intersections Interchanges (1 week)
9. Mass Transit Facilities (1 week)
10. Drainage (1 week)
11. Traffic Engineering (1 week)
12. Surveys Plans and Estimates (1 week)
13. Contracts and Supervision (1 week)
14. Highway Materials (1/2 week)
15. Flexible Pavements (1/2 week)
16. Flexible Pavements (1/2 week)
17. Rigid Pavements (1 week)
18. Highway Maintenance and Rehabilitation (1/2 week)

Course Outcomes:
At the conclusion of the course the students will be able to:
1. learn about basic transportation elements [Contributes to PO a, c, h]
2. Study the main elements of highway design:
   - Horizontal Alignment [Contributes to PO c, e. k]
   - Vertical Alignment [Contributes to PO c, e, k]
   - Transportation planning [Contributes to PO a, h, k, m]
3. Pavement Design [Contributes to PO c, e, m]
4. Drainage [Contributes to PO c, e, m]
5. Economic analysis of transportation projects [Contributes to PO e, m]

Relationship to Civil engineering program outcomes (PO)

a. an ability to apply knowledge of mathematics, science and engineering (R)
c. ability top design a system, component, or process to meet desired needs (E)
e An ability to identify, formulate, and solve engineering problems (E)
h. The broad education necessary to understand the impact of engineering solutions in a global and societal context (E)
k. An ability to understand the techniques, skills and modern engineering tools necessary for engineering practice (E)
m. An understanding of the elements of project management, construction, and asset management (E)
n. An understanding of business and public policy and administration fundamentals (E)

Class/Laboratory Schedule:

- 2-75 minutes lectures per week

Contribution of course to meet professional component:

This course provides the basic concepts of transportation and highway design.

Evaluation Methods:

1. Homework
2. Midterm exams (2)
3. Final exam (comprehensive)
4. Term project

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance Criteria:

Course outcomes 1 through 7 are evaluated using evaluation methods [1, 2, 3, and 4]

Course Content:

Engineering Science: 2 credits
Engineering Design 1 credit

Coordinator:

Dr. J. Weissmann, Professor of CEE

Persons who prepared this description:

Dr. J. Weissmann, Professor of CEE

CE 4233 - Transportation Systems
Part A-Course Outline

Technical elective in the Civil Engineering program

Catalog description:
(3-0) 3 hours credit. Prerequisite: STA 2303
Planning, design, construction, operation, and maintenance of transportation systems; and concepts of various modes of transportation. (Formerly CE 4113. Credit cannot be earned for both CE 4233 and CE 4113.)

Prerequisites:
1. STA 2303 Applied Probability and Statistic for Engineers

Textbook(s) and/or required material:
- Transportation Systems, Hoel, Garber, Sadek, Transportation Infrastructure Engineering: A Multimodal Integration, Cengage Learning, 1st Ed., 9780534952891

Major prerequisites by topic:
1. Probability and statistical concepts and data analysis

Topics covered:
1. Introduction (1/2 week)
2. Road, vehicle and road user's characteristics (1 week)
3. Transportation system models (1 ½ weeks)
4. Geometric design of travel ways (2 weeks)
5. Transportation safety and/or intelligent transportation systems (2 weeks)
6. Transportation system geometrics (2 weeks)
7. Traffic and Level of Service Analysis (2 weeks)
8. Transit Operations (2 weeks)
9. Transportation Project Evaluation (2 weeks)

Course Outcomes:
At the conclusion of the course the students will be able to:
1. learn about civil engineering applications of transportation systems [Contributes to PO a, c, e, f]
2. study transportation systems including [Contributes to PO a, c, f, h, g, j, k]
   - Transportation Planning
   - Highway systems
   - Rail systems
   - Airports
3. understand various methods of solving civil engineering problems [Contributes to PO c, e, h]
4. identify various types of transportation system problems [Contributes to PO c, e, f]
5. use tables, equations, and charts to generate solutions [Contributes to PO c, e, j]
6. use computer software in solving transportation system problems [Contributes to PO c, j, k]

Relationship to Civil Engineering Outcomes (PO)
   a. an ability to apply knowledge of mathematics, science, and engineering (R)
   b. an ability to conduct experiments and interpret data (R).
   c. an ability to design a system, component, or process to meet desired needs (R)
   e. an ability to identify, formulate, and solve engineering problems (R)
   f. an understanding of professional and ethical responsibility (R)
   i.
   j. a knowledge of contemporary issues (R)

k. an ability to understand the techniques, skills and modern engineering tools necessary for engineering practice (R)

Class/laboratory schedule:
150 minutes of lectures per week

Contribution of course to meet the professional component:
This course builds the foundation for preparing students to work professionally in the area of civil engineering.

Evaluation methods:
1. Homework assignments
2. Semester Project
3. In semester exams (3)
4. Final exam (comprehensive)

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance criteria:
Course outcomes 1 through 6 are evaluated using evaluation methods [1, 2, 3 and 4].

Course content:
Engineering Science: 3 credits
Engineering Design: 0 credits

Coordinator:
Dr. A.T. Papagiannakis, Professors of CEE

Persons who prepared this description:
Dr. A.T. Papagiannakis and Dr. A. Arroyo, Professors of CEE

CE 4313 - Computer-Aided Design in Civil Engineering
Part A-Course Outline

Required course in the Civil Engineering program

Catalog description:
(2-3) 3 hours credit. Prerequisite: CE 1403 and 2103.
Organization and programming of civil engineering problems for computer solutions; and application of computer-aided design in civil engineering.

Prerequisites:
1. CE 1403 - Engineering Communication
2. CE 2103 - Civil Engineering Measurements

Textbook(s) and/or required material:
- R. W. Larsen, Introduction to MathCAD 13, Pearson/Prentice Hall, 2nd Ed., ISBN 0131890735.
- R. W. Larsen, Engineering With Excel, Pearson/Prentice Hall, 3rd Ed., ISBN 0136017754.
- T. M. Walski, Computer Applications in Hydraulic Engineering, Bentley Institute, 7th Ed., ISBN 0971414165.

Major prerequisites by topic:
1. AutoCAD 2-D
2. AutoCAD 3-D
3. Surveying principles
4. Measurements and error analysis
5. Data acquisition and reduction

Topics covered:
1. Excel – (Graphing, matrices, built-in functions, iterative solutions) (4 weeks)
2. Mathcad – (Functions, matrices, numerical techniques) (5 weeks)
3. Haestad – (Flow Master, Storm Cad, Culvert Master, Pond Pak, Water Cad, Sewer Cad) (6 weeks).

Course outcomes:
To provide an opportunity for students to:
1. learn about computer aided design in civil engineering [contributes to PO a, e, k].
2. study computer software applications including [contributes to PO e, k]:
   - Microsoft Excel 2000
   - Mathcad 11
   - Haestad Methods Hydraulics software
3. understand various methods of solving civil engineering problems [contributes to PO a, c, e].
4. identify various types of software applications [contributes to PO k].
5. use tables, equations, and charts to generate software solutions [contributes to PO a, e, k].
6. use computer software in solving civil engineering problems [contributes to PO k].
7. enhance student problem solving skills [contributes to PO a, c] .

Relationship to Civil Engineering program outcomes (PO):
This course contributes to the following program outcomes:

a. an ability to apply knowledge of mathematics, science, and engineering. (R)
c. an ability to design a system, component, or process to meet desired needs. (R)
e. an ability to identify, formulate, and solve engineering problems. (R)
k. an ability to understand the techniques, skills and modern engineering tools necessary for engineering practice. (E)

Class/laboratory schedule:
150 minutes of lectures per week

Contribution of course to professional education:
This course prepares students to work professionally in the area of civil engineering.

Evaluation methods:
1. Homework assignments
2. In semester exams (3)
3. Final exam (comprehensive)

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance criteria:
Course objectives 1 through 7 will be evaluated using evaluation methods [1, 2, and 3].

Course content:
Engineering Science: 1 credits
Engineering Design: 2 credits

Coordinator:
Mr. J. Strybos, Lecturer II of CEE

Persons who prepared this description:
Mr. J. Strybos, Lecturer II of CEE

CE 4413 – Foundation Analysis and Design
Part A-Course Outline

Technical elective course in the Civil Engineering Program

Catalog description:
(3-0) 3 hours credit. Prerequisite: CE 3413.
Design of footings, mats and slab-on-grade; earth pressures and design of retaining walls, piles and drilled piers; soil improvement and ground modification.

Prerequisites:
1. CE 3413 – Geotechnical Engineering and Applications

Textbook(s) and/or required material:
- B.M Das, Principles of Foundation Engineering, Cengage Learning, 6th Ed., ISBN 0495082465.

Major prerequisites by topic:
1. Soil exploration and weight/volume relationships
2. Engineering classification of soils
3. Soil compaction
4. Stress in soils
5. Seepage
6. Consolidation of soil and settlement of structures
7. Shear strength of soil

Topics covered:
1. Subsoil exploration (1 week)
2. Shallow Foundations (Ultimate bearing capacity and Allowable bearing capacity/settlement) (2 weeks)
3. Mat foundations (2 week)
4. Lateral earth pressures (2 week)
5. Retaining walls (2 week)
6. Sheet pile walls (2 week)
7. Piles (2 week)
8. Drilled shafts and caissons (1 week)
9. Soil improvement (1 week)

Course outcomes:
At the conclusion of the course the students will be able to:
1. Understand soil field exploration techniques and the resulting soil profiles [contributes to PO a, b, e, g].
2. Design shallow foundations [contributes to PO a, b, d, e, k].
3. Analyze lateral earth pressures and design retaining walls [contributes to PO a, b, e, k].
4. Design piles and drilled shafts and caissons
5. Understand the commonly used techniques for soil improvement [contributes to PO a, c, h, j, k].

Contribution of course to professional education:
This course prepares students to work professionally in the area of geotechnical engineering.

Relationship to Civil Engineering program outcomes (PO):
This course contributes to the following program outcomes:
- a. an ability to apply knowledge of mathematics, science, and engineering. (R)
- b. an ability to conduct experiments and analyze data (R)
- c. an ability to design a system, component, or process to meet desired needs. (R)
- e. an ability to identify, formulate, and solve engineering problems. (R)

i. a recognition of the need for, and an ability to engage in life-long learning. (R)
k. an ability to understand the techniques, skills and modern engineering tools necessary for engineering practice. (R)

Class/laboratory schedule:
150 minutes of lectures per week

Contribution of course to professional education:
This course prepares students to work professionally in the area of geotechnical engineering.

Evaluation methods:
1. Homework assignments
2. Midterm exams (3)
3. Final exam (comprehensive)

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance criteria:
Course outcomes 1 through 5 will be evaluated using evaluation methods [1, 2, and 3].

Course content:
Engineering Science: 1 credits
Engineering Design: 2 credits

Coordinator:
Dr. S. Bin-Shafique, Assistant Professor of CEE

Persons who prepared this description:
Dr. S. Bin-Shafique, Assistant Professor of CEE

CE 4603 - Water Resources Engineering
Part A-Course Outline

Required course in the Civil Engineering program

Catalog description:
(3-0) 3 hours credit. Prerequisites: CE 2633 and CE 3603.
Analysis and design of surface and subsurface water resource systems; dam and reservoir design for recharge, flood control, and water supply; and design of water supply, wastewater collection, and stormwater systems.

Prerequisites:
1. CE 2633 – Environmental Engineering (requires a grade of C or better)
2. CE 3603 – Fluid Mechanics (requires a grade of C or better)

Textbooks(s) and/or required material:
- R. A. Wurbs, W. P. James, Water Resources Engineering, Pearson/Prentice-Hall, 1st Ed., ISBN 0130812935.

Major prerequisites by topic:
1. Understanding of basic fluid properties
2. Understanding of fluid static principles
3. Understanding of steady state flow-rate conservation of mass and conservation of energy equations
4. Understanding of mass-rate impulse-momentum phenomena
5. Ability to calculate friction losses in pipes

Topics covered
1. Introduction, Definitions and fluid Mechanics Review (1/2 week)
2. Hydrology (1/2 week)
3. Pipes(1/2 week)
4. Pipe Networks (1/2 week)
5. Open Channel Flow (2 weeks)
6. Open Channel Design (1 week)
7. Kinematic Routing (1/2 week)
8. Hydraulic Routing (1/2 week)
9. Watershed Analysis & Models (1 week)
10. Water shed Hydrology & Characteristics (2 weeks)
11. Rational Method and Lag Time (1 week)
12. Precipitation Infiltration & Runoff (1 week)
13. Curb, Gutter and Culvert Design (1 week)
14. Ground-Water and Well Design (2 weeks)

Course outcomes:
To provide an opportunity for students to
1. learn about the history of water resources engineering and its importance to mankind [contributes to PO k].
2. learn about pipe and pipe network design [contributes to PO a, c, e, k].
3. learn about perform open channel design [contributes to PO a, c, k] .
4. learn and apply flood routing techniques [contributes to PO a, c, k].
5. learn about watershed analysis & drainage design [contributes to PO a, c, k].
6. learn about water resource project planning [contributes to PO a, c, k].
7. learn about river basin management [contributes to PO a, c, k].

Relationship to Civil Engineering program outcomes (PO):
This course contributes to the following program outcomes:
a. an ability to apply knowledge of mathematics, science, and engineering. (E)
c. an ability to design a system, component, or process to meet desired needs. (E)

e. an ability to identify, formulate, and solve engineering problems. (E)
k. an ability to understand the techniques, skills and modern engineering tools necessary for engineering practice. (E)

Class/laboratory schedule:

- 150 minutes of lectures per week
- 2 hours of self-directed field trip per week

Contribution of course to professional education:

This course prepares students to practice the design of hydraulic structures.

Evaluation methods:

1. Homework assignments
2. Self-directed field trip reports
3. Midterm exams (3)
4. Comprehensive Final Exam

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance criteria:

Outcomes 1 through 7 are evaluated using evaluation methods [1, 2, 3 and 4]. In addition, student performance is evaluated by means of a course-specific exit survey. Furthermore, Senior Design (CE 4813) project that involve elements of water resource design are evaluated by the CEE Advisory Board.

Course content:

Engineering Science: 2 credits
Engineering Design: 1 credit

Coordinator:

Dr. R. French, Professor of CEE

Persons who prepared this description:

Dr. R. French, Professor of CEE

CE 4653 - Design of Pollution Control Systems
Part A-Course Outline

Technical elective course in the Civil Engineering Program

Catalog description:
(2-3) 3 hours credit. Prerequisite: CE 3633.
Analysis, synthesis, design, and system optimization of integrated processes and operations to handle and treat water, wastewater, and hazardous wastes.

Prerequisites:
1. CE 3633 - Water and Wastewater Treatment

Textbook(s) and/or required material:
- Metcalf & Eddy, Wastewater Engineering: Treatment, Disposal, and Reuse, 4th Ed., McGraw Hill, ISBN 0070418780
- Qasim, Syed R., Wastewater Treatment Plants: Planning, Design, and Operation, CRC Press, ISBN 1566766885

Major prerequisites by topic:
1. Water treatment unit operations and processes
2. Wastewater treatment unit operations and processes
3. Solids disposal operations

Topics covered:
1. Wastewater Engineering: An Overview (1 week)
2. Constituents in Wastewater (1 week)
3. Analysis and Selection of Wastewater Flow Rates and Constituent Loadings (1 week)
4. Introduction to Process Analysis and Selection (1 week)
5. Physical Unit Operations (2 weeks)
6. Chemical Unit Processes (2 weeks)
7. Fundamental Biological Treatment (2 weeks)
8. Suspended Growth Biological Treatment Processes (1 week)
9. Attached Growth Biological Treatment Processes (1 week)
10. Anaerobic Suspended Growth Biological Treatment Processes (1 week)
11. Treatment, Reuse, and Disposal of Solids and Biosolids (1 week)

Course outcomes:
To provide an opportunity for students to:
1. Learn about unit operations and system optimization of water and wastewater treatment facilities [contributes to PO a, b, c, e, i, k].
2. Learn how to design major components needed in wastewater treatment facilities [contributes to PO a, b, c, e, i, k].

Relationship to Civil Engineering program outcomes (PO):
This course contributes to the following program outcomes:

a. an ability to apply knowledge of mathematics, science, and engineering. (R)
b. an ability to design and conduct experiments, as well as analyze and interpret data. (R)
c. an ability to design a system, component, or process to meet desired needs. (R)
e. an ability to identify, formulate, and solve engineering problems. (R)
i. a recognition of the need for, and an ability to engage in life-long learning. (E)
k. an ability to understand the techniques, skills and modern engineering tools necessary for engineering practice. (R)

Class/laboratory schedule:
150 minutes of lectures per week

Contribution of course to professional education:
This course prepares students to work professionally in the field of civil engineering

Evaluation methods:
1. Homework assignments and quizzes
2. Regular exams (4)
3. Final design project and presentation

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance criteria:
Course outcomes 1 and 2 are evaluated using evaluation methods [1 to 3].

Course content:
Engineering Science: 2 credits
Engineering Design: 1 credit

Coordinator:
Dr. R. French, Professor of CEE

Persons who prepared this description:
Dr. D. Johnson, Assistant Professor of CEE

CE 4723 – Hydraulic Systems Design
Part A-Course Outline

Technical Elective course in the Civil Engineering program

Catalog description:
(3-0) 3 hours credit. Prerequisite: CE 4603.
Analysis and design of water resource systems; dam and reservoir design for recharge, flood control, and water supply, and demand forecasting, optimization of multiobjective systems, and allocations planning and management.

Prerequisites:
1. CE 4603 - Water Resources Engineering

Textbook(s) and/or required material:
- Metcalf & Eddy, Wastewater Engineering: Treatment, Disposal, and Reuse, 4th Ed., McGraw Hill, ISBN 0070418780

Major prerequisites by topic:
1. Water Treatment Unit Operations and Processes
2. Wastewater Treatment Unit Operations and Processes
3. Solids disposal operations

Topics covered:
1. Wastewater Engineering: An Overview (1 week)
2. Constituents in Wastewater (1 week)
3. Analysis and Selection of Wastewater Flowrates and Constituent Loadings (2 weeks)
4. Introduction to Process Analysis and Selection (2 weeks)
5. Physical Unit Operations (1 week)
6. Chemical Unit Processes (1 week)
7. Fundamental Biological Treatment (1 week)
8. Suspended Growth Biological Treatment Processes (1 week)
9. Attached Growth Biological Treatment Processes (1 week)
10. Anaerobic Suspended Growth Biological Treatment Processes (1 week)
11. Treatment, Reuse, and Disposal of Solids and Biosolids (2 week)

Course outcomes:
To provide an opportunity for students to:
1. analyze unit operations and system optimization of water and wastewater treatment facilities[contributes to PO]
2. design major components needed in wastewater treatment facilities [contributes to PO]

Relationship to Civil Engineering program outcomes (PO):
This course contributes to the following program outcomes:

a. an ability to apply knowledge of mathematics, science, and engineering. (R)
b. an ability to design and conduct experiments, as well as analyze and interpret data. (R)
c. an ability to design a system, component, or process to meet desired needs. (R)
e. an ability to identify, formulate, and solve engineering problems. (R)
i. a recognition of the need for, and an ability to engage in life-long learning. (E)
j. a knowledge of contemporary issues. (E)
k. an ability to understand the techniques, skills and modern engineering tools necessary for engineering practice. (R)

Class/laboratory schedule:

150 minutes of lectures per week

Contribution of course to professional education:
This course prepares students to work professionally in the field of civil engineering

Evaluation methods:
1. Homework assignments and Quizzes
2. Regular Exams (4)
3. Final Design Project and Presentation

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance criteria:
Objectives 1 through 1 will be evaluated using evaluation methods [1 to 3].

Course content:
Engineering Science: 2 credits
Engineering Design: 1 credit

Coordinator:
Dr. R. French, Professor of CEE

Persons who prepared this description:
Dr. R. French, Professor of CEE

CE 4813 - Civil Engineering Design
Part A-Course Outline

Required course in the Civil Engineering program

Catalog description:
(2-3) 3 hours credit. Prerequisites: CE 3213, , CE 3233, and CE 3543.
Opportunity to apply design skills to execution of an open-ended integrated civil engineering design project, including field and laboratory investigations, numerical and scale modeling, design, and formal oral and written presentation of results. Considers safety, reliability, environmental, economic, and other constraints, and ethical and social impacts.

Prerequisites:
1. CE 3213 – Reinforced Concrete Design (requires a grade of C or better)
2. CE 3233 – Steel Design
3. CE 3543 – Project Design & Construction Management

Textbook(s) and/or required material:
No textbook

Major prerequisites by topic:
1. The design process
2. Material properties and behavior
3. Concrete Design
4. Steel design
5. Hydraulic Computations
6. Civil Work
7. Detention Pond Design
8. Street Design
9. Utilities Design
10. Unit Pricing
11. Take Off quantities
12. Basics of Specifications, Regulations and Permits
13. Basic elements of C.E. contracts
14. Engineering Economics
15. Financing of C.E. projects
16. Oral and written communication

Topics covered:
1. The design process (Throughout the semester)
2. Project Proposal (1 week)
3. Progress Reports (Throughout the semester)
4. Ethics (Throughout the semester)
5. Economics and financing (Throughout the semester)
6. Formal Written Report (Throughout the semester)
7. Formal Oral Presentation (Throughout the semester)

Course outcomes:
1. Participate in all aspects of a team project [contributes to PO d, f, g, o].
2. Perform the design of a complex civil engineering system [contributes to PO a, b, c, e, f, h, i, j, k, m, n].
3. Present the results of the design project in a formal, written report [contributes to PO c, d, e, g, k, m, n, o].
4. Report the results of the design project in a formal oral and graphical presentation [contributes to PO c, d, e, g, j, k, m, n, o].

Relationship to Civil Engineering program outcomes (PO):

This course contributes to the following program outcomes:

a. an ability to apply knowledge of mathematics, science, and engineering. (R)
b. an ability to design and conduct experiments, as well as analyze and interpret data. (R)
c. an ability to design a system, component, or process to meet desired needs. (R)
d. an ability to function on multi-disciplinary teams. (R)
e. an ability to identify, formulate, and solve engineering problems. (R)
f. an understanding of professional and ethical responsibility. (R)
g. an ability to communicate effectively. (R)
h. the broad education necessary to understand the impact of engineering solutions in a global and societal context. (R)
i. a recognition of the need for, and an ability to engage in life-long learning. (R)
j. a knowledge of contemporary issues. (R)
k. an ability to understand the techniques, skills and modern engineering tools necessary for engineering practice. (R)
m. an understanding of the elements of project management, construction, and asset management. (R)
n. an understanding of business and public policy and administration fundamentals. (R)
o. an understanding of the role of the leader and leadership principles and aptitudes. (E)

Class/laboratory schedule:

150 minutes of meetings per week

Contribution of course to professional education:

This course is the capstone course, which prepares students to work professionally in the field of civil engineering.

Evaluation methods:

1. Progress reports and the final report are evaluated by the CEE Advisory Board on the basis of the technical content and presentation.

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance criteria:

Course outcomes 1 through 4 are evaluated using evaluation method [1]. In addition, the course and the overall program performance is evaluated by the CEE Advisory Board.

Course content:

Engineering Design: 3 credits
Engineering Science: 0 credit

Coordinator:

Dr. M. Diaz Associate Professor of CEE

Persons who prepared this description:

Dr. M. Diaz Associate Professor of CEE and Dr. J. Weissmann, Professor of CEE

CE 4911-3 - Independent Study
Part A-Course Outline

Technical Elective course in the Civil Engineering program

Catalog description:
1 to 3 hours credit. Prerequisites: Permission in writing (form available) from the instructor, the student's advisor, the Department Chair and Dean of the College. Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 semester credit hours of independent study, regardless of discipline, will apply to a bachelor's degree.

Prerequisites:
Permission in writing (form available) from the instructor, the student's advisor, the Department Chair and Dean of the College.

Textbook(s) and/or required material:
Depends on topic

Major prerequisites by topic:
Depends on topic

Topics covered:
Depend on topic

Course outcomes:
Depend on topic. In general, this elective course provides some specialization in the selected field of civil engineering.

Relationship to Civil Engineering program outcomes (PO):
Depends on topic.

Class/laboratory schedule:
Routine meetings with instructor.

Contribution of course to professional education:
This course offers students specialization in a technical area of civil engineering.

Evaluation methods:
1. Progress reports as requested by instructor and
2. Project and/or final exam

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance criteria:
Evaluated by the methods outlined above.

Course content:
Engineering/Science credits depend on topic

Coordinator:
Dr. T. Papagiannakis Professor of CEE

Persons who prepared this description:
Dr. T. Papagiannakis Professor of CEE

CE 4953 - Special Studies in Civil Engineering
Part A-Course Outline

Technical Elective course in the Civil Engineering program

Catalog description:
(3-0) 3 hours credit. Prerequisite: Consent of instructor.
An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies may be repeated for credit when topics vary, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor's degree.

Prerequisites:
Permission in writing (form available) from the instructor, the student's advisor, the Department Chair and Dean of the College.

Textbook(s) and/or required material:
Depends on topic

Major prerequisites by topic:
Depends on topic.

Topics covered:
Depend on topic.

Course outcomes:
Depend on topic. In general, this elective course provides some specialization in the selected field of civil engineering. It is used to introduce new technical elective course topics in the curriculum.

Relationship to Civil Engineering program outcomes (PO):
Depend on topic.

Class/laboratory schedule:
150 minutes of lectures per week

Contribution of course to professional education:
This course offers students specialization in a technical area of civil engineering.

Evaluation methods:
1. Assignments
2. Midterm exams(s)
3. Project and/or final exam

Students with disabilities are encouraged to consult with the UTSA Disability Services (http://www.utsa.edu/disability/) for arrangements accommodating any special needs.

Performance criteria:
Evaluated by the methods outlined above.

Course content:
Engineering/Science credits depend on topic

Coordinator:
Dr. T. Papagiannakis Professor of CEE

Persons who prepared this description:
Dr. T. Papagiannakis Professor of CEE