

## **Criterion 2. Program Educational Objectives**

The program must have published program educational objectives that are consistent with the mission of the institution, the needs of the program's various constituencies, and these criteria. There must be a documented, systematically utilized, and effective process, involving program constituencies, for the periodic review of these program educational objectives that ensures they remain consistent with the institutional mission, the program's constituents' needs, and these criteria.

### **Current Program Educational Objectives**

<http://civil-engineering.uark.edu/academics/index.php>

<http://catalog.uark.edu/undergraduatecatalog/collegesandschools/collegeofengineering/civilengineeringcveg/>

The objective of the civil engineering program is to produce graduates who are prepared to pursue:

- careers in the broad field of civil engineering
- licensure as a Professional Engineer.
- advanced education.

### **Periodic Review of Objectives**

1. Annual review by the Civil Engineering faculty
2. Annual review by the Arkansas Academy of Civil Engineering (AACE)  
*(typically completed at the Annual Business Meeting)*

### **Documentation**

- Minutes of the CVEG faculty meeting at which the Objectives were reviewed.
- Minutes of the AACE meeting at which the Objectives were reviewed.

### **Criterion 3. Student Outcomes**

The program must have documented student outcomes that prepare graduates to attain the program educational objectives.

Student outcomes are outcomes (a) through (k) plus any additional outcomes that may be articulated by the program.

- (a) an ability to apply knowledge of mathematics, science, and engineering
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data
- (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- (d) an ability to function on multidisciplinary teams
- (e) an ability to identify, formulate, and solve engineering problems
- (f) an understanding of professional and ethical responsibility
- (g) an ability to communicate effectively
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- (i) a recognition of the need for, and an ability to engage in life-long learning
- (j) a knowledge of contemporary issues
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

### **Current Student Outcomes**

The ABET Criterion 3 Student Outcomes (“a” through “k”) are mapped to the Department of Civil Engineering Student Outcomes in Table 1.

## ABET PLAN FOR CIVIL ENGINEERING

**TABLE 1. ABET and UA Civil Engineering Student Outcomes**

| ABET<br>Criterion<br>3 | ABET Student Outcome Statement   | UA Student Outcome Statement  |
|------------------------|--|---|
| a                      | ...an ability to apply knowledge of mathematics, science, and engineering  | <b>Apply</b> knowledge of mathematics and science to <b>solve</b> engineering problems.   |
| b                      | ...an ability to design and conduct experiments, as well as to analyze and interpret data  | <b>Design</b> and <b>conduct</b> experiments, and <b>analyze</b> and <b>evaluate</b> the resulting data.  |
| c                      | ...an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability | <b>Design</b> a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and constructability. |
| d                      | ...an ability to function on multidisciplinary teams   | <b>Function</b> effectively as a member of a multidisciplinary team.  |
| e                      | ...an ability to identify, formulate, and solve engineering problems   | <b>Identify, formulate,</b> and <b>solve</b> engineering problems.  |
| f                      | ...an understanding of professional and ethical responsibility   | <b>Identify</b> key elements of professional ethics; <b>discuss</b> the importance of professional licensure.   |
| g                      | ...an ability to communicate effectively   | <b>Organize</b> and <b>deliver</b> effective communications.  |
| h                      | ...the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context  | <b>Explain</b> possible impacts of engineering solutions on the economy, environment, political landscape, and society.   |
| i                      | ...a recognition of the need for, and an ability to engage in life-long learning   | <b>Discuss</b> the need for life-long learning, and <b>demonstrate</b> the ability to learn through independent study.  |
| j                      | ...a knowledge of contemporary issues  | <b>Explain</b> the impact of contemporary issues on the identification, formulation, and solution of engineering problems.  |
| k                      | ...an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice   | <b>Apply</b> relevant knowledge, techniques, skills, and modern engineering tools to <b>address</b> engineering problems.   |

### **Criterion 4. Continuous Improvement**

The program must regularly use appropriate, documented processes for assessing and evaluating the extent to which the student outcomes are being attained. The results of these evaluations must be systematically utilized as input for the continuous improvement of the program. Other available information may also be used to assist in the continuous improvement of the program.

### **Current Assessment Plan for Student Outcomes**

Assessment of the extent to which the Student Outcomes are being attained is performed primarily through the use of both “direct measures” of student performance and “indirect measures” of the students’ perception regarding preparation to achieve the Outcomes. Data for the “indirect” measures is gathered via survey of all graduating seniors as part of the Senior Exit Interview process. There are three (3) aspects to the “direct” measures for assessment:

1. Selection of an appropriate assessment instrument;
2. Establishment of the minimum acceptable student performance level for each assessment instrument;
3. Establishment of the target achievement level sufficient to demonstrate attainment of the Student Outcome by program graduates.

Table 2 lists assessment instruments, minimum acceptable student performance levels, and target achievement levels for the CVEG assessment plan. Forms are provided to each faculty member for reporting assessment data. Assessment data is collected each semester. Table 3 summarizes the assessment instruments by CVEG course.

### **Evaluation of Outcomes**

Student Outcome assessment data is reviewed and evaluated annually by the CVEG faculty. Decisions resulting from the evaluation follow:

- **No Action.** The assessment data indicate students are attaining the Outcome, at or above target levels.
- **Monitor.** The assessment data indicate trends which would suggest students may not attain the Outcome on an ongoing basis without intervention.
- **Action Required.** The assessment data indicate students are not attaining the Outcome at target levels.

In addition to the annual evaluation of Outcome assessment data, CVEG faculty also assess and evaluate the effect(s) of past actions taken to rectify any identified issues.

### **Documentation**

- Minutes of the CVEG faculty meeting at which the Outcomes were evaluated.

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**TABLE 2. UA Civil Engineering Assessment Plan for Student Outcomes**

| ABET Criterion 3 | UA Student Outcome Statement  | “Direct Measure” Assessment Instrument   | Minimum Acceptable Performance Level                               | Target Achievement Level                          |
|------------------|---|--|--|---|
| a                | <b>Apply</b> knowledge of mathematics and science to <b>solve</b> engineering problems.   | <ol style="list-style-type: none"> <li>1. <b>CVEG 3243</b> (Env. Engineering) Exam/HW/Quiz question (<i>science emphasis</i>)</li> <li>2. <b>CVEG 3303</b> (Strt. Analysis) Exam/HW/Quiz question (<i>math emphasis</i>)</li> <li>3. <b>FE Exam</b> Probability &amp; Statistics section</li> </ol>  | Student must obtain <b>70%</b> of points possible                  | <b>90%</b> of students meet the performance level |
|                  |   |  | Ratio Score $\geq 1.0$<br><i>Meets or exceeds national average</i> |   |
| b                | <b>Design</b> and <b>conduct</b> experiments, and <b>analyze</b> and <b>evaluate</b> the resulting data.  | <ol style="list-style-type: none"> <li>1. <b>CVEG 2113</b> (Structural Materials) <ol style="list-style-type: none"> <li>a. Experimental plan for sensitivity analysis (effect of w/c, air entrainment on <math>f'_c</math>)</li> <li>b. Lab testing / data collection / analysis</li> </ol> </li> <li>2. <b>CVEG 3131L</b> (Soil Mechanics) <ol style="list-style-type: none"> <li>a. Experimental plan for soil classification</li> <li>b. Lab testing / data collection / analysis</li> </ol> </li> </ol> | Student must obtain <b>80%</b> of points possible                  | <b>75%</b> of students meet the performance level |
| c                | <b>Design</b> a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and constructability. | <ol style="list-style-type: none"> <li>1. <b>CVEG 48x2</b> (“Senior Design”) Grading rubric Item 2: Technical Achievement</li> <li>2. <b>CVEG 48x2</b> (“Senior Design”) Grading rubric Item 3: Constraints</li> </ol>   | Student must obtain <b>70%</b> of points possible                  | <b>90%</b> of students meet the performance level |
| d                | <b>Function</b> effectively as a member of a multidisciplinary team.  | <ol style="list-style-type: none"> <li>1. <b>CVEG 48x2</b> (“Senior Design”) Grading rubric Item 4: Leadership and Teamwork</li> </ol>   | Student must obtain <b>80%</b> of points possible                  | <b>90%</b> of students meet the performance level |

## ABET PLAN FOR CIVIL ENGINEERING

**TABLE 2. UA Civil Engineering Assessment Plan for Student Outcomes (continued)**

|   |  |  |  |   |
|---|--|--|--|---|
| e | Identify, formulate, and solve engineering problems.   | 1. FE Exam, Soil Mechanics section<br>2. FE Exam, Environmental Engineering section<br>3. FE Exam, Structural Analysis section<br>4. FE Exam, Transportation section | Ratio Score $\geq$ 1.0<br><i>Meets or exceeds national average</i> |   |
|   |  | 5. CVEG 48x2 (“Senior Design”) Grading Rubric Item 2: Technical Achievement  | Student must obtain <b>70%</b> of points possible                  | <b>90%</b> of students meet the performance level |
| f | Identify key elements of professional ethics; discuss the importance of professional licensure.                  | 1. CVEG 4851 (Professional Practice Issues) Ethics and Licensure Exam  | Student must obtain <b>70%</b> of points possible                  | <b>90%</b> of students meet the performance level |
|   |  | 2. FE Exam, Ethics and Business Practices section  | Ratio Score $\geq$ 1.0<br><i>Meets or exceeds national average</i> |   |
| g | Organize and deliver effective communications.   | 1. CVEG 48x2 (“Senior Design”) Grading Rubric Item 1: Communications   | Student must obtain <b>80%</b> of points possible                  | <b>90%</b> of students meet the performance level |
| h | Explain possible impacts of engineering solutions on the economy, environment, political landscape, and society. | 1. CVEG 4851 (Professional Practice Issues) Essay Assignment   | Student must obtain <b>70%</b> of points possible                  | <b>90%</b> of students meet the performance level |

## ABET PLAN FOR CIVIL ENGINEERING

**TABLE 2. UA Civil Engineering Assessment Plan for Student Outcomes (continued)**

|   |  |  |   |   |
|---|--|--|---|---|
| i | <b>Discuss</b> the need for life-long learning, and <b>demonstrate</b> the ability to learn through independent study.     | <ol style="list-style-type: none"> <li>1. <b>CVEG 48x2</b> ("Senior Design") Grading Rubric Item 2a: Use of Standards, Codes and Regulations</li> <li>2. <b>CVEG 48x2</b> ("Senior Design") Grading Rubric Item 3: Constraints</li> <li>3. <b>CVEG 4851</b> (Professional Practice Issues) Essay Assignment</li> </ol>   | Student must obtain <b>70%</b> of points possible   | <b>90%</b> of students meet the performance level |
| j | <b>Explain</b> the impact of contemporary issues on the identification, formulation, and solution of engineering problems. | <ol style="list-style-type: none"> <li>1. <b>CVEG 4851</b> (Professional Practice Issues) Essay Assignment</li> </ol>  | Student must obtain <b>70%</b> of points possible   | <b>90%</b> of students meet the performance level |
| k | <b>Apply</b> relevant knowledge, techniques, skills, and modern engineering tools to address engineering problems.         | <ol style="list-style-type: none"> <li>1. <b>CVEG 3303</b> (Strt. Analysis) Homework problem demonstrating a modern analysis technique</li> <li>2. <b>CVEG 3223</b> (Hydrology) Homework assignment to solve a detention pond sizing problem using Excel</li> <li>3. <b>CVEG 4143</b> (Foundations) Homework/project assignment related to drilled shaft design using Excel</li> </ol> | Student must obtain <b>70%</b> of points possible   | <b>90%</b> of students meet the performance level |
|   |  | <ol style="list-style-type: none"> <li>4. <b>CVEG 2051L</b> (Surveying Systems) Field (Lab) exercise using a Total Station</li> </ol>  | Students must use a Total Station to close a traverse not to exceed 0.5 ft (horiz) and 0.1 ft (vert) within 3 tries | <b>70%</b> of students meet the performance level |

## ABET PLAN FOR CIVIL ENGINEERING

**TABLE 3. Student Outcome Assessment Instruments by CVEG Course**

| CVEG Course | Assessment Instrument  | Student Outcome(s) Addressed |
|-------------|--|------------------------------|
| CVEG 2051L  | Field (Lab) exercise using a Total Station   | k                            |
| CVEG 2113   | Experimental plan for sensitivity analysis (effect of w/c, air entrainment on $f'_c$ ); Lab testing / data collection / analysis | b                            |
| CVEG 2851   | Ethics and Licensure Exam  | f                            |
|             | Essay Assignment – Societal Impacts  | h                            |
|             | Essay Assignment – Lifelong Learning   | k                            |
|             | Essay Assignment – Contemporary Issues   | j                            |
| CVEG 3131L  | Experimental plan for soil classification<br>Lab testing / data collection / analysis  | b                            |
| CVEG 3223   | Homework assignment to solve a detention pond sizing problem using Excel   | k                            |
| CVEG 3243   | Exam/HW/Quiz question ( <i>science emphasis</i> )  | a                            |
| CVEG 3303   | Exam/HW/Quiz question ( <i>math emphasis</i> )   | a                            |
|             | Homework problem demonstrating a modern analysis technique   | k                            |
| CVEG 4143   | Homework/project assignment related to drilled shaft design using Excel  | k                            |
| CVEG 48x2   | Grading Rubric Item 1: Communications  | g                            |
|             | Grading rubric Item 2: Technical Achievement   | c e                          |
|             | Grading Rubric Item 2a: Use of Standards, Codes and Regulations  | i                            |
|             | Grading rubric Item 3: Constraints   | c i                          |
|             | Grading Rubric Item 4: Leadership and Teamwork   | d                            |