

# **Student Guide to Developing Your Graduation Portfolio**



**Bachelor of Science in Civil Engineering  
Bachelor of Science in Architectural Engineering  
Bachelor of Science in Construction Engineering  
Bachelor of Science in Environmental Engineering**

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## **Introduction**

This guide is provided to help you with developing and assembling a strong graduation portfolio. To graduate, all students must submit a graduation portfolio that clearly demonstrates his or her understanding and attainment of each and every student learning outcome. All aspects of each outcome must be addressed in your portfolio.

For each learning outcome, a brief explanation is provided to help you understand the outcome and why it is important. This is followed by some guidance for you to consider as you assemble your portfolio. Finally, courses that include materials appropriate for each outcome are listed. In addition, at the end of this guide, a table of all CE courses and their relationship to the student learning outcomes is provided.

## **LiveText – Electronic Portfolio (ePortfolio)**

An active LiveText account is required for all upper-division CE courses and is required for you to create and submit your graduation portfolio. You are encouraged to consider sharing using your graduation portfolio with prospective employers as part of your career placement efforts. If you do not already have a LiveText account, you can purchase your five-year LiveText membership online with a credit or debit card at [www.livetext.com](http://www.livetext.com).

## **Explanations and Guidance for Each Student Learning Outcome**

A complete description is provided for each student learning outcome beginning on page 3. This provides you with an explanation as to why the outcome is important and relevant to your degree, and guidance to help you properly prepare your graduation portfolio, including a description of what you need to include for each outcome. Finally, specific required courses that include appropriate materials to include in your graduation portfolio are noted. Other courses may also include materials that may illustrate your attainment of an outcome. Please check your course syllabi for additional outcomes that may be included.

***You are encouraged to use materials resulting from any official UA activities if they clearly illustrate your attainment of student learning outcomes at the level of achievement expected at graduation. You should try to provide materials that are related to or support your own career interests.***

## **Student Learning Outcomes Rubric and Levels of Achievement**

A common set of 14 student learning outcomes has been established for the Bachelor of Science in Civil Engineering (BSCivE), Bachelor of Science in Construction Engineering (BSConE), Bachelor of Science in Architectural Engineering (BSArchE), and Bachelor of Science in Environmental Engineering (BSEnvE). Bloom's Taxonomy is a classification system for learning and is used here to define the targeted level of achievement for the student learning outcomes. There are six levels in the taxonomy, moving through the lowest order processes to the highest: (1) Knowledge, (2) Comprehension, (3) Application, (4) Analysis, (5) Synthesis, and (6) Evaluation. The 14 student learning outcomes are each targeted at an appropriate level in order to fully prepare you for entry into the engineering profession or graduate school.

Table 1, beginning on page 23, provides the outcome statement for each student learning outcome at each level of achievement, including the level expected at graduation (bold outlines). Outcomes statements are also included for the MS and PhD degrees, but you only need to document your achievement of the BS graduation outcomes. Each outcome should be interpreted in the context of your degree program. If you happen to be pursuing a double major, you should interpret each outcome in the context of both majors.

### **CE-Prefix Courses and Student Learning Outcomes**

Table 2 provides a listing of CE-prefix courses and their relationship to the student learning outcomes. A check mark means that the course includes homework, projects, quizzes, exams, or other assignments at a level appropriate for you to consider including in your graduation portfolio related to that outcome.

### **Non-CE Courses and Student Learning Outcomes**

Table 3 provides a listing of non-CE-courses and their potential relationship to the student learning outcomes. A check mark means that the course includes homework, projects, quizzes, exams, or other assignments that the faculty feels confident are at a level appropriate for you to consider including in your graduation portfolio related to that outcome. Other non-CE courses may also include homework, projects, quizzes, exams, or other assignments that are at a level appropriate for you to consider including in your graduation portfolio related to that outcome. Also, documentation and work products from other official university activities may also be included in your portfolio if it illustrates your attainment of student learning outcomes at the level of achievement expected at graduation. Other potential university activities could include documented involvement in student organizations (e.g., ASCE), student government or other university leadership activities; cooperative education (included in Table 3); intercollegiate athletics; etc.

### **Student Responsibility and Good Faith Effort**

**As a graduating student, it is your professional and ethical responsibility to put forth a good faith effort in assembling a graduation portfolio that accurately represents your abilities and that clearly documents your *achievement* of the program's student learning outcomes *at the level expected for graduation.***

Care must be taken to select materials that are relevant to the outcomes and that are at the targeted level of achievement. For example, Outcome T6 states that at the time of graduation you must “document your ability to design a system or process....” Your documentation must be at the design or synthesis level, and it would be inappropriate to include items that were at a lower level of achievement (e.g., at the analysis or application levels). Please review the Student Learning Outcome Levels of Achievement Rubric (Table 1) so you can fully understand outcome statements at the graduation level as well as lower levels.

***Please see any department faculty member if you have any questions regarding an outcome, what is expected, or if a particular work assignment is appropriate to document your achievement of an outcome.***

## Outcome F1 – Math and Science

**Outcome Statement.** At the time of graduation, you must document your ability to solve problems in (1) mathematics through calculus and differential equations, (2) probability and statistics, and (3) at least two areas of natural science.

**Explanation.\*** All areas of civil engineering rely on mathematics, probability and statistics, and natural science for the performance of quantitative analysis of engineering systems. A technical core of knowledge and breadth of coverage in these areas, and the ability to apply them to solve engineering problems, are essential skills for you to be successful in your professional career.

**Guidance.** Your graduation portfolio should include the following:

- A) A statement, written by you, demonstrating your understanding of this outcome,
- B) An explanation how you feel you attained the outcome, and
- C) Sample homework problems, quizzes, and/or exam questions with solutions that support your claim and clearly illustrate your ability to solve programs in
  - (1) Mathematics, including both calculus and differential equations,
  - (2) Probability and statistics, and
  - (3) At least two areas of natural science.

Your sample work must include both the problem statements and your solutions. You must *include documentation of your attainment in all three areas* (mathematics, probability and statistics, and natural science), and you should try to provide work that is related to or support your career interests.

**Supporting Coursework.** The following courses include homework, projects, quizzes, exams or other assignments supporting this outcome that you may consider including in your graduation portfolio:

- (1) Mathematics – MATH 125, MATH 126, MATH 227, MATH 238, CE 331, and CE 475
- (2) Probability and Statistics – GES 255, CE 350, CE 420, and CE 464
- (3) Natural Science – BSC 114/115, CH 101, CH 102, GEO 101, GEO 102, GEO 105, GY101, GY 102, PH 105, PH 106, other approved Natural Science (N) electives, and CE 320

Other courses may also include materials that may illustrate your attainment of an outcome. Tables 2 and 3 provided at the end of this guide list all CE courses and some common non-CE courses, respectively, along with their relationships to the student learning outcomes. You are encouraged to use any materials resulting from official UA activities if they clearly illustrate your attainment of student learning outcomes at the level of achievement expected at graduation. You should try to provide materials that are related to or support your own career interests.

\*The explanation is adapted from the American Society of Civil Engineers (ASCE) Body of Knowledge report, Second Edition.

## Outcome F2 – Humanities and Social Behavior

**Outcome Statement.** At the time of graduation, you must document your ability to explain the importance of (1) humanities, literature, and fine arts, and (2) history and social behavior.

**Explanation.\*** Humanities are academic disciplines that use critical or speculative methods to study the human condition and include philosophy, literature, the visual and performing arts, language, and religion. History and social behavior are data-driven and use the scientific method, including both qualitative and quantitative methods. As a professional, you must be able to work effectively within a social framework with consideration and respect given to the diversity of our society.

**Guidance.** Your graduation portfolio should include the following:

- A) A statement, written by you, demonstrating your understanding of this outcome,
- B) An explanation how you feel you attained the outcome, and
- C) Sample homework problems, quizzes, and/or exam questions with solutions that support your claim and clearly illustrate your ability to explain the importance of (1) Humanities, literature and fine arts (HU/L/FA), and (2) History and social behavior (HI/SB).

You must *include documentation of your attainment in both (1) humanities, literature, and fine arts and (2) history and social behavior*, and you should try to provide work that is related to or support your career interests.

**Supporting Coursework.** The following courses include homework, projects, quizzes, exams or other assignments supporting this outcome that you may consider including in your graduation portfolio:

- (1) Humanities, literature, and fine arts – COM 123, foreign languages, any approved HU/L/FA elective, and CE 121
- (2) History and Social Behavior – any approved HI/SB elective, CE 220, EC 220, and CE 121

Other courses may also include materials that may illustrate your attainment of an outcome. Tables 2 and 3 provided at the end of this guide list all CE courses and some common non-CE courses, respectively, along with their relationships to the student learning outcomes. You are encouraged to use any materials resulting from official UA activities if they clearly illustrate your attainment of student learning outcomes at the level of achievement expected at graduation. You should try to provide materials that are related to or support your own career interests.

\*The explanation is adapted from the American Society of Civil Engineers (ASCE) Body of Knowledge report, Second Edition.

## Outcome T1 – Materials and Mechanics

**Outcome Statement.** At the time of graduation, you must document your ability to analyze and solve problems in engineering mechanics and materials.

**Explanation.\*** Engineering mechanics includes the mechanics of continuous and particulate solids subjected to load, and the mechanics of fluid flow through pipes, channels, and porous media. Materials used within infrastructure include Portland cement concrete, hot mix asphalt concrete, steel, aluminum, masonry, wood and wood-based composites, and synthetic fibers. It is critical that you have knowledge engineering mechanics and how materials systems interact with the environment so that durable materials can be specified that can withstand extreme loading and aggressive environments.

**Guidance.** Your graduation portfolio should include the following:

- A) A statement, written by you, demonstrating your understanding of this outcome with reference to your major,
- B) An explanation how you feel you attained the outcome, and
- C) Sample homework problems, quizzes, and/or exam questions with solutions that support your claim and clearly illustrate your ability to analyze and solve problems in both
  - (1) Engineering mechanics, and
  - (2) Engineering materials.

Your sample work must include both the problem statements and your solutions. You must *include documentation of your attainment in both (1) engineering mechanics and (2) materials*. You should try to provide work that is related to or support your career interests.

**Supporting Coursework.** The following courses include homework, projects, quizzes, exams or other assignments supporting this outcome that you may consider including in your graduation portfolio:

- (1) Engineering mechanics – AEM 201, AEM 250, AEM 264, AEM 311, CE 331, and CE 378
- (2) Engineering materials – CE 262 and CE 340

Other courses may also include materials that may illustrate your attainment of an outcome. Tables 2 and 3 provided at the end of this guide list all CE courses and some common non-CE courses, respectively, along with their relationships to the student learning outcomes. You are encouraged to use any materials resulting from official UA activities if they clearly illustrate you attainment of student learning outcomes at the level of achievement expected at graduation. You should try to provide materials that are related to or support your own career interests.

\*The explanation is adapted from the American Society of Civil Engineers (ASCE) Body of Knowledge report, Second Edition.

## Outcome T2 – Experiments and Data Analysis

**Outcome Statement.** At the time of graduation, you must document your ability to select and conduct engineering experiments, and analyze and evaluate the resulting data.

**Explanation.\*** Engineers frequently design and conduct field and laboratory studies, gather data, create numerical simulations and other models, and then analyze and interpret the results. You should be able to select appropriate experiments to meet specific needs. You should also be able to conduct engineering experiments, and analyze and interpret the results.

**Guidance.** Your graduation portfolio should include the following:

- A) A statement, written by you, demonstrating your understanding of this outcome with reference to your major,
- B) An explanation how you feel you attained the outcome, and
- C) Sample homework problems, quizzes, and/or exam questions with solutions that support your claim and clearly illustrate your ability to
  - (1) Select an appropriate engineering experiment to meet a need
  - (2) Conduct engineering experiments, and analyze and evaluate the resulting data

Your sample work must include both the problem statements and your solutions, and you must *include documentation of your attainment of both parts of this outcome*. You may document your ability to “select and conduct” the same experiment, or you may provide separate documentation of your ability to “select” and appropriate experiment to meet a need and to “conduct” a different experiment. Regardless, you must also document your ability to analyze and evaluate data resulting from a conducted experiment. You should try to provide work that is related to or support your career interests.

**Supporting Coursework.** The following courses include homework, projects, quizzes, exams or other assignments supporting this outcome that you may consider including in your graduation portfolio:

- (1) Select an appropriate engineering experiment to meet a need – CE 262, CE 340, and CE 420
- (2) Conduct engineering experiments, and analyze and evaluate the resulting data – CE 260, CE 262, CE 340, and CE 420

Other courses may also include materials that may illustrate your attainment of an outcome. Table 2 provided at the end of this guide lists all CE courses and their relationships to the student learning outcomes. You are encouraged to use any materials resulting from official UA activities if they clearly illustrate your attainment of student learning outcomes at the level of achievement expected at graduation. You should try to provide materials that are related to or support your own career interests.

\*The explanation is adapted from the American Society of Civil Engineers (ASCE) Body of Knowledge report, Second Edition.

## Outcome T3 – Tools and Engineering Problems

**Outcome Statement.** At the time of graduation, you must document your ability to apply relevant knowledge, techniques, skills, and modern engineering tools to identify, formulate, and solve engineering problems, including problems in:

BSCivE – environmental, water resources, transportation, structural, construction, and geotechnical;

BSArchE – building structures, building mechanical systems, building electrical systems, and construction engineering and management;

BSConE – project controls, construction methods, materials, and safety;

BSEnvE – air, land, and water systems and associated environmental health impacts.

**Explanation.\*** Engineering is a problem-solving profession. However, in addition to solving problems, engineers must have the ability to recognize, identify, and formulate problems before solving them. Then, engineers must be able to apply their knowledge and use the appropriate tools and techniques to solve the complex problems of today.

**Guidance.** Your graduation portfolio should include the following:

- A) A statement, written by you, demonstrating your understanding of this outcome with reference to your major,
- B) An explanation how you feel you attained the outcome, and
- C) Sample homework problems, quizzes, and/or exam questions with solutions that support your claim and clearly illustrate your ability to apply relevant knowledge, techniques, skills, and modern engineering tools to identify, formulate, and solve engineering problems.

Your sample work must include both the problem statements and your solutions, and you must *include documentation of your attainment in all areas listed for your major:*

**BSCivE** – (a) environmental, (b) water resources, (c) transportation, (d) structural, (e) construction, and (f) geotechnical

**BSArchE** – (a) building structures, (b) building mechanical systems, (c) building electrical systems, and (d) construction engineering and management

**BSConE** – (a) project controls, (b) construction methods, (c) materials, and (d) safety

**BSEnvE** – (a) air, (b) land, and (c) water systems, and (d) associated environmental health impacts

You should try to provide work that is related to or support your career interests.

**Supporting Coursework.** Regardless of your major, you are required to complete courses that directly support the areas listed above for your major in the outcome. A list of the specific courses covering these areas is provided on the next page. Additionally, Tables 2 and 3 provided in this guide list all CE courses and some non-CE courses, respectively, and their relationships to the student learning outcomes, including this outcome.

\*The explanation is adapted from the American Society of Civil Engineers (ASCE) Body of Knowledge report, Second Edition.

### Outcome T3 – Tools and Engineering Problems (continued)

**BS CivE** – (a) environmental: CE 320  
(b) water resources: CE 378  
(c) transportation: CE 350  
(d) structural: CE 331  
(e) construction: CE 366  
(f) geotechnical: CE 340

**BS ArchE** – (a) building structures: CE 331  
(b) building mechanical systems: ME 407  
(c) building electrical systems: ECE 350  
(d) construction engineering and management: CE 366, CE 462/562

**BS ConE** – (a) project controls: CE 418/518, CE 463/563, CE 468/568  
(b) construction methods: CE 418/518, CE 461/561, CE 462/562  
(c) materials: CE 418/518, CE 464/564  
(d) safety: CE 418/518, CE 464/564

**BS EnvE** – (a) air: CE 425/525  
(b) land: CE 422/522, CE 475/575  
(c) water systems: CE 424/524, CE 475/575  
(d) and associated environmental health impacts: CE 422/522, CE 425/525

## Outcome T4 – Impacts of Historical and Contemporary Events

**Outcome Statement.** At the time of graduation, you must document your ability to explain the impact of historical and contemporary issues on engineering practice.

**Explanation.\*** Engineering history is useful, if not essential, to understanding the nature of engineering. A historical perspective assists engineers in identifying failure modes and catching errors in logic and design. In addition to historical impacts, you must understand how current events also impact engineering. When generating and comparing alternatives and assessing performance, engineers must consider the impact that engineering solutions have on the economy, environment, political landscape, and society.

**Guidance.** Your graduation portfolio should include the following:

- A) A statement, written by you, demonstrating your understanding of this outcome with reference to your major,
- B) An explanation how you feel you attained the outcome, and
- C) Sample homework problems, quizzes, and/or exam questions with solutions that support your claim and clearly illustrate your ability to explain the impact of both
  - (1) Historical issues on engineering practice, and
  - (2) Contemporary issues on engineering practice.

Your sample work must include both the problem statements and your responses or solutions. You must *include documentation of your ability to explain the impacts of both (1) historic and (2) contemporary events*. You should try to provide work that is related to or support your career interests.

**Supporting Coursework.** The following courses include homework, projects, quizzes, exams or other assignments supporting both aspects of this outcome that you may consider including in your graduation portfolio:

CE 320, CE 331, CE 340, CE 350, CE 350, and CE 378

Other courses may also include materials that may illustrate your attainment of an outcome. Table 2 provided at the end of this guide lists all CE courses and their relationships to the student learning outcomes. You are encouraged to use any materials resulting from official UA activities if they clearly illustrate your attainment of student learning outcomes at the level of achievement expected at graduation. You should try to provide materials that are related to or support your own career interests.

\*The explanation is adapted from the American Society of Civil Engineers (ASCE) Body of Knowledge report, Second Edition.

## Outcome T5 – Project Management

**Outcome Statement.** At the time of graduation, you must document your ability to develop solutions to well-defined project management problems.

**Explanation.\*** Engineers manage projects, some may be rather small or limited in scope, others may be quite large and valued in the billions of dollars. According to the Project Management Institute, “Project management is the application of knowledge, skills, tools, and techniques to project activities to meet project requirements. Project management is accomplished through the application and integration of the project management processes of initiating, planning, executing, monitoring and controlling, and closing.”

**Guidance.** Your graduation portfolio should include the following:

- A) A statement, written by you, demonstrating your understanding of this outcome with reference to your major,
- B) An explanation how you feel you attained the outcome, and
- C) Sample homework problems, quizzes, and/or exam questions with solutions that support your claim and clearly illustrate your ability to develop solutions to well-defined project management problems.

Your sample work must include both the problem statements and your responses or solutions. You should try to provide project management problems and solutions that are related to or support your career interests.

**Supporting Coursework.** CE 366, CE 401 and CE 403 include homework, projects, quizzes, exams or other assignments supporting this outcome that you may consider including in your graduation portfolio.

Other courses may also include materials that may illustrate your attainment of an outcome. Table 2 provided at the end of this guide lists all CE courses and their relationships to the student learning outcomes. You are encouraged to use any materials resulting from official UA activities if they clearly illustrate your attainment of student learning outcomes at the level of achievement expected at graduation. You should try to provide materials that are related to or support your own career interests.

\*The explanation is adapted from the American Society of Civil Engineers (ASCE) Body of Knowledge report, Second Edition.

## Outcome T6 – Design

**Outcome Statement.** At the time of graduation, you must document your ability to design a system or process in more than one area within the discipline to meet desired needs, including sustainability and within other realistic constraints such as environmental, economic, social, political, ethical, health and safety, and constructability.

**Explanation.\*** Engineering design is a creative, systematic, and often iterative application of scientific, mathematical, and basic engineering principles to conceive and develop components, systems, and processes in response to a defined need. Engineering design includes a consideration of multiple criteria – economic, health and safety, social and environmental, and appropriate measures of functionality and performance – as well as applicable codes, standards, and regulations. The engineering design process is made up of several stages, which may include identification of need, definition of scope and constraints, definition of design problem statements and applicable codes and standards, iteration between synthesis and analysis of design alternatives, selection of the best design based on applicable criteria, and documentation.

**Guidance.** Your graduation portfolio should include the following:

- A) A statement, written by you, demonstrating your understanding of design and this outcome,
- B) An explanation how you feel you attained the outcome, and
- C) Sample homework problems, quizzes, and/or exam questions with solutions that support your claim and clearly illustrate your ability to design a system or process in more than one area within the discipline to meet desired needs, and which include the following:
  - (1) At least one of your design samples must illustrate consideration of sustainability in the design, and
  - (2) Other realistic constraints (such as environmental, economic, social, political, ethical, health and safety, and constructability) must be included in all design samples you provide.

You must provide the design problem statement and *make sure that your sample work provided do, in fact, illustrate you abilities in design* (versus analysis or other lower level examples), and you must *include documentation of consideration of (1) sustainability and (2) other realistic constraints* in your design. You should try to provide work that is related to or support your career interests.

**Supporting Coursework.** Regardless of your major, you are required to complete at least three design courses plus CE 401 and CE 403. Table 2 provided in this guide lists all CE courses and their relationships to the student learning outcomes. Courses that are considered to have sufficient design content for you to include in your portfolio have a check mark for outcome, T6 Design. Please refer to the “*Student Guide to Senior Plan of Study Electives, Senior Design, Licensure, and Graduate School*” for additional information about design within each major and a full listing of all design courses.

\*The explanation is adapted from the American Society of Civil Engineers (ASCE) Body of Knowledge report, Second Edition.

## Outcome T7 – Specialization

**Outcome Statement.** At the time of graduation, you must document your ability to explain key aspects of at least one traditional or emerging area of area of advanced specialization within the discipline.

**Explanation.\*** Engineering has become a professional of specialization. As your career develops, you will need to develop specialized knowledge and skills within a traditional or emerging area of practice. Advanced technical specialization includes traditionally defined areas of engineering practice within the discipline, but also includes coherent combinations of these traditional areas. Many non-engineering disciplines also have content that would be beneficial to the professional practice of civil engineering.

**Guidance.** Your graduation portfolio should include the following:

- A) A statement, written by you, demonstrating your understanding of this outcome with reference to your major,
- B) An explanation how you feel you attained the outcome, and
- C) Sample homework problems, quizzes, and/or exam questions with solutions that support your claim and clearly illustrate your ability to explain key aspects of at least one traditional or emerging area of area of advanced specialization within the discipline.

Your sample work must include both the problem statements and your responses or explanations. You should try to provide explanations of specialization that are related to or support your career interests.

**Supporting Coursework.** Being able to explain key aspects of specialization in any area requires an understanding of that area of practice. Therefore, the faculty has linked this outcome with outcome T3, Tools and Engineering Problems. Each course listed as supporting outcome T3 also includes homework, projects, quizzes, exams or other assignments supporting this outcome.

Table 2 provided in this guide lists all CE courses and their relationships to the student learning outcomes, including this outcome. Many other senior level courses within each area also provide an opportunity for you to learn and document your fulfillment of this outcome.

\*The explanation is adapted from the American Society of Civil Engineers (ASCE) Body of Knowledge report, Second Edition.

## Outcome P1 – Professional, Ethical, and Legal Aspects

**Outcome Statement.** At the time of graduation, you must document your ability to analyze a situation involving multiple conflicting professional, legal, and ethical interests, and determine an appropriate course of action.

**Explanation.\*** Engineers in professional practice have a unique obligation to society, and this obligation is defined by professional, ethical, and legal responsibilities of each engineer. Each engineer must adhere to a doctrine of professionalism and ethical responsibility. As a graduating student, you must go beyond satisfying code requirements. You must be able to illustrate a firm understanding of an engineer’s professional, ethical, and legal responsibilities.

**Guidance.** Your graduation portfolio should include the following:

- A) A statement, written by you, demonstrating your understanding of this outcome,
- B) An explanation how you feel you attained the outcome, and
- C) Sample homework problems, quizzes, and/or exam questions with solutions that support your claim and clearly illustrate your ability to analyze a situation involving multiple conflicting professional, legal, and ethical interests, and determine an appropriate course of action.

Your sample work must *include documentation of professional, legal and ethical issues (all three)*. Legal aspects can include consideration of regulatory constraints (but not design codes or standards). You should try to provide work that is related to or support your career interests.

**Supporting Coursework.** Professional, ethical, and legal aspects of engineering are often, but not exclusively, associated with design. All of the design-designated courses (except CE 378), in addition to providing you with a significant design experience, also include assignments or other activities related to this outcome. Table 2 provided in this guide lists all CE courses and their relationships to the student learning outcomes, and you will note that design courses, which have outcome T6 Design checked, also have outcome P1 Professional, Ethical, and Legal Aspects checked. These courses have sufficient relevant content for you to include in your portfolio for this outcome.

Other courses may also include materials that may illustrate your attainment of an outcome. Table 2 provided at the end of this guide lists all CE courses and their relationships to the student learning outcomes. You are encouraged to use any materials resulting from official UA activities if they clearly illustrate you attainment of student learning outcomes at the level of achievement expected at graduation.

\*The explanation is adapted from the American Society of Civil Engineers (ASCE) Body of Knowledge report, Second Edition.

## Outcome P2 – Communication

**Outcome Statement.** At the time of graduation, you must document your ability to organize and deliver effective written, verbal, and graphical communications.

**Explanation.\*** Engineers must communicate effectively with technical and nontechnical individuals and audiences in a variety of settings. Having the ability to effectively write, orally communicate, and communicate through graphical means requires practice and is critical to successful project completion.

**Guidance.** Your graduation portfolio should include the following:

- A) A statement, written by you, demonstrating your understanding of this outcome,
- B) An explanation how you feel you attained the outcome, and
- C) Sample homework problems, quizzes, and/or exam questions with solutions that support your claim and clearly illustrate your ability to organize and deliver effective
  - (1) written communications,
  - (2) verbal communications, and
  - (3) graphical communications.

Your sample work must *include documentation of your attainment of this outcome with respect to all three aspects of communication: (1) written, (2) verbal, and (3) graphical*. You should try to provide work that is related to or support your career interests.

**Supporting Coursework.** The following courses include homework, projects, quizzes, exams or other assignments supporting the three aspects of this outcome that you may consider including in your graduation portfolio:

- (1) Written – EN 101 (FC), EN 102 (FC), CE 340, CE 401, and CE 403
- (2) Verbal – COM 123, CE 401, and CE 403
- (3) Graphical – ENGR 103, ENGR 171, CE 260, CE 401, and CE 403

Other courses may also include materials that may illustrate your attainment of an outcome. Tables 2 and 3 provided at the end of this guide list all CE courses and some common non-CE courses, respectively, along with their relationships to the student learning outcomes. You are encouraged to use any materials resulting from official UA activities if they clearly illustrate your attainment of student learning outcomes at the level of achievement expected at graduation. You should try to provide materials that are related to or support your own career interests.

\*The explanation is adapted from the American Society of Civil Engineers (ASCE) Body of Knowledge report, Second Edition.

## Outcome P3 – Independent Study

**Outcome Statement.** At the time of graduation, you must document that you can demonstrate your ability to learn through independent study, without the aid of formal instruction.

**Explanation.\*** Considering the ever-increasing quantity of technical and nontechnical knowledge required of practicing engineers, the ability to engage in lifelong learning is essential. Learning how to learning independently is part of your undergraduate preparation for a successful career. Independent learning is defined as the ability to acquire knowledge, understanding, or skill on your own without the aid of formal educational, be it in a classroom or online.

**Guidance.** Your graduation portfolio should include the following:

- A) A statement, written by you, demonstrating your understanding of this outcome,
- B) An explanation how you feel you attained the outcome, and
- C) Sample homework problems, quizzes, and/or exam questions with solutions that support your claim and clearly demonstrates your ability to learn through independent study, without the aid of formal instruction.

Your sample work must include documentation of your attainment of this outcome. For example, you should indicate what you may have been given and what you had to learn on your own though outside research or reading. You should try to provide work that is related to or support your career interests.

**Supporting Coursework.** While independent study is an integral part of engineering in general, the program has associated this outcome with design. All of the design-designated courses (except 340), in addition to providing you with a significant design experience, also include assignments or other activities related to this independent study. Table 2 provided in this guide lists all CE courses and their relationships to the student learning outcomes, and you will note that design courses, which have outcome T6 Design checked, also have outcome P3 Independent Study checked. These courses have sufficient relevant content for you to include in your portfolio for this outcome.

Other courses may also include materials that may illustrate your attainment of an outcome. Table 2 provided at the end of this guide lists all CE courses and their relationships to the student learning outcomes. You are encouraged to use any materials resulting from official UA activities if they clearly illustrate you attainment of student learning outcomes at the level of achievement expected at graduation.

\*The explanation is adapted from the American Society of Civil Engineers (ASCE) Body of Knowledge report, Second Edition.

## Outcome P4 – Attributes, Leadership, and Teaming

**Outcome Statement.** At the time of graduation, you must document that you can (1) demonstrate attributes supportive of the professional practice of engineering; (2) apply leadership principles to direct the efforts of a small group to solve a relatively constrained problem; and (3) function effectively as a member of a multidisciplinary team to solve open-ended engineering problems.

**Explanation.\*** Positive attributes generally considered effective in the professional practice of engineering include commitment, confidence, consideration of others, curiosity, entrepreneurship, fairness, high expectations, honesty, integrity, intuition, judgment, optimism, persistence, positiveness, respect, self esteem, sensitivity, thoughtfulness, thoroughness, and tolerance. Leadership can be considered as the ability to engage others in a common vision, clearly planning and organizing resources, developing and maintaining trust, sharing perspectives, inspiring creativity, heightening motivation, and being sensitive to competing needs. Engineers must be willing to lead as well as to be able to work well with others and function effectively as members of a team.

**Guidance.** Your graduation portfolio should include the following:

- A) A statement, written by you, demonstrating your understanding of this outcome,
- B) An explanation how you feel you attained the outcome, and
- C) Sample homework problems, quizzes, and/or exam questions with solutions that support your claim and clearly illustrate that you have the ability to
  - (1) demonstrate attributes supportive of the professional practice of engineering;
  - (2) apply leadership principles to direct the efforts of a small group to solve a relatively constrained problem; and
  - (3) function effectively as a member of a multidisciplinary team to solve open-ended engineering problems.

Your sample work must *include documentation of your ability to (1) demonstrate supportive attributes, (2) apply leadership principles, and (3) function as a member of a team.* You should try to provide work that is related to or support your career interests.

**Supporting Coursework.** The following courses include homework, projects, quizzes, exams or other assignments supporting the three aspects of this outcome that you may consider including in your graduation portfolio:

- (1) Attributes – CE 401, and CE 403
- (2) Leadership – CE 262, CE 340, CE 420, CE 401, and CE 403
- (3) Teaming – CE 262, CE 340, CE 420, CE 401, and CE 403

Other courses may also include materials that may illustrate your attainment of an outcome. Table 2 provided at the end of this guide lists all CE courses and their relationships to the student learning outcomes. You are encouraged to use any materials resulting from official UA activities if they clearly illustrate you attainment of student learning outcomes at the level of achievement expected at graduation.

\*The explanation is adapted from the American Society of Civil Engineers (ASCE) Body of Knowledge report, Second Edition.

## Outcome P5 – Licensure, Business, and Globalization

**Outcome Statement.** At the time of graduation, you must document that you can explain (1) the importance of professional licensure and (2) basic concepts in engineering management, business, law, and globalization.

**Explanation.\*** By law, only licensed professional engineers are allowed to provide engineering services. Engineering, or at least consulting and engineering services, is a business, and graduates need to understand and be able to explain some basic concepts in engineering management, business, and law. This can include personnel and/or organizational structure, implications of current laws and regulations, and responsibilities to the public and/or client, developing budgets and project schedules, understanding funding mechanisms, and business ethics. Global issues and the fact that the world is increasingly interconnected are dramatically changing the profession of engineering.

**Guidance.** Your graduation portfolio should include the following:

- A) A statement, written by you, demonstrating your understanding of this outcome,
- B) An explanation how you feel you attained the outcome, and
- C) Sample homework problems, quizzes, and/or exam questions with solutions that support your claim and clearly illustrate your understanding of
  - (1) the importance of professional licensure and
  - (2) basic concepts in (a) engineering management and business, (b) law, and (c) globalization.

Your sample work must *include documentation of your understanding of (1) the importance of professional licensure and (2) basic concepts in the following three areas (a) engineering management and business, (b) law, and (c) globalization.*

***Official notification that you passed the Fundamentals of Engineering (FE) Exam is strongly encouraged as part of your documentation for satisfying the professional licensure component of this outcome.***

**Supporting Coursework.** The following courses include homework, projects, quizzes, exams or other assignments supporting the three aspects of this outcome that you may consider including in your graduation portfolio:

- (1) Licensure – CE 121, CE 401, CE 403 and all design courses (except CE 378)
- (2a) Engineering management and business – CE 366, CE 401, and CE 403
- (2b) Law – CE 366, CE 418, and CE 422
- (2c) Globalization – CE 320, CE 331, CE 350, CE 366, and CE 378

Other courses may also include materials that may illustrate your attainment of an outcome. Table 2 provided at the end of this guide lists all CE courses and their relationships to the student learning outcomes. You are encouraged to use any materials resulting from official UA activities if they clearly illustrate your attainment of student learning outcomes at the level of achievement expected at graduation. You should try to provide materials that are related to or support your own career interests.

\*The explanation is adapted from the American Society of Civil Engineers (ASCE) Body of Knowledge report, Second Edition.

**Table 1 – Student Learning Outcome Levels of Achievement Rubric**

This table provides the outcome statement for each student learning outcome at each level, including the level expected at graduation (bolded). Outcomes statements are also included for the MS and PhD degrees, but you only need to document your achievement of the BS graduation outcomes.

Outcome ID	Outcome Name	Level 1 Knowledge	Level 2 Comprehension	Level 3 Application	Level 4 Analysis	Level 5 Synthesis	Level 6 Evaluation
F1	Math and Science	Define key factual information related to (1) mathematics through calculus and differential equations; (2) probability and statistic; and (3) at least two areas of natural science.	Explain key concepts and problem-solving processes in (1) mathematics through calculus and differential equations; (2) probability and statistics; and (3) at least two areas of natural science.	Solve problems in (1) mathematics through calculus and differential equations; (2) probability and statistics; and (3) at least two areas of natural science. <b>(BS)</b>			
F2	Humanities and Social Behavior	Define key facts from (1) humanities, literature, and fine arts; and (2) history and social.	Discuss the key facts of (1) humanities, literature, and fine arts; and (2) history and social behavior.	Explain the importance of (1) humanities, literature, and fine arts; and (2) history and social behavior. <b>(BS)</b>			
T1	Materials and Mechanics	Define key factual information related to engineering mechanics and materials.	Explain key concepts and problem-solving processes in engineering mechanics and materials.	Solve problems in engineering mechanics and materials.	Analyze and solve problems in engineering mechanics and materials. <b>(BS)</b>		
T2	Experiments and Data Analysis	Identify the procedures and equipment necessary to conduct engineering related experiments.	Explain the purpose, procedures, equipment, and practical applications of engineering related experiments.	Conduct engineering related experiments according to established procedures, and report the results.	Select and conduct engineering experiments, and analyze and evaluate the resulting data. <b>(BS)</b>	Specify or design an experiment to meet a need, conduct the experiment, and analyze and explain the resulting data.	Evaluate the effectiveness of a designed experiment and the implications of the resulting data. <b>(PhD)</b>

Outcome ID	Outcome Name	Level 1 Knowledge	Level 2 Comprehension	Level 3 Application	Level 4 Analysis	Level 5 Synthesis	Level 6 Evaluation
T3	Tools and Engineering Problems	Identify the techniques, skills, and modern engineering tools that are necessary for engineering practice.	Explain how relevant techniques, skills, and modern engineering tools are used in engineering practice, including key concepts and problem-solving processes.	<p>Apply relevant knowledge, techniques, skills, and modern engineering tools to identify, formulate, and solve engineering problems, including problems in:</p> <p>BSCivE – environmental, water resources, transportation, structural, construction, and geotechnical <b>(BS)</b></p>	<p>Identify, formulate, and solve complex relevant engineering problems by selecting and applying appropriate tools and techniques. <b>(MS)</b></p> <p>BSArchE – building structures, building mechanical systems, building electrical systems, and construction engineering and management <b>(BS)</b></p>	<p>Synthesize and explain the solution to complex relevant engineering problems, including the use of appropriate tools and techniques. <b>(BS)</b></p> <p>BSConE – project controls, construction methods, materials, and safety <b>(BS)</b></p>	<p>Verify and justify the solution to a complex relevant engineering problem, including the use of appropriate tools and techniques. <b>(PhD)</b></p> <p>BSEnvE – air, land, and water systems, and associated environmental health impacts <b>(BS)</b></p>
T4	Impacts of Historical and Current Events	Define the impacts of specific historical and contemporary issues on engineering practice.	Discuss the impact of historical and contemporary issues on engineering practice.	<b>Explain the impact of historical and contemporary issues on engineering practice. (BS)</b>			
T5	Project Management	List key principles of project management.	Explain what a project is and the key aspects of project management.	<b>Develop solutions to well-defined project management problems. (BS)</b>			

Outcome ID	Outcome Name	Level 1 Knowledge	Level 2 Comprehension	Level 3 Application	Level 4 Analysis	Level 5 Synthesis	Level 6 Evaluation
T6	Design	Define engineering design; list the major steps in the engineering design process; and list constraints that affect the process and products of engineering design.	Describe the engineering design process, and explain how real-world constraints affect the process and products of engineering design.	Apply the engineering design process to a component to meet a well-defined set of requirements and constraints.	Illustrate the engineering design process for a basic engineering system or process to meet a well-defined set of requirements and constraints.	Design a system or process in more than one area within the discipline to meet desired needs, including sustainability and within other realistic constraints such as environmental, economic, social, political, ethical, health and safety, and constructability. <b>(BS)</b>	
T7	Specialization	Define key aspects of at least one traditional or emerging area of advanced specialization within the discipline.	Explain key aspects of at least one traditional or emerging area of advanced specialization within the discipline. <b>(BS)</b>	Apply specialized knowledge to solve problems in a traditional or emerging area of advanced specialization.	Analyze complex system of process in a traditional or emerging area of advanced specialization.	Synthesize advanced technical knowledge in a traditional or emerging area of specialization. <b>(MS)</b>	Develop and evaluate new, advanced technical knowledge in a traditional or emerging area of specialization. <b>(PhD)</b>
P1	Professional, Ethical, and Legal Aspects	List the professional, legal, and ethical responsibilities of an engineer.	Describe the professional, legal, and ethical responsibilities of an engineer.	Apply standards of professional, legal, and ethical responsibility in a relatively clear-cut situation to determine an appropriate course of action.	<b>Analyze a situation involving multiple conflicting professional, legal, and ethical interests, and determine an appropriate course of action. (BS)</b>		
P2	Communication	List the characteristics of effective verbal, written, and graphical communications.	Describe the characteristics of effective verbal, written, and graphical communications.	Apply rules of grammar, composition and appropriate graphical standards to deliver verbal, written, and graphical communications.	Organize and deliver effective written, verbal, and graphical communications. <b>(BS)</b>	Synthesize and explain the relevance and application of new, advanced technical knowledge in both technical and non-technical terms. <b>(PhD)</b>	

Outcome ID	Outcome Name	Level 1 Knowledge	Level 2 Comprehension	Level 3 Application	Level 4 Analysis	Level 5 Synthesis	Level 6 Evaluation
P3	Independent Study	Define life-long learning.	Explain the need for life-long learning and describe the skills required of a life-long learner.	Demonstrate the ability to learn through independent study, without the aid of formal instruction. <b>(BS)</b>			
P4	Attributes, Leadership, and Teaming	Describe attributes supportive of the professional practice of engineering, and key aspects of leadership and teamwork.	Discuss attributes supportive of the professional practice of engineering, leadership principles, and the principles of collaborative teaming.	Demonstrate attributes supportive of the professional practice of engineering; apply leadership principles to direct the efforts of a small group to solve a relatively constrained problem; and function effectively as a member of a multidisciplinary team to solve open-ended engineering problems. <b>(BS)</b>			
P5	Licensure, Business, and Globalization	List key concepts of licensure, engineering management, business, law, and globalization.	Explain the importance of professional licensure and basic concepts in engineering management, business, law, and globalization. <b>(BS)</b>				

**Table 2 – CE-Prefix Courses and Student Learning Outcomes**

This table provides a listing of CE-prefix courses and their relationship to the student learning outcomes. A check mark means that the course includes homework, projects, quizzes, exams, or other assignments at a level appropriate for you to consider including in your graduation portfolio related to that outcome. Other outcomes may also be included in a course; please refer to your syllabus.

Course	Course Title	Student Learning Outcomes													
		F1	F2	T1	T2	T3	T4	T5	T6	T7	P1	P2	P3	P4	P5
		level 3	level 3	level 4	level 4	level 3	level 3	level 3	level 5	level 2	level 4	level 4	level 3	level 3	level 2
		math and science	humanities and social behavior	material and mechanics	experiments and data analysis	tools and engg problems	impacts of historical and current events	project management	design	specialization	professional, ethical, and legal aspects	communication	independent study	attributes, leadership, and teaming	license, business, and globalization
CE 121	Intro to Civil, Construction & Environmental Engrg		✓												✓
CE 220	Society, Infrastructure and the Environment (SB)		✓				✓								
CE 260	Civil and Construction Engineering Surveying				✓						✓				
CE 262	Civil and Construction Engineering Materials			✓	✓									✓	
CE 270	Climate and Climate Change: European Alps (N)	✓					✓				✓				
CE 320	Intro to Environmental Engineering	✓				✓	✓			✓	✓				✓
CE 331	Intro to Structural Engineering	✓		✓		✓	✓			✓					✓
CE 340	Geotechnical Engineering			✓	✓	✓				✓		✓		✓	
CE 350	Intro to Transportation Engineering	✓				✓	✓			✓					✓
CE 366	Intro to Construction Engineering					✓	✓	✓		✓					✓
CE 378	Water Resources Engineering			✓		✓	✓		✓	✓					✓

Course	Course Title	Student Learning Outcomes													
		F1	F2	T1	T2	T3	T4	T5	T6	T7	P1	P2	P3	P4	P5
		level 3	level 3	level 4	level 4	level 3	level 3	level 3	level 5	level 2	level 4	level 4	level 3	level 3	level 2
		math & science	humanities & social behavior	material science & mechanics	experiments & data analysis	tools & engng problems	impacts of historical and current events	project mgmt	design	specialization	professional, ethical, & legal aspects	communication	independent study	attributes, leadership, and teaming	licensure, business, globalization
CE 401 CE 403	Capstone Project - Site Design Capstone Project - Building Design							✓	✓			✓		✓	✓
CE 414* CE 514*	Information Systems Design					✓			✓		✓	✓	✓	✓	
CE 417 CE 517*	Advanced Project Management					✓		✓	✓		✓	✓	✓	✓	✓
CE 418 CE 518*	Engineering Management					✓				✓	✓				✓
CE 420	Environmental Measurements	✓			✓									✓	
CE 422 CE 522*	Solid and Hazardous Waste Management					✓				✓					✓
CE 424 CE 524*	Water and Wastewater Treatment					✓			✓	✓	✓		✓		✓
CE 425 CE 525*	Air Pollution Engineering					✓			✓	✓	✓		✓		✓
CE 432 CE 532*	Matrix Analysis of Structures			✓		✓						✓			
CE 433	Reinforced Concrete Structures I								✓		✓		✓		✓
CE 434	Structural Steel Design I								✓		✓		✓		✓
CE 435 CE 535*	Concrete Materials				✓		✓		✓		✓	✓	✓		✓
CE 437 CE 537*	Reinforced Concrete Structures II			✓					✓	✓	✓		✓		✓

\* 500-level courses are available only to students with a 3.0 or higher overall GPA or in the University Scholars Program.

Course	Course Title	Student Learning Outcomes													
		F1	F2	T1	T2	T3	T4	T5	T6	T7	P1	P2	P3	P4	P5
		level 3	level 3	level 4	level 4	level 3	level 3	level 3	level 5	level 2	level 4	level 4	level 3	level 3	level 2
		math & science	humanities & social behavior	material science & mechanics	experiments & data analysis	tools & engng problems	impacts of historical and current events	project mgmt	design	specialization	professional, ethical, & legal aspects	communication	independent study	attributes, leadership, and teaming	licensure, business, globalization
CE 438 CE 538*	Structural Steel Design II			✓					✓	✓	✓		✓	✓	
CE 439	Design of Wood and Masonry Structures			✓					✓	✓	✓		✓	✓	
CE 442 CE 542*	Waste Containment Facilities				✓		✓		✓		✓		✓	✓	
CE 444 CE 444*	Foundation Engineering				✓	✓			✓	✓	✓		✓	✓	
CE 451	Geometric Design of Roadways					✓			✓		✓		✓	✓	
CE 454 CE 554*	Urban Transportation Planning	✓	✓				✓			✓					
CE 458	Traffic Engineering	✓			✓	✓									
CE 459 CE 559*	Pavement Design and Rehabilitation						✓		✓		✓	✓	✓	✓	
CE 461 CE 561*	Horizontal Construction Methods					✓			✓	✓	✓		✓	✓	
CE 462 CE 562*	Vertical Construction Methods					✓			✓	✓	✓		✓	✓	
CE 463 CE 563*	Construction Cost Estimating					✓				✓					
CE 464 CE 564*	Safety Engineering	✓				✓				✓					
CE 467 CE 567*	Construction Accounting and Finance					✓	✓	✓				✓		✓	

\* 500-level courses are available only to students with a 3.0 or higher overall GPA or in the University Scholars Program.

Course	Course Title	Student Learning Outcomes													
		F1	F2	T1	T2	T3	T4	T5	T6	T7	P1	P2	P3	P4	P5
		level 3	level 3	level 4	level 4	level 3	level 3	level 3	level 5	level 2	level 4	level 4	level 3	level 3	level 2
		math & science	humanities & social behavior	material science & mechanics	experiments & data analysis	tools & engg problems	impacts of historical and current events	project mgmt	design	specialization	professional, ethical, & legal aspects	communication	independent study	attributes, leadership, and teaming	license, business, globalization
CE 468 CE 568*	Construction Scheduling					✓				✓					
CE 470	Climate and Climate Change: European Alps						✓				✓	✓	✓		
CE 475 CE 575*	Hydrology	✓				✓			✓	✓	✓		✓	✓	
CE 480 CE 580*	Forensic Engineering						✓		✓	✓	✓	✓	✓	✓	
CE 481 CE 581*	Legal Aspects of Engineering & Construction							✓			✓	✓		✓	
CE 486 CE 586*	GIS for Civil Engineers					✓						✓	✓		
CE 491 CE 591*	Special Problems	See instructor for outcomes associated with the specific course/section													
CE 498	Undergraduate Research Experience	See instructor (research advisor) for outcomes associated with this course/section													
CE 521*	Environmental Microbiology					✓				✓		✓	✓		
CE 531*	Structural Dynamics	✓		✓	✓	✓									
CE 533*	Structural Loads			✓		✓	✓								
CE 534*	Advanced Structural Mechanics	✓		✓		✓									
CE 536*	Wood Structural Design			✓					✓	✓	✓		✓	✓	

\* 500-level courses are available only to students with a 3.0 or higher overall GPA or in the University Scholars Program.

Course	Course Title	Student Learning Outcomes													
		F1	F2	T1	T2	T3	T4	T5	T6	T7	P1	P2	P3	P4	P5
		level 3	level 3	level 4	level 4	level 3	level 3	level 3	level 5	level 2	level 4	level 4	level 3	level 3	level 2
		math & science	humanities & social behavior	material science & mechanics	experiments & data analysis	tools & enrg problems	impacts of historical and current events	project mgmt	design	specialization	professional, ethical, & legal aspects	communication	independent study	attributes, leadership, and teaming	licensure, business, globalization
CE 542*	Wind and Earthquake Engineering			✓	✓	✓				✓					
CE 543*	Prestressed Concrete Structures			✓		✓			✓		✓	✓		✓	
CE 553*	Intelligent Transportation Systems						✓			✓		✓			
CE 556*	Transportation System Analysis	✓				✓					✓				
CE 560*	Front End Planning					✓		✓		✓				✓	
CE 570*	Open Channel Flow	✓		✓		✓			✓		✓	✓		✓	
CE 573*	Statistical Applications in Civil Engineering	✓			✓	✓						✓			
CE 616**	Advanced Information Systems					✓			✓	✓	✓	✓		✓	
CE 624**	Water Quality Modeling	✓				✓				✓		✓			
CE 626**	Physical and Chemical Processes	✓				✓				✓		✓			
CE 631**	Experimental Structural Dynamics	✓		✓	✓	✓									
CE 633**	Structural Reliability	✓			✓	✓						✓			

\* 500-level courses are available only to students with a 3.0 or higher overall GPA or in the University Scholars Program.

\*\*600-level courses are available only to students in the University Scholars Program.

Course	Course Title	Student Learning Outcomes													
		F1	F2	T1	T2	T3	T4	T5	T6	T7	P1	P2	P3	P4	P5
		level 3	level 3	level 4	level 4	level 3	level 3	level 3	level 5	level 2	level 4	level 4	level 3	level 3	level 2
		math & science	humanities & social behavior	material science & mechanics	experiments & data analysis	tools & engrg problems	impacts of historical and current events	project mgmt	design	specialization	professional, ethical, & legal aspects	communication	independent study	attributes, leadership, and teaming	license, business, globalization
CE 635**	Analytical Methods in Cement and Concrete				✓	✓				✓		✓			
CE 636**	Advanced Infrastructure Materials			✓		✓				✓		✓			
CE 640**	Earthquake Engineering			✓	✓	✓				✓					
CE 641**	Wind Engineering				✓		✓						✓		
CE 655**	Sustainable Transportation		✓									✓	✓		
CE 656**	Transportation Demand and Network Modeling	✓				✓						✓			
CE 658**	Traffic Flow Theory	✓										✓	✓		
CE 671**	Hydrologic Modeling	✓				✓						✓	✓		
CE 686**	Advanced GIS					✓						✓	✓		

\*\*600-level courses are available only to students in the University Scholars Program.

### Table 3 – Non-CE Courses and Student Learning Outcomes

This table provides a listing of non-CE-courses and their potential relationship to the student learning outcomes. A check mark means that the course includes homework, projects, quizzes, exams, or other assignments that the faculty feels confident are at a level appropriate for you to consider including in your graduation portfolio related to that outcome. Other non-CE courses may also include homework, projects, quizzes, exams, or other assignments that are at a level appropriate for you to consider including in your graduation portfolio related to that outcome. Also, documentation and work products from other official university activities may also be included in your portfolio if it illustrates your attainment of student learning outcomes at the level of achievement expected at graduation. Other potential university activities could include documented involvement in student organizations (e.g., ASCE,), student government or other university leadership activities; cooperative education (included in this table); intercollegiate athletics; etc. Please consult with a faculty member for advice on appropriate materials that clearly illustrate your attainment of each student learning outcome.

Course	Course Title	Student Learning Outcomes														
		F1	F2	T1	T2	T3	T4	T5	T6	T7	P1	P2	P3	P4	P5	
		level 3	level 3	level 4	level 4	level 3	level 3	level 3	level 5	level 2	level 4	level 4	level 3	level 3	level 2	
		math & science	humanities & social behavior	material science & mechanics	experiments & data analysis	tools & engng problems	impacts of historical and current events	project mgmt	design	specialization	professional, ethical, & legal aspects	communication	independent study	attributes, leadership, and teaming	licensure, business, globalization	
GES 255	Engineering Statistics	✓														
MATH 125 MATH 126 MATH 227 MATH 238	Calculus I Calculus II Calculus III Differential Equations	✓														
“N”	Any Natural Science (N) courses, including BSC, CH, GEO, GY, and PH courses	✓														
“HU/L/FA” “HI/SB”	Any Humanities, Literature, and Fine Arts (HU/L/FA) or History and Social Behavior (HI/SB) courses		✓													

Course	Course Title	Student Learning Outcomes													
		F1	F2	T1	T2	T3	T4	T5	T6	T7	P1	P2	P3	P4	P5
		level 3	level 3	level 4	level 4	level 3	level 3	level 3	level 5	level 2	level 4	level 4	level 3	level 3	level 2
		math & science	humanities & social behavior	material science & mechanics	experiments & data analysis	tools & engg problems	impacts of historical and current events	project mgmt	design	specialization	professional, ethical, & legal aspects	communication	independent study	attributes, leadership, and teaming	licensure, business, globalization
AEM 201	Statics														
AEM 250	Mechanics of Materials														
AEM 264	Dynamics			✓											
AEM 311	Fluid Mechanics														
ECE 350*	Electrical Power and Machines					✓*									
ME 401*	Heating, Ventilation, and Air Conditioning					ArchE									
COM 123	Public Speaking										✓				
EN 101	English Composition I										✓				
EN 102	English Composition II										✓				
ENGR 103	Engineering Foundations Large-Scale										✓				
ENGR 171	Engineering Graphics										✓				
Co-op**	Cooperative Education										✓**	✓**	✓**	✓**	

\* ECE 350 and ME 401 include materials that are appropriate for the BSArchE student learning outcome T3.

\*\* Cooperative Education, depending on the specific work you are involved in, supports many of the student learning outcomes, likely including P2, P3, P4, and P5. Your experience may provide appropriate materials for other outcomes as well, such as T3, T4, T5, T6, and P1.