

## Bachelor of Engineering in Environmental Engineering

2020 – 2021

|                                  |   |                      |    |
|----------------------------------|---|----------------------|----|
| Awarding Institution             | A'Sharqiyah University  |                      |    |
| College / Centre                 | College of Engineering  |                      |    |
| Program Title                    | Environmental Engineering   |                      |    |
| Final Award                      | Bachelor of Engineering in Environmental Engineering (BEng)   |                      |    |
| Credit hours                     | 137   |                      |    |
| Mode of Study                    | Full time - Part Time - Special Part Time   |                      |    |
| Language of Study                | English   |                      |    |
| Benchmarks                       |   |                      |    |
| Entry requirements               | <p>A student</p> <ul style="list-style-type: none"> <li>- should have successfully completed the courses of all subjects of the general education diploma or equivalent;</li> <li>- should achieve the standards set for the subjects of the General Foundation Program;</li> <li>- should have studied subjects which qualify him/her to be enrolled in programs in the College of engineering,</li> <li>- Must be medically fit.</li> </ul> |                      |    |
| Minimum period of registration   | FULL-TIME: 9 semesters  | PART-TIME: Semesters | 13 |
| Maximum period of registration   | FULL-TIME: 18 Semesters   | PART-TIME: Semesters | 22 |
| Date specification produced      | September 2013 (first version)  |                      |    |
| Date specification last reviewed | (July 2018)   |                      |    |

## 1 THE COLLEGE OF Engineering

The College of Engineering at A'Sharqiyah University (ASU) opened in 2011 and has grown quickly to a current enrollment of over 300 students. The College will continue to grow at this rapid pace in order to accommodate over 1000 students in new classrooms and laboratories located in the new College of Engineering building that was completed in September 2017. With a first-rate building and state-of-the-art laboratories, the ASU Engineering College will continue to draw community members and prospective students to the growing campus. The College of Engineering at present offers undergraduate academic programs at Diploma/Degree levels in Civil Engineering, Environmental Engineering, Electronics and Communications Engineering and Construction Project Management.

The mission of the College is to educate creative professional engineers, technologists and technicians and to equip them to serve society in a globalized knowledge economy. Working in partnership with its stakeholders, the College is committed to the creation and transfer of new knowledge and technologies through the efforts of faculty, staff and students. The College vision is to achieve national and international stature as a College of Engineering through excellence in engineering education, research and innovation, outreach and external community engagement whilst contributing to the competitiveness, social and economic development and prosperity of the Sultanate of Oman

## 2 PROGRAM OUTLINE

The ASU Environmental Engineering Program teaches students about the technology and tools required to practice Professional Environmental Engineering during the engineering and design of structures, transportation systems, buildings, roads, and many other major facilities. The Environmental Engineering program is designed to fulfill industry's need for licensed professional environmental engineers. Emphasis of the ASU Environmental Engineering Program is placed on engineering, scientific, and technical courses so that the requirements for professional-engineering licensure are met. The curriculum was chosen to concentrate on the application of environmental engineering principles to the solution of real world environmental-engineering problems.

## 3 PROGRAM AIM/S

The aims of this program are to:

- a. Provide high quality instruction and opportunities to prepare graduates for environmental engineering practice and to engage in life-long learning;
- b. Provide research opportunities for students that generate communicate and apply new knowledge to improve society;
- c. Provide opportunities for leadership and service;
- d. Prepare students to uphold high ethical and professional standards; and
- e. Prepare students to work effectively in a multi-disciplinary environment as parts of working teams.

#### 4 LEARNING OUTCOMES (Definitive)

Upon successful completion of the program, students will be able to:

|  |  |
|--|--|
| <b>A. KNOWLEDGE AND UNDERSTANDING</b>          | <ol style="list-style-type: none"> <li>1. Apply knowledge of mathematics, science, and engineering;</li> <li>2. Design and conduct experiments, as well as to analyze and interpret data;</li> <li>3. 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;</li> <li>4. Function on multidisciplinary teams.</li> </ol> |
| <b>B. SUBJECT-SPECIFIC INTELLECTUAL SKILLS</b> | <ol style="list-style-type: none"> <li>5. Apply knowledge of mathematics through differential equations, calculus-based physics, chemistry, and at least one additional area of science, consistent with the program educational objectives;</li> <li>6. Proficiency in environmental engineering, water resources engineering; and</li> <li>7. Introduction to structural engineering, geotechnical engineering and transportation engineering.</li> </ol>                        |
| <b>C. PROFESSIONAL / PRACTICAL SKILLS</b>      | <ol style="list-style-type: none"> <li>8. Conduct environmental engineering experiments and analyze and interpret the resulting data;</li> <li>9. Design a system, component, or process in more than one environmental engineering context;</li> <li>10. Explain basic concepts in management, business, public policy, and leadership;</li> <li>11. Explain the importance of professional licensure.</li> </ol>   |
| <b>D. GENERAL COMPETENCE</b>                   | <p><b>Communication</b></p> <ul style="list-style-type: none"> <li>• Communicate effectively.</li> </ul> <p><b>Teamwork and interpersonal skills</b></p> <ul style="list-style-type: none"> <li>• Function on multidisciplinary teams.</li> </ul> <p><b>Leadership and entrepreneurship</b></p> <ul style="list-style-type: none"> <li>• Lead group of employees</li> <li>• Establish companies in the field of interest</li> </ul>  |

#### 5 PROGRAM STRUCTURE

Students must achieve the required credit hours for the program by completing University Required and Elective courses listed in sections 5.1 to 5.5 below:

**5.1 University Requirements: Total Credit hours 12**

| Course Code | Course Title                    | Pre-Requisites (P)<br>Co-Requisites (C) | Credit hours |
|-------------|---------------------------------|---|--------------|
| ISLM101     | Islamic Civilization            |   | 3            |
| ENGL101     | English Communication Skills I  |   | 3            |
| ENGL102     | English Communication Skills II | ENGL101                                 | 3            |
| MNGT313     | Entrepreneurship                |   | 3            |
| TOTAL       |                                 |   | 12           |

**5.2 University Electives: Total Credit hours XX**

| Course Code | Course Title | Pre-Requisites (P)<br>Co-Requisites (C) | Credit hours |
|-------------|--------------|---|--------------|
|             |              |   |              |
|             |              |   |              |

**5.3 College Requirements: Total Credit hours 42**

| Course Code | Course Title                       | Pre-Requisites (P)<br>Co-Requisites (C) | Credit hours |
|-------------|------------------------------------|---|--------------|
| MATH101     | Calculus I                         | FPPM002 (C)                             | 3            |
| MATH102     | Calculus II                        | MATH101                                 | 3            |
| MATH406     | Calculus III                       | MATH102                                 | 3            |
| MATH203     | Differential Equations             | MATH102                                 | 3            |
| MATH204     | Probability and Statistics         | MATH102                                 | 3            |
| MATH305     | Numerical Methods                  | MATH102–<br>ENGR111                     | 3            |
| PHYS101     | Physics I                          |   | 3            |
| MATH215     | Linear Algebra                     |   | 3            |
| PHYS102     | Physics II                         | PHYS101                                 | 3            |
| CHEM101     | Chemistry                          |   | 3            |
| ENGR201     | Engineering Drawing                | FPIT002                                 | 3            |
| ENGR202     | Technical Writing and Presentation | ENGL102                                 | 3            |
| ENGR404     | Engineering Economics              | MATH204                                 | 3            |
| ENGR111     | Computer Applications              |   | 3            |
| ENGR322     | Internship                         | 105 Credits                             | 0            |
| TOTAL       |                                    |   | 42           |

**5.4 Program Requirements: Total Credit hours 83**

| Course Code | Course Title             | Pre-Requisites (P)<br>Co-Requisites (C) | Credit hours |
|-------------|--------------------------|---|--------------|
| ENGR110     | Engineering Laboratories |   | 3            |
| ENGR220     | Statics                  | MATH102                                 | 3            |
| ENGR321     | Dynamics                 | ENGR220                                 | 3            |

|              |  |         |           |
|--------------|--|---------|-----------|
| CVEN310      | Surveying                                |         | 3         |
| CVEN231      | Engineering Geology                      | CHEM101 | 2         |
| CVEN332      | Civil Engineering Materials              |         | 3         |
| ENEN201      | Renewable Energy                         |         | 3         |
| ENEN301      | Environmental Chemistry                  | CHEM101 | 3         |
| ENEN302      | Environmental Microbiology               | CHEM101 | 3         |
| ENEN422      | Environmental Measurements               | CHEM101 | 3         |
| ENEN461      | Solid Waste Management                   | CVEN361 | 3         |
| ENEN441      | Air Pollution                            |         | 3         |
| ENEN431      | Water and Wastewater Treatment           | CVEN361 | 3         |
| ENEN360      | Environmental Law                        |         | 3         |
| CVEN361      | Environmental Engineering                |         | 3         |
| CVEN350      | Thermofluids Engineering                 | ENGR321 | 3         |
| CVEN451      | Hydraulics Engineering                   | CVEN350 | 3         |
| CVEN552      | Engineering Hydrology                    | CVEN451 | 3         |
| CVEN470      | Engineering Project Management           |         | 3         |
| CVEN554      | Hydrogeology & Groundwater Contamination |         | 3         |
| CVEN491      | Capstone Design Project I                |         | 3         |
| CVEN592      | Capstone Design Project II               | CVEN491 | 3         |
| CVEN553      | Water Resources Engineering              | CVEN451 | 3         |
| ENEN582      | Desalination Engineering                 | CVEN361 | 3         |
| ENEN572      | Environmental Impact Assessment          | CVEN361 | 3         |
| Sub-total    |  |         | 75        |
|              | Environmental Engineering Elective       |         | 9         |
| <b>TOTAL</b> |  |         | <b>83</b> |

### 5.5 Program Electives: Total Credit hours 9

Choose from the following:

| Course Code | Course Title                         | Pre-Requisites (P)<br>Co-Requisites (C) | Credit hours |
|-------------|--------------------------------------|---|--------------|
| CNMN405     | Building Information Modelling       | ENGR201                                 | 3            |
| ENEN531     | Advanced Wastewater Treatment        | ENEN431                                 | 3            |
| ENEN561     | Industrial and Hazardous Waste       | CVEN361                                 | 3            |
| ENEN571     | Environmental Pollution              | CVEN361                                 | 3            |
| ENEN581     | Climate Change                       | CVEN361                                 | 3            |
| ENEN583     | Waste and Energy                     | CVEN461                                 | 3            |
| ENEN584     | Sustainable Engineering              | CVEN361                                 | 3            |
| COEN280     | Construction Methodology             |   | 3            |
| COEN282     | Construction Equipment               |   | 3            |
| COEN585     | GIS Application in Civil Engineering |   | 3            |



### 5.5 Program Electives: Total Credit hours 9

Choose from the following:

| Course Code | Course Title             | Pre-Requisites (P)<br>Co-Requisites (C) | Credit hours |
|-------------|--------------------------|---|--------------|
| COEN586     | Sustainable Construction | CVEN361                                 | 3            |
| CVEN260     | Geotechnical Engineering |   | 3            |
| CVEN564     | Coastal Engineering      | CVEN451                                 | 3            |

## 6 PROGRAM REFERENCE POINTS

The Environmental Engineering Program described herein, was developed based on the current curriculum at Texas Tech University (TTU), but more importantly, it was structured for ABET accreditation which is a form of quality assurance that declares a program meets the quality standards set by the technical profession.

ABET accreditation of the Environmental Engineering Program will be the main tool used to insure future developments of the program are maintained at high international standard.

The learning objectives, learning outcomes, performance indicators, and the course contents described below, will be continuously updated to reflect future developments in Environmental Engineering as part of the internal assessment process that will lead to ABET accreditation.

## 7 TEACHING AND LEARNING METHODS (indicative)

Lecturers, seminars, laboratory experiments, site visits, self-study, projects.

## 8 ASSESSMENT METHODS (Indicative)

Quizzes, midterm exams, final exams, practical assessment in labs, project evaluation, viva questions.

## 9 CAREER and STUDY OPPORTUNITIES

The program facilitates entries to job and work opportunities in a number of market and industrial settings such as:

1. Consulting firms
2. Municipalities and government organizations
3. Oil Companies
4. Industry

The graduate from this course can also pursue further study and can improve their academic qualification by doing a Master degree.

## 10 STUDENT SUPPORT

Students attend an orientation program at the start of their studies. They are supported by a Course Coordinator and the Head of Department is also available to advice on program-related queries.

Academic advising is an essential element of the educational process. Students are assigned academic advisors who help them in selecting their course of study and in planning their schedules. Academic advisors also approve students' schedules each semester. The academic advisor assists students in obtaining a well-balanced education and in interpreting university policies and procedures, it is ultimately the students' individual responsible for selecting their courses, meeting course prerequisites, and adhering to university policies and procedures. Students may also consult faculty, department or program chairs, program coordinators, and deans.

Students have access to the University's library with a range of reading materials, online resources and study support.

The University's Student Affairs Office supports students in adjusting to university life and advises on issues such as finance, regulations, legal matters, accommodation, transportation, disabilities and career guidance. Opportunities are also provided for students to participate in various extra-curricular activities.

The Student Council is also an important source of support and guidance.

The University has a Student Fund, which considers applications on a case-by-case basis.

### 11 PROGRAM STRUCTURE DIAGRAM (Indicative)

| Year 1                                    |  | Year 2   |  | Year 3  |   | Year 4   |   | Year 5  |
|---|--|--|--|---|---|--|---|---|
| FALL                                      | SPRING   | FALL   | SPRING   | FALL  | SPRING  | FALL   | SPRING  | FALL  |
| ISLM101<br>Islamic Civilization           | ENGL102<br>English Communication Skills II<br>Pre-R: ENGL101 | CVEN310<br>Surveying                                     | CVEN231<br>Engineering Geology<br>Pre-R: CHEM101 | MNGT 313<br>Entrepreneurship                            | ENEN431<br>Water & Wastewater Treatment<br>Pre-R: CVEN361 | ENEN582<br>Desalination Engineering<br>Pre-R: CVEN361        | CVEN491<br>Capstone Design Project I                | CVEN592<br>Capstone Design Project II<br>Pre-R: CVEN491 |
| ENGL101<br>English Communication Skills I | ENGR110<br>Engineering Laboratories                          | ENEN301<br>Environmental Chemistry<br>CHEM101            | ENEN201<br>Renewable Energy                      | CVEN332<br>Civil Engineering Materials                  | MATH305<br>Numerical Methods<br>Pre-R: MATH102 - ENGR111  | MATH406<br>Calculus III<br>Pre-R: MATH102                    | CVEN554<br>Hydrogeology & Groundwater Contamination | CVEN553<br>Water Resources Engineering<br>CVEN451       |
| ENGR111<br>Computer Applications          | MATH102<br>Calculus II<br>Pre-R: MATH101                     | ENGR201<br>Engineering Drawing<br>Pre-R: FPIT002         | CVEN361<br>Environmental Engineering             | ENEN422<br>Environmental Measurements<br>CHEM101        | CVEN350<br>Thermofluids Engineering<br>ENGR321            | CVEN451<br>Hydraulics Engineering<br>Pre-R: CVEN350          | ENEN441<br>Air Pollution                            | CVEN552<br>Engineering Hydrology<br>Pre-R: CVEN451      |
| MATH101<br>Calculus I<br>FPPM002 (C)      | PHYS102<br>Physics II<br>Pre-R: PHYS101                      | ENGR202<br>Technical Writing and Presentation<br>ENGL102 | ENEN302<br>Environmental Microbiology<br>CHEM101 | MATH204<br>Probability and Statistics<br>Pre-R: MATH102 | ENEN360<br>Environmental Law                              | ENGR404<br>Engineering Economics<br>Pre-R: MATH204           | ENEN461<br>Solid Waste Management<br>Pre-R: CVEN361 | Environmental Engineering Elective                      |
| PHYS101<br>Physics I                      | CHEM101<br>Chemistry   | ENGR220<br>Statics<br>Pre-R: MATH102                     | ENGR321<br>Dynamics<br>Pre-R: ENGR220            | CVEN470<br>Engineering Project Management               | MATH203<br>Differential Equations<br>Pre-R: MATH102       | ENEN572<br>Environmental Impact Assessment<br>Pre-R: CVEN361 | Environmental Engineering Elective                  | Environmental Engineering Elective                      |
|   |  | MATH215<br>Linear Algebra                                |  |   |   |  | <b>Summer Internship</b>                            |   |



## 12 MAPPING of ASSESSMENT of LEARNING OUTCOMES - YEAR 1

KEY: **F** = Formative assessment    **S** = Summative assessment    **FS** = Formative AND Summative assessment

Upon completion of the program, students will be able to:

|   |   | REQUIRED COURSES: |         |         |         |         |         |         |         |         |         |
|---|---|-------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
|   |   | ENGR111           | ISLM101 | ENGL101 | MATH101 | PHYS101 | ENGR110 | ENGL102 | MATH102 | PHYS102 | CHEM101 |
| <b>KNOWLEDGE AND UNDERSTANDING</b>          |   |                   |         |         |         |         |         |         |         |         |         |
| 1   | An ability to apply knowledge of mathematics, science, and engineering  | FS                |         |         | S       | S       | FS      |         | S       | S       | S       |
| 2   | An ability to design and conduct experiments, as well as to analyze and interpret data  | FS                |         |         | F       | F       | FS      |         | F       | F       | F       |
| 3   | 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 | FS                |         |         | S       |         | FS      |         |         |         |         |
| 4   | An ability to function on multidisciplinary teams   |                   | F       |         |         |         | FS      |         |         |         |         |
| <b>SUBJECT-SPECIFIC INTELLECTUAL SKILLS</b> |   |                   |         |         |         |         |         |         |         |         |         |
| 5   | Apply knowledge of mathematics through differential equations, calculus-based physics, chemistry, and at least one additional area of science, consistent with the program educational objectives                             | F                 |         |         | S       | S       | F       |         | S       | S       | S       |
| 6   | Proficiency in environmental engineering, water resources engineering   | F                 |         |         |         |         | F       |         |         |         |         |

|   |   |   |    |    |  |  |  |  |  |  |  |  |  |    |    |  |  |  |
|---|---|---|----|----|--|--|--|--|--|--|--|--|--|----|----|--|--|--|
| 7   | Introduction to structural engineering, geotechnical engineering and transportation engineering |   |    |    |  |  |  |  |  |  |  |  |  |    |    |  |  |  |
| <b>PROFESSIONAL / PRACTICAL SKILLS</b>                  |   |   |    |    |  |  |  |  |  |  |  |  |  |    |    |  |  |  |
| 8   | Conduct environmental engineering experiments and analyze and interpret the resulting data      | F |    |    |  |  |  |  |  |  |  |  |  | FS |    |  |  |  |
| 9   | Design a system, component, or process in more than one environmental engineering context       | F |    |    |  |  |  |  |  |  |  |  |  | F  |    |  |  |  |
| 10  | Explain basic concepts in management, business, public policy, and leadership                   |   | F  |    |  |  |  |  |  |  |  |  |  | F  |    |  |  |  |
| 11  | Explain the importance of professional licensure  |   |    |    |  |  |  |  |  |  |  |  |  | F  |    |  |  |  |
| <b>GENERAL COMPETENCE (INCLUDING FOR EMPLOYABILITY)</b> |   |   |    |    |  |  |  |  |  |  |  |  |  |    |    |  |  |  |
| Communication   |   | F | FS | FS |  |  |  |  |  |  |  |  |  | FS | FS |  |  |  |
| Teamwork and interpersonal skills                       |   |   | FS |    |  |  |  |  |  |  |  |  |  | FS |    |  |  |  |
| Leadership and entrepreneurship                         |   |   | FS |    |  |  |  |  |  |  |  |  |  | FS |    |  |  |  |



## 12 MAPPING of ASSESSMENT of LEARNING OUTCOMES - YEAR 2

|   |   | REQUIRED COURSES: |         |         |         |         |         |         |         |         |         |         |
|---|---|-------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
|   |   | CVEN310           | ENEN301 | ENEN231 | ENGR220 | ENEN201 | CVEN361 | ENGR202 | ENEN302 | ENGR201 | MATH215 | ENGR321 |
| <b>KNOWLEDGE AND UNDERSTANDING</b>          |   |                   |         |         |         |         |         |         |         |         |         |         |
| 1   | An ability to apply knowledge of mathematics, science, and engineering  | S                 | F       |         |         | FS      | F       |         | F       |         | S       | FS      |
| 2   | An ability to design and conduct experiments, as well as to analyze and interpret data  |                   | F       |         |         | FS      | F       |         | F       |         | F       |         |
| 3   | 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 | FS                | FS      | FS      |         | FS      | FS      |         | FS      |         | S       |         |
| 4   | An ability to function on multidisciplinary teams   |                   | F       |         |         |         | F       |         | F       | FS      |         |         |
| <b>SUBJECT-SPECIFIC INTELLECTUAL SKILLS</b> |   |                   |         |         |         |         |         |         |         |         |         |         |
| 5   | Apply knowledge of mathematics through differential equations, calculus-based physics, chemistry, and at least one additional area of science, consistent with the program educational objectives                             | S                 | FS      |         | FS      | FS      | FS      |         | FS      |         | S       | FS      |
| 6   | Proficiency in environmental engineering, water resources engineering   |                   | FS      | FS      |         | FS      |         |         | FS      |         |         | FS      |
| 7   | Introduction to structural engineering, geotechnical engineering and transportation engineering   | S                 |         |         | FS      | FS      | S       |         |         |         |         | FS      |

| <b>PROFESSIONAL / PRACTICAL SKILLS</b>                  |  |   |    |  |    |    |    |    |    |    |  |    |
|---|--|---|----|--|----|----|----|----|----|----|--|----|
| 8   | Conduct environmental engineering experiments and analyze and interpret the resulting data |   | FS |  |    | FS | F  |    | FS |    |  | FS |
| 9   | Design a system, component, or process in more than one environmental engineering context  | S | FS |  | FS | FS | FS |    | FS | FS |  | FS |
| 10  | Explain basic concepts in management, business, public policy, and leadership              |   |    |  |    |    |    |    |    |    |  |    |
| 11  | Explain the importance of professional licensure   |   |    |  |    |    |    |    |    |    |  |    |
| <b>GENERAL COMPETENCE (INCLUDING FOR EMPLOYABILITY)</b> |  |   |    |  |    |    |    |    |    |    |  |    |
|   | Communication  |   |    |  |    |    |    | FS |    | FS |  |    |
|   | Teamwork and interpersonal skills  |   |    |  |    |    |    | FS |    | FS |  |    |
|   | Leadership and entrepreneurship  |   |    |  |    |    |    |    |    |    |  |    |

## 12 MAPPING of ASSESSMENT of LEARNING OUTCOMES - YEAR 3

|   |   | REQUIRED COURSES: |         |         |         |         |         |         |         |         |         |
|---|---|-------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
|   |   | CVEN332           | MNGT313 | ENEN431 | CVEN470 | MATH305 | MATH203 | MATH204 | CVEN350 | ENEN422 | ENEN360 |
| <b>KNOWLEDGE AND UNDERSTANDING</b>          |   |                   |         |         |         |         |         |         |         |         |         |
| 1   | An ability to apply knowledge of mathematics, science, and engineering  |                   |         | F       | FS      | S       | FS      | FS      | S       | F       | F       |
| 2   | An ability to design and conduct experiments, as well as to analyze and interpret data  |                   |         | F       | F       | S       | FS      | FS      | S       | F       | F       |
| 3   | 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 | FS                | FS      | FS      | FS      | S       |         |         | S       | FS      | FS      |
| 4   | An ability to function on multidisciplinary teams   |                   | FS      | F       | FS      | S       |         |         |         | F       | F       |
| <b>SUBJECT-SPECIFIC INTELLECTUAL SKILLS</b> |   |                   |         |         |         |         |         |         |         |         |         |
| 5   | Apply knowledge of mathematics through differential equations, calculus-based physics, chemistry, and at least one additional area of science, consistent with the program educational objectives                             |                   |         | FS      | FS      | S       | FS      | FS      | S       | FS      | FS      |
| 6   | Proficiency in environmental engineering, water resources engineering   |                   |         | FS      | FS      | F       | F       | F       |         | FS      | FS      |
| 7   | Introduction to structural engineering, geotechnical engineering and transportation engineering   | FS                |         |         | FS      |         | FS      | FS      | S       |         |         |
| <b>PROFESSIONAL / PRACTICAL SKILLS</b>      |   |                   |         |         |         |         |         |         |         |         |         |

PROGRAM SPECIFICATION

|   |  |    |    |    |    |   |  |  |    |    |    |
|---|--|----|----|----|----|---|--|--|----|----|----|
| 8   | Conduct environmental engineering experiments and analyze and interpret the resulting data | FS |    | FS | F  | F |  |  | FS | FS | FS |
| 9   | Design a system, component, or process in more than one environmental engineering context  |    |    | FS | F  | F |  |  | FS | FS | FS |
| 10  | Explain basic concepts in management, business, public policy, and leadership              |    | FS |    | FS |   |  |  |    |    | FS |
| 11  | Explain the importance of professional licensure   |    | FS |    | FS |   |  |  |    |    | FS |
| <b>GENERAL COMPETENCE (INCLUDING FOR EMPLOYABILITY)</b> |  |    |    |    |    |   |  |  |    |    |    |
|   | Communication  |    | FS |    | FS |   |  |  |    |    | F  |
|   | Teamwork and interpersonal skills  |    | FS |    | FS |   |  |  |    |    | F  |
|   | Leadership and entrepreneurship  |    | FS |    | FS |   |  |  |    |    |    |

## 12 MAPPING of ASSESSMENT of LEARNING OUTCOMES - YEAR 4

|   |   | REQUIRED COURSES: |         |         |         |         |         |         |         |            |         |
|---|---|-------------------|---------|---------|---------|---------|---------|---------|---------|------------|---------|
|   |   | ENEN582           | MATH406 | ENEN572 | ENGR404 | CVEN451 | CVEN491 | CVEN554 | ENEN441 | ELECTIVE01 | CVEN461 |
| <b>KNOWLEDGE AND UNDERSTANDING</b>          |   |                   |         |         |         |         |         |         |         |            |         |
| 1   | An ability to apply knowledge of mathematics, science, and engineering  | F                 | S       | F       | F       | F       | FS      | F       | F       | F          | F       |
| 2   | An ability to design and conduct experiments, as well as to analyze and interpret data  | F                 | S       | F       | F       | F       | FS      | F       | F       | F          | F       |
| 3   | 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 | FS                | S       | FS      | FS      | FS      | FS      | FS      | FS      | FS         | FS      |
| 4   | An ability to function on multidisciplinary teams   | F                 | S       | F       | F       | F       | FS      | F       | F       | F          | F       |
| <b>SUBJECT-SPECIFIC INTELLECTUAL SKILLS</b> |   |                   |         |         |         |         |         |         |         |            |         |
| 5   | Apply knowledge of mathematics through differential equations, calculus-based physics, chemistry, and at least one additional area of science, consistent with the program educational objectives                             | FS                | S       | FS      | F       | FS      | FS      | FS      | FS      | FS         | FS      |
| 6   | Proficiency in environmental engineering, water resources engineering   | FS                |         | FS      |         | FS      |         | FS      | FS      | FS         | FS      |
| 7   | Introduction to structural engineering, geotechnical engineering and transportation engineering   |                   | F       |         |         |         | FS      |         |         |            |         |

| <b>PROFESSIONAL / PRACTICAL SKILLS</b>                  |  |    |   |    |   |    |    |    |    |    |    |
|---|--|----|---|----|---|----|----|----|----|----|----|
| 8   | Conduct environmental engineering experiments and analyze and interpret the resulting data | FS | F | FS | F | FS | FS | FS | FS | FS | FS |
| 9   | Design a system, component, or process in more than one environmental engineering context  | FS | F | FS | S | FS | FS | FS | FS | FS | FS |
| 10  | Explain basic concepts in management, business, public policy, and leadership              |    | F |    | S |    | FS |    |    |    |    |
| 11  | Explain the importance of professional licensure   |    |   |    |   |    | FS |    |    |    |    |
| <b>GENERAL COMPETENCE (INCLUDING FOR EMPLOYABILITY)</b> |  |    |   |    |   |    |    |    |    |    |    |
|   | Communication  |    |   |    |   |    | FS |    |    |    |    |
|   | Teamwork and interpersonal skills  |    |   |    |   |    | FS |    |    |    |    |
|   | Leadership and entrepreneurship  |    |   |    |   |    | FS |    |    |    |    |



## 12 MAPPING of ASSESSMENT of LEARNING OUTCOMES - YEAR 5

|   |   | REQUIRED COURSES: |         |         |            |            |
|---|---|-------------------|---------|---------|------------|------------|
|   |   | CVEN592           | CVEN553 | CVEN552 | Elective02 | Elective03 |
| <b>KNOWLEDGE AND UNDERSTANDING</b>          |   |                   |         |         |            |            |
| 1   | An ability to apply knowledge of mathematics, science, and engineering  | FS                | F       | F       | F          | F          |
| 2   | An ability to design and conduct experiments, as well as to analyze and interpret data  | FS                | F       | F       | F          | F          |
| 3   | 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 | FS                | FS      | FS      | FS         | FS         |
| 4   | An ability to function on multidisciplinary teams   | FS                | F       | F       | F          | F          |
| <b>SUBJECT-SPECIFIC INTELLECTUAL SKILLS</b> |   |                   |         |         |            |            |
| 5   | Apply knowledge of mathematics through differential equations, calculus-based physics, chemistry, and at least one additional area of science, consistent with the program educational objectives                             | FS                | FS      | FS      | FS         | FS         |
| 6   | Proficiency in environmental engineering, water resources engineering   |                   | FS      | FS      | FS         | FS         |
| 7   | Introduction to structural engineering, geotechnical engineering and transportation engineering   | FS                |         |         |            |            |

| <b>PROFESSIONAL / PRACTICAL SKILLS</b>                  |  |    |    |    |    |    |
|---|--|----|----|----|----|----|
| 8   | Conduct environmental engineering experiments and analyze and interpret the resulting data | FS | FS | FS | FS | FS |
| 9   | Design a system, component, or process in more than one environmental engineering context  | FS | FS | FS | FS | FS |
| 10  | Explain basic concepts in management, business, public policy, and leadership              | FS |    |    |    |    |
| 11  | Explain the importance of professional licensure   | FS |    |    |    |    |
| <b>GENERAL COMPETENCE (INCLUDING FOR EMPLOYABILITY)</b> |  |    |    |    |    |    |
|   | Communication  | FS |    |    |    |    |
|   | Teamwork and interpersonal skills  | FS |    |    |    |    |
|   | Leadership and entrepreneurship  | FS |    |    |    |    |