FIU Engineering & Computing

FLORIDA INTERNATIONAL UNIVERSITY

PROGRAM REVIEW

SELF-STUDY REPORT

FOR THE

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

September 2016

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

The Department offers the Bachelor of Science both in Civil Engineering (BSCE) and Environmental Engineering (BSEnvE). The BSCE degree was first accredited by the Engineering Accreditation Commission (EAC) of Accreditation Board of Engineering and Technology (ABET) in 1987. This accreditation action extended retroactively from October 1, 1985. The accreditation was renewed in 1990, 1993, 1996, 2002, 2008 and most recently, fall 2014. The degree in Environmental Engineering was implemented in fall 2006 and received its first ABET accreditation after the ABET visit in fall 2008. This accreditation action extended retroactively from October 1, 2006. The program was accredited again in 2014. Both BS programs were accredited by EAC of ABET to September 30, 2021.

The Department also offers advanced study for the Masters of Science and Doctor of Philosophy degrees that include Master of Science in Civil Engineering, Master of Science in Environmental Engineering, and Doctor of Philosophy in Civil Engineering. Currently, a total of 21 full-time faculty members are responsible for the various teaching, research, and service activities of the Department. The new faculty member in Structural Engineering, Dr. Armin Mehrabi, will join the Department in spring 2017. Another new faculty member in Wind Engineering will join the Department next year.

Since 2011, the Department recruited a new department chair, seven new Assistant Professors with lines for an additional two positions, and three Professors of Practice. Together with a strong core of tenured faculty, the unit has strong expertise to address the technical challenges associated with the sustainability of civil engineering systems especially in emerging research areas. Laboratories and research capabilities have been recognized at the state and national level including Tier 1 UTC for Accelerated Bridge Construction, NSF EF designation for the NHERI program recognizing the Wall of Wind as well as State and local support of research in transportation, environmental, bridge, and corrosion engineering. New classes in emerging research areas in Sustainability, Ecohydrology, Hurricane Engineering, Wind Engineering, Corrosion Engineering, Building Diagnostics, and Geographic Information System (GIS) among others add to the already deep program curriculum in Civil and Environmental Engineering. The unit has seen tremendous growth in external research funding and laboratory research capabilities to support advanced research with recognition by state and national institutions. From 2013-2016, the unit has been awarded over $18.6 million in external funding. Currently, the Department has a plan to develop a fully online M.S. degree in Structural Engineering with Bridge Engineering as one concentration area.

The Undergraduate Program Self-Study for the Civil Engineering Program was prepared by Professor and Undergraduate Program Director Dr. Berrin Tansel and the Associate Chair of Undergraduate Programs Dr. Ton-Lo Wang, and reviewed by the program faculty, undergraduate program advisors, Undergraduate Program Advisory Committee (UPAC), and Department Chair Dr. Atorod Azizinamini. The Department is currently developing its new strategic plan for the period 2016-2020. The new strategic plan will be finalized by December 2016.

II. PROGRAM OVERVIEW

II.A. History and evolution of the program

Florida International University (FIU) – Miami's public research university – is one of America's most dynamic institutions of higher learning. FIU was established by the Florida Legislature in 1965, and classes began in September 1972. In 1974, the School of Technology began offering both Bachelor of Science and Bachelor of Technology degrees in Civil Engineering Technology.

In 1984, the College of Engineering and Applied Sciences was established, which included the Department of Civil and Environmental Engineering (the Department). The Department is part of the College of Engineering and Computing of Florida International University. The Department offers the Bachelor of Science both in Civil Engineering (BSCE) and Environmental Engineering (BSEnvE). The BSCE degree was first accredited by the Accreditation Board of Engineering and Technology (ABET) in 1987, and accreditations were renewed in 1990, 1993, 1996, 2002, 2008 and most recently, fall 2014. The degree in Environmental Engineering was implemented in fall 2006 and received its first ABET accreditation after the ABET visit in fall 2008, and the last ABET visit was in 2014. Both BS programs were accredited by EAC of ABET to September 30, 2021.

The Department also offers advanced study for the Masters of Science and Doctor of Philosophy degrees that include Master of Science in Civil Engineering, Master of Science in Environmental Engineering, and Doctor of Philosophy in Civil Engineering. A total of 21 full-time faculty members are responsible for the various teaching, research, and service activities of the Department.

The Civil Engineering program has gone through significant changes since fall 2008. These have included changes in faculty, administrative leadership, committee organization, program educational objectives, student outcomes, curricula, the advising process, and other program changes. The changes have occurred as a result of faculty departures and the normal evolution of program modifications brought about by efforts for continuous improvement. Starting with freshmen entering in 2010, the University implemented “Global Learning” initiative for all undergraduate programs. Capitalizing on FIU’s unique demographics and location in the gateway to the Americas, Global Learning for Global Citizenship enables students to achieve specific learning outcomes: global awareness, global perspective, and global engagement. Global Learning for Global Citizenship is a promise to every FIU student: graduates of the University will be empowered with the knowledge, skills, and attitudes they need to become informed and engaged citizens of the world.

Since the previous review in 2008, there are nine new tenured or tenure-track faculty members: Dr. Xia Jin and Dr. Priyanka Alluri in Transportation Engineering, Dr. Omar Abdul-Aziz in Water Resources Engineering, Dr. Atorod Azizinamini, Dr. Kingsley Lau, Dr. Ralf Arndt, and Dr. David Garber in Structural Engineering, Dr. Ioannis Zisis in Wind Engineering, and Dr. Seung Jae Lee in Geotechnical Engineering. The Department also hired two Professors of Practice; Dr. Michael Bienvenu and Dr. Hesham Ali in the Pavement Engineering.

Three instructors, Dr. Anna Bernardo Bricker, Dr. Khokiat Kengskool, and Dr. Cora Martinez joined the Department in 2010-11. Dr. Anna Bernardo Bricker teaches the courses in air pollution area and manages all environmental engineering labs. Dr. Khokiat Kengskool is responsible for teaching engineering economics and engineering drawing courses. Dr. Cora Martinez and Ms. Joanna Sanabria serve as the undergraduate advisors. The Department has a full-time lab manager, Mr. Edgar Polo, who oversees our teaching labs and assists with some of our research labs. Over the same period, the Department lost ten faculty members to career moves as follows:

1) Dr. Girma Bitsuamlak, a tenure-track faculty, left to join Western University in Canada.
2) Dr. Fernando Miralles-Wilhelm, a tenured faculty, left to join University of Maryland.
3) Dr. Nakin Suksawang, a tenure-track faculty, left to join Florida Institute of Technology.
4) Dr. Omar Abdul-Aziz, a tenure-track faculty, left to join University of West Virginia.
5) Dr. Caesar Abi Shdid, a senior instructor, left to join Lebanese American University
6) Dr. Amir Mirmiran, a tenured faculty and Dean of College of Engineering and Computing, left to join University of Texas at Tyler.
7) Dr. Luis Prieto, a tenured faculty, retired.
8) Dr. Sylvan Jolibois, a tenured faculty, left.
9) Dr. Ralf Arndt, a tenure-track faculty, left.
10) Dr. Fang Zhao, a tenured faculty and acting chair, deceased.

The Department currently has 16 tenured and tenure-track faculty members, 2 professors of practice, and 3 instructors. Totally, there are 21 full-time faculty members. Eight years ago, the Department had 16 tenured and tenure-track faculty members and 1 instructor. These numbers represent an increase in the faculty size from 17 to 21 over the past decade. The current faculty members are listed in Table II.1 and their detailed qualifications as well as workload are shown in Appendix D.

The data of Enrollment, degrees awarded, and student-to-faculty ratio is shown in Table II.2, Figure II.1, and Figure II.2. The growth of BS in Civil Engineering program can be seen in terms of enrollment and degrees awarded. For the past eight years, the enrollment increased from 526 to 726 and BS degrees awarded in Civil Engineering program from 63 to 91. The enrollment is expected to continue to grow. However, the student-to-faculty ratio also increased. The current student-to-faculty is 40:1 and 47:1 for BS degree programs and the whole Department, respectively. The ratio is much higher than that in the similar programs in the top research universities, like Georgia Tech, Virginia Tech, Purdue, and UT-Austin. Their student-to-faculty ratio is in the range of 18:1. This is a very tough challenge for the Department to make any major progress in both teaching and research.

Table II.1 List of Faculty members in the Civil and Environmental Engineering Department

Area	Faculty Member	Rank
Environmental and Water Resources Engineering	Anna Bernardo-Bricker, Ph.D.	Instructor
	Hector R. Fuentes, Ph.D., P.E.	Professor
	Cora Martinez, Ph.D.	Instructor
	Shonali Laha, Ph.D., P.E.	Associate Professor

	Walter Tang, Ph.D., P.E.	Associate Professor
	Berrin Tansel, Ph.D., P.E.	Professor
Geotechnical Engineering	Seung Jae Lee, Ph.D.	Assistant Professor
Pavement Engineering	Hesham Ali, Ph.D., P.E., C.P.M.	Professor of Practice
	Michael Bienvenu, Ph.D., P.E.	Professor of Practice
Structural Engineering	Atorod Azizinamini, Ph.D., P.E.	Professor
	David Garber, Ph.D.	Assistant Professor
	Kingsley Lau, Ph.D.	Assistant Professor
	Ton-Lo Wang, Ph.D., P.E.	Professor
Transportation Engineering	Priyanka Alluri, Ph.D., P.E.	Assistant Professor
	Albert Gan, Ph.D.	Professor
	Mohammed Hadi, Ph.D., P.E.	Professor
	Xia Jin, Ph.D., AICP	Assistant Professor
	Khokiat Kengskool, Ph.D.	Instructor
	L. David Shen, Ph.D., P.E.	Professor
Wind Engineering	Arindam Gan Chowdhury, Ph.D.	Associate Professor
	Ioannis Zisis, Ph.D.	Assistant Professor

Table II.2 Enrollment and Degree Data for Civil and Environmental Engineering Programs

Academic Year	Program	Enrollment		Degrees Awarded		Faculty	Student-to-Faculty Ratio	
			Total		Total		BS	Department
2008-2009	BS in CE	525	557	63	66	17	33:1	41:1
	BS in EnvE	32		3				
	MS in CE	72	94	30	38			
	MS in EnvE	22		8				
	PhD in CE	43	43	8	8			
2009-2010	BS in CE	606	664	80	82	17	39:1	47:1
	BS in EnvE	58		2				
	MS in CE	65	93	21	32			
	MS in EnvE	28		11				
	PhD in CE	47	47	9	9			
2010-2011	BS in CE	627	699	85	94	16	44:1	52:1
	BS in EnvE	72		9				
	MS in CE	61	89	25	43			
	MS in EnvE	28		18				
	PhD in CE	50	50	6	6			
2011-2012	BS in CE	590	682	85	94	20	34:1	41:1
	BS in EnvE	92		9				
	MS in CE	50	74	30				
	MS in EnvE	24		12	42			
	PhD in CE	54	54	7	7			
2012-2013	BS in CE	542	648	98	107	23	28:1	34:1
	BS in EnvE	106		9				
	MS in CE	53	68	26	35			
	MS in EnvE	15		9				
	PhD in CE	61	61	9	9			
2013-2014	BS in CE	599	705	86	102	21	34:1	40:1
	BS in EnvE	106		16				
	MS in CE	47	62	25	36			
	MS in EnvE	15		11				
	PhD in CE	71	71	8	8			
2014-2015	BS in CE	643	750	85	95	23	33:1	38:1
	BS in EnvE	107		10				
	MS in CE	39	47	21	22			
	MS in EnvE	8		1				
	PhD in CE	74	74	11	11			
2015-2016	BS in CE	623	728	91	104	21	35:1	40:1
	BS in EnvE	105		13				
	MS in CE	31	41	19	25			
	MS in EnvE	10		6				
	PhD in CE	65	65	13	13			

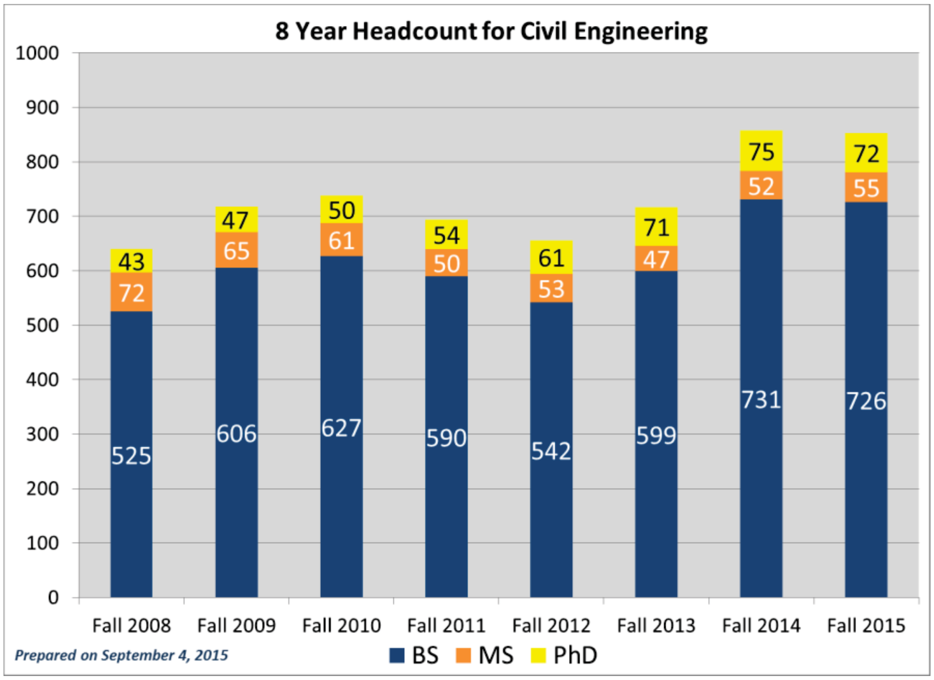

Figure II.1 Enrollment of BS, MS, and PhD Programs in Civil Engineering from 2008 to 2015

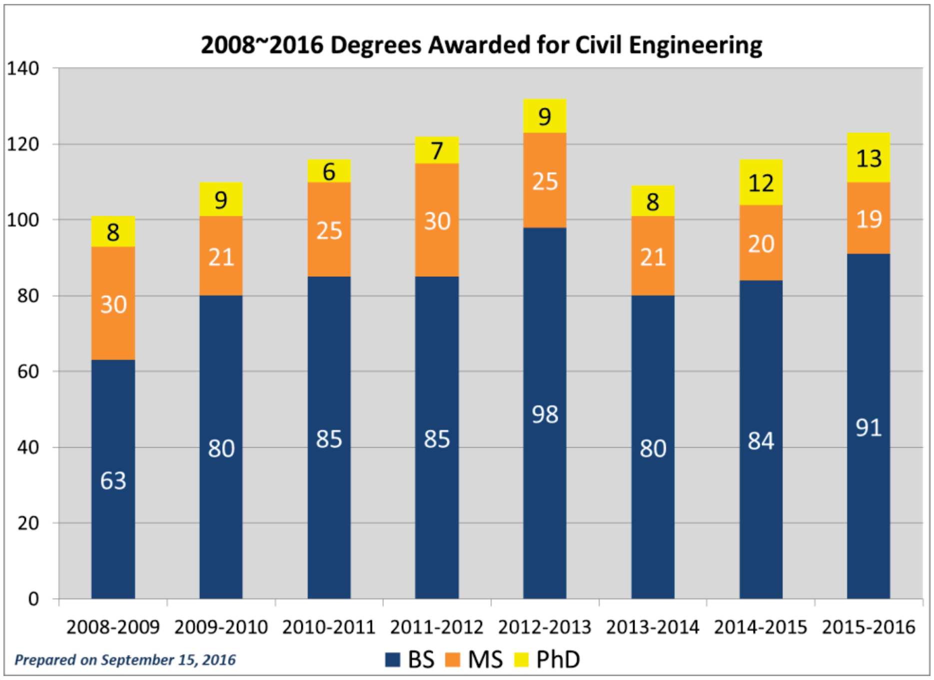

Figure II.2 Degrees Awarded for BS, MS, and PhD Programs in Civil Engineering from 2008 to 2015

For the undergraduate program in the Department, the Undergraduate Program Advisory Committee (UPAC) has been coordinating all ABET, SACS accreditation matters, program review and actions for continuous improvement related to the two undergraduate programs (Civil Engineering and Environmental Engineering) since its establishment in 2003. Keeping up with the university wide changes, the Civil Engineering (CE) program has been implementing a series of changes to its undergraduate advising to improve process. New PantherSoft queries were developed in the College in collaboration with PantherSoft developers to check course prerequisites. These new queries were customized for CE requirements. These queries are now run every semester after the drop-and-add period is over. All students found not to have the required prerequisite(s) for a course are notified and administratively dropped from the course.

The curriculum consists of 128 credits: 39 credits for mathematics and basic sciences, 57 credits for engineering sciences and engineering topics, and 32 credits for general education. Courses in the Civil Engineering curriculum have varying laboratory components, oral/written communication activities, computer use, teamwork, and design projects. The detailed curriculum for BS in Civil Engineering is shown in Appendix C.

II.B. Goals developed and major changes as a result of last program review

II.B.1. Goals

The Department is currently developing its new strategic plan for the period 2016-2020. The new strategic plan will be finalized by December 2016.

The last strategic plan was developed in 2010 for the period 2010-2015. Driving values for the last strategic plan were defined as:

- Freedom of thought and expression
- Respect for the dignity of the individual
- Honesty, integrity and truth
- Excellence in teaching and in the pursuit of generation, dissemination, and application of knowledge
- Global issues awareness
- Pursuit of sustainable solutions

The goals were developed in areas that relate to education, research, service and enhancement. The goals that relate to the graduate programs are not included here. The numbering of the goals is how they are numbered in the Department Strategic plan 2010-2015. The specific goals developed for each area that relate to the undergraduate programs are as follows.

I. Education (ED)

Goal ED-I. The Civil and Environmental Engineering Department will comply with the ABET program educational objectives of its undergraduate degree programs in civil and environmental engineering.

<u>*Strategy A*</u>*: Prepare graduates for jobs for which a civil or environmental engineering degree is used or required, or for graduate study*

Metrics:

1. Percent of faculty members who regularly emphasize the societal impacts and related contemporary issues of civil and environmental projects (target: 100%)
2. Effectiveness of the Capstone Senior Design experiences in applying knowledge and techniques from at least four technical areas in both civil engineering and environmental engineering.
3. Number of invited professional practitioners in the civil and environmental fields giving presentations to students on real-world projects (target: 10 in each area)

<u>Strategy B</u>*. Help graduates make progress towards obtaining professional registration, special licensing, or certification*

Metrics:

1. Percent of students who passed the Fundamentals of Engineering (FE) Exam (target: consistently exceeds the national average).
2. Minimum passing grade for FE course (target: requires a "C+" to pass the course).
3. A 30-credit-hour post-baccalaureate non-degree option established.

<u>Strategy C</u>*: Help and encourage graduates to update and expand their knowledge through practice, educational venues, or graduate study.*

Metrics:

1. Number of alumni subscriptions in mailing list (to be added to the departmental website; target: 2010).
2. Number of reported activities in an electronic survey (to be added to the departmental website; target: 2010).
3. Frequency of dissemination of information on educational and training opportunities through alumni mailing list.

Goal ED-IV. The Civil and Environmental Engineering Department will increase the quality of our undergraduate students.

<u>Strategy A</u>*: Increase entrance requirements to upper division*

Metrics:

1. Approval of minimum requirement for mathematics and science courses of "C+" or higher
2. Establishment of an exam-based approach for all transferred courses
3. Implementation of a tutoring program run by senior and graduate students for all upper division courses
4. Participation of faculty members in an annually established or attended "teaching effectiveness" workshop for all faculty members
5. Implementation of additional effort to continuously increase the FE passing rate
6. Enhancement of curriculum by integrating sustainability and global issues aspects throughout the undergraduate upper division offerings

<u>Strategy B</u>*: Establish communication and new partnerships in Universities within the American Hemisphere and other unrepresented countries*

Metrics:

1. Number of Civil and Environmental Engineering students of different geographic, ethnic and cultural origins enrolled on an annual basis (measured in FTE)
2. Number of Civil and Environmental Engineering faculty of different geographic, ethnic and cultural origins enrolled on an annual basis (measured in FTE).

Goal ED-VI. The Civil and Environmental Engineering Department will embrace and modify the degree program curricula to the guidelines of the "Body of Knowledge (BOK)" documents developed by the American Society of Civil Engineers and the American Academy of Environmental Engineers.

Strategy: *Appoint and support a BOK Faculty Committee to Assess and Implement BOK contents for both degree programs in civil engineering and environmental engineering at all levels*

Metrics:

1. Appointment of a committee in Spring 2010
2. Committee report on assessment of BOK's scope and proposed plan for full implementation
3. Committee report to adjust undergraduate curricula (also meeting ABET criteria)
4. ABET accreditation steps for the MS degrees in both civil engineering and environmental engineering

II. Research (R)

Goal R-I. The Civil and Environmental Engineering Department will increase research funding per faculty.

Strategy A: *Increase faculty size in strategic areas and foster practices conducive to research funding generation (Target: $0.5M/year in 5 years)*

Metrics:

1. Increase in new tenure-track or tenured faculty in strategic areas, e.g., sustainability, energy, green engineering, etc. *Target: 5 new tenure-track or tenured faculty in 5 years*.
2. Increase in non-tenure research faculty with high potential for fund generation. *Target: 5 new non-tenure research faculty in 5 years*.
3. Increase postdoctoral candidates with experience in grant writing to help faculty in proposal development. *Target: 4 postdoctoral candidates per year should be hired and supported for the next 5 years*.
4. Active participation in Grant Development workshops and Funding Opportunity workshops (such as workshop by Department of Homeland Security). *Target: 2 Grant Development workshops to be attended by each faculty per year*.
5. Application for new grant opportunities (resources: websites, OSRA updates, RFPs). Collaboration with intra- and inter-departmental faculty to develop multi-disciplinary proposals is highly encouraged. *Target: Minimum of 2 new proposals amounting to minimum of $200,000 should be submitted per faculty per year*.
6. Collaboration with faculty in strategic areas from other universities to develop collaborative proposal. *Target: Minimum of 2 new collaborative proposals should be submitted by Civil and Environmental Engineering per year*.
7. Networking with industry to develop joint proposals with faculty in strategic areas (e.g., NSF's GOALI, DOD's SBIR, STTR). *Target: Minimum of 2 new collaborative proposals with industry should be submitted by Civil and Environmental Engineering per year*.

GOAL R-II. The Civil and Environmental Engineering Department will increase journal publications per faculty member.

Strategy: *Increase research activities and actively pursue dissemination of results through peer reviewed journal publications (Target: 3 Publications/faculty /year in 5 years)*

Metrics:

1. Number of quality PhD students capable of excellent research. *Target: Minimum of 1 new PhD student should be supervised by each faculty per year in addition to the current students.*
2. Increase in number of joint journal publications with students. This can be encouraged by motivating students to have PhD dissertation written in the form of several journal papers (Abstract, Paper 1, Paper 2, Paper 3, Conclusions). Peer-reviewed journals with <u>shorter turnaround time</u> should be targeted. *Target: Minimum of 2 journal publications coauthored with students by each faculty per year.*
3. Collaboration with intra- and inter-disciplinary faculty and faculty in other universities to perform multi-disciplinary research and publish the results. *Target: Minimum of 1 journal publication coauthored with other researchers by each faculty per year (in addition to the 2 publications per year with the students).*
4. Increase in high quality postdoctoral candidates with track record of several publications to help you in continuously publishing research results. *Target: 4 postdoctoral candidates per year should be hired and supported in the next 5 years*.
5. Increase in publications in national and international conferences and seek the opportunity to get invited in submitting extended versions of the papers in journals. *Target: Minimum of 1 international or national conference should be attended per faculty per year and minimum of 2 conference proceedings should be published per faculty per year.*

Goal R-III. The Civil and Environmental Engineering Department will increase faculty and student participation in interdisciplinary research activities.
<u>Strategy</u>: Promote, establish and expand collaborative research initiatives with other FIU academic units, other universities or research organizations
Metrics:

1. Level of effort of Civil and Environmental Engineering faculty and students involved in active funded research projects that involve multi/cross/interdisciplinary collaborations of faculty and students: faculty and student time will be measured in FTE on an annual basis.
2. Level of effort of Civil and Environmental Engineering faculty and students involved in proposed pending research projects that involve multi/cross/interdisciplinary collaborations of faculty and students: faculty and student time will be measured in FTE on an annual basis presented in proposals pending.

III. Service (S)
Goal S-I. The Civil and Environmental Engineering Department will provide a good customer service in support of FIU 3.0 objectives.
<u>Strategy</u>: Provide a positive experience for FIU students, alumni, donors, and visitors with their academic and departmental needs as well as to create a strong sense of loyalty to the Civil and Environmental Engineering Department and FIU.
Metrics:

1. The time for prospective and current students, alumni, donors, and visitors spending on the phone, waiting in line, or scheduling an appointment. Target: To fully shift from traditional one-on-one appointment to an easy-to-navigate departmental website, web-based registration and updated information.

2. Survey from student forums and Department Advisory Board (DAB) meeting. Target: To achieve at a minimum 70% positive feedback.

Goal S-II. The Civil and Environmental Engineering Department will raise the national standing of the Department through professional and community services.
Strategy: Increase participation and reputation of the Civil and Environmental Engineering Department and FIU in professional societies, conventions, conferences, and editorial board as well as serving the local community.
Metrics:

1. Numbers of professional, technical, and/or standard committees serving by faculty as active members, secretary, and/or chair. Target: An average of 3 committees per faculty.
2. Numbers of editorial boards serving by faculty members. Target: An average of one editorial board per faculty.
3. Numbers of conferences and/or sessions organized or moderated by the faculty members. Target: A total of 2 conferences and/or sessions per year for the Civil and Environmental Engineering Department.
4. Numbers of publications submitted and presented by students and faculty annually at national and international conventions and conferences. Target: An average of 3 publications per faculty per year.
5. Number of faculty and students nominated for national and international awards, scholarship, and fellowships. Target: A total of 4 awards per year for the Civil and Environmental Engineering Department.
6. Student placement in regional and national competitions. Target: To place in the top 5 of every competition.
7. Number of community services participated by the faculty and students. Target: A total of 6 community services per year for the Civil and Environmental Engineering Department.

IV. Enhancement (EN)

Goal EN-I. The Civil and Environmental Engineering Department will work to enhance the image of all its research and education programs.
Strategy A: Active participation in state and national conferences
Metrics:

1. At least two papers to be annually submitted/presented at well attended conferences by students and faculty members annually
2. Objective to get each faculty member in national committees of leading professional societies for our engineering programs (at least, 1 for assistant professor, 2 for associate professor and 3 for full professor)
3. Department will annually have a booth, with FIU and departmental information, at one state and one national conference and exhibitions

Strategy B: Establish a task force to study information and indicators that are used by US News & World Report specialty rankings of engineering programs and to implement a program to maintain and increase rankings
Metrics:

1. Data collection and number of indicators reported annually to the peer assessment survey of the US News & World Report

2. Ranking of the US News & World Report

Goal EN-II. The Civil and Environmental Engineering Department will achieve a sustainable level of growth in its faculty size.
Strategy: Develop a recruiting plan to hire the best tenure-track and non-tenured track faculty to support both teaching and research in main technical areas of the civil and environmental engineering professions.
Metrics:

1. Rate of faculty growth per year, measured in FTE. All tenure track, research track and teaching track faculty will be accounted for in this metric.

Goal EN-III. The Civil and Environmental Engineering Department will broaden its efforts in securing an endowment for the Department.
Strategy: Identify and secure a number of contributors to an endowment and start the endowment within the coming year.
Metrics:

- Consolidated amount of annual Civil and Environmental Engineering endowment, expressed in monetary value ($) for all cash, infrastructure, equipment and in-kind contributions.

Goal EN-IV. The Civil and Environmental Engineering Department will expand its involvement in training and technology transfer (T^3) activities
Strategy: Expansion of current continuing education programs to serve the civil engineering and environmental engineering communities of the region.
Metrics:

1. Number of contact hours imparted through T^3 activities on an annual basis, discriminated by program areas: general CE, structural/construction, environmental, water resources, transportation, and others of relevant priority.

Goal EN-V. The Civil and Environmental Engineering Department will increase its impact on solving global problems.
Strategy: Encourage an active faculty and student participation in areas of research that address global problems and needs in cooperation with other disciplines and national and international institutions and organizations
Metrics:

1. Level of effort of Civil and Environmental Engineering faculty and students involved in active funded research projects that involve collaborations of faculty and students on global problems: faculty and student time will be measured in FTE on an annual basis.
2. Level of effort of Civil and Environmental Engineering faculty and students involved in proposed pending research projects that involve collaborations of faculty and students on global problems: faculty and student time will be measured in FTE on an annual basis presented in proposals pending.

II.B.2. Major Accomplishments tied to these goals

1. **Goal ED-I**. The Civil and Environmental Engineering Department will comply with the ABET program educational objectives of its undergraduate degree programs in civil and environmental engineering.

   The Department has a formalized process to conduct direct and indirect assessments periodically (with specific cycles), evaluate results and implement necessary changes. The ABET review of the program took place in fall 2014. The final statement received in summer 2015 stated no major shortcomings for the program. The program accreditation was approved for 6-years until the next accreditation cycle. The next accreditation visit will occur in fall 2020.

2. **Goal ED-IV**. The Civil and Environmental Engineering Department will increase the quality of our undergraduate students.

   Department has implemented monitoring policies and procedures for student progress. The final report received from ABET in summer 2015 stated had no major shortcomings.

3. **Goal ED-VI.** The Civil and Environmental Engineering Department will embrace and modify the degree program curricula to the guidelines of the "Body of Knowledge (BOK)" documents developed by the American Society of Civil Engineers and the American Academy of Environmental Engineers

   The Civil and Environmental Engineering Department has formalized the review cycles and activities. UPAC continuously monitors the changes in the requirements in degree program curricula during periodic review of the national exam criteria changes; ABET accreditation requirements as well as professional society expectations. The curriculum is continuously reviewed and feedback is received and evaluated during UPAC meetings (monthly), student forums (once per semester), DAB meetings (once per year), faculty meetings (monthly), and faculty retreat (once per year).

4. **Goal R-I**. The Civil and Environmental Engineering Department will increase research funding per faculty.

   As shown in Figure II.3., below, from July 2013 to June 2016, the unit was awarded $18.6 million in external funding. Approximately 250 awards were granted to 18 separate Principal Investigators from the unit in this time period. The awards varied as the number of awards included initial awards, increases, and supplements. The highest initial award amount was $1.4 million for a Tier 1 UTC. The lowest initial amount was $2,000 for a fellowship program. The average initial award was $108,407. The faculty continues to well represent the university in its academic productivity and service in national and international organizations.

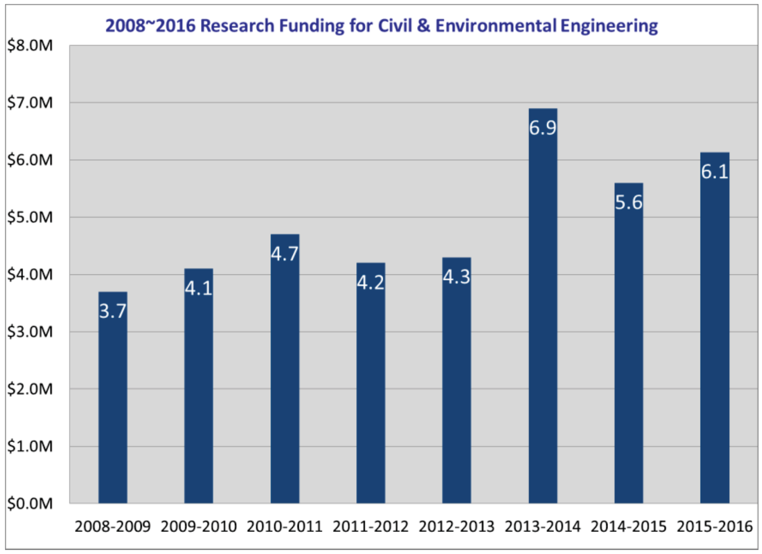

Figure II.3 Research Funding in Civil and Environmental Engineering from 2008 to 2016

5. **GOAL R-II**. The Civil and Environmental Engineering Department will increase journal publications per faculty member.

   With increasing funding and research activities, journal publications have also increased during the last 5 years. The details of the publications are shown in the Self-Study-Report for PhD program.

6. **Goal S-I**. The Civil and Environmental Engineering Department will provide a good customer service in support of FIU 3.0 objectives.

   The Civil and Environmental Engineering Department has an active involvement with the community. Community engagement is one of the top priorities in FIUs mission. Faculty and students are actively involved with service activities (i.e., serving on the County boards, projects from the State and County, public service/volunteer activities).

7. **Goal S-II**. The Civil and Environmental Engineering Department will raise the national standing of the Department through professional and community services.

   The Civil and Environmental Engineering Department has been the home for two national research centers. In the 2017 Best Graduate School Rankings, the Civil and Environmental Engineering Department was ranked 110th. This is the first time for the Department ranked by the U.S. News and World Report.

8. **Goal ED-I**. The Civil and Environmental Engineering Department will comply with the ABET program educational objectives of its undergraduate degree programs in civil and environmental engineering.

   Department has implemented monitoring policies and procedures for student progress. The final report received from ABET in summer 2015 stated had no major shortcomings.

9. **Goal EN-II**. The Civil and Environmental Engineering Department will achieve a sustainable level of growth in its faculty size.

   Since the previous review in 2008, nine new tenured or tenure-track faculty members were hired: Dr. Xia Jin and Dr. Priyanka Alluri in Transportation Engineering, Dr. Omar Abdul-Aziz in Water Resources Engineering, Dr. Atorod Azizinamini, Dr. Kingsley Lau, Dr. Ralf Arndt, and Dr. David Garber in Structural Engineering, Dr. Ioannis Zisis in Wind Engineering, and Dr. Seung Jae Lee in Geotechnical Engineering. The Department also hired two Professors of Practice; Dr. Michael Bienvenu and Dr. Hesham Ali in the Pavement Engineering.

   Three instructors, Dr. Anna Bernardo Bricker, Dr. Khokiat Kengskool, and Dr. Cora Martinez joined the Department in 2010-11. Dr. Anna Bernardo Bricker teaches the courses in air pollution area and manages all environmental engineering labs. Dr. Khokiat Kengskool is responsible for teaching engineering economics. Dr. Cora Martinez and Ms. Joanna Sanabria serve as the undergraduate advisors. The Department has a full-time lab manager, Mr. Edgar Polo, who oversees our teaching labs and assists with some of our research labs. Over the same period, the Department lost ten faculty members to career moves. Among these ten faculty members, Dr. Omar Abdul-Aziz in Water Resources Engineering and Dr. Ralf Andt in Structural Engineering have joined and left the Department.

   The Department currently has 16 tenured and tenure-track faculty members, 2 professors of practice, and 3 instructors. Totally, there are 21 full-time faculty members. Eight years ago, the Department had 16 tenured and tenure-track faculty members and 1 instructor. These numbers represent an increase in the faculty size from 17 to 21 over the past decade.

10. **Goal EN-III**. The Civil and Environmental Engineering Department will broaden its efforts in securing an endowment for the Department.

    Department is actively engaged with alumni to increase funding from organizations for student scholarships, financial support for student competitions, and endowment funds.

11. **Goal EN-IV**. The Civil and Environmental Engineering Department will expand its involvement in training and technology transfer (T^3) activities.

    The Civil and Environmental Engineering faculty are actively engaged in technology development and technology transfer. Department also conducts the Construction Training Qualification Program (CTQP) and Maintenance of Traffic (MOT) training programs for Florida Department of Transportation (FDOT). In addition, workshops, seminars, webinars and conferences are routinely organized in areas that are of growing interest such as sea level rise, resilient and sustainable engineering solutions, water quality, infrastructure, and human-environment-building interfaces.

12. **Goal EN-V**. The Civil and Environmental Engineering Department will increase its impact on solving global problems.

    Starting with freshmen entering in 2010, the University implemented “Global Learning” (GL) initiative for all undergraduate programs. Capitalizing on FIU’s unique demographics and location in the gateway to the Americas, Global Learning for Global Citizenship enables students to achieve specific learning outcomes: global awareness, global perspective, and global engagement. Global Learning for Global Citizenship is a promise to every FIU student: graduates of the University will be empowered with the knowledge, skills, and attitudes they need to become informed and engaged citizens of the world. Global Learning courses are categorized as either Foundations or Discipline-Specific. Foundations courses are part of the University Core Curriculum. Discipline-Specific courses are offered within the context of an academic program. A few GL courses may count towards either category. However, no single course may count towards both categories. Each student must take at least two courses that are designated as Global Learning courses by the Office of Global Learning. The student must take at least one Global Learning Foundations (University Core Curriculum) Course and one Global Learning Discipline-Specific Course. The ENV 3001 Introduction to Environmental Engineering course is designated as the “Discipline-Specific” Global Learning course in the Department. The faculty who teach the Global Learning courses must attend a 4-hour training class and must conduct activities and assessments each time the course is offered so that the students develop global awareness, global perspective, and global engagement. Global Learning courses must demonstrate team-based, interdisciplinary exploration of real-world problems.

II.B.3. Significant accomplishments reached as a result of continuous quality improvement and ability to capture emerging trends, needs and opportunities

The Civil and Environmental Engineering Department had a formalized process and review cycles for evaluating Student Learning Outcomes (SLOs) which are equivalent to the ABET Student Outcomes, program needs, curriculum changes, and quality improvement. An accountability system, shown in Figure II.4 on the next page, was also adopted at that time to evaluate and continuously improve the program. The system primarily consists of outcome assessments using a combination of measures, an evaluation of those measures (by faculty, regularly every term, and the DAB, for major changes as needed), and to develop the decisions and actions to enhance achievement of the Student Outcomes for continued program improvement. The Undergraduate Program Advisory Committee (UPAC) has led all program efforts related with the assessment, evaluation, and corrective actions to ensure that all students achieve the Student Outcomes.

The UPAC, after review of the assessment results, is also responsible for coordinating with the faculty and the DAB, as needed, to achieve the periodic evaluation of all Program Indicators (PIs) and development and implementation of appropriate improvement actions as needed. The program has actively and continuously implemented the process since its first accreditation visit in 2008. Over the past years, the student outcomes have been regularly assessed and evaluated by the UPAC and the faculty, with DAB input at times

In spring 2014, the UPAC reviewed the previous 12 Student Outcomes and made minor changes and combined 3i.1 and 3i.2 to student outcome (i). Then, the current 11 Student Outcomes were thoroughly reviewed by the DAB via email communications by DAB. The Student Outcomes were also reviewed by the entire Civil and Environmental Engineering faculty during the monthly meeting on February 25, 2014. The entire Civil and Environmental Engineering faculty agreed that the current 11 Student Outcomes (a through k) fully comply with Clauses (a) through (k) of Criterion 3 of the ABET 2014-15 Criteria for Accrediting Engineering Programs. The 11 Student Outcomes are thematically grouped under five categories: Technical Proficiency, Communication, Responsible Citizenship, Lifelong Learning, and Ethical Behavior. The relationship of 11 Student Outcomes to three Program Educational Objectives is shown Table II.3.

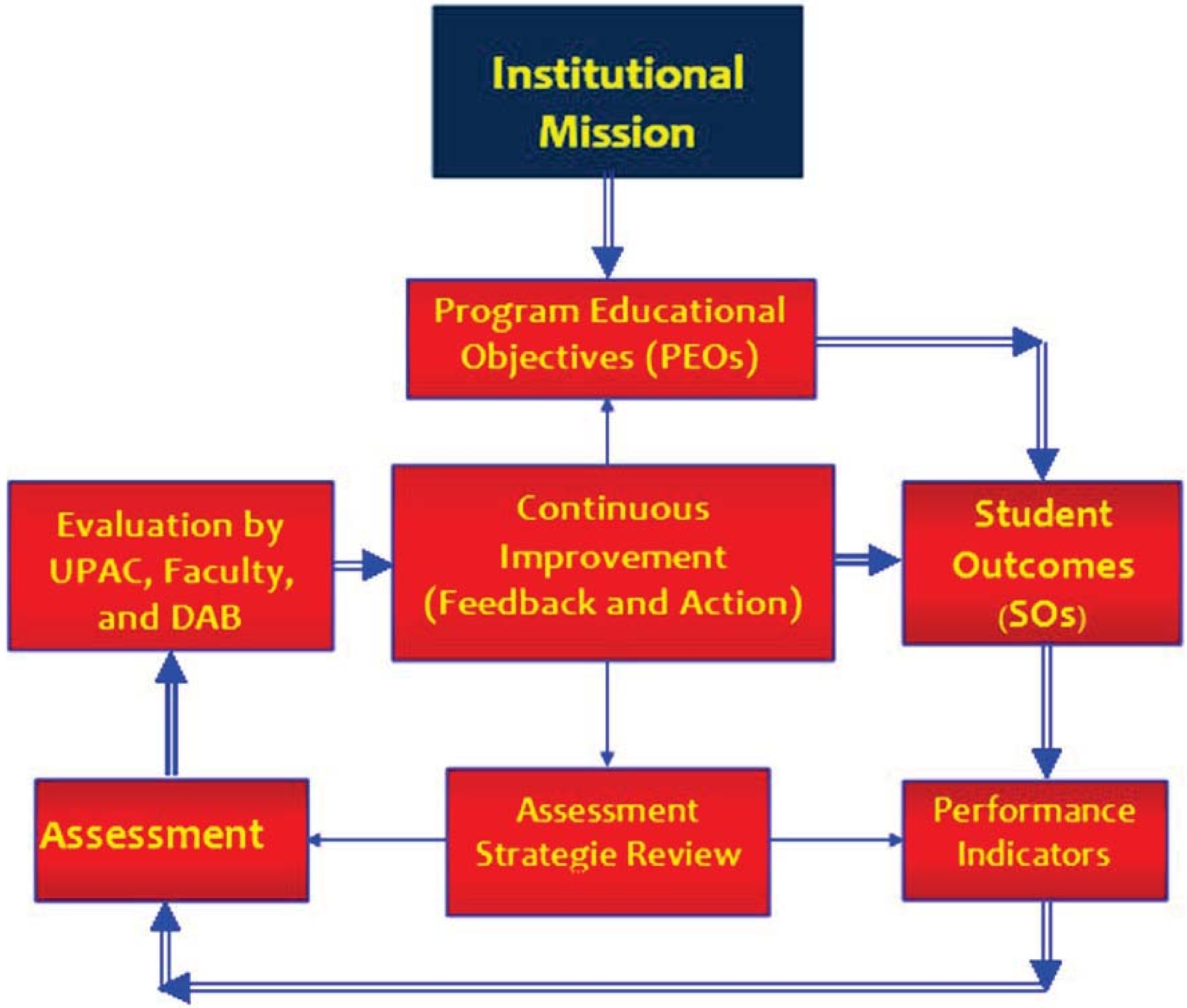

Figure II.4 Evaluation Process of Student Outcomes and Continuous Improvement of Program

Table II.3 Relationship of Student Outcomes to Program Educational Objectives

Themes	Student Outcomes		Program Educational Objective 1: Career Success Graduates will advance in their careers in civil engineering or related areas by demonstrating technical proficiency, communication skills, responsible citizenship, leadership, and ethical behavior.	Program Educational Objectives 2: Professional Licensure Graduates will make progress towards obtaining professional registration, special licensing, or certification.	Program Educational Objective 3: Lifelong Learning Graduates will pursue continued life-long learning to become the problem solvers considering the global, economic, environmental, and social impact.
1.Technical Proficiency	**(a)**	an ability to apply knowledge of mathematics, science, and engineering	√	√	
	(b)	an ability to design and conduct experiments, as well as to analyze and interpret data	√	√	
	(c)	an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	√	√	
	(e)	an ability to identify, formulate, and solve engineering problems	√	√	
	(k)	an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	√	√	
2. Communication	**(d)**	an ability to function on multidisciplinary teams	√	√	
	(g)	an ability to communicate effectively	√	√	
3. Responsible Citizenship	**(h)**	the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	√	√	√
	(j)	a knowledge of contemporary issues	√	√	√
4.Lifelong Learning	**(i)**	a recognition of the need for, and an ability to engage in life-long learning		√	√
5. Ethical Behavior	**(f)**	an understanding of professional and ethical responsibility	√	√	√

Based on the systematic reviews, the following changes have been made in the program.

1. Corrective Actions to Improve FE Exam Performance (FE Review Class)

The student performance in the Fundamentals of Engineering (FE) exam provides an assessment method for Student Outcomes (a), (e), and (k) (Technical Proficiency); Outcome (i) (Lifelong Learning); and Outcome (f) (Ethical Behavior). In order to improve the performance of the students in the FE exam the following corrective actions were taken in Spring 2013:

FE Review course improvement plan:

1) Require the FE Review course in the senior year rather than junior year (this is already implemented).
2) Prepare students for the morning exam and the general option for the afternoon exam. It is more efficient to study the same subjects for both, morning and afternoon exams.
3) Post FE review supporting material from PPI on Blackboard for students to view for free.
4) Make the students review the material and then come to class where the instructor does FE-style practice problems for 2 hours.
5) Administer two exams, one mid-term exam including Math, Chemistry, Statistics, Engineering Economy, Ethics, Statics and Dynamics; then a cumulative exam at the end of the course, including all the sections.
6) Count both, mid-term exam grade and cumulative exam grade in determining pass or fail for the course (60% final exam, 40% mid-term exam).
7) Do not sign the letter of good standing if students have not passed the FE Review course (Undergraduate Advisor).
8) Train faculty on how to conduct the review sessions. Provide them with the PPI FE Review Manual, NCEES FE Reference Handbook, PPI FE review notes.
9) Create a library available for students in our labs with web-based FE practice exams, for the morning and afternoon sessions. Encourage students to practice taking these exams.

After changes, the average passing rate has improved from 33.3% for the October 2012 FE exam (30.3% below the national average) to 66.7% (12.5% below the national average) for the April 2013 FE exam and 68.3% (only 4.3% below the national average) for the October 2013 FE exam. The improvement of FE exam results can be seen in Figure II.5 and Table II.4.

Since the FE exam format has been changed to a 6-hour computer-based test (CBT) starting in January 2014, the FE review class contents have been revised and updated for Fall 2013. The Civil and Environmental Engineering Department encourages now students to take the discipline-specific version in Civil Engineering or in Environmental Engineering, depending on the student's major, and the FE review class has been modified to prepare students for these exams in two different tracks.

Faculty, with recommendation from UPAC agreed to separate the FE Review course for the environmental engineering students as FE Review for Environmental Engineers for appropriate coverage of topics related to environmental engineering and to better align the topical coverage with those in the environmental FE exam (Proposed: Summer 2013; Implemented: Fall 2013, Catalog updated: Fall 2014).

Sections and topics covered in the FE review class include:

1) Mathematics

2) Probability and Statistics
3) Ethics and Professional Practice
4) Engineering Economics
5) Materials Science
6) Environmental Science and Chemistry
7) Thermodynamics
8) Fluid Mechanics
9) Hydraulics and Hydrologic Systems
10) Air Quality
11) Water Resources
12) Water and Wastewater
13) Solid and Hazardous Waste
14) Risk Assessment and Radiation

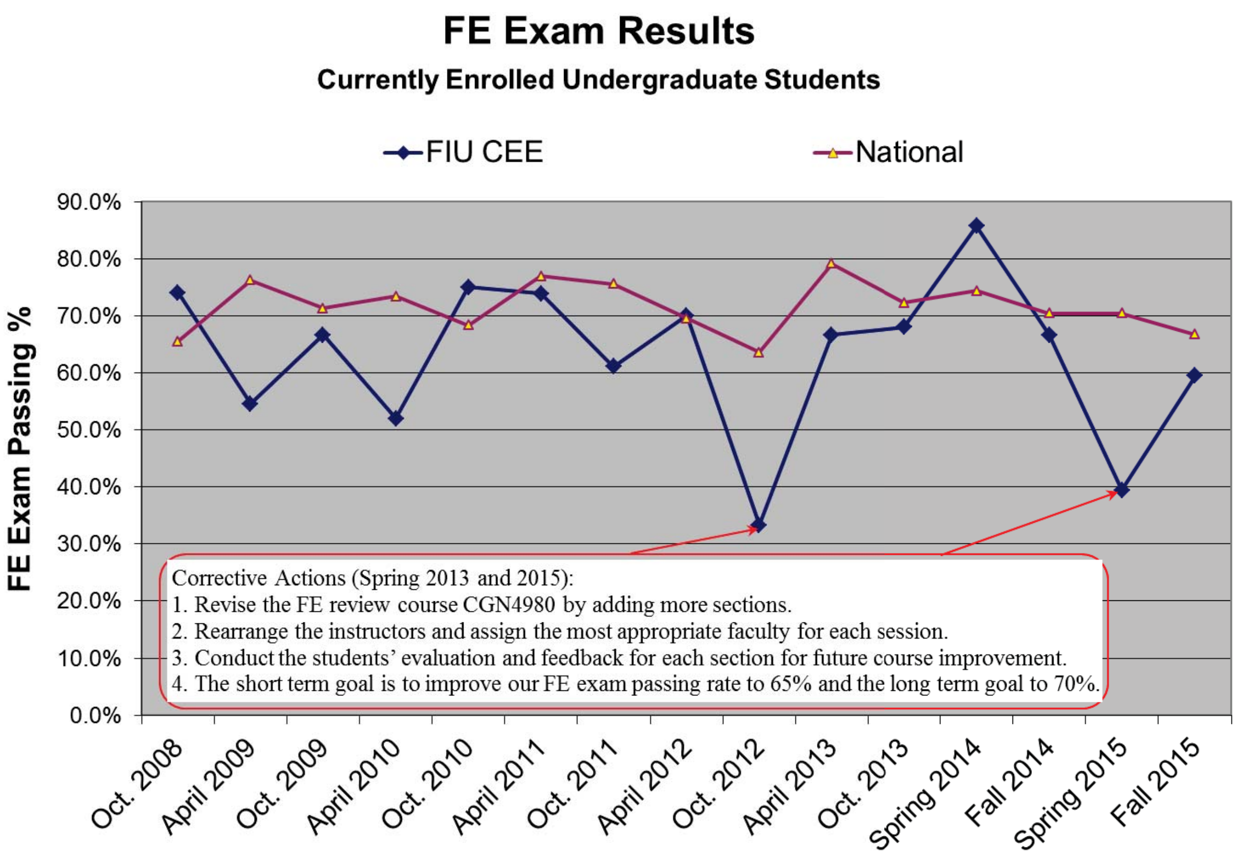

Figure II.5 FE Exam Passing Rate (%) for Currently Enrolled Undergraduate Students

Table II.4 Summary of FE Exam Passing Rate (%) for Currently Enrolled Undergraduate Students

Exam Date	Department of Civil and Environmental Engineering									National		
	PM Exam FE-Civil/Envi./Struc			PM Exam FE-Other Disciplines			Total					
	Examinees		Passing Rate	Examinees		Passing Rate	Examinees		Passing Rate	Examinees		Passing Rate
	Taking	Passing		Taking	Passing		Taking	Passing		Taking	Passing	
Oct. 2008	1	0	0.0%	26	20	76.9%	27	20	74.1%	871	571	65.6%
April 2009	1	1	100.0%	10	5	50.0%	11	6	54.5%	5863	4469	76.2%
Oct. 2009	1	0	0.0%	2	2	100.0%	3	2	66.7%	3757	2680	71.3%
April 2010	2	1	50.0%	23	12	52.2%	25	13	52.0%	6260	4597	73.4%
Oct. 2010	9	7	77.8%	15	11	73.3%	24	18	75.0%	4092	2797	68.4%
April 2011	13	10	76.9%	10	7	70.0%	23	17	73.9%	6463	4975	77.0%
Oct. 2011	4	2	50.0%	14	9	64.3%	18	11	61.1%	4621	3494	75.6%
April 2012	1	0	0.0%	9	7	77.8%	10	7	70.0%	6767	4705	69.5%
Oct. 2012	15	6	40.0%	9	2	22.2%	24	8	33.3%	5025	3197	63.6%
April 2013	3	3	100.0%	6	3	50.0%	9	6	66.7%	7064	5592	79.2%
Oct. 2013	7	6	85.7%	18	11	61.1%	25	17	68.0%	4652	3364	72.3%
Spring 2014	6	5	83.3%	1	1	100.0%	7	6	85.7%	3157	2348	74.4%
Fall 2014	36	24	66.7%				36	24	66.7%	2499	1760	70.4%
Spring 2015	38	15	39.5%				38	15	39.5%	4377	3084	70.5%
Fall 2015	37	22	59.5%				37	22	59.5%	2893	1931	66.7%

Corrective Actions (Spring 2013 and 2015):

1. Revise the FE review course CGN4980 by adding more sections.
2. Rearrange the instructors and assign the most appropriate faculty for each session.
3. Conduct the students' evaluation and feedback for each section at the end of the course for future course improvement.
4. The short term goal is to improve our FE exam passing rate to 65% and the long term goal to 70%.

2. Revision of Course CGN2420 Computer Tools for Civil Engineers
According to the results of the average percent correct for the Computers portion given during the morning session of the FE exam (12% below the national average for the April 2010 FE exam), and the average score of the student assessment for course outcomes (3.04 out of 4.00 for Fall 2010), the course contents and learning outcomes were comprehensively reviewed by the UPAC and the following corrective actions for improving the course were taken:

1) The course outcomes were re-evaluated.
2) The course outcomes were modified to include programming using MathCAD in place of Visual Basic in Excel.
3) The pre-requisites of the course were changed from EGN1110C-Engineering Drawing, to MAC2311-Calculus I and PHY2048-Physics w/Calculus I.
4) Numerical Techniques, such as root finding, numerical integration, numerical differentiation, regression analysis and linear programming were incorporated in the course contents.
5) Introduction to linear algebra, vector and matrix operations, and solution of systems of linear algebraic equations was also incorporated.

New contents of the course would also be important for the Mathematics portion of the FE exam, since there are not mandatory courses in Linear Algebra or Numerical Methods in the Civil Engineering program.

The average score of the student assessment for the course outcomes has changed from 3.04 for Fall 2010 to 3.67 out of 4.0 for Spring 2013.

3. General Course Improvement for Student Outcomes (c), (d), (g), and (j)

Based on the average score of the Student Outcomes student assessment measure, the following general course improvements have been successfully undertaken, increasing the achievement of Student Outcomes (c), (d), (g), and (j).

Student Outcome (c): an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
In Spring 2012, the faculty members teaching design courses were required to introduce more practical design examples and contemporary issues. The average score of the student assessment for Student Outcome (c) has been improved from 3.20 for Spring 2012 to 3.74 for Fall 2012.

Student Outcome (d): an ability to function on multidisciplinary teams
In Fall 2011, the Department chair discussed student outcome (d) with the corresponding instructors to improve teamwork in the classes. The average score of the student assessment for Student Outcome (d) has been improved from 3.24 for Fall 2011 to 3.62 for Summer 2012.

Student Outcome (g): an ability to communicate effectively
Beginning in Spring 2012, except for the Senior Design Project course, the faculty members teaching 4000 level courses were suggested to include a term paper, final project, and/or final

presentation as a part of the course curriculum. The average score of the student assessment for Student Outcome (g) has been improved from 3.24 for Fall 2011 to 3.61 for Summer 2012.

Student Outcome (J): a knowledge of contemporary issues

Beginning in Spring 2012, the faculty members teaching design courses were required to introduce more practical design examples and contemporary issues. Global Learning classes also require projects and activities that expose the students to contemporary global issues. Implementation of the Global Learning initiative by the University has made a noticeable impact on the students' global awareness of the contemporary challenges. The average score of the student assessment for Student Outcome (j) has been improved from 3.26 for Fall 2011 to 3.82 for Summer 2012.

II.B.4. Major changes in the Program as a result of changes in discipline, student demand, faculty feedback and labor dynamics.

1. Improvement of Advising System

1.1. Graduation Success Initiative (GSI)

During the last three years, a university-wide Graduation Success Initiative (GSI) was implemented to help students to succeed academically. The objectives of the GSI are:

1) Help students find their appropriate major as early as possible.
2) Provide students with a clear path for timely graduation.
3) Give students immediate feedback and support if they get off their path to graduation.
4) Reach students proactively with guidance and not wait for them to contact the advisor.

1.2. Changes Implemented for the Advising System

To improve the advising process, the following actions have been implemented in response to GSI:

1) The Undergraduate Education Academic Advising Center, located in MMC, provides academic advising for exploratory students and those who need assistance in identifying or transitioning into an appropriate major. However, most of the freshman students are now placed in their corresponding majors since the first year of studies and receive advice from their corresponding Department since the very first semester. For engineering students, advising is done centrally at the Engineering Advising Center. The Center is located at the Engineering Center and currently has 7 engineering advisors. The Civil and Environmental Engineering Department recently hired a second full time Undergraduate Advisor to achieve the 300:1 advisor-to-student ratio that defines best practice nationally.

2) Advising holds are placed every semester only on engineering students having a GPA of 2.5 or less and on students who were not enrolled courses in the past academic term. Such students cannot register until the hold is lifted. An advising hold is only removed after a student has been properly advised as to the courses to register in that particular semester. Additionally, Panthersoft places low GPA, Warning/Probation holds on students with GPA less than 2.00 or that are in Academic Warning or Probation.

3) The UA uses Curriculum Flowcharts to illustrate the program's required coursework and pre-requisite chains in a graphical format. The Civil and Environmental Engineering Department updates its program flowcharts every year and makes them available at the Engineering Advising Center or online at the Civil and Environmental Engineering Department advising website:
   http://www.cee.fiu.edu/wp-content/uploads/2012/12/CIVIL_FLOWCHART.pdf
   In addition, the new tool Major Map, is used by the UA to provide students with a clear academic plan towards graduation. The Major Maps are term by term plans of study created for each program to help students select their courses while staying on track. The Civil and Environmental Engineering Department developed two, three, four and five year major maps for transfer and freshman students who plan to graduate in the corresponding amount of time. Three and five year maps are currently being implemented by the Advising Technology Office. The two and four year major maps can be seen in the following website: http://mymajor.fiu.edu

4) The UA also uses the My_eAdvisor system for monitoring student performance and progress. The new tool My_eAdvisor provides undergraduate students and advisors with immediate feedback with regard to the student's progress on interactive Major Maps. My_eAdvisor alerts students and advisors if a student is off track. High severity alerts are triggered when: 1) a student has a GPA of less than 2.00, and 2) a student did not pass a course. Medium severity alerts are triggered when: 1) a student has a GPA of less than 2.25, and 2) a student enrolled in a course out of sequence with the student's major map or 3) a student enrolled in a course outside his/her plan of study. Low severity alerts are triggered when: 1) earned a passing grade that is less than a threshold (critical indicator) grade set by the academic department to indicate student success in the major, and 2) a student did not meet full time enrollment status. When alerts are generated (at the end of the academic term), the UA reaches out to the student using intrusive advising via the eAdvisor dashboard.

5) The UA also utilizes the Panther Degree Audit (PDA) to observe the student academic progress. This new feature allows students and advisors to review the courses student have taken, including in-progress courses, and review and plan for courses needed to complete their degree. For continuing undergraduate students, the Panther Degree Audit replaces the SASS Report used in the past as the degree audit tool. In the PDA, requirements are arranged into groups/sections, as the student completes a requirement, the system updates the PDA (normally at the end of every term) and the different groups/sections are gradually closed. The Degree Audit is also used to record any transfer credits that are used to satisfy specific program requirements.

6) In order to enforce appropriate sequence of courses, the UA uses a customized engineering course prerequisite query, which is run immediately after current semester grades are posted and also during the first week of the following term. The query reports the names of students who have not met course pre-requisites. These students are notified by phone and email to contact their advisor as soon as possible to review their course registration. The advisor then works with the student to adjust his/her course enrollment. If the student

does not respond and remains registered, he/she is dropped from the course for which a pre-requisite has been violated.

II.B.5. Curricular changes that have been implemented, including new course development

1. Revisions of Program Curriculum

The current curriculum for the BS in Civil Engineering has undergone changes for students admitted as of the 2015-2016 academic year. These changes were made to strengthen the curriculum and better align the courses with the Student Outcomes. One of the proposed changes includes removing the requirement for EEL 3110 Circuit Analysis from the engineering science requirements.

A new one-credit course, CGN2161 Career Orientation in Civil Engineering, has been developed to provide students with an overview of the professional practice for Civil Engineering. Students will be presented with the subfields within Civil and various job opportunities in both practice and research environments. The intent of the course is to assist the students in identifying and selecting area(s) of emphasis they may wish to pursue in their studies and professional careers. Students are introduced to professionals from the area and will be exposed to current civil engineering projects, as well as their societal implications. The course also helps students gain a better understanding of the importance of lifelong learning and professional development.

At that time, CGN4980 Civil Engineering Seminar: FE Review do not count in the total required credits for the BS degree. This course is a preparatory course for the Fundamentals of Engineering (FE) Exam, as described previously in this section. The FE Review course will now be counted as one-credit of the 128 credits required for the degree.

2. Development of New Electives

The Undergraduate Electives Concentration Policy was developed to advise students to take electives in one of the following seven concentration tracks: Construction Engineering, Geotechnical Engineering, Environmental Engineering, Structural Engineering, Transportation Engineering, Water Recourses Engineering, and General Civil Engineering. The details of the Undergraduate Electives Concentration Policy are shown in Appendix D Curriculum. In order to offer enough electives for each concentration, the following new electives were developed and offered individually, without cross-listing with graduate courses as CEN4930 Special topics.

Structural Engineering	
CES 4580 Hurricane Engineering and Global Sustainability	(3)
CES 4711 Intro to Prestressed Concrete Structures	(3)
CGN 4510 Sustainable Building Engineering	(3)
Water Resources Engineering	
CWR 4204 Hydraulic Engineering	(3)
CWR 4620C Ecohydrological Engineering	(3)
Geotechnical Engineering	
CES 4580 Hurricane Engineering and Global Sustainability	(3)

Environmental Engineering

ENV 4101 Fundamentals of Air Pollution Engineering	(3)
EGN 4070 Engineering for Global Sustainability and Environmental Protection	(3)

Construction Engineering

CES 4580 Hurricane Engineering and Global Sustainability	(3)
CGN 4510 Sustainable Building Engineering	(3)

Transportation Engineering

TTE 4102 Urban Transportation Planning	(3)
TTE 4202 Traffic Engineering	(3)
TTE 4203 Highway Capacity Analysis	(3)

General Civil Engineering

EGN 4070 Engineering for Global Sustainability and Environmental Protection	(3)

The revised Civil Engineering program curriculum is detailed in Appendix C: Curriculum.

3. Development of Undergraduate Electives Policy

In order to ensure full compliance with ABET Criterion, with regard to the application of knowledge in four civil engineering technical areas, UPAC and the program have worked to improve the curriculum for students at the senior level. These students have to take four technical Civil and Environmental Engineering elective courses to satisfy the BS Civil Engineering program requirements. Each student is advised to select a concentration or a track. Concentrations are available in seven different areas: Construction Engineering, Geotechnical Engineering, Environmental Engineering, Structural Engineering, Transportation Engineering, Water Recourses Engineering, and General Civil Engineering. Selecting any one of the concentration tracks entails taking a minimum of three of the four technical electives in that area of concentration. If a student selects the General Civil Engineering track, he/she can take at most one course in each concentration as a technical elective. Student transcripts show that, over the past years, all students have effectively completed either concentration or general tracks. Transcripts that show the effectiveness of the approach will be available during the site visit.

The following are the recommended technical electives for each track:

Structural Engineering

CES 4320 Intro to the Design of Highway Bridges	(3)
CES 4580 Hurricane Engineering and Global Sustainability	(3)
CES 4605 Steel Design	(3)
CES 4711 Intro to Prestressed Concrete Structures	(3)
CGN 4510 Sustainable Building Engineering	(3)

Water Resources Engineering

CWR 4204 Hydraulic Engineering	(3)
CWR 4530 Modeling Application in Water Resources Engineering	(3)
CWR 4620C Ecohydrological Engineering	(3)
ENV 4401 Water Supply Engineering	(3)

Geotechnical Engineering

CEG 4012 Geotechnical Engineering II	(4)
CEG 4126 Fundamentals of Pavement Design	(3)
CES 4580 Hurricane Engineering and Global Sustainability	(3)

Environmental Engineering

ENV 4024 Bioremediation Engineering	(3)
ENV 4101 Fundamentals of Air Pollution Engineering	(3)
ENV 4330 Hazardous Waste Assessment & Remediation	(3)
ENV 4351 Solid Waste Management	(3)
ENV 4401 Water Supply Engineering	(3)
ENV 4513 Chemistry for Environmental Engineers	(3)
ENV 4551 Sewerage and Wastewater Treatment	(3)
ENV 4560 Reactor Design	(3)

Construction Engineering

CCE 4001 Heavy Construction	(3)
CCE 5036 Advanced Project Planning for Civil Engineers	(3)
CES 4580 Hurricane Engineering and Global Sustainability	(3)
CGN 4510 Sustainable Building Engineering	(3)

Transportation Engineering

CEG 4126 Fundamentals of Pavement Design	(3)
CGN 4321 GIS Applications in Civil and Environmental Engineering	(3)
TTE 4102 Urban Transportation Planning	(3)
TTE 4202 Traffic Engineering	(3)
TTE 4203 Highway Capacity Analysis	(3)
TTE 4804 Geometric Design of Highways	(3)

General Civil Engineering

EGN 4070 Engineering for Global Sustainability and Environmental Protection	(3)

II.C. Current annual goals (2015-2016)

Currently the university is in the midst of a profound transformation. In May 2013, FIU initiated a process to create this new strategic plan through the integrating Research, Engagement, Assessment and Learning (iREAL) Commission. FIUBeyondPossible2020 was developed as FIU's roadmap for the future. The university has implemented a number of initiates to monitor the progress and achieve these goals. The program adapted the goals that relate to the Department performance and graduates from the program as shown below.

Table II.5 20 FIU Beyond Possible 2020 Critical Performance Indicator Goals

2014	NO	PERFORMANCE INDICATOR	2020	PROGRAM GOALS
79%	1	FTIC 2-year retention with GPA above 2.0	90%	x
53%	2	FTIC 6-year graduation rate	70%	x
64%	3	AA transfer 4-year graduation rate	70%	x
68%	4	Percent bachelor's degrees without excess hours	80%	x

77%	5	Percent of bachelor's graduates employed full-time or in continuing education	80%	x
46%	6	Bachelor's degrees in strategic areas	50%	x
52%	7	Graduate degrees in strategic areas	60%	x
$26K	8	Average cost per bachelor's degree	$20K	x
$36K	9	Median wage of bachelor's graduates	$40K	x
6,219	10	Bachelor's degrees awarded to minorities	7,200	x
1,982	11	Number of First Gen graduates	2,300	x
4,737	12	Number of students participating in internships	6,000	x
159	13	Research doctoral degrees per year	200	x
83	14	Research staff/post-doctoral Fellows	129	x
2	15	Number of patents per year	20	x
2:8	16	Number of startups-AUTM:SBDC definitions	5:20	
$176M	17	Private gifts - overall endowments	$300M	x
$53M	17a	Private gifts - annual gifts	$70M	x
$197M	18	Auxiliary revenue per year	$240M	x
$20M	18a	Auxiliary operating income	$25M	x
$133M	19	Research expenditures	$200M	x
$107M	19a	S&E expenditures	$165M	x
54,000	20	Total number of FIU students enrolled	65,000	
67:8:25	20a	Mode of delivery (face-to-face:hybrid:online)	30:30:40	x

Based on FIU Beyond Possible 2020 Critical Performance Indicators, the current goals and achievement of Civil Engineering programs are shown in Table II.5. For goal #1, FTIC 2nd Yr Retention with GPA above 2.0, the retention rate for BS in Civil Engineering changed from 75.56% (2013-14) to 79.31% (2014-15). For goal #4, Percent of BS Degrees without Excess Hours, the data changed from 38.95% (2012-13) to 43.04% (2013-14), then 46.99% (2014-15). The results of other goals also have minor improvement.

Table II.6 Current Goals and Achievement of Programs in Civil Engineering

FIU Beyond Possible 2020						
CIVIL ENGINEERING		20 Critical Performance Indicator Goals				
No	Metric	PAST	CURRENT	PROJECTED		
		2014-15	2015-16	2016-17	2018-19	2019-20
1	FTIC 2Yr Retention with GPA above 2.0 (2013-14)	**75.56%**	**79.31%**	**79%**	**81%**	**83%**
2	FTIC 6Yr graduation rate (2008-09)	**33%**	**34%**	**36%**	**38%**	**40%**
3	AA Transfer 4-year graduation rate (2010-11)	**42%**	**44%**	**46%**	**48%**	**50%**
4	Percent bachelor's degrees w/o excess hours (2013-14)	**43.04%**	**46.99%**	**46%**	**48%**	**50%**
5	Percent of bachelor's graduates employed full-time or in continuing education (2012-13 Graduates)	**73%**	**74%**	**76%**	**78%**	**80%**
6	Bachelor's degrees in strategic areas (2013-14)*	**84**	**84**	**85**	**88**	**92**
7	Graduate degrees in strategic areas (2013-14)	**32**				
8	Average cost per bachelor's degree (2013-14)	**N/A**				
9	Median wage of bachelor's graduates (2011-2012 Graduates)	**$40,328**	**$41,135**	**$41,546**	**$41,961**	**$42,381**
10	Bachelor's degrees awarded to minorities (2013-14)	**66/84**	**64/84**	**65/85**	**68/88**	**72/92**
11	Number of First Gen graduates (2013-14)	**21**	**22**	**23**	**24**	**25**
12	Number of students participating in internships (2014-15)					
13	Research doctoral degrees per year (2013-14)	**12**				
14	Research staff/post-doctoral Fellows					
15	Number of patents per year					
16	Number of startups-AUTM:SBDC definitions					
17	Private gifts-overall endowment (FY 2013-14)					
17a	Private gifts-annual gifts (FY 2013-14)					
18	Auxiliary revenue per year (FY 2014-15)					
18a	Auxiliary operating income					
19	Research expenditures in millions (FY 2013-14)					
19a	S&E expenditures					
20	Total number of FIU students enrolled	**731**	**720**	**740**	**760**	**780**
20a	Mode of delivery (face-to-face:hybrid:online) (2014-15)					**30:30:40**

II.D. Recommendations of any specialized accreditation (ABET)

The program was reviewed by ABET in Fall 2014 (November 16-18, 2014). During the visit, one program concern in Criterion 7 Facilities was identified as follow:

1. Criterion 7. Facilities This criterion requires that modern tools, equipment, computing resources, and laboratories are available, accessible, and systematically maintained and upgraded. In addition, the criterion requires that laboratories are adequate to support attainment of student outcomes and provide an atmosphere conductive to learning. The equipment in the Materials and Geotechnical Testing laboratories is adequate but dated. In addition, the laboratory space is barely adequate to simultaneously accommodate all equipment used in the experiments and students' book bags. While the laboratories adequately satisfy the criterion at present, unless the equipment is modernized and space is appropriately expanded, the potential exists for the program to fall out of compliance with this criterion in the future.

Due to the limited budget of the College of Engineering and Computing and space in Engineering Center, this concern remains unresolved. BS in Civil Engineering program was accredited by EAC of ABET to September 30, 2021.

III. PROGRAM ANALYSIS

III.A. Program Description, Purpose, and Objectives

III.A.1. Mission and Vision Statement

III.A.1.1. University Mission Statement

Florida International University (FIU) – Miami's public research university – is one of America's most dynamic institutions of higher learning. FIU was established by the Florida Legislature in 1965 and classes began in September 1972. In 1984, FIU received authority to begin offering degree programs at the doctoral level. The Carnegie Foundation for the Advancement of Teaching ranks FIU as a Research University in the High Research Activity Category. A member of the State University System (SUS) of Florida, FIU offers a diverse selection of undergraduate, graduate, and professional programs. Through its 12 colleges and schools, FIU offers more than 185 baccalaureate, master's, and doctoral degree programs and also conducts basic and applied research. All programs received Level IV accreditation from the Southern Association of Colleges and Schools (SACS) in 1986 and 2000. SACS reaffirmed FIU's accreditation on December 6, 2010. FIU has more than 50,000 students, 1,100 full-time faculty, and 191,000 degrees awarded, making it the largest university in South Florida and placing it among the nation's largest colleges and universities. Committed to both quality and access, FIU meets the educational needs of traditional students as well as those of part-time students and lifelong learners. Interdisciplinary centers and institutes conduct research and teaching that addresses economic and social concerns.

The following section from the FIU Mission Statement, which is located on the FIU Home » About Us » Vision & Mission web site (http://www.fiu.edu/about-us/vision-mission/) and on FIU Provost Office web site (http://academic.fiu.edu/provost_mission.html), has also been published in the yearly University Course Catalogs (http://catalog.fiu.edu/2013_2014/undergraduate/admissions-and-registration-information/university-information.pdf).

> *"Florida International University is an urban, multi-campus, public research university serving its students and the diverse population of South Florida. We are committed to high-quality teaching, state-of-the-art research and creative activity, and collaborative engagement with our local and global communities."*

III.A.1.2. College Mission Statement

The College of Engineering and Computing recognizes the importance of a quality engineering education, particularly in the rapidly growing South Florida region. Here, the challenges facing an urban, diversified community depend heavily on technical and innovative solutions to resolve the problems in our infrastructure. FIU's College of Engineering and Computing strives to serve the engineering and technology management needs of Florida, the nation, and the international community.

The following section is reproduced from the college mission statement that is posted on the college web site, http://www.cec.fiu.edu/about/strategic-plan/vision-and-mission/.

> *"As the research engine of the university, and as a strong force for Miami's economic development, the College is committed to providing quality education, problem-solving research, and community engagement through local relevance, national visibility, and global exposure. The College will strive to enhance the quality of life for its students, faculty, alumni, and the community. The College's research mission is the pursuit of the discovery and application of innovative engineering ideas and technologies that will continue to enhance the economic vitality and quality of life in our community, our region, and the nation."*

III.A.1.3. Department Mission Statement

The Department of Civil and Environmental Engineering offers a Bachelor's Degree Program in Civil Engineering and a Bachelor's Degree Program in Environmental Engineering. It also offers advanced study for Master of Science and Doctor of Philosophy degrees that include Master of Science in Civil Engineering, Master of Science in Environmental Engineering, and Doctor of Philosophy in Civil Engineering. The following section from the Departmental mission statement has been posted on the departmental web site at http://www.cee.fiu.edu/about-cee/vision-mission/ and http://www.cee.fiu.edu/accreditation-and-assessment/ as well as was published in the FIU Course Catalogs; (http://catalog.fiu.edu/2016_2017/undergraduate/College_of_Engineering_and_Computing/Undergraduate_Civil_and_Environmental_Engineering.pdf).

> *"The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence."*

III.A.1.4. Department Vision

The Civil and Environmental Engineering Department will make meaningful progress over the coming decade as it strives to attain teaching, research and scholarly productivity, actively seeking performance levels of research universities and expanding recognition for excellence in the study of global issues and pursuit of sustainable solutions.

III.A.2. Consistency of the Program with the current State University System (SUS) Strategic Planning Goals

The State University System of Florida has experienced extraordinary changes and shifts in recent years, as economic challenges in Florida have compelled state universities to implement innovative strategies and efficiencies to respond to both increased enrollment demands and budget constraints. These changes are reflected in the 2014 update of the State University System 2025 Strategic Plan, which was originally approved in November of 2011.

The Board's Access and Attainment Commission conducted a supply–demand study of the State's projected occupations and current baccalaureate degree production, and was rewarded with a legislative appropriation to close those gaps in degree production. The Board's list of Programs of Strategic Emphasis was also revised in November 2013 to reflect changes in workforce demands. Two additional Board committees–the Innovation and Online Committee and the Health Initiatives Committee–were created to assist in System strategic planning. The University of Florida and Florida State University were designated as Preeminent Universities and rewarded with additional funding to raise their national rankings.

And perhaps most importantly, the Board of Governors worked with the Florida Legislature and the Governor to implement a Performance–Based Funding Model that is a dramatic change to how the System will receive funding. The Performance–Based Funding Model provides incentives to universities to meet the Board's benchmarks – which are largely based on the 2025 goals in this Strategic Plan.

Performance–Based Funding Model has opened up unprecedented opportunities for universities to rethink how best to educate the next generation of thought leaders. In May 2013, FIU initiated a process to create this new strategic plan through the integrating Research, Engagement, Assessment and Learning (iREAL) Commission. The commission was appointed by FIU President Mark B. Rosenberg and chaired by then-Dean of the College of Arts and Sciences Kenneth G. Furton. Since then, more than 150 students, faculty, staff, alumni and community leaders have analyzed numerous challenges and opportunities to develop a path forward for the next five years, laying the foundation for FIUBeyondPossible2020.

This is a plan of action, one that when fulfilled will ensure that our university and students continue to thrive. This plan is consistent with who we are – an urban public research university proudly committed to providing a state-of-the-art education for traditional and non-traditional learners – locally and globally; a university that understands its role as an anchor institution in one of the most dynamic and energized cities in the world, Miami. The plan’s key measurable goals include:

1. Improving the first-to-second-year retention rate of our first-time-in-college (FTIC) students from 79 to 90 percent
2. Boosting our six-year graduation rate among FTIC students from 53 to 70 percent
3. Improving our four-year graduation rate of state college (AA) transfer students from 64 to 70 percent
4. Strategically increasing our enrollment to 65,000 students and increasingly using digital technologies to enhance face-to-face and distance learning

5. Expanding experiential learning opportunities for our students, with special attention to growing available student internships from 4,737 to more than 6,000 annually
6. Raising research expenditures from $133 million annually to $200 million annually
7. Increasing by 30 percent the number of Ph.D. degrees granted to more than 200 annually
8. Nurturing an expansion in patents and startups from an average of two per year to 20 annually
9. Growing our philanthropic giving to achieve the Next Horizon capital campaign goal of $750 million

The program is consistent with the goals identified and provides benefit to the University, region, State, and global community. The fragile South Florida ecosystem is a major national point of research, study and concern. FIU enjoys unique opportunities to leverage our tropical location for learning and research that focuses on environmental issues. With the Florida Everglades in our backyard, FIU scientists at the Southeast Environmental Research Center have been at the forefront of Florida Everglades research for more than two decades and have made great strides to restore and build resiliency for this vital ecosystem. Additionally, the academic centers include the International Center for Tropical Botany at The Kampong (the only garden of the National Tropical Botanical Garden outside Hawaii) in Coconut Grove, the Aquarius Reef Base in the Florida Keys, the Wall of Wind at the Engineering Center and the Batchelor Environmental Center (in collaboration with the Patricia and Phillip Frost Museum of Science) at BBC. These initiatives will play an important role moving forward in the development of preeminent programs that directly address the needs of the community and enhance community sustainability.

III.A.3. Programmatic information

III.A.3.a. BOG metrics

1. Employment and Continuing Education Data for baccalaureate graduates
The data obtained from FIU Analysis and Information Management (AIM) office is shown as below. Average annual salary increased by $12,700 over the last 4 years of post-graduate data. Percent employed after 1 year also increased slightly from 2010-2011 (73.2%) to 2013-14 (74.0%).

	2010-2011	2011-2012	2012-2013	2013-2014
# of Graduates	82	78	96	76
% Employed after 1 year	73.2%	65.4%	61.0%	74.0%
Average of Annual Salary	$41,540	$40,752	$45,384	$54,240
Average of Percent Continuing Education	22.0%	35.0%	24.0%	14.0%

Source: FETPIP
Note: The years noted above represent the graduation years for FIU baccalaureate recipients. The salary and continuing education figures are based on outcomes from one year after graduation. Salary data are only for graduates who are employed full-time in Florida. Salary data are not provided for years with 10 or fewer full-time employees.

In addition, this indicator is related to FIUBeyondPossible2020 Performance Indicator Goal #5, Percent of bachelor's graduates employed full-time or in continuing education. The data of this goal is shown in Table II.6 for the past (2014-15) and current (2015-16) AYs. According to the data, the improvement for the goal is in the right trend and the program will achieve the projected target (80%) in 2019-20.

2. FTIC six-year graduation and retention rates **(**based on latest declared major**)**
The data obtained from FIU Analysis and Information Management (AIM) office is shown as below. The six-year graduation rate for FTIC students fluctuated between 29.5% and 35.7% over the last 3 cohort years. The retention rate for Civil Engineering FTIC students mildly decreased by 4.3% from 2007-08 to 2009-10.

LAST TERM PROGRAM	COHORT YEAR	COHORT HEADCOUNT	GRADUATION RATE	RETENTION RATE
Civil Engineering	2007 - 2008	61	29.5%	55.7%
	2008 - 2009	42	35.7%	64.3%
	2009 - 2010	37	29.7%	51.4%

Note: The cohort years noted above represent the entering cohort year. Graduation rate represents the students from the particular cohort year who graduated within six years of entering the university. Retention rate includes students who graduated from the particular cohort years as well as those still enrolled at the university.

Furthermore, this indicator is related to FIUBeyondPossible2020 Performance Indicator Goal #2, FTIC 6Yr graduation rate. The data of this goal is shown in Table II.6 for the past (2014-15) and current (2015-16) AYs. According to the data, the improvement for the goal is in the right trend and the program will achieve the Department projected target (40%) in 2019-20.

3. 2014 FTICs Academic Progress Rate: 2nd-year Retention with GPA above 2.0 (based on first declared major, includes full-time students only)
The data obtained from FIU Analysis and Information Management (AIM) office shown as below is for 2014. FTIC second year retention with GPA above 2.0 is a new metric in the program review. The second year retention is just 1.0% lower than the university-wide second year retention (80%).

FIRST TERM CIP DESCRIPTION	COHORT HEADCOUNT	2ND YEAR RETENTION WITH GPA ABOVE 2.0
Civil Engineering	52	78.85%

Moreover, this indicator is related to FIUBeyondPossible2020 Performance Indicator Goal #1, FTIC 2Yr Retention with GPA above 2.0. The data of this goal is shown in Table II.6 for the past (2014-15) and current (2015-16) AYs. According to the data, the improvement for the goal is in the right trend and the program will achieve the Department projected target (83%) in 2019-20.

4. Bachelor’s without Excess Hours
The data obtained from FIU Analysis and Information Management (AIM) office shown as below is for 2014-2015. The percent of Bachelor’s degrees without excess hours is a new metric in the program review. Due to challenged curriculum and cutting-edge professional requirements in engineering programs, Civil Engineering’s percent of Bachelor’s degrees without excess hours is 23% lower than the university-wide percent of Bachelor’s degrees without excess hours (70%).

CIP DESCRIPTION	% DEGREES WITHOUT EXCESS HOURS
Civil Engineering	46.99%

Besides, this indicator is related to FIUBeyondPossible2020 Performance Indicator Goal #4, Percent bachelor's degrees w/o excess hours. The data of this goal is shown in Table II.6 for the past (2014-15) and current (2015-16) AYs. According to the data, the improvement for the goal is in the right trend and the program will achieve the Department projected target (50%) in 2019-20.

5. Bachelor's Degrees awarded to Minorities (1^{st} Majors)
The data obtained from FIU Analysis and Information Management (AIM) office is shown as below. The number of Bachelor's degrees in Civil Engineering awarded to minorities fluctuated between 56 and 74 students over the last 5 years. The percent of Bachelor's degrees in Civil Engineering awarded to minorities also fluctuated between 79% and 97% over the last 5 years. Currently (2014-15), 90% of degrees were awarded to underrepresented minorities.

	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015
Count	69	56	74	66	67
Percent	90.8%	78.9%	82.2%	97.1%	90.1%

Note: This report uses BOG Methodology which counts on Hispanic and African American students as underrepresented minorities, and excludes Non- resident Aliens and Not Reported from the totals used to calculate the percentages.

Additionally, this indicator is related to FIUBeyondPossible2020 Performance Indicator Goal #10, Bachelor's degrees awarded to minorities. The data of this goal is shown in Table II.6 for the past (2014-15) and current (2015-16) AYs. According to the data, the improvement for the goal is in the right trend and the program will achieve the Department projected target (72/92) in 2019-20.

III.A.3.b. FIU Metrics

1. Enrollment Data
The data obtained from FIU Analysis and Information Management (AIM) office is shown as below. Enrollment at the Lower Level decreased by -21% from 173 to 136 students over the last 6 years. However, enrollment at the Upper Level increased by 7% from 454 to 487 students over the last 6 years. The headcount of the entire BS degree in Civil Engineering program is around 625 without change for this period.

CIP Description	Student Level	Fall 2010	Fall 2011	Fall 2012	Fall 2013	Fall 2014	Fall 2015
Civil Engineering	Lower	173	156	147	178	183	136
	Upper	454	434	395	421	460	487
	Grad I	61	50	53	47	39	31
	Grad II	50	54	61	71	74	65
Civil Engineering Total		**738**	**694**	**656**	**717**	**756**	**719**

Note: Students are counted as enrolled if they are taking at least one class during the term specified above and their program is based on their declared major.

In addition, the enrollment data of BS degree in Civil Engineering program is shown in Table II.2 and Figure II.1 for the past eight years. The enrollment increased from 526 to 726 in 2008-09 and 2015-16, respectively. The enrollment is expected to continue to grow.

2. Degree Production

The data obtained from FIU Analysis and Information Management (AIM) office is shown as below. Bachelors degrees awarded increased by 5 from 80 to 85 over the last 6 years.

CIP Description	Student Level	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015
Civil Engineering	Bachelors	80	85	85	98	86	85
	Masters	21	25	30	26	25	21
	Doctoral	9	6	7	9	8	11
Civil Engineering Total		**110**	**116**	**122**	**133**	**119**	**117**

Furthermore, the degrees awarded for BS degree in Civil Engineering program is shown in Table II.2 and Figure II.2 for the past eight years. The degrees awarded increased from 63 to 91 in 2008-09 and 2015-16, respectively. The trend is expected to continue to grow.

3. Instructional Efforts (Fall and Spring only)

The data obtained from FIU Analysis and Information Management (AIM) office is shown as below. The percent of full-time faculty decreased by 24% at the lower level and 12% at the upper level over the last 3 years. However, total course credits increased from 58 to 63 (8.6%) at the lower level and 270 to 294 (8.9%) at the upper level over the last 3 years.

Department	Acad. Year	Level	Percent Full-Time	Total Course Credits
Civil Engineering	2012-2013	LOWER	63.79%	58
		UPPER	93.33%	270
		GRAD	99.17%	483
	2013-2014	LOWER	42.19%	64
		UPPER	72.30%	278
		GRAD	100.00%	507
	2014-2015	LOWER	39.68%	63
		UPPER	81.63%	294
		GRAD	98.61%	577

4. FTEs and Fundable Student Credit Hours (FSCH)

The data obtained from FIU Analysis and Information Management (AIM) office is shown as below. FTE increased from 59.3 to 68.7 (16%) at the lower level and from 143.7 to 187.6 (31%) at the upper level over the last 5 years. Total FTE for BS degree in Civil Engineering program increased by 53.3 (26 %) between 2010-2011 (203.0) and 2014-2015 (256.3). FSCH increased from 2373 to 2749 (16%) at the lower level and from 5746 to 7504 (31%) at the upper level over the last 5 years. Total FSCH for BS degree in Civil Engineering program increased by 2,134 (26 %) between 2010-2011 (8,119) and 2014-2015 (10,253).

		2010-2011		2011-2012		2012-2013		2013-2014		2014-2015	
		FTE	FSCH	FTE	FSCH	FTE	FSCH	FTE	FSCH	FTE	FSCH
Civil Engineering	LOWER	59.3	2,373	59.5	2,379	56.2	2,249	63.0	2,518	68.7	2,749
	UPPER	143.7	5,746	139.2	5,567	169.2	6,766	187.0	7,481	187.6	7,504
	GRAD I	46.9	1,502	40.2	1,285	39.0	1,248	27.3	873	21.3	681
	GRAD II	28.8	922	32.4	1,036	32.0	1,024	41.6	1,330	40.8	1,307
	TOTAL	**278.7**	**10,543**	**271.2**	**10,267**	**296.4**	**11,287**	**318.8**	**12,202**	**318.5**	**12,241**

5. AA Transfer Four-Year Graduation and Retention Rates (based on latest declared major)
The data obtained from FIU Analysis and Information Management (AIM) office is shown as below. The four-year graduation rate decreased for AA Transfer students over the last three years by 20.1%. The retention rate also decreased slightly for AA Transfer students from 2009-10 (85.0%) to 2011-12 (78.9%).

LAST TERM PROGRAM	COHORT YEAR	COHORT HEADCOUNT	GRADUATION RATE	RETENTION RATE
Civil Engineering	2009 - 2010	17	67.5%	85.0%
	2010 - 2011	14	41.9%	58.1%
	2011 - 2012	21	47.4%	78.9%

Note: The cohort years noted above represent the entering cohort year. Graduation rate represents the students from the particular cohort year who graduated within four years of entering the university. Retention rate includes students who graduated from the particular cohort years as well as those still enrolled at the university.

Moreover, this indicator is related to FIUBeyondPossible2020 Performance Indicator Goal #3, AA Transfer 4-year graduation rate. The data of this goal is shown in Table II.6 for the past (2014-15) and current (2015-16) AYs. According to the data, the improvement for the goal is in the right trend and the program will achieve the Department projected target (50%) in 2019-20.

6. Graduate Students' Time to Degree
The data obtained from FIU Analysis and Information Management (AIM) office is shown as below. The detailed analysis is shown in the self-study report for PhD in Civil Engineering program.

Degree	2010-11	2011-12	2012-13	2013-14	2014-15
Masters	2.06	1.85	2.25	1.68	2.33
Doctoral	5.00	4.62	4.96	5.38	4.52

Source: UGS

7. First-Time Pass Rate on Licensure Exam(s)
The first-time passing rate on FE exam results are shown in Figure II.5 and Table II.4. The detailed improvement on this indicator is presented in previous Section II.B.2. The passing rate of FE exam has improved from 33.3% for the October 2012 (30.3% below the national average) to 66.7% (12.5% below the national average) for the April 2013 and 68.3% (only 4.3% below the national average) for the October 2013. In addition, the passing rate of FE exam has improved from 39.5% for spring 2015 (31% below the national average) to 59.5% (7.2% below the national average) for fall 2015. According to the data, the improvement for the indicator is in the right

trend and the program will achieve the department short term goal (65%) and the long term goal (70%) in 2019-20.

III.A.3.c. Academics analytics departmental data

The departmental data provided by AIM and trend has been analyzed in the previous sections. In addition, in Table II.6 for the past (2014-15) and current (2015-16) AYs, the related Performance Indicator Goals listed in FIUBeyondPossible2020 have been discussed. Overall, the data demonstrates the improvement of these goals in the right trend and the program will achieve the Department projected targets in 2019-20. However, due to challenged curriculum and cutting-edge professional requirements in engineering programs, the Department targets of goals #1 to #4 are lower than FIU's targets for 2019-20. In order to reach FIU's targets, the following improvement action plan has been established.

Performance Indicator #1, FTIC 2-Yr Retention with GPA above 2.0
Performance Indicator #2, FTIC 6-Yr graduation rate
Performance Indicator #3, AA Transfer 4-year graduation rate

1. New Courses:
   CGN2161 Career Orientation in Civil Engineering and ENV3081 Career Orientation & Project Management Skills have been developed and offered since spring 2015. The Civil Engineering undergraduate students will take one of these two courses once they enter the programs. These courses will help the students understand clearly the degree requirements.

2. Acceptance Requirements:
   - For FTIC Students
     The students will be accepted into engineering majors only when they are ready to take Calculus I.
   - For Transfer Students with an AA Degree
     The students will be accepted into engineering majors only when they completed Calculus II, Physics I, and Chemistry I.

3. Critical Courses (Early alert will be sent to the students who are not performing well in the critical courses.):
   - Math courses
     The math department has implemented online tutoring which has shown excellent results.
     http://undergrad.fiu.edu/cas/learning-center/online-tutoring.html

   - EGN 3311 Statics and EGN 3321 Dynamics
   - Problems:
     (1) Limited offering at Engineering Center (EC)
         As shown in the attached tables, the total capacity for all sections offered at EC is around 100, which are not enough for both Mechanical and Civil Engineering students. Sections at another campus are definitely not convenient for the students and they rather wait a semester than drive to these locations.
     (2) Course Quality

Particularly, the sections offered by instructor Claudius Carnegie at Biscayne Bay Campus or FEEDS are totally unproductive. As shown in the attached tables, the capacity of these sections taught by Carnegie in Statics or Dynamics is around 60, yet the enrollment is usually less than 20. Furthermore, on an average, only 4 or 5 students passed the class in each term.

- Action Items
  (1) The Mechanical Engineering Department should offer more sections at EC.
  (2) The Mechanical Engineering Department should assign better qualified professors to teach these two courses.

➢ EGM 3520 Engineering Mechanics of Materials

- Problems:

(1) Deficiency of Statics (Pre-requisite of EGM3520)
The success in the class is dependent on the pre-requisite Statics. According to the results of Static quiz held each term on the 1st day of Engineering Mechanics of Materials course, more than half of the students don't know how to figure out the moment of inertial. Improvement in Statics is imperative.

- Action Items

(1) The Mechanical Engineering Department should assign better qualified professors to teach Statics course.
(2) The tutoring center in the college should offer tutoring service for students taking Engineering Mechanics of Materials.

➢ CGN4980 FE Seminar

- Problems:

(1) Low Class Passing Rate
More than 40% of the students fail the class each term and some students have to take it more than twice.
(2) Skipping the FE Seminar Class
Some students registered directly for the official FE exam, with the intention of skipping the FE Seminar course. Few of them successfully passed the exam, while the others failed and delayed their graduation.

- Action Items

(1) A better team of instructors has been selected and the contents of lectures have been modified.
(2) Homework is mandatory and counted as 25% of the student grade.
(3) Tutoring sessions will be offered to the students before each exam.
(4) Attendance to the lectures and the tutoring sessions will be counted as 5% of the student grade.
(5) Two exams will be counted as 35% each of the grade. The 1st exam covers General Engineering sections and the 2nd covers Civil Engineering specific sections. The 2nd exam will not be cumulative.

III.A.3.d. Goals and strategies to redress any deficiency (ies)

The BS degree in Civil Engineering program is not considered a "Low Performing/Productivity Program." There is no need to develop goals and strategies to redress any deficiency.

III.A.4. Review of Common Prerequisites

The common prerequisites of all required courses in Mathematics and Basic Sciences components (39 credit hours) as well as in General Education components (32 credit hours) have been reviewed by Dr. Janie Valdés, Assistant Vice President, Undergraduate Education, on October 3, 2016. The overarching goal of this review is to be compliant with the State's common prerequisites, which supports the most seamless transition possible for transfer students. The review involves comparing the State Common Prerequisite Manual (CPM) with University resources and tools. Any recommendations made are meant to ensure compliance and consistency in the information available to transfer students. The review results are shown as below.

LOWER LEVEL COURSES

	Course	Cr. Hrs.
	MACX311	4
or	MACX281	4
&	MACX312	4
or	MACX282	4
&	MACX313	4
or	MACX283	4
&	MAPX302	3
or	MAPX305	3
&	CHMX045/X045L	4
or	CHMX045C	4
or	CHSX440/X440L	
&	PHYX048/X048L	4
or	PHYX048C	4
or	PHYX043	
&	PHYX048L	
or	PHYX041	3
&	PHYX048L	1
&	PHYX049/X049L (1)	4
or	PHYX049C	4
or	PHYX044	
&	PHYX049L	
or	PHYX042	3
&	PHYX049L	1

FOR ALL MAJORS: Students are strongly encouraged to select required lower division electives that will enhance their general education coursework and that will support their intended baccalaureate degree program. Students should consult with an academic advisor in their major degree area.

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(1) PHYX049L does not count toward the degree at FIU.

The detailed review comments and corresponding responses are shown as below. In addition, the details of the common prerequisites of the required courses are shown in Appendix A: Undergraduate Catalog and Appendix C: Curriculum.

[Common Prerequisite Manual (CPM)]

- The CPM includes the program credit hours as 130, while the Undergraduate Catalog notes it as 128 hours. Please let me know which of these is correct as we need to ensure consistency with the CPM. There is a section of the website below titled Bachelor's Degree Requirements that notes it as 128 hours. https://cee.fiu.edu/prospective-students/undergraduate-programs/bachelors-degree-requirements/

➢ ***Response:*** *The curriculum of BS degree in Civil Engineering has been reviewed and made minor changes in 2014. The details of these changes are shown in Section II.B.5. The current minimum degree program hours are 128 which is also shown in Appendix A: Undergraduate Catalog.*

2016-2017 Undergraduate Catalog

- Under Common Prerequisite Courses and Equivalencies, the following minor correction for acceptable equivalencies is needed for complete alignment with the CPM:
  - For CHM 1045, CHM 1045L. Add the lab course (in bold) to the CHSX440 equivalency option as follows, CHSX440/**X440L** and delete CHM X045L (while still keeping CHMX045C).
  - For PHY 2048, PHY 2048L. Add PHYX041 and PHYX048L as an acceptable equivalency option.
  - For PHY 2049. Add PHYX042 and PHYX049L as an acceptable equivalency option.

➢ ***Response:*** *The aforementioned minor revisions will be made in the Undergraduate Catalog.*

2-yr Transfer Major Map

- Page 3. General Requirements section does not include any information about prerequisites. We recommend including them all. There is a statement included in this section referring students to the Panther Degree Audit (PDA) for more information on program requirements, however, prospective transfer students do not have a PDA.

➢ ***Response:*** *The information about prerequisites in General Requirements will be included in 2-yr Transfer Major Map.*

Panther Degree Audit

- No changes.

Program Website(s)

- Source(s): https://cee.fiu.edu/prospective-students/undergraduate-programs/

- The flowchart in this section is very helpful for all students; however, the one posted is for academic year 2014-2015. If there are updates, we recommend posting the new one. Also, be aware that the UCC has been updated, and that some UCC courses have changed course titles (ENC 1101/1102). As well, some UCC sections also have different titles. For example, there is no "Humanities with Writing," rather, "Humanities Group One" and "Humanities Group Two," while writing-intensive courses are Gordon Rule Writing, or GRW. These GRW courses are now distributed throughout the UCC.

➢ ***Response:*** *The course information and flowchart in the Civil and Environmental Engineering Department website will be updated.*

- Source(s): https://cee.fiu.edu/current-students/undergraduate-advising/#
  - The UCC outdated titles and categories mentioned above also appear on your Civil Engineering Advising Card 2014.
  - The Undergraduate Course Catalog 2014-2015 sheet posted in this section needs to be updated. In addition to this sheet, we recommend including a link to the (general) catalog website so that students always have access to the original source.
  - There are two links in this section that are no longer active, Transient Student Procedure and Change of Major Form. We recommend removing these altogether if they are no longer being used (both include strikethroughs).

➢ ***Response:*** *The Civil and Environmental Engineering Department website for undergraduate advising will be updated.*

- Source(s): https://cee.fiu.edu/prospective-students/transfer-students/
  - The link to the UCC FIU Requirements takes students to an outdated version. Please update. We recommend linking to the actual UCC page (link below) so students always have access to the original source. http://undergrad.fiu.edu/advising/university-core-curriculum.html
  - The link to the MDC Curriculum Transfer to FIU for Civil Engineering is outdated.
    Please update. We actually recommend linking to the actual Transfer Guide page (link below) so students always have access to the original source. We have recently included guides for Broward College as well. http://undergrad.fiu.edu/transfer/transfer-guides.html

➢ ***Response:*** *The Civil and Environmental Engineering Department website for undergraduate advising will be updated.*

- Source(s): https://cec.fiu.edu/civil-engineering/bs-civil-engineering/
  - This website makes several references to the CLAST, which is no longer required.

Please remove.

- ***Response:*** *The aforementioned links in the Civil and Environmental Engineering Department website for undergraduate advising will be removed.*

III.A.5. Evaluation of doctoral programs

Not applicable

III.A.6. Synthesis and Analysis of Student Learning and Program Outcomes

III.A.6.a. Student Learning Outcomes (SLOs)

Summary of Assessment Results

Four Student Learning Outcomes (SLOs) and the corresponding assessment methods are shown in Table III.2. The details of assessment results and improvement of SLOs are presented in Appendix E: SLOs and POs Assessment Results. CE Senior Design Project (CGN 4802) class is selected to assess the outcomes. The assessments were recorded using a 3-point rubric scale where 1 corresponds to "weak", 2 with "average", and 3 with "excellent. Minimum Criteria for Success is "average (2 out of 3)". The summary of assessment results of SLOs over the past three years (2012-2015) is displayed in Table III.1. The assessment results of four SLOs have met minimum criteria for success for the past three years (2012-2015).

Table III.1 Summary of Assessment Results of Student Learning Outcomes (SLOs) for BS in Civil Engineering Program over the past three years (2012-2015)

Student Learning Outcome	2012-2013	2013-2014	2014-2015
#1 Content	Met (2.3 mean)	Met (2.4 mean)	Met (2.4 mean)
#2 Critical Thinking	Met (2.5 mean)	Met (2.5 mean)	Met (2.5 mean)
#3 Technology Outcome	Met (2.7 mean)	Met (2.7 mean)	Met (2.8 mean)
#4 Communication	Met (2.6 mean)	Met (2.6 mean)	Met (2.7 mean)

Note:
1. CE Senior Design Project (CGN 4802) is selected to assess the outcomes.
2. A 3-point rubric scale where 1 corresponds to "weak", 2 with "average", and 3 with "excellent" is adopted.
3. Minimum Criteria for Success is "average (2 out of 3)".

Table III.2 Student Learning Outcomes (SLOs) and Assessment Methods for BS in Civil Engineering Program

Student Learning Outcome (Stated in Measurable Terms)	Assessment Method
1. Content: Graduates will demonstrate the ability to apply the integrated knowledge of mathematics, science, and engineering to solve civil engineering design problems.	The Undergraduate Program Advisory Committee (UPAC) identified Civil Engineering Senior Design Project (CGN 4802) as appropriate to assess this outcome. In the Senior Design course, students will propose, design, analyze, and present a comprehensive solution for a civil engineering design problem in a multidisciplinary team using concepts of mathematics, physics, and engineering. **Artifact** This outcome will be assessed with the detailed calculations and analysis in the technical report that each team submits for the senior design project. **Evaluation Process** The artifact will be assessed by a faculty panel consisting of the course instructor(s), a minimum of two additional faculty members, and the external panelists invited to the senior design presentations. **Sampling** All senior design team projects will be assessed every semester. **Minimum Criteria for Success** Student teams will achieve a minimum of "average" on a 3-point rubric where 1 corresponds to "weak", 2 with "average", and 3 with "excellent.
2. Critical Thinking: Graduates will collect information, analyze and interpret results, and apply these in a civil engineering design system.	CE Senior Design Project (CGN 4802) is selected to assess this outcome. **Artifact** This outcome will be assessed with the discussion, conclusion, and justification sections of the technical report and corresponding oral presentation areas, including the overall reasonableness of the engineering solution proposed. **Evaluation Process** The artifact will be assessed by a faculty panel with a minimum of three members. **Sampling** All senior design team projects will be assessed every semester. **Minimum Criteria for Success** Student teams will achieve a minimum of "average" on a 3-point rubric.
3. Technology outcome: Graduates will utilize the techniques and skills of modern scientific and engineering technology (such as MathCad and AutoCad) for civil engineering practice.	CE Senior Design Project (CGN 4802) is selected to assess this outcome. **Artifact** This outcome will be assessed with the AutoCad drawings and demonstration of use of appropriate software to assist in design calculations as evidenced in the technical report. **Evaluation Process** The artifact will be assessed by a faculty panel with a minimum of three members. **Sampling** All senior design team projects will be assessed every semester. **Minimum Criteria for Success** Student teams will achieve a minimum of "average" on a 3-point rubric.
4. Communication: Graduates will communicate engineering ideas orally and in a written format by presenting their semester-long design efforts in a formal and professional manner.	CE Senior Design Project (CGN 4802) is selected to assess this outcome. **Artifact** This outcome will be assessed with the oral presentation component and the overall written technical report. **Evaluation Process** The artifact will be assessed by a faculty panel with a minimum of three members. **Sampling** All senior design team projects will be assessed every semester. **Minimum Criteria for Success** Student teams will achieve a minimum of "average" on a 3-point rubric.

Past Improvements Based on Results

Even though the assessment results of all SLOs have met minimum criteria for success for the past three years, the UPAC has regularly reviewed all undergraduate courses based on student course evaluation and course survey. Some courses, like CGN4980 FE Review and CGN2420 Computer Tools for CE, have been improved. The details of improvement are presented in Section II.B.3. The Curriculum of BS in Civil Engineering program has been annually reviewed by the UPAC. The revisions of Program Curriculum are displayed in Section II.B.5.

Future Directions

Based on the assessment results of SLOs, the UPAC will regularly review the program curriculum and all courses in the program. The current improvement action plan shown in Section III.A.3.c has been established.

III.A.6.b. Program Outcomes (POs)

Summary of Assessment Results

Three Program Outcomes (POs) and the corresponding assessment methods are shown in Table III.4. The details of assessment results and improvement of POs are presented in Appendix E: SLOs and POs Assessment Results. Alumni survey is selected to assess the outcomes. The assessments were recorded using a rubric scale based on "above average", "average", and "below average" for PO #1 and "Yes" and "No" for POs #2 and #3. The minimum criteria for success are to have a minimum of 80% of the alumni submitting the survey to either above average or average for PO #1, 50% of the alumni that passing the EIT/FE exam for PO #2, and 80% of the alumni submitting the survey to "yes" for PO #3. The summary of assessment results of POs over the past three years (2012-2015) is displayed in Table III.3. The assessment results of three POs have met minimum criteria for success for the past three years (2012-2015).

Table III.3 Summary of Assessment Results of Program Outcomes (POs) for BS in Civil Engineering Program over the past three years (2012-2015)

Program Outcome	2012-2013	2013-2014	2014-2015
#1 Technical Proficiency, Communication Skills, Responsible Citizenship, Leadership, and Ethical Behavior.	Met (100% mean)	Met (100% mean)	Met (100% mean)
#2 Professional Registration	Met (81% mean)	Met (80% mean)	Met (70% mean)
#3 Life-long Learning	Met (97% mean)	Met (100% mean)	Met (100% mean)

Note:
1. Alumni survey is selected to assess the outcomes.
2. A rubric scale based on "above average", "average", and "below average" for PO #1 and "Yes" and "No" for POs #2 and #3 is adopted.
3. The minimum criteria for success are to have a minimum of 80% of the alumni submitting the survey to either above average or average for PO #1.
4. The minimum criterion for success is to have a minimum of 50% of the alumni that passing the EIT/FE exam for PO #2.
5. The minimum criterion for success is to have a minimum of 80% of the alumni submitting the survey to "yes" for PO #3

Table III.4 Program Outcomes (POs) and Assessment Methods for BS in Civil Engineering

Program Outcome (Stated in Measurable Terms)	**Assessment Methods**
1. Graduates will advance in their careers in civil engineering or related areas by demonstrating technical proficiency, communication skills, responsible citizenship, leadership, and ethical behavior.	**<u>Alumni Survey</u>** **<u>Procedure:</u>** Alumni surveys are conducted at the end of each Spring semester. The Undergraduate Program Director is responsible for conducting the surveys, as well as collecting and analyzing the results. The survey consists of 9 questions and sent via email to Civil Engineering alumni that have graduated during the last three years. The survey responses were recorded using rubric (above average, average, below average). The answers from the survey are used to determine the percentage of graduates who report that the program prepared them: 1. To advance in their careers by demonstrating technical proficiency. 2. To advance in their careers by demonstrating communication skills. 3. To advance in their careers by demonstrating responsible citizenship. 4. To advance in their careers by demonstrating progress to maintain and enhance their professional competency. 5. To advance in their careers by demonstrating professional and ethical performance. <u>Minimum criteria for success:</u> The minimum criteria for success are to have a minimum of 80% of the alumni submitting the survey to either above average or average.
2. Graduates will make progress towards obtaining professional registration, special licensing, or certification.	Alumni survey is used to assess this outcome. The survey responses were recorded using rubric (Yes, No). The answers from the survey are used to: 1. Determine the percentage of graduates who have passed the Fundamentals of Engineering (FE) exam. <u>Minimum criteria for success:</u> The minimum criterion for success is to have a minimum of 50% of the alumni that passing the EIT/FE exam.
3. Graduates will pursue continued life-long learning to become the problem solvers considering the global, economic, environmental, and social impact.	Alumni survey is used to assess this outcome. The survey responses were recorded using rubric (Yes, No). The answers from the survey are used to: 1. Determine the percentage of graduates who report that the program prepared them to advance in their careers by demonstrating progress lifelong learning to improve their skills. (progress to maintain and enhance their professional competency by continued professional development by attending training seminars, workshops, courses, or meetings organized by education institutes or professional organizations like ASCE, FES, WEF, AWWA, SWANA, NSPE, etc.) <u>Minimum criteria for success:</u> The minimum criterion for success is to have a minimum of 80% of the alumni submitting the survey to “yes”.

Past Improvements Based on Results

Even though the assessment results of all POs have met minimum criteria for success for the past three years, the UPAC has regularly reviewed all undergraduate courses based on student course evaluation and course survey. Some courses, like CGN4980 FE Review and CGN2420 Computer Tools for CE, have been improved. The details of improvement are presented in Section II.B.3. The Curriculum of BS in Civil Engineering program has been annually reviewed by the UPAC. The revisions of Program Curriculum are displayed in Section II.B.5.

Future Directions

Based on the assessment results of POs, the UPAC will regularly review the program curriculum and all courses in the program. The current improvement action plan shown in Section III.A.3.c has been established.

III.B. Research Productivity

III.B.1. Grant Support

From July 2013 to June 2016, the unit was awarded $18.6 million in external funding. Approximately 250 awards were granted to 18 separate Principal Investigators from the unit in this time period. The awards varied as the number of awards included initial awards, increases, and supplements. The highest initial award amount was $1.4 million for a Tier 1 UTC. The lowest initial amount was $2,000 for a fellowship program. The average initial award was $108,407. The faculty continues to well represent the university in its academic productivity and service in national and international organizations. The research funding from 2008 to 2016 is shown previously, in Figure II.3, on page 13.

III.B.2. Publications

A listing of peer-reviewed publications is shown in the Self-Study-Report for PhD in Civil Engineering program.

III.C. Partnerships/Entrepreneurial/Community Engagement Activities

III.C.1. Foundation and auxiliary entrepreneurial activities

The Civil and Environmental Engineering Department is actively engaged with alumni to increase funding from organizations for student scholarships, financial support for student competitions, and endowment funds. The Department has an active involvement with the community. Community engagement is one of the top priorities in FIUs mission. Faculty and students are actively involved with service activities (i.e., serving on the County boards, projects from the State and County, public service/volunteer activities). Furthermore, the Civil and Environmental Engineering faculty are actively engaged in technology development and technology transfer. Department also conducts the Construction Training Qualification Program (CTQP) and Maintenance of Traffic (MOT) training programs for Florida Department of Transportation (FDOT). In addition, workshops, seminars, webinars and conferences are routinely organized in areas that are of growing interest such as sea level rise, resilient and sustainable engineering solutions, water quality, infrastructure, and human-environment-building interfaces. Moreover, the Civil and Environmental Engineering Department has been the home for two national research centers.

III.D. SWOC Preparation

III.D.1. SWOC analysis

Strengths

- FIU is located in the significant geographical location which is the gateway to rest of continent with strong economic connectivity and among communities.

- The Department has been nationally recognized in terms of recognition of faculty's contribution in White House, acceptance of Wall of Wind (WOW) as NSF NHERI Experimental Facility, and establishing the national Accelerated Bridge Construction (ABC) center. The Department constantly conducts seminars, workshops, sessions, and webinars.

- Faculty is committed to department success, for both undergraduate and graduate programs.

- The Department has been able to increase the faculty size and the number of active researchers. The faculty size has increased from 17 in 2008 to 21 today.

- The BS and PhD programs have grown significantly. During the past seven years, the students increased from 525 to 647 in BS in Civil Engineering, 32 to 103 in BS in Environmental Engineering, and 43 to 63 in PhD in Civil Engineering programs. The yearly degrees awarded also increases from 63 to 91 BS in Civil Engineering, 3 to 13 in BS in Environmental Engineering, and 8 to 13 in PhD in Civil Engineering programs.

- Support to researchers has been increased with a differential teaching assignment policy implemented. Faculty has also been provided funding for professional development consistently in the last seven years.

- The Department has been successful in increasing external support from \$3.7M in 2008 to an average of \$6.1M in the last seven years.

- A number of research areas have gained regional, national, and international attention and are supported by State-of-the-art experimental facilities such as WOW, Titan America Structures Lab, ITS Lab, and Driving Simulator.

- Student body of the Department represents the diversity of the population of south Florida.

- The involvement of undergraduates in faculty research and high interests among undergraduate students in the combined 4+1 BS/MS programs.

- Large alumni body is employed in the region and has been recognized in many sectors of the south Florida community, including the private and government sector.

- The Department has developed and operated several successful training programs, like Construction Training Qualification Program (CTQP) and Maintenance of Traffic (MOT), which have served the community needs for continuing education and job training as well as have provided additional revenues for the Department.

- The Department has stretch goals and high faculty expectations.

Weaknesses

- The student to faculty ratio is extremely high, making it difficult to grow enrollment at either the undergraduate or graduate level.

- Some of the areas lack faculty, such as construction, geotechnical, and water resources.

- The equipment in the Materials and Geotechnical Testing laboratories is dated. The laboratory space is not enough to accommodate all equipment used in the experiments and students' book bags.

- The Department does not have enough qualified staffs to support administrative needs, teaching, and streamline research activities (e.g. purchases, travel, hiring, etc.)

- The serious space limitations have affected both of teaching and research performance.

Opportunities

- The regional demographic pattern is favorable for it involves a group of diverse, large, to different extents, underrepresented minority students in advanced degrees and cutting edge research activities.

- Demand for enrollment is expected to continue to grow in the region with diversified growing population that have family and commercial ties and relationships with the rest of the American continent.

- With increasing attention to global warming (sea level rise), hurricane hazards, transportation infrastructure, environment impacts in South Florida, resilient and sustainable infrastructure, water quality, and human-environment-building interfaces which are closely related to civil and environmental engineering, there will be opportunities for both innovative research and new federal funding initiatives.

- The Wall-of-Wind research program has gained momentum, as well as recognition nationally and internationally. This is an area where significant funding can be expected.

Challenges/Threats

- The student to faculty ratio is extremely high, making it difficult to grow enrollment at either the undergraduate or graduate level.

- The size of the faculty is inadequate to achieve both of teaching and research agenda, especially in the areas of construction, geotechnical, and water resources.

- It has been a challenge to recruit quality graduate students, especially doctoral and MS in Environmental Engineering students, given the decline in the number of graduate applicants in recent years.

- The serious space limitations have affected both of teaching and research performance.

- The shortage of department budget and staff support could hamper the growth of the Department and its ability to attract students or research funding.

- The need to improve faculty salaries may not be met based on the current limited budget.

IV. CONCLUSIONS

(This segment is to be completed after the consultant visits FIU and submits report.)

IV.A. Strategic Planning and Improvement Action Plan

To be developed after the consultant visits.

IV.B. Program Review Summary Report

To be developed after the consultant visits.

APPENDIX A: UNDERGRADUATE CATALOG

Civil and Environmental Engineering

Atorod Azizinamini, Ph.D., P.E., *Professor and Chair*
Omar I. Abdul-Aziz, Ph.D., *Assistant Professor*
Hesham Ali, Ph.D., P.E., *Professor of Practice*
Priyanka Alluri, Ph.D., P.E., *Assistant Professor*
Michael Bienvenu, Ph.D., P.E., *Professor of Practice*
Anna Bernardo Bricker, Ph.D., *Instructor and Environmental Lab Manager*
Arindam G. Chowdhury, Ph.D., *Associate Professor and Director, Laboratory for Wind Engineering Research*
Hector R. Fuentes, Ph.D., P.E., D.E.E., *Professor and Associate Chair of Graduate Studies*
Albert Gan, Ph.D., *Professor*
David Garber, Ph.D., P.E., T.E., *Assistant Professor*
Lawrence Griffis, P.E., *Professor of Practice, Member of the National Academy of Engineering*
Mohammed Hadi, Ph.D., P.E., *Associate Professor*
Peter A. Irwin, Ph.D., P.Eng., *Professor of Practice*
Xia Jin, Ph.D., *Assistant Professor*
Khokiat Kengskool, Ph.D., *Instructor*
Shonali Laha, Ph.D., P.E., *Associate Professor*
Kingsley Lau, Ph.D., *Assistant Professor*
Seung J. Lee, Ph.D., *Assistant Professor*
Cora Martinez, Ph.D., *Instructor and Undergraduate Advisor*
Lakshmi Reddi, Ph.D., P.E., *Professor and Dean, University Graduate School*
L. David Shen, Ph.D., P.E., T.E., *Professor and Graduate Program Director, and Director, LCTR*
Lambert Tall, Ph.D., P.E., *Professor Emeritus*
Walter Z. Tang, Ph.D., P.E., *Associate Professor*
Berrin Tansel, Ph.D., P.E., *Professor and Undergraduate Program Director*
LeRoy E. Thompson, Ph.D., P.E., *Professor Emeritus*
Oktay Ural, Ph.D., *Professor Emeritus*
Ton-Lo Wang, Ph.D., P.E., *Professor and Associate Chair of Undergraduate Studies*
Ioannis Zisis, Ph.D., *Assistant Professor*

Affiliated Faculty
Assefa M. Melesse, Ph.D., P.E., *Department of Earth and Environment*
Fernando Miralles-Wilhelm, Ph.D., P.E., *Department of Earth and Environment*

Lehman Center for Transportation Research

L. David Shen, Ph.D., P.E., T.E., *Professor, Director*
Fabian Cevallos, Ph.D., *Transit Program Director*

Accelerated Bridge Construction University Transportation Center (ABC-UTC)

(www.abc-utc.fiu.edu)
Atorod Azizinamini, Ph.D., P.E., *Director*
David Garber, Ph.D., P.E., T.E., *Co-Director*

Civil and Environmental Engineering Mission Statement

The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Bachelor of Science in Civil Engineering

Program Educational Objectives

The Department of Civil and Environmental Engineering of Florida International University offers the Program in Civil Engineering with three main objectives that broadly describe the professional and career accomplishments that our graduates are prepared to achieve. These three objectives are:

Objective 1:
Graduates will advance their careers in civil engineering or related areas by demonstrating technical proficiency, communication skills, responsible citizenship, leadership, and ethical behavior.

Objective 2:
Graduates will make progress towards obtaining professional registration, special licensing, or certification.

Objective 3:
Graduates will pursue continued life-long learning to become the problem solvers considering the global, economic, environmental, and social impact.

Common Prerequisite Courses and Equivalencies

FIU Course(s)	Equivalent Course(s)
CHM 1045, CHM 1045L	CHMX045/X045L or CHM045C or CHSX440 and CHMX045L
MAC 2311	MACX311 or MACX281
MAC 2312	MACX312 or MACX282
MAC 2313	MACX313 or MACX283
MAP 2302	MAPX302 or MAPX305
PHY 2048, PHY 2048L	PHYX048/X048L or PHYX048C or PHYX043 and PHYX048L
PHY 2049	PHYX049/X049L[1] or PHYX049C or PHYX044 and PHYX049L

[1]PHYX049L does not count toward the degree at FIU.

Courses which form part of the statewide articulation between the State University System and the Florida College System will fulfill the Lower Division Common Prerequisites.

For generic course substitutions/equivalencies for Common Program Prerequisites offered at community colleges, state colleges, or state universities, visit: http://www.flvc.org, See Common Prerequisite Manual.

Common Prerequisites

CHM 1045	General Chemistry I
CHM 1045L	General Chemistry Lab I
MAC 2311	Calculus I
MAC 2312	Calculus II
MAC 2313	Multivariable Calculus
MAP 2302	Differential Equations
PHY 2048	Physics with Calculus
PHY 2048L	General Physics Lab I
PHY 2049	Physics with Calculus II

Additional lower-division courses required for the degree:

CHM 1046	General Chemistry II
CHM 1046L	General Chemistry Lab II
GLY 1010	Physical Geology
GLY 1010L	Physical Geology Lab

Degree Program Hours: Minimum 128

The Civil Engineering curriculum provides a program of interrelated technical areas of Civil Engineering with their fundamental core subjects of the engineering program. The technical interdisciplinary courses are in the areas of construction, geotechnical, environmental, structural, surveying, transportation, and water resources engineering.

Civil engineers play an essential role in serving people and the environmental needs of society. These needs relate to shelter, mobility, water, air and development of land and physical facilities.

The academic program is designed to meet the State of Florida's articulation policy as well as to satisfy criteria outlined by the Accreditation Board for Engineering and Technology (ABET), among others.

Lower Division Preparation

Students admitted to the university are admitted directly to their chosen major. Students are expected to make good progress based on critical indicators, such as GPA in specific courses or credits earned. In cases where students are not making good progress, a change of major may be required. Advisors work to redirect students to more appropriate majors when critical indicators are not met.

Lower division preparation includes completion of pre-engineering courses which include Engineering Drawing with CAD application (required unless previously taken and does not count towards the 128 credits required for graduation), Calculus I & II, Multivariable Calculus, Differential Equations, Chemistry I & II and Labs, Physics I with Calculus and Lab, Physics II with Calculus, and Introduction to Earth Sciences and Lab, all with a grade of 'C' or better. See the example semester by semester program in the following pages.

Effective pursuit of engineering studies requires careful attention to both the sequence and the type of courses taken. It is therefore important, and the college requires, that each student plan a curriculum with the departmental faculty advisor.

All students must comply with the University Core Curriculum Requirements for the University for Social Science, Humanities, Arts and English. The department requires a minimum of 15 semester hours in the area of Humanities, Arts and Social Science. All transfer students should refer to the Undergraduate Education section of this catalog to determine if they have met the requirements for Humanities, Social Science, Arts, and English at their previous institution.

A minimum grade of 'C' is required in all writing, physics, chemistry, and mathematics courses.

A minimum grade of 'C' is required of all Civil Engineering courses and prerequisite courses.

Students who have been dismissed for the first time from the University due to low grades may appeal to the Dean for reinstatement. A second dismissal will result in no possibility of reinstatement.

Other Requirements

Students must have a minimum 2.0 GPA, must complete all required classes, and must otherwise meet all of the state and university requirements in order to graduate.

Students who enter the university with fewer than 60 transferred credits must take 9 summer credits. Refer to the appropriate sections in the Catalog's for more information.

Courses are to be taken in the proper sequence. Any course taken without the required prerequisites and corequisites will be dropped automatically before the end of the term, resulting in a 'DR' or 'DF'.

Upper Division Course Objectives

The program of study encourages the development of a broadly educated civil engineering graduate, who can succeed as a productive engineer with continued professional growth. The courses listed as requirements for the BS degree not only provide the students with mathematical and scientific knowledge, but also include other essential areas necessary for a successful engineering career. The courses have been designed to increase student competence in written and oral communication skills as well as to develop critical thinking and creative problem solving strategies. Course projects are designed to teach engineering science fundamentals and their applications while providing enriching opportunities for laboratory and computer-based experiences. Furthermore, students are supplied with an understanding of the economic, social, ethical and professional responsibilities of engineers in our society and are encouraged to include sustainable development in all project designs.

Foreign Language Requirement

Students must meet the University Foreign Language Requirement. Refer to the appropriate sections in the Catalog's General Information for Admission and Registration and Records.

Upper Division Program

The basic upper division requirements for the BSCE degree are as follows:

Applied Mathematics (3)

STA 3033	Intro to Probability and Statistics	3
	or	
EIN 3235	Evaluation of Engineering Data	3

Engineering Sciences (17)

CGN 2420	Computer Tools for Engineers	3
CWR 3201	Fluid Mechanics	3

CWR 3201L	Fluid Mechanics Laboratory	1
EGM 3520	Engineering Mechanics of Materials	3
EGM 3520L	Materials Testing Lab	1
EGN 3311	Statics	3
EGN 3321	Dynamics	3

General Engineering Courses (8)

CGN 2161	Career Orientation in Civil Engineering	1
EGS 2030	Ethics and Legal Aspects in Engineering	1
EGN 3613	Engineering Economy	3
ENC 3213	Professional and Technical Writing	3

Civil Engineering Curriculum (42)

CCE 4031	Project Planning for CE	3
CEG 4011	Geotechnical Engineering I	3
CEG 4011L	Geotechnical Testing Laboratory	1
CES 3100	Structural Analysis	3
CES 4702	Reinforced Concrete Design	3
CGN 4802	Civil Engineering Senior Design Project	3
CWR 3540	Water Resources Engineering	3
ENV 3001	Introduction to Environmental Engineering – *GL*	3
ENV 3001L	Environmental Laboratory I	1
SUR 2101C	Surveying	3
TTE 4201	Transportation and Traffic Engineering	3
CGN 4980	Civil Engineering Seminar	1
C.E. Elective	(min)	3
C.E. Elective	(min)	3
C.E. Elective	(min)	3
C.E. Elective	(min)	3

Note: Students may be eligible to select some graduate level civil engineering technical electives as approved by the instructor and the undergraduate advisor.

Professional Graduation Requirement

Civil Engineering students must take and pass CGN 4980 (FE Seminar). Students showing evidence of passing the state FE (EIT) examination will have this requirement waived.

Civil Engineering Program

Students may have a different sequence of courses as arranged with their advisor. For complete program information, students should refer to the Program Summary Sheet available at the Department.

First Semester: (16)

MAC 2311	Calculus I	4
CHM 1045	General Chemistry I	3
CHM 1045L	General Chemistry I Lab	1
ENC 1101	Writing and Rhetoric I	3
GLY 1010	Physical Geology	3
GLY 1010L	Physical Geology Lab	1
SLS 1501	Freshman Experience	1

Second Semester: (13)

MAC 2312	Calculus II	4
ENC 1102	Writing and Rhetoric II	3
PHY 2048	Physics with Calculus	4
PHY 2048L	General Physics Lab I	1
CGN 2161	Career Orientation in Civil Engineering	1

Third Semester: (14)

UCC Humanities Group 1		3
MAC 2313	Multivariable Calculus	4
CHM 1046	General Chemistry II	3
CHM 1046L	General Chemistry Lab II	1
UCC Social Science Group 1		3

Fourth Semester: (16)

PHY 2049	Physics with Calculus II	4
MAP 2302	Differential Equations	3
CGN 2420	Computer Tools for Engineers	3
UCC Arts		3
UCC Humanities Group 2		3

Fifth Semester: (13)

EGN 3311	Statics	3
SUR 2101C	Surveying	3
ENC 3213	Professional and Technical Writing	3
EGS 2030	Ethics and Legal Aspects in Engineering	1
UCC Social Science Group 2		3

Sixth Semester: (13)

STA 3033	Introduction to Probability and Statistics for CS	3
	or	
EIN 3235	Evaluation of Engineering Data	3
EGN 3321	Dynamics	3
EGM 3520	Engineering Mechanics of Materials	3
EGM 3520L	Engineering Mechanics of Material Lab	1
EGN 3613	Engineering Economy	3

Seventh Semester: (14)

CWR 3201	Fluid Mechanics	3
CWR 3201L	Fluid Mechanics Lab	1
CES 3100	Structural Analysis	3
ENV 3001	Introduction to Environmental Engineering – *GL*	3
ENV 3001L	Environmental Laboratory I	1
TTE 4201	Transportation & Traffic Engineering	3

Eighth Semester: (16)

CEG 4011	Geotechnical Engineering I	3
CEG 4011L	Soil Testing Laboratory	1
CWR 3540	Water Resources	3
CES 4702	Reinforced Concrete Design	3
CE Elective		3
CE Elective		3

Ninth Semester: (13)

CCE 4031	Project Planning for Civil Engineers	3
CGN 4802	Civil Engineering Senior Design Project	3
CGN 4980	Civil Engineering Seminar	1
CE Elective		3
CE Elective		3

Suggested Electives for Structural Engineering Option**

CES 4320	Intro to the Design of Highway Bridges	3
CES 4580	Hurricane Engineering and Global Sustainability – *GL*	3
CES 4605	Steel Design	3
CES 4711	Introduction to Prestressed Concrete Structures	3
CGN 4510	Sustainable Building Engineering	3
CES 5106	Advanced Structural Analysis	3
EGM 5421	Structural Dynamics	3

Suggested Electives for Water Resources Engineering Option**

CWR 4204	Hydraulic Engineering	3
CWR 4530	Modeling Applications in Water Resources Engineering	3
CWR 4620C	Ecohydrological Engineering	3
CWR 5235	Open Channel Hydraulics	3
ENV 4401	Water Supply Engineering	3

Suggested Electives for Geotechnical Engineering Option**

CEG 4012	Geotechnical Engineering II	4
CEG 4126	Fundamentals of Pavement Design	3
CEG 5065	Geotechnical Dynamics	3
CES 4580	Hurricane Engineering and Global Sustainability – *GL*	3

Suggested Electives for Environmental Engineering Option**

ENV 4005L	Environmental Laboratory II	1
ENV 4024	Bioremediation Engineering	3
ENV 4101	Fundamentals of Air Pollution Engineering	3
ENV 4330	Hazardous Waste Site Assessment	3
ENV 4351	Solid and Hazardous Waste Management	3
ENV 4401	Water Supply Engineering	3
ENV 4513	Chemistry for Environmental Engineers	3
ENV 4551	Wastewater Treatment Engineering	3
ENV 4560	Reactor Design	3

Suggested Electives for Construction Engineering Option**

CCE 4001	Heavy Construction	3
CES 4580	Hurricane Engineering and Global Sustainability – *GL*	3
CGN 4510	Sustainable Building Engineering	3
CGN 4930	Special Topics in Civil Engineering	1-4
CCE 5035	Construction Engineering Management	3
CCE 5036	Adv Project Planning for Civil Engineers	3

Suggested Electives for Transportation Engineering Option**

CEG 4126	Fundamentals of Pavement Design	3
CGN 4321	GIS Applications in Civil & Environmental Engineering	3
TTE 4102	Urban Transportation Planning	3
TTE 4202	Traffic Engineering	3
TTE 4203	Highway Capacity Analysis	3
TTE 4804	Geometric Design of Highways	3

**All recommended and other technical electives must be approved by the advisor and must concentrate on relevant applications of civil engineering design. Selection of a proper sequence would allow the student to specialize within a focus area of interest (e.g., structural, geotechnical, construction, water, environmental, or transportation).

Bachelor of Science in Environmental Engineering

Program Educational Objectives

The Department of Civil and Environmental Engineering of Florida International University offers the Program in Environmental Engineering with three main objectives that broadly describe the professional and career accomplishments that our graduates are prepared to achieve. These three objectives are:

Objective 1:

Graduates will advance their careers in environmental engineering or related areas by demonstrating technical proficiency, communication skills, responsible citizenship, leadership, and ethical behavior.

Objective 2:

Graduates will make progress towards obtaining professional registration, special licensing, or certification.

Objective 3:

Graduates will pursue continued life-long learning to become the problem solvers considering the global, economic, environmental, and social impact.

Common Prerequisite Courses and Equivalencies

FIU Course(s)	Equivalent Course(s)
CHM 1045, CHM 1045L	CHMX045/X045L or CHM045C or CHSX440 and CHMX045L
CHM 1046, CHM 1046L	CHMX046/X046L or CHMX046C
MAC 2311	MACX311 or MACX281
MAC 2312	MACX312 or MACX282
MAC 2313	MACX313 or MACX283
MAP 2302	MAPX302 or MAPX305
PHY 2048, PHY 2048L	PHYX048/X048L or PHYX048C or PHYX043 and PHYX048L
PHY 2049	PHYX049/X049L[1] or PHYX049C or PHYX044 and PHYX049L

[1]PHYX049L does not count toward the degree at FIU.

Courses which form part of the statewide articulation between the State University System and the Florida College System will fulfill the Lower Division Common Prerequisites.

For generic course substitutions/equivalencies for Common Program Prerequisites offered at community colleges, state colleges, or state universities, visit: http://www.flvc.org, See Common Prerequisite Manual.

Common Prerequisites

CHM 1045	General Chemistry I
CHM 1045L	General Chemistry Lab I
CHM 1046	General Chemistry II
CHM 1046L	General Chemistry Lab II
MAC 2311	Calculus I
MAC 2312	Calculus II
MAC 2313	Multivariable Calculus
MAP 2302	Differential Equations
PHY 2048	Physics with Calculus
PHY 2048L	General Physics Lab I
PHY 2049	Physics with Calculus II

Additional lower-division courses required for the degree:

BSC 1010	General Biology I
BSC 1010L	General Biology Lab I

Degree Program Hours: 127

The Environmental Engineering curriculum provides a background of interrelated subdisciplines of Environmental Engineering and related science subjects with the fundamental core subjects of the engineering program. The technical interdisciplinary courses are in the areas of biology, geology, chemistry, ecology, atmospheric sciences, geotechnical engineering, urban planning, water resources engineering, pollution prevention and waste management. Environmental engineers play an essential role in serving people and the environmental needs of society. These needs relate to water, air and development of land and physical facilities.

The academic program is designed to meet the State of Florida's articulation policy as well as to satisfy criteria outlined by the Accreditation Board for Engineering and Technology (ABET).

Lower Division Preparation

Students admitted to the university are admitted directly to their chosen major. Students are expected to make good progress based on critical indicators, such as GPA in specific courses or credits earned. In cases where students are not making good progress, a change of major may be required. Advisors work to redirect students to more appropriate majors when critical indicators are not met.

The lower division requirements include pre-engineering courses which include the common prerequisites listed above, and Engineering Drawing with CAD application (required unless previously taken and does not count towards the 127 credits required for graduation).

Effective pursuit of engineering studies requires careful attention to both the sequence and the type of courses taken. It is therefore important, and the college requires, that each student plan a curriculum with the departmental academic advisor.

All students must comply with the University Core Curriculum Requirements for the University for Social Science, Humanities, Arts and English. The department requires a minimum of 15 semester hours in the area of Humanities, Arts and Social Science. All transfer students should refer to the Undergraduate Education section of this catalog to determine if they have met the requirements for Humanities, Social Science, Arts, and English at their previous institution.

A minimum grade of "C" is required in all writing courses, physics, chemistry, biology, and mathematics courses. A minimum grade of 'C' is required of all Environmental Engineering courses and prerequisite courses.

In addition, all students must meet the University Foreign Language Requirement and meet all of the state and university requirements for graduation.

Students who have been dismissed for the first time from the University due to low grades may appeal to the Dean for reinstatement. A second dismissal will result in no possibility of reinstatement.

Other Requirements

Students must have a minimum 2.0 GPA, must complete all required classes, and must otherwise meet all of the state and university requirements in order to graduate.

Students who enter the university with fewer than 60 transferred credits must take 9 summer credits. Refer to the appropriate sections in the Catalog for more information.

Courses are to be taken in the proper sequence. Any course taken without the required prerequisites and corequisites will be dropped automatically before the end of the term, resulting in a 'DR' or 'DF'.

Upper Division Program

The upper division program of study encourages the development of a broadly educated environmental engineering graduate, who can succeed as a productive engineer with continued professional growth. The courses listed as requirements for the BS degree not only provide the students with mathematical and scientific knowledge, but also include other essentials necessary for a successful engineering career. The courses have been designed to increase student competence in written and oral communication skills as well as develop critical thinking and creative problem solving strategies. Course projects are designed to teach engineering science fundamentals and their applications while providing enriching opportunities for laboratory and computer-based experiences. Furthermore, students are supplied with an understanding of the economic, social and ethical responsibilities of engineers in our society and are encouraged to include sustainable development in all project designs.

The basic upper division requirements for the BSENVE degree are as follows:

Applied Mathematics: (3)

STA 3033	Intro to Probability and Statistics	3

Engineering Sciences: (22)

Science Elective (Biological Science)**		4
Science Elective (Earth Science)**		4
CGN 2420	Computer Tools for Engineers	3
EGM 3503	Applied Mechanics	4
EGN 3343	Thermodynamics I	3
CWR 3201	Fluid Mechanics	3
CWR 3201L	Fluid Mechanics Lab	1

General Engineering Courses: (7)

EGS 2030	Ethics and Legal Aspects in Engineering	1
EGN 3613	Engineering Economy	3
ENC 3213	Professional and Technical Writing	3

Environmental Engineering Curriculum: (37)

CWR 3540	Water Resources Engineering	3
ENV 3001	Introduction to Environmental Engineering – *GL*	3
ENV 3001L	Environmental Laboratory I	1
ENV 3081	Career Orientation and Project Management Skills	1
ENV 4005L	Environmental Laboratory II	1
ENV 4513	Chemistry for Environmental Engineers	3
ENV 4351	Solid and Hazardous Waste Management	3
ENV 4101	Fundamentals of Air Pollution Engineering	3
ENV 4401	Water Supply Engineering	3
ENV 4551	Wastewater Treatment Engineering	3
ENV 4891	Environmental Eng. Senior Design Project	3
ENV 4960	Environmental Engineering Seminar	1
ENV Technical Elective		3
ENV Technical Elective		3
ENV Technical Elective		3

Professional Graduation Requirement

Environmental Engineering students must take and pass ENV 4960 (FE Seminar). Students showing evidence of passing the state FE (EIT) examination will have this requirement waived.

Course & Credit Hours Listing

The curriculum includes a sequence of courses which complies with the ABET requirements for mathematics and basic sciences, engineering science, engineering design, and general engineering degree requirements including humanities and social sciences. A typical nine semester sequence is shown below. Students may complete the program, by specific selection of science and technical elective courses, as arranged with the undergraduate program advisor and based on personal interests in a specialization area.

First Semester: (13)

MAC 2311	Calculus I	4
CHM 1045	General Chemistry I	3
CHM 1045L	General Chemistry I Lab	1
SLS 1501	Freshman Experience	1
ENC 1101	Writing and Rhetoric I	3
EGS 2030	Ethics & Legal Aspects in Engineering	1

Second Semester: (16)

MAC 2312	Calculus II	4
ENC 1102	Writing and Rhetoric II	3
PHY 2048	Physics with Calculus I	4
PHY 2048L	General Physics Laboratory I	1
BSC 1010	General Biology I	3
BSC 1010L	General Biology Lab I	1

Third Semester: (14)

UCC Social Science Group 1		3
MAC 2313	Multivariable Calculus	4
CHM 1046	General Chemistry II	3
CHM 1046L	General Chemistry II Lab	1
UCC Humanities Group 1		3

Fourth Semester: (13)

PHY 2049	Physics with Calculus II	4
MAP 2302	Differential Equations	3
CGN 2420	Computer Tools for Engineers	3
UCC Social Science Group 2		3

Fifth Semester: (16)

ENV 3001	Introduction to Environmental Engineering – *GL*	3
ENV 3001L	Environmental Laboratory I	1
EGM 3503	Applied Mechanics	4
Science Elective	(Earth Science)*	4
STA 3033	Introduction to Probability and Statistics for CS or equivalent	3
ENV 3081	Career Orientation and Project Management Skills	1

Sixth Semester: (15)

EGN 3343	Thermodynamics I	3
ENC 3213	Professional and Technical Writing	3
EGN 3613	Engineering Economy	3
ENV 4513	Chemistry for Environmental Engineers	3
Art Elective		3

Seventh Semester: (14)

CWR 3201	Fluid Mechanics	3
CWR 3201L	Fluid Mechanics Lab	1
ENV 4351	Solid and Hazardous Waste Management	3
Science Elective	(Biological Science)*	4
UCC Humanities Group 2		3

Eighth Semester: (13)

ENV 4101	Fundamentals of Air Pollution Engineering	3
ENV 4401	Water Supply Engineering	3
ENV 4551	Wastewater Treatment Engineering	3
ENV 4005L	Environmental Laboratory II	1
CWR 3540	Water Resources Engineering	3

Ninth Semester: (13)

ENV 4891	Environmental Engineering Senior Design Project	3
ENV 4960	Environmental Engineering Seminar	1
ENV	Technical Elective	3
ENV	Technical Elective	3
ENV	Technical Elective	3

*One Science Elective should be in Earth Sciences and the other should be in Biological Sciences. Electives must be selected from the following:

Earth Science electives: (one required)

GLY 1010/L	Physical Geology	4
GLY 2072/L	Earth Climate and Global Change	4
GLY 3039/L	Environmental Geology	4
GLY 3202/L	Earth Materials	4
GLY 4822/L	Hydrogeology	4
MET 2010/L	Meteorology & Atmospheric Physics	4

Biological Science electives (one required):

MCB 2000	Introductory Microbiology – *GL*	3
MCB 2000L	Introductory Micro Lab	1
OCB 2003	Introductory Marine Biology – *GL*	3
OCB 2003L	Introductory Marine Biology Lab	1
PCB 3043/L	Ecology	4
EVR 3013/L	Ecology of South Florida	4

ENV technical electives must be selected from the following:

CEG 4011	Geotechnical Engineering	3
CGN 4321	GIS Applications in Civil Environmental Engineering	3
CGN 4510	Sustainable Building Engineering	3
CWR 5235	Open Channel Hydraulics	3
CWR 4204	Hydraulic Engineering	3
CWR 4530	Modeling Applications in Water Resources Engineering	3
CWR 4620C	Ecohydrological Engineering	3
EGN 4070	Engineering for Global Sustainability and Environmental Protection – *GL*	3
ENV 4330	Hazardous Waste Site Assessment	3
ENV 5062	Environmental Health	3
ENV 4560	Reactor Design	3
ENV 4024	Bioremediation Engineering	3
ENV 4930	Special Topics in Environmental Engineering	1-4
ENV 5104	Indoor Air Quality	3
ENV 5666	Water Quality Management	3
EVR 3010	Energy Flow in Natural and Man-made Systems	3
EVR 3011	Environmental Resources and Pollution	3
EVR 4321	Sustainable Resource Development	3
EVR 4592	Soils and Ecosystems	3
EVR 4026	Ecology of Biotic Resources	3
EVR 4323	Restoration Ecology	3

All recommended and other technical electives must be approved by the advisor and must concentrate on relevant applications of environmental engineering design. Selection of a proper sequence would allow the student to specialize within a focus area of interest (e.g., air, water, or land resources).

Combined BS/MS in Civil Engineering

Students who pursue a BS degree in Civil Engineering and have completed 75-90 credits and have at least a 3.3 GPA on both overall and upper division courses may apply to enroll in the combined BS/MS program in Civil Engineering upon recommendation from three CEE faculty members. In addition to the admission requirements of the combined BS/MS program, students must meet all the admission requirements of both the department and the University Graduate School. Students need only apply once to the combined degree program, but the application must be submitted to Graduate Admissions before the student starts the last 30 credits of the bachelor's degree program. A student admitted to the combined degree program will be considered to have undergraduate status until the student applies for graduation from their bachelor's degree program. Upon conferral of the bachelor's degree, the student will be granted graduate status and be eligible for graduate assistantships.

Students enrolled in the program may count up to nine credit hours of CEE graduate courses as credits for both the BS and MS degrees. The combined BS/MS program has been designed to be a continuous program. However, upon completion of all the requirements of the undergraduate program, students will receive their BS degrees. Students in this program have up to one year to complete the master's degree after receipt of the bachelor's degree. Students who fail to meet this one year post BS requirement or who elect to leave the combined program at any time and earn only the BS degree will have the same access requirements to regular graduate programs as any other student, but will not be able to use the nine credits in both the bachelor's and master's degrees.

For each of the graduate courses counted as credits for both BS and MS degree, a minimum grade of B is required. All double counted courses must be at 5000 level or higher. Students enrolled in the program may count up to nine credit hours of CEE graduate courses toward the elective engineering BS requirements as well as toward the MS degree. Only graduate courses with formal lectures can be counted for both degrees. The students are responsible for confirming the eligibility of each course with the Undergraduate Advisor.

Students interested in the program should consult with the Undergraduate Advisor on their eligibility for the program. The students should also meet the Graduate Program Director to learn about the graduate program and available courses before completing the application form and submitting it to the Undergraduate Advisor. Applicants will be notified by the department and the University Graduate School of the decision on their applications.

Undergraduate students enrolled in the program are encouraged to seek employment with a department faculty to work as student assistants on sponsored research projects. The students will be eligible for graduate assistantships upon full admission into the graduate school.

Combined BS in Civil Engineering/MS in Environmental Engineering

Students who pursue a BS degree in Civil Engineering and are in their senior year and have at least a 3.3 GPA on both overall and upper division courses may apply to the department to enroll in the combined BS (Civil)/MS program in Environmental Engineering upon recommendation from three CEE faculty members. To be considered for admission to the combined bachelor's/masters degree program in Environmental Engineering, students must have completed at least 75-90 credits in the bachelor's degree program in Civil Engineering at FIU and meet the admissions criteria for the graduate degree program at FIU and meet the admissions criteria for the graduate degree program to the which they are applying. Students need only apply once to the combined degree program, but the application must be submitted to the Graduate Admissions before the student starts the last 30 credit of the bachelor's degree program. A student admitted to the combined degree program will be considered to have undergraduate status until the student applies for graduation from their bachelor's degree program. Upon conferral of the bachelor's degree, the student will be granted graduate status and will be eligible for graduate assistantships. Only 5000-level or higher courses, and no more than the credits specified by the program catalog, may be applied toward both degrees. In addition to the admission requirements of the combined BS/MS program, students must meet all the admission requirements of both the department and the University Graduate School.

Students enrolled in the program may count up to nine credit hours of CEE graduate courses as credits for both the BS and MS degrees. The combined BS/MS program has been designed to be a continuous program. However, upon completion of all the requirements of the undergraduate program, students will receive their BS degrees. Students in this program have up to one year to complete the master's degree after receipt of the bachelor's degree. Students who fail to meet this one year post BS requirement or who elect to leave the combined program at any time and earn only the BS degree will have the same access requirements to regular graduate programs as any other student, but will not be able to use the nine credits in both the bachelor's and master's degrees.

For each of the graduate courses counted as credits for both BS and MS degree, a minimum grade of B is required. All double counted courses must be at 5000 level or higher. Students enrolled in the program may count up to nine credit hours of CEE graduate courses toward the elective engineering BS requirements as well as toward the MS degree. Only graduate courses with formal lectures can be counted for both degrees. The students are responsible for confirming the eligibility of each course with the Undergraduate Advisor.

Students interested in the program should consult with the Undergraduate Advisor on their eligibility for the program. The students should also meet the Graduate Program Director to learn about the graduate program and available courses before completing the application form and submitting it to the Undergraduate Advisor. Applicants will be notified by the department and the University Graduate School of the decision on their applications.

Undergraduate students enrolled in the program are encouraged to seek employment with a department faculty to work as student assistants on sponsored research projects. The students will be eligible for graduate assistantships upon full admission into the graduate school.

Combined BS/MS in Environmental Engineering

Students who pursue a BS degree in Environmental Engineering and are in their senior year and have at least a 3.3 GPA on both overall and upper division courses may apply to the department to enroll in the combined BS/MS program in Environmental Engineering upon recommendation from three CEE faculty members. To be considered for admission to the combined bachelor's/masters degree program in Environmental Engineering, students must have completed at least 75-90 credits in the bachelor's degree program in Environmental Engineering at FIU and meet the admissions criteria for the graduate degree program at FIU and meet the admissions criteria for the graduate degree program to the which they are applying. Students need only apply once to the combined degree program, but the application must be submitted to the Graduate Admissions before the student starts the last 30 credit of the bachelor's degree program. A student admitted to the combined degree program will be considered to have undergraduate status until the student applies for graduation from their bachelor's degree program. Upon conferral of the bachelor's degree, the student will be granted graduate status and will be eligible for graduate assistantships. Only 5000-level or higher courses, and no more than the credits specified by the program catalog, may be applied toward both degrees. In addition to the admission requirements of the combined BS/MS program, students must meet all the admission requirements of both the department and the University Graduate School.

Students enrolled in the program may count up to nine credit hours of CEE graduate courses as credits for both the BS and MS degrees. The combined BS/MS program has been designed to be a continuous program. However, upon completion of all the requirements of the undergraduate program, students will receive their BS degrees. Students in this program have up to one year to complete the master's degree after receipt of the bachelor's degree. Students who fail to meet this one year post BS requirement or who elect to leave the combined program at any time and earn only the BS degree will have the same access requirements to regular graduate programs as any other student, but will not be able to use the nine credits in both the bachelor's and master's degrees.

For each of the graduate courses counted as credits for both BS and MS degree, a minimum grade of "B" is required. All double counted courses must be at 5000 level or higher. Students enrolled in the program may count up to nine credit hours of CEE graduate courses toward the elective engineering BS requirements as well as toward the MS degree. Only graduate courses with formal lectures can be counted for both degrees. The students are responsible for confirming the eligibility of each course with the Undergraduate Advisor.

Students interested in the program should consult with the Undergraduate Advisor on their eligibility for the program. The students should also meet the Graduate Program Director to learn about the graduate program and available courses before completing the application form and submitting it to the Undergraduate Advisor. Applicants will be notified by the department and the University Graduate School of the decision on their applications.

Undergraduate students enrolled in the program are encouraged to seek employment with a department faculty to work as student assistants on sponsored research projects. The students will be eligible for graduate assistantships upon full admission into the graduate school.

Course Descriptions

Definition of Prefixes

CCE-Civil Construction Engineering; CEG-Engineering, General; CES-Civil Engineering Structures; CGN-Civil Engineering; CWR-Civil Water Resources; EES-Environmental Engineering Science; EGM-Engineering, Mechanics; EGN-Engineering, General; EGS-Engineering Support; ENV-Engineering, Environmental; SUR-Surveying and Related Areas; TTE-Transportation and Traffic Engineering; URP-Urban and Regional Planning

Courses that meet the University's Global Learning requirement are identified as GL.

CCE 4001 Heavy Construction (3). Contractor's organization, contracts, services, safety, planning and scheduling. Equipment and their economics. Special project applications, coffer-dams, dewatering, river diversions, tunneling. Prerequisites: CES 4702 and CEG 4011.

CCE 4031 Project Planning for Civil Engineers (3). Introduction to techniques for planning activities, operations, finance, budget, workforce, quality, safety. Utilize case studies as learning tools for students aspiring to superintendent positions. Prerequisite: CES 3100. Corequisite: CEG 4011.

CCE 5035 Construction Engineering Management (3). Course will cover construction organization, planning and implementation; impact and feasibility studies; contractual subjects; liability and performance; the responsibility of owner, contractor and engineer. Prerequisites: CES 3100 or equivalent and CEG 4011 or equivalent.

CCE 5036 Advanced Project Planning for Civil Engineers (3). Advanced techniques and methods for planning activities, operations, finance, budget, workforce, quality, safety. Utilize case studies as learning tools for students aspiring to management positions. Prerequisite: CCE 4031 or equivalent.

CCE 5405 Advanced Heavy Construction Techniques (3). Heavy construction methods and procedures involved in large construction projects such as bridges, cofferdams, tunnels, and other structures. Selection of equipment based on productivity and economics. Prerequisite: CCE 4001.

CCE 5505 Computer Integrated Construction Engineering (3). Course covers the discussion of available software related to construction engineering topics; knowledge based expert systems and their relevance to construction engineering planning and management. Prerequisite: CCE 4031 or equivalent.

CEG 4011 Geotechnical Engineering I (3). Engineering 3 geology, soil properties; stresses in soils; failures; criteria; consolidation and settlement; compaction, soil improvement and slope stabilization. Prerequisites: GLY 1010 and GLY 1010L, CWR 3201 and CWR 3201L, EGM 3520, and EGM 3520L.

CEG 4011L Soil Testing Laboratory (1). Laboratory experiments to identify and test behavior of soils and rocks. Prerequisites: CWR 3201, CWR 3201L, EGM 3520, EGM 3520L. Corequisite: CEG 4011. (Lab fees assessed).

CEG 4012 Geotechnical Engineering II (4). Principles of foundation analysis and design: site improvement for bearing and settlement, spread footings, mat foundations, retaining walls, cofferdams, piles, shafts, caissons, tunnels, and vibration control. Computer applications. Prerequisites: CEG 4011 and CEG 4011L.

CEG 4126 Fundamentals of Pavement Design (3). This course is designed to provide the student with a basic understanding of the fundamental principles underlying pavement structural analysis and design. Asphalt Institute, Portland Cement Association and AASHTO methods will be covered. Prerequisites: CEG 4011, CEG 4011L, TTE 4201.

CEG 5065 Geotechnical Dynamics (4). Analytical, field, and laboratory techniques related to vibration problems of foundations, wave propagations, behavior of soils and rocks, earth dams, shallow and deep foundations. Earthquake engineering. Prerequisite: CEG 4011.

CES 3100 Structural Analysis (3). To introduce the student to the basic concepts and principles of structural theory relating to statically determinate beams, arches, trusses and rigid frames, including deflection techniques. Prerequisite: EGM 3520 and EGM 3520L.

CES 4320 Introduction to the Design of Highway Bridges (3). The course covers the different types of modern highway bridges, and systematically analyzes all the components of the superstructures. Design procedures are based on AASHTO codes and specialized software. Prerequisites: CEG 4011, CES 4605, CES 4702.

CES 4580 Hurricane Engineering and Global Sustainability – *GL* (3). This course examines the impacts of hurricanes and explores the role of engineers in achieving sustainable coastal communities around the globe. This course serves as a global learning course. Prerequisites: CWR 3201, CWR 3201L.

CES 4600 Introduction to the Design of Tall Buildings (3). The course reviews the different modern high-rise structural systems, a simple analysis of wind and seismic loading to efficiently design very tall buildings. Prerequisites: CEG 4011, CES 4702.

CES 4605 Steel Design (3). The analysis and design of structural elements and connections for buildings, bridges, and specialized structures utilizing structural steel. Both elastic and plastic designs are considered. Prerequisite: CES 3100.

CES 4702 Reinforced Concrete Design (3). The analysis and design of reinforced concrete beams, columns, slabs, retaining walls and footings; with emphasis corresponding to present ACI Building Code. Introduction to prestressed concrete is given. Prerequisite: CES 3100 with a grade of 'C' or better.

CES 4711 Introduction to Prestressed Concrete Structures (3). The fundamental principles of design for prestressed concrete structures. Understanding of the behavior of prestressed concrete structures, material properties, and the detailed considerations in limit state design. Prerequisite: CES 4702.

CES 5106 Advanced Structural Analysis (3). Extension of the fundamental topics of structural analysis with emphasis on energy methods and methods best suited for nonprismatic members. Prerequisite: CES 3100.

CES 5325 Design of Highway Bridges (3). Structural analysis and design for highway bridge systems which includes design criteria, standards of practice and AASHTO specifications for designing super-structures and substructure elements of various types of bridges. Prerequisites: CES 4605, CES 5715, and CEG 4011.

CES 5565 Computer Applications in Structures (3). Discussion and application of available computer programs, techniques and equipment for the analysis, design and drafting of structures. Graduate students have to do a project. Prerequisites: CES 4605 and CES 4702.

CES 5587 Topics in Wind Engineering (3). The course will cover the nature of wind related to wind-structure interaction and design loads for extreme winds, tornadoes and hurricanes. Prerequisites: CES 3100 and CWR 3201.

CES 5606 Advanced Structural Steel Design (3). Extension of the analysis and design of structural elements and connections for buildings, bridges, and specialized structures utilizing structural steel. Prerequisite: CES 4605.

CES 5715 Prestressed Concrete Design (3). The behavior of steel and concrete under sustained load. Analysis and design of pre-tensioned and post-tensioned reinforced concrete members, and designing these members into the integral structure. Prerequisite: CES 4702.

CES 5800 Timber Design (3). The analysis and design of modern wood structures. Effect of plant origin and physical structure of wood on its mechanical strength; fasteners and their significance in design. Prerequisite: CES 3100.

CGN 2161 Career Orientation in Civil Engineering (1). Course provides an overview of the Civil Engineering profession, including understanding of the discipline subfields, to assist students in determining the area(s) of emphasis they might want to follow for their professional career.

CGN 2420 Computer Tools for Engineers (3). Introduction to common civil engineering software such as MathCad, VBA, and others. Prerequisites: MAC 2312 and PHY 2048.

CGN 3949 Co-Op Work Experience (1-3). Supervised full-time work experience in engineering field. Limited to students admitted to the Co-op program with consent of advisor. Evaluation and reports required.

CGN 4321 GIS Applications in Civil and Environmental Engineering (3). Introduction to the basics of geographic information systems and their applications in civil and environmental engineering, landscape architecture, and other related fields. Prerequisites: TTE 4201 or ENV 3001 or CWR 3540 or the equivalents.

CGN 4510 Sustainable Building Engineering (3). Introduces students to the basic concepts of designing building materials and complimentary systems in such a way that the enclosures control heat, air and moisture so that a durable, energy efficient, healthy building is provided without using excess materials and energy. Students from different backgrounds will learn principles and methodologies to enhance the environmental performance of buildings, including all applicable regulatory and sustainability frameworks. Prerequisites: CWR 3201, CWR 3201L.

CGN 4802 Civil Engineering Senior Design Project (3). Mandatory course for all senior students, to experience the design of a practical project by utilizing knowledge learned from previous courses for presenting a solution. Done under the supervision of a faculty member and professional engineer. Prerequisites: CEG 4011, CEG 4011L, TTE 4201, CES 4702.

CGN 4911 Undergraduate Research Experience (1-3). Participate in research activities in the areas of structures, geotechnical, transportation, construction and environmental engineering. Prerequisite: Permission of a faculty advisor.

CGN 4930 Special Topics in Civil Engineering (1-4). A course designed to give groups of students an opportunity to pursue special studies not otherwise offered.

CGN 4949 Co-Op Work Experience (1-3). Supervised full-time work experience in engineering field. Limited to students admitted to the Co-op program with consent of advisor. Evaluation and report required.

CGN 4980 Civil Engineering Seminar (1). Basic principles and applications of civil engineering, including structural, transportation, environmental, geotechnical, construction, and water resources engineering for civil engineering students. Prerequisites: EGS 2030, EGN 3613, ENV 3001, CES 3100, CWR 3540. Corequisites: CEG 4011, TTE 4201.

CGN 5315 Civil Engineering Systems (3). Application of systems analysis techniques to large scale civil engineering problems. Prerequisites: ESI 3314 or equivalent.

CGN 5320 GIS Applications in Civil and Environmental Engineering (3). Introduction to the basics of geographic information systems, their software and hardware, and their applications in Civil and Environmental Engineering, landscape architecture, and other related fields. Corequisites: TTE 4201 or CWR 3540 or ENV 3001.

CGN 5870 Corrosion Control in Civil Engineering (3). The course provides understanding of principles of corrosion phenomena with emphasis on its application to materials in civil engineering including testing methods, corrosion control, and durability. Prerequisite: Permission of the instructor.

CGN 5874 Building Diagnostics (3). This course will give an introduction into building diagnostics with a focus on non-destructive testing (NDT) techniques used to investigate Civil Engineering materials and structures. Prerequisites: Graduate standing, enrolled in engineering curriculum.

CGN 5930 Special Topics in Civil Engineering (1-3). A course designed to give groups of students an opportunity to pursue special studies not otherwise offered. Prerequisite: Permission of the instructor.

CGN 5935 Professional Engineering (Civil) Review (4). Prepares qualified candidates to take the P.E. written examination in the field of Civil Engineering. Reviews hydraulics, hydrology, water supply and wastewater, geotechnics, structures, concrete and steel design, etc.

CWR 3201 Fluid Mechanics (3). A study of the properties of fluids and their behavior at rest and in motion. Continuity, momentum, and energy principles of fluid flow. Prerequisites: MAP 2302, and EGN 3321 or EGM 3503. Corequisite: CWR 3201L.

CWR 3201L Fluid Mechanics Laboratory (1). Application of fluid mechanics principles in the laboratory. Experiments in surface water, ground-water and pipe flow. Prerequisites: MAP 2302, and EGN 3321 or EGM 3503. Corequisite: CWR 3201. (Lab fees assessed).

CWR 3540 Water Resources Engineering (3). Hydrologic and hydraulic engineering fundamentals and applications: water resources issues, hydrologic cycle and processes, measurements, hyetographs, hydrographs, probability and design, groundwater flow and well hydraulics. Prerequisites: CWR 3021, CWR 3201L, STA 3033 or EIN 3235.

CWR 4204 Hydraulic Engineering (3). Design and analysis applications to systems and facilities, such as open channels, culverts, storm water control, flood control, pumps, and hydroelectric power. Prerequisite: CWR 3201.

CWR 4530 Modeling Applications in Water Resources Engineering (3). Model applications in hydrology, hydraulics, hydrosystems engineering and environmental interconnections. Prerequisite: CWR 3201. Corequisite: CWR 3540.

CWR 4620C Ecohydrological Engineering (3). Introduction and incorporation of the fundamental concepts of ecohydrology into hydrologic and water resources engineering principles and designs. Prerequisite: CWR 3540.

CWR 5140C Ecohydrology (3). Hydrology of ecosystems, interaction between the hydrologic cycle and vegetative processes. Prerequisite: Permission of the instructor.

CWR 5235 Open Channel Hydraulics (3). Theoretical treatment and application of hydraulics. Flow in open channels with special reference to varied flow, critical state hydraulic jump, and wave formation. Prerequisite: CWR 3103.

CWR 5251 Environmental Hydraulics (3). Application of fluid mechanics in the study of physical mixing in surface water bodies, dispersion of materials, and design of hydraulic systems. Prerequisite: Permission of the instructor.

CWR 5305 Surface Hydrology (3). Principles of Hydrology with a particular focus on surficial processes of interest to engineering design. Emphasizes applications to flood prevention and mitigation and stormwater management issues. Prerequisites: CWR 3201, CWR 3540 (or equivalent).

CWR 5535C Advanced Modeling Applications in Water Resources Engineering (3). Complex model applications in hydrology, hydraulics, hydrosystems engineering and environmental interconnections. Prerequisite: Permission of the instructor.

EES 5135 Water Quality Indicators (3). Ecological studies of micro and macro organisms which are indicators of water quality. Emphasis of bioassays and early warning systems. Prerequisite: Permission of the instructor.

EES 5137 Biological Monitoring of Freshwater Ecosystems (3). The use of aquatic insects and other invertebrates to monitor changes in the aquatic environment. The ecological aspects of aquatic insects in relation to pollution stress are assessed. Prerequisites: EES 5135 or permission of the instructor.

EES 5506 Occupational Health (3). Effects, assessments, and control of physical and chemical factors in man's environment, including chemical agents, electromagnetic radiation, temperature, humidity, pressures, illumination, noise, and vibration. Prerequisite: Admission to graduate program.

EES 5605 Noise Control Engineering (3). Fundamentals of sound and noise. Health hazards and other effects. Measurement and noise control in transportation, construction, and other environments. Prerequisite: Admission to graduate program.

EGM 3520 Engineering Mechanics of Materials (3). Analysis of axial, torsional, bending, combined stresses, and strains. Plotting of shear, moment and deflection diagram with calculus applications and interpretations. Prerequisites: CGN 2420, MAC 2313, MAP 2302 and EGN 3311 with a grade of 'C' or better.

EGM 3520L Materials Testing Laboratory (1). Introduction to measurements of basic mechanical properties of materials. Experiments include axial tension, compression, torsion, flexure, and the response of simple structural elements. Prerequisites or Corequisites: EGM 3520, MAC 2312 and EGN 3311. (Lab fees assessed).

EGM 5111 Experimental Stress Analysis (3). Course covers the necessary theory and techniques of experimental stress analysis and the primary methods employed: brittle coating, strain gauges, photo-elasticity and Moire. Prerequisites: EGM 3520, EGM 5653.

EGM 5351 Finite Element Methods in Mechanics (3). Matrix techniques and variational methods in solid mechanics; single element, assemblage and generalized theory; non-linear analysis; applications in structural and soil mechanics, torsion, heat conduction and hydro-elasticity, etc. Prerequisite: CES 5106.

EGM 5421 Structural Dynamics (3). Fundamentals of free, forced, and transient vibration of singles and multidegree of freedom structures, including damping of lumped and distributed parameters systems. Graduate students have to do a project. Prerequisite: CES 3100 and MAP 2302.

EGN 1110C Engineering Drawing (3). Introduction to elementary design concepts in engineering, principles of drawing, descriptive geometry, pictorials and perspectives and their computer graphics counterpart.

EGN 3311 Statics (3). Forces on particles, equilibrium of forces, moments, couples, centroids, section properties, and load analysis of structures. Prerequisites: MAC 2312 and PHY 2048. Corequisite: MAC 2313.

EGN 3613 Engineering Economy (3). Assist students to develop competency in the fundamentals of engineering economics for all engineering disciplines. The methods of economic analysis in general engineering applications include: decision analysis techniques, time value of money calculations, essential techniques in economic analysis of alternatives, depreciation, corporate income tax considerations, and criteria for decisions under various constraints.

EGN 4070 Engineering for Global Sustainability and Environmental Protection – *GL* (3). This course examines the effects of modern humans on the environment and explores the role of engineers in creating an environmentally sustainable future. Also serves as a global learning course. Prerequisites: ENV 3001 or PHY 2049 and CHM 1046.

EGN 5439 Design of Tall Buildings (3). The course analyzes different modern high-rise structural systems, and includes the dynamics of wind and earthquakes to efficiently design very tall buildings and their ancillary structures. Prerequisite: Permission of the instructor.

EGN 5455 Numerical Methods in Engineering (3). Study of procedures that permit rapid approximate solutions, within limits of desired accuracy, to complex structural analysis. Graduate students have to do a project. Prerequisite: CES 3100.

EGN 5990 Fundamentals of Engineering (FE) Review (4). Prepares upper level engineering students to take the Fundamentals of Engineering (FE) State Board examinations. Reviews chemistry, computers, statics, dynamics, electrical circuits, fluid mechanics, mechanic of materials, material science and thermodynamics.

EGS 2030 Ethics and Legal Aspects in Engineering (1). Codes of ethics, professional responsibilities and rights, law and engineering, contracts, torts, evidence.

ENV 3001 Introduction to Environmental Engineering – *GL* (3). Introduction to environmental engineering problems; water and wastewater treatment, air pollution, noise, solid and hazardous wastes. Prerequisites: CHM 1046, CHM 1046L, and MAC 2312. Corequisite: ENV 3001L.

ENV 3001L Environmental Laboratory I (1). A corequisite to ENV 3001. Practical applications of the theory learned in the course and experience in detecting and measuring some environmental problems. Prerequisites: CHM 1046 and CHM 1046L, MAC 2312 and permission of undergraduate advisor. Corequisite: ENV 3001. (Lab fees assessed).

ENV 3081 Career Orientation and Project Management Skills (1). Course provides an overview of the professional practice and project management skills for Environmental Engineering. Topics focus on understanding of the discipline subfields, job opportunities, and research environments. Prerequisites: MAC 2312 and PHY 2049.

ENV 3949 Co-Op Work Experience (3). Supervised full-time work experience in engineering field. Limited to students admitted to the Co-op program with consent of advisor.

ENV 4005L Environmental Laboratory II (1). Experiments involving use of analysis and instrumental techniques for the evaluation of environmental samples, and hands-on design aspects associated to environmental engineering treatment processes. Prerequisites: ENV 3001L, CWR 3201L, and EGN 3343.

ENV 4024 Bioremediation Engineering (3). Biotransformation of sub-surface contaminants in gaining recognition as a viable treatment tool. This course provides students with quantitative methods required to design bioremediation systems. Prerequisites: ENV 3001 and ENV 3001L.

ENV 4101 Fundamentals of Air Pollution Engineering (3). Factors contributing to air pollution: pollutants and their effects, sources, chemical transformations, and meteorology. Regulatory framework and design principles of emissions control technology. Prerequisites: CWR 3201 and CWR 3201L or EML 3126 and 3126L, ENV 3001 and ENV 3001L.

ENV 4330 Hazardous Waste Site Assessment (3). Hazardous waste site assessment, remedial investigation, design of site monitoring strategies and remediation plans. Prerequisites: CHM 1046 and CHM 1046L.

ENV 4351 Solid and Hazardous Waste Management (3). Generation, transport, treatment and disposal of solid and hazardous wastes; risk assessment and treatment of contaminated media. Prerequisites: CHM 1046 and CHM 1046L.

ENV 4401 Water Supply Engineering (3). Quantity, quality, treatment, and distribution of drinking water. Prerequisites: CWR 3201, CWR 3201L, ENV 3001, ENV 3001L.

ENV 4401L Water Laboratory (1). Laboratory exercises in the physical, chemical, and bacteriological quality of potable water. Prerequisites: CWR 3201, ENV 3001 and ENV 3001L. Corequisite: ENV 4401. (Lab fees assessed).

ENV 4513 Chemistry for Environmental Engineers (3). A practical basis for applying microbial and physiochemical principles to understand reactions occurring in natural and engineered systems including water/wastewater treatment processes. Prerequisites: CHM 1046 and CHM 1046L.

ENV 4551 Wastewater Treatment Engineering (3). Collection and transportation of wastewater, design of sanitary and storm sewers. Physical, chemical, and biological principles of wastewater treatment. Prerequisites: CWR 3201, CWR 3201L, ENV 3001, ENV 3001L.

ENV 4551L Wastewater Laboratory (1). Laboratory exercises in the physical, chemical, and bacteriological quality of raw and treated wastewaters. Prerequisites: CWR 3201 and CRW 3201L, ENV 3001 and ENV 3001L, Corequisite: ENV 4551. (Lab fees assessed).

ENV 4560 Reactor Design (3). A theoretical and practical basis for reaction kinetics to understand multi-phase reactions, analysis and design of batch and continuous flow reactors. Prerequisites: CHM 1046, CHM 1046L.

ENV 4891 Environmental Engineering Senior Design Project (3). Team design project involving applications of fundamental environmental engineering concepts to project design, specifications, contracts and implementation. Emphasis on written and oral communication. Prerequisites: CWR 3540, ENV 4351, and ENV 4401 or ENV 4551. Corequisites: ENV 4101, ENV 4401, ENV 4551.

ENV 4910 Undergraduate Research Experience (1-3). Participate in research activities in the areas of air, land and water systems and associated environmental health impacts. Prerequisites: Permission of a faculty advisor.

ENV 4930 Special Topics in Environmental Engineering (1-4). A course designed to give groups of students an opportunity to pursue special studies not otherwise offered.

ENV 4949 Co-Op Work Experience (3). Supervised full-time work experience in engineering field. Limited to students admitted to the Co-op program with consent of advisor. Evaluation and reports required.

ENV 4960 Environmental Engineering Seminar (1). Basic principles and applications of environmental engineering, including environmental science, solid and hazardous waste, water resources, water supply, wastewater, and air quality for environmental engineering students. Prerequisites: EGS 2030, EGN 3613, ENV 3001, EGN 3343, CWR 3540, ENV 4351. Corequisites: ENV 4101, ENV 4401, ENV 4551.

ENV 5002C Fundamentals for Environmental Engineers (3). Laws and principles of the physical, chemical and biological phenomena that define and control the fate of chemical species in natural and engineered systems. Prerequisite: Permission of the instructor.

ENV 5007 Environmental Planning (3). Environmental laws and regulations, ecological principles, planning policies and processes, risk assessment, environmental impact due to growth, and environmental indicators.

ENV 5008 Appropriate Technology for Developing Countries (3). Appropriate environmental technologies and associated factors. Topics include water, air, soil and waste management. Low cost and energy alternatives are emphasized. Prerequisite: Permission of the instructor.

ENV 5027 Bioremediation Processes (3). Bio-transformation of subsurface contaminants is gaining recognition as a viable treatment tool. This course provides students with quantitative methods required to design bioremediation systems. Project required. Prerequisite: Permission of the instructor.

ENV 5062 Environmental Health (3). Study of the control and prevention of environmental-related diseases, both communicable and non-communicable, injuries, and other interactions of humans with the environment. Prerequisite: Permission of the instructor.

ENV 5104 Indoor Air Quality (3). Sources and causes of poor indoor air quality (IAQ). Protocols for IAQ investigations; problem evaluation and solution proposals. Approaches to sustainable construction; best IAQ and energy savings.

ENV 5105 Air Quality Management (3). Technical and regulatory aspects of air quality management. Emissions inventories, ambient monitoring, and models used to evaluate the impact of pollutants on local, regional and global air quality.

ENV 5116 Air Sampling Analysis (3). Practical laboratory work and theoretical aspects involved in a wide range of air sampling and analysis systems. Critical comparison and examination of methods and instrumentation. Source testing, instrumental sensitivity, applicability and remote sensing systems. Prerequisites: ENV 5105 or ENV 4101.

ENV 5126 Particulate Air Pollution Control (3). Particulate pollution control devices, principles, design, costs. Cyclones, electrostatic precipitators, filters, bag houses, scrubbers, noval control devices.

ENV 5127 Gaseous Air Pollution Control (3). Gaseous pollution control devices, principles, design, costs. Gaseous pollutants control using adsorption, absorption, incineration, and other novel control systems.

ENV 5334 Spill Response and Hazardous Materials Transport (3). Consequence analysis of accident scenarios covering the release and dispersion of toxic substances during transport into air, soil, or aquifer and fast response to spills and toxics recovery. Prerequisite: Permission of the instructor.

ENV 5335 Advanced Hazardous Waste Treatment Processes (3). Hazardous waste site assessment, remedial investigation, design of site monitoring strategies and remediation plans. Prerequisites: CHM 1046 and CHM 1046L.

ENV 5347 Waste Incineration (3). Domestic and industrial waste incineration and pollutant stream control of aqueous and airborne pollutants. Design of incineration's.

ENV 5356 Solid and Hazardous Waste (3). Generation, transport, treatment and disposal of solid and hazardous wastes; risk assessment and treatment of contaminated media. Prerequisites: CHM 1046 and CHM 1046L.

ENV 5406 Water Treatment Systems and Design (3). Course emphasizes water quality, quantities, treatment, and distribution systems particularly as relates to municipal water supply. Requires laboratory project. Prerequisite: Permission of the instructor.

ENV 5512 Water and Wastewater Analysis (3). Relevance of the main quality parameters and their measurements by wet chemistry and analytical equipment. Includes BOD, COD, TOC, CO, TSS, VSS, alkalinity, acidity, pH hardness, ammonia, TKN, NO2, NO3, PO4, etc. Prerequisites: ENV 5666, CHM 1046, and CHM 1046L. Corequisite: ENV 5512L.

ENV 5512L Water and Wastewater Analysis Laboratory (1). Experiments are conducted which measure gross organic pollution indicators, suspended solids, conductivity, alkalinity, acidity, pH, nitrate, nitrite, TKN, ammonia, total phosphates, chlorine residual and chlorine breakpoint. Prerequisites: ENV 5666, CHM 1046, and CHM 1046L. Corequisite: ENV 5512.

ENV 5517 Design of Wastewater Treatment Plants (3). Wastewater collection systems. Integration of unit operations into the planning and design of treatment plants, including sludge handling and disposal. Prerequisite: Permission of the instructor.

ENV 5519 Chemistry for Environmental Engineers (3). Basis for applying microbial and physicochemical principles to understand reactions occurring in natural and engineered systems including water/wastewater treatment processes. Includes laboratory project. Prerequisite: Permission of the instructor.

ENV 5559 Reactor Design (3). A theoretical and practical basis for reaction kinetics to understand multiphase reactions, analysis and design of batch and continuous flow reactors. Projects on analysis of reactor design and operating data.

ENV 5613 Environmental Entrepreneurship (3). Application of environmental engineering concepts in the development of innovative ideas, products or services; interactive experiences with environmental businesses. Prerequisites: ENV 3001 or permission of the instructor.

ENV 5659 Regional Planning Engineering (3). Theories of urban and regional growth; collective utility analysis; input-output models in planning; application of linear programming to regional social accounting; economic base analysis. Prerequisites: Computer Programming or permission of the instructor.

ENV 5666 Water Quality Management (3). Predicting and evaluating the effect of human activities on streams, lakes, estuaries, and ground waters; and the relation of human activities to water quality and protection of water resources. Prerequisite: Permission of the instructor.

ENV 5905 Independent Study (1-3). Individual research studies available to academically qualified students on graduate status.

ENV 5930 Special Topics in Environmental Engineering (1-3). Specific aspects of environmental technology and urban systems not available through formal course study. Open to academically qualified students only.

SUR 2101C Surveying (3). Computations and field procedures associated with the measurement of distances and angles using tape, level, transit, EDMs, and total station. Laboratory is included with field measurements. Prerequisite: EGN 1110C.

TTE 4102 Urban Transportation Planning (3). Introduces the fundamental concepts, theory, and history in transportation planning, the connections between transportation system and other components in the society, and basic planning methods. Prerequisite: TTE 4201.

TTE 4201 Transportation and Traffic Engineering (3). Transportation characteristics; transportation planning, traffic control devices, intersection design, network design, research. Prerequisites: STA 3033 or EIN 3235, EGN 3321, and SUR 2101C.

TTE 4202 Traffic Engineering (3). Speed and volume studies, traffic operations and characteristics, traffic flow theory, accident characteristics. Prerequisite: TTE 4201.

TTE 4203 Highway Capacity Analysis (3). Procedures involved in the capacity analysis of interrupted and uninterrupted flow highway facilities. Applications of highway capacity analysis software. Prerequisite: TTE 4201.

TTE 4804 Geometric Design of Highways (3). Parameters governing geometric design of highways; curve superelevation, widening of highway curves, intersection design; highway interchanges, use of AASHTO design guidelines. Prerequisite: TTE 4201.

TTE 4930C Transportation Seminar (1-3). Oral presentations made by students, guests, and faculty members on current topics and research activities in traffic and transportation engineering. Prerequisite: TTE 4201.

TTE 5007 Transportation Systems in Developing Nations (3). Transportation systems in the Developing Nations. Role of international organizations, technology transfer/choices, orientation of transport networks, socio-economic and environmental impacts. Prerequisites: Graduate standing or permission of the instructor.

TTE 5015 Applied Statistics in Traffic and Transportation (3). Civil and Environmental Engineering statistics methods as applied to traffic and transportation are covered. Topics include: significance tests, standard distributions, analysis of variance, and regression analysis. Prerequisite: Graduate standing.

TTE 5100 Transportation and Growth Management (3). Theory and principles of transportation and growth management, including the growth phenomena and regional impact planning. Design projects required. Prerequisite: TTE 4201.

TTE 5205 Advanced Highway Capacity Analysis (3). Parameters involved in calculating highway capacity and level of service on different highway and transportation facilities. Computer application will be also discussed. Prerequisite: TTE 4201.

TTE 5215 Fundamentals of Traffic Engineering (3). Speed and volume studies, stream characteristics, traffic flow theory, accident characteristics. Prerequisite: TTE 4201.

TTE 5273 Intelligent Transportation Systems (3). ITS functional areas, planning architecture, standards, and evaluation. Implementation of selected ITS technologies and strategies. Prerequisites: TTE 4201 or equivalent.

TTE 5315 Highway Safety Analysis (3). Influencing factors (roadway characteristics, vehicle characteristics, and human factors), safety data, network screening, identification and diagnosis of safety problems, selection of countermeasures, evaluation studies, accident reconstruction. Prerequisites: STA 3033, TTE 4201.

TTE 5606 Transportation Systems Modeling and Analysis (3). Modeling and analysis techniques in transportation. Linear Programming, queueing theory, decision making techniques. Prerequisite: TTE 4201.

TTE 5607 Transportation Demand Analysis (3). Travel demand analysis and forecasting. Modeling techniques including trip generation and distribution, mode split, and trip assignment. Practical applications. Prerequisite: TTE 4201.

TTE 5805 Advanced Geometric Design of Highways (3). Parameters governing the geometric design of highways; curve super-elevation; widening on highway curves; elements of intersection design; design of interchanges; use of AASHO design guidelines. Design project required. Prerequisites: SUR 3101C and TTE 4201.

TTE 5835 Pavement Design (3). Analysis and design of sub-base, base, and pavement of a roadway. Discussions of flexible pavement and rigid pavement as structural units. Boussinesq's approach. Westergaard's theory. Beams on Elastic Foundations. Prerequisites: CEG 4011 and CES 4702.

TTE 5925 Urban Traffic Workshop (3). Selected laboratory problems related to urban traffic. Prerequisite: TTE 4201.

TTE 5930 Transportation Seminar (1-3). Oral presentations made by students, guests, and faculty members on current topics and research activities in traffic and transportation engineering. Prerequisite: TTE 4201.

URP 5312 Urban Land Use Planning (3). Elements of the general land use plan, location and space requirements; the use of models in planning; development of the land use plan; policy plan, implementation. Prerequisite: Permission of the instructor.

URP 5316 Environmental and Urban Systems (3). Overview of basic issues and principles of environmental and urban planning/design systems. Emphasis will be placed on multidisciplinary linkages.

URP 5912 Research Methods (3). Methods of information search, data interpretation, and hypotheses formulation used in the field.

APPENDIX B: PROGRAM CONSTITUENCIES

The main constituencies of the civilengineering program, that is, the most direct beneficiaries of the contributions of its graduates, have primarily been defined as the various sectors of the South Florida community that are directly served by our graduates and these graduates' professions. Most graduates stay in the community after their graduation, which directly adds to the human resources of the region. The faculty of the program identified the following three main external (to the institution) constituencies:

1) The profession (private sector)
2) The profession (public sector)
3) The alumni (i.e., graduates themselves)

The faculty also recognized that the following two internal groups (from the institution) were also directly or indirectly impacted by the success or failure of the graduates. This is because their success or failure may affect the job opportunities offered to other students after graduation, as well as the reputation of the faculty and program, amongst others:

4) The students
5) The faculty

To facilitate the input from the external constituencies, a Departmental Advisory Board (DAB) was established in 2001. The diverse membership of DAB represents alumni (junior and senior), engineering professionals, practitioners in the private sector, practitioners in the public sector, and parents of our students and alumni. The DAB membership of the constituencies is presented in the following Table.

DAB Constituency Membership

Representing Group of Constituencies	Number of Members
Profession (Private Sector)	5
Profession (Public Sector)	4
FIU Alumni	5

DAB: Departmental Advisory Board, an advisory body that represents the program-defined constituencies

The DAB developed its own bylaws in 2003 as an advisory body to the program, having the objective of being the main vehicle for the periodic evaluation of the Program Educational Objectives. The Board may also provide, as needed, periodic evaluations of program outcomes, assessment indicators of outcomes, and corrective actions. The nine (9) members of the DAB were selected by the faculty and appointed by the Chair in August 2001. The DAB members are appointed for a period of three (3) years on a rotating basis, and 1/3 of the members are either reelected or reappointed each year. The DAB has meeting regularly, on average, twice a year, once in the spring and once in the fall, since 2001. The names of the current DAB members and the constituencies that they represent are provided below:

1) Ms. Mary D. Benitez, P.E., DAB Chair, Senior Project Manager, CDM
Private Sector and Civil/Environmental Engineering Profession

2) Dr. Ben H. Chen, P.E., DAB Co-Chair, Chairman, Chen Moore and Associates
Private Sector and Civil/Environmental Engineering Profession

3) Ms. Jacquelyn Caro, E.I.
Private Sector, Civil/Environmental Engineering Profession, and Junior Alumna

4) Mr. Bruno Sanabria, P.E., Director, Baxter Export Corporation
Parents of Students/Alumni, Private Sector, and Civil/Environmental Engineering Profession

5) Mr. Dat T. Huynh, P.E., Project Development Engineer, District VI, Florida Department of Transportation
Public Sector, Civil/Environmental Engineering Profession, and Senior Alumnus

6) Mr. Rashid Z. Istambouli, P.E., Miami-Dade County Department of Regulatory and Economic Resources, Pollution Regulation Division
Public Sector, Civil/Environmental Engineering Profession, and Senior Alumnus

7) Ms. Layla Llewelyn, P.E., Project Manager/Environmental Engineer, CDM Smith
Private Sector, Civil/Environmental Engineering Profession, and Senior Alumna

8) Dr. Rena Chen, P.E., Manager, Miami-Dade Water and Sewer Department (WASD)
Public Sector, Civil/Environmental Engineering Profession, and Senior Alumna

9) Mr. Franklin A. Torrealba, P.E. Director, 300 Engineering Group, P.A.
Private Sector and Civil/Environmental Engineering Profession

APPENDIX C: CURRICULUM

Plan of study

The Civil Engineering curriculum at Florida International University is comprised of 128 credits in the areas of mathematics, basic sciences, engineering topics, and general education requirements. A full list of all required courses and selective electives, as well as a suggested schedule of courses semester-by-semester, can be found in Table C.1. Additional information about the courses and requirements for the program are included in the sections below.

Prerequisite Structure and Flow Chart for Required Courses

The program's assurance that students will comply with all curricular requirements is founded on a well-organized and established advising process. The process was previously introduced in the section on Criterion 1. The program curriculum is carefully implemented by the faculty through an advising system that ensures that each student complies with the required level of attention to, and time of study for, each professional component. The curriculum is designed as a sequence of courses that include pre-requisites and technical electives. The Department has two appointed Undergraduate Advisors, Dr. Cora Martinez and Ms. JoAnna Sanabria, whose primary responsibility is to work with each student on fulfilling all of the requirements of the program curriculum in the proper sequence.

A detailed summary of the curriculum by semester (or term) often used to advise students can be found in Table C.1. Figure C.1 presents the prerequisite flow chart for the Civil Engineering program. This course flow chart is strictly enforced by the undergraduate advisors using the Department's computerized registration system. For example, if a student did not take EGN 3311, Statics, the registration system will automatically reject the attempt to enroll in EGM 3520, Mechanics of Materials.

Description of Credit Hours and Depth of Study for Each Subject Area

The Civil Engineering program requires 128 credit hours for graduation. As shown in Table C.1, the curriculum includes 39 credits for mathematics and basic sciences, 57 credits for engineering topics, and 32 credits for general education. Courses in the Civil Engineering curriculum have varying laboratory components, oral/written communication activities, computer usage, teamwork, and design projects. Detailed course description can be found in Appendix A: Undergraduate Catalog. As previously mentioned, the course and section size summary for the Civil Engineering program is shown in Table C.1.

The Civil Engineering program curriculum is designed to provide adequate coverage of mathematics, basic sciences, engineering sciences, and general education, as well as in-depth education in six areas of Civil Engineering: structural, geotechnical, construction, water resources, environmental, and transportation engineering. The curriculum is designed to educate and train the students for graduate school and for employment in industry, government, and consulting. Laboratory experiences are integrated throughout the curriculum to give students hands-on experience in various areas of study. Students are also encouraged to gain additional laboratory exposure through undergraduate research experiences with faculty and research centers, such as the Applied Research Center and International Hurricane Research Center. Students are also encouraged to pursue summer internships for additional laboratory experience.

Included in the lower division requirements are several courses specified in the University Core Curriculum. These include two English composition courses, an Arts course, two Humanities with Writing courses (at least one being historically oriented), and two Social Science courses. All students must comply with the University Core Curriculum Requirements for the University as well as comply with departmental requirements for Social Science, Arts, Humanities, and English.

The upper division program of study encourages the development of a broadly educated Civil Engineering graduate that is able to succeed as a productive engineer with continued professional growth. The courses listed as requirements for the BS degree not only provide the students with mathematical and scientific knowledge, but also include other essentials necessary for a successful engineering career. The courses have been designed to increase student competence in written and oral communication skills, as well as develop critical thinking and creative problem solving strategies. Course projects are designed to teach engineering science fundamentals and their applications while providing enriching opportunities for laboratory and computer-based experiences. Furthermore, students are supplied with an understanding of the economic, social, and ethical responsibilities of engineers in our society and are encouraged to include sustainable development in project designs.

The program curriculum can be completed in a sequence of nine semesters and prepares the student for engineering practice in the context of technical proficiency. An example of a semester-by-semester schedule is shown in Table C.1. During the first four semesters, the curriculum provides students with a foundation in mathematics, physics, chemistry, statistics, and earth science. The curriculum then leads to a core of engineering science courses and their applications in engineering design during the last five semesters. During the first half of the curriculum, students also complete courses in English, humanities, arts, and social sciences that constitute the general educational component of the curriculum, and that complement the technical content of the curriculum beyond engineering. The program curriculum recommends that students take general education courses such as Public Speaking (for art), Microeconomics and Technology, Humans and Society (for social sciences), and History of Architecture (for humanities). Such courses complement the technical content of the curriculum by enhancing the students' communication abilities, providing general knowledge of the role of engineering and technology in society and the economy, and giving the student an overview of the origins of building design.

The required 128 credit hours necessary to graduate consist of the following groups of courses and specific courses:

1. Mathematics and Basic Sciences Component (39 credit hours, 30%):

18 credit hours in Mathematics:

- 4 in MAC 2311 Calculus I
- 4 in MAC 2312 Calculus II
- 4 in MAC 2313 Multivariable Calculus
- 3 in MAP 2302 Differential Equations
- 3 in STA3033 Introduction to Probability & Statistics for Computer Science or
  EIN 3235 Evaluation of Engineering Data

17 credit hours in Physical Science:

- 3 in CHM 1045 General Chemistry I
- 1 in CHM 1045L General Chemistry I Lab
- 3 in CHM 1046 General Chemistry II
- 1 in CHM 1046L General Chemistry II Lab
- 4 in PHY 2048 Physics I w/Calculus
- 1 in PHY 2048L Physics I Lab
- 4 in PHY 2049 Physics II w/Calculus

4 credit hours in Earth Science:

- 3 in GLY 1010 Introduction to Earth Science
- 1 in GLY 1010L Introduction to Earth Science Lab

These 39 credit hours in Mathematics, Physical Science, and Earth Science are sufficient to fulfill the ABET Program Criteria for Civil Engineering Program Curriculum: *"The program must prepare graduates to apply knowledge of mathematics through differential equations, calculus-based physics, chemistry, and at least one additional area of basic science, consistent with the program educational objectives."*

ABET General Criteria: The credit hour requirements for one year (32 semester hours or one-fourth of the total credits required for graduation) of a combination of college level mathematics and basic sciences (some with experimental experience) appropriate to the discipline. Basic sciences are defined as biological, chemical, and physical sciences.

2. General Education and Other Components (32 credit hours):

Besides the Mathematics and Physical Science courses, there are
9 credit hours in English:

- 3 in ENC 1101 Freshman Composition (University requirement)
- 3 in ENC 1102 Literary Analysis (University requirement)
- 3 in ENC 3213 Technical Writing (Departmental requirement)

16 credit hours in Humanities-Social Science:

- 1 in SLS 1501 Freshman Experience
- 3 in Societies & Identities, EGN 1033 Technology, Humans, and Society (suggested)
- 3 in Arts, SPC 2608 Public Speaking (suggested)
- 3 in Humanities with Writing I*
- 3 in Humanities with Writing II*
- 3 in Social Science,
  - ECO 2013 Macro Economics or ECO 2023 Micro Economics (suggested)

*Humanities with Writing: Choose 2 courses from the following (at least one of the courses must have a history component):

- PHI 2600 Introduction to Ethics (3)
- ARC 2701 History of Design from Antiquity to the Middle Ages (3)
- HUM 3306 History of Ideas (3)
- WOH 2001 World Civilization (3)
- EUH 2030 Western Civilization: Europe in the Modern Era (3)

AMH 2041 Origins of American Civilization (3)
AMH 2042 Modern American Civilization (3)
LAH 2020 Latin American Civilization (3)

4 credit hours in General Core Courses:
1 in EGN 2030 Ethics & Legal Aspects in Engineering
3 in EGN 3613 Engineering Economy

3 credit hours in Computer Courses:
3 in CGN 2420 Computer Tools for Engineers

ABET General Criteria:
A general education component complements the technical content of the curriculum and is consistent with the program and institution objectives.

3. Engineering Sciences and Engineering Topics Components (57 credit hours, 45%):
14 credit hours in Engineering Science:
3 in EGN 3311 Statics
3 in EGN 3321 Dynamics
3 in EGM 3520 Engineering Mechanics of Materials
1 in EGM 3520L Materials Testing Lab
3 in CWR 3201 Fluid Mechanics
1 in CWR 3201L Fluid Mechanics Lab

43 credit hours in Civil Engineering:
These 43 credit hours in civil engineering areas include at least one required course in all six recognized major Civil Engineering areas (Structural, Geotechnical, Construction, Water Resources, Environmental, and Transportation Engineering), 4 elective courses, C.E. Senior Design Project, Career Orientation in Civil Engineering, and CE Seminar: FE Review.
(1) Structural Engineering (Required 6 credit hours):
3 in CES3100 Structural Analysis
3 in CES4702 Reinforced Concrete Design*
(2) Geotechnical Engineering (Required 4 credit hours):
3 in CEG4011 Geotechnical Engineering I*
1 in CEG4011L Geotechnical Testing Lab I
(3) Construction Engineering (Required 3 credit hours):
3 in CCE 4031 Project Planning for Civil Engineers
(4) Transportation Engineering (Required 6 credit hours):
3 in SUR2101C Surveying
3 in TTE4201 Transportation & Traffic Engineering*
(5) Water Resources Engineering (Required 3 credit hours):
3 in CWR3103 Water Resources Engineering
(6) Environmental Engineering (Required 4 credit hours):
3 in ENV3001 Introduction to Environmental Engineering
1 in ENV3001L Environmental Lab
Technical Electives (Required 12 credit hours)
Senior Design* (Required 3 credit hours)

CGN 2161 Career Orientation in Civil Engineering (Required 1 credit hour)
CGN 4980 CE Seminar: FE Review (Required 1 credit hour)

Note: *These courses consist of design contents.

List of Suggested Civil Engineering Electives

	Course	Credit Hours
Structural Engineering Option	CES 4320 Intro to the Design of Highway Bridges	3
	CES 4580 Hurricane Engineering and Global Sustainability	3
	CES 4605 Steel Design	3
	CES 4711 Intro to Prestressed Concrete Structures	3
	CGN 4510 Sustainable Building Engineering	3
Water Resources Engineering Option	CWR 4204 Hydraulic Engineering	3
	CWR 4530 Modeling Application in Water Resources Engineering	3
	CWR 4620C Ecohydrological Engineering	3
	ENV 4401 Water Supply Engineering	3
Geotechnical Engineering Option	CEG 4012 Geotechnical Engineering II	4
	CEG 4126 Fundamentals of Pavement Design	3
	CES 4580 Hurricane Engineering and Global Sustainability	3
Environmental Engineering Option	ENV 4005L Environmental Laboratory II	1
	ENV 4024 Bioremediation Engineering	3
	ENV 4101 Fundamentals of Air Pollution Engineering	3
	ENV 4330 Hazardous Waste Assessment & Remediation	3
	ENV 4351 Solid & Hazardous Waste Management	3
	ENV 4401 Water Supply Engineering	3
	ENV 4513 Chemistry for Environmental Engineers	3
	ENV 4551 Wastewater Treatment Engineering	3
	ENV 4560 Reactor Design	3
Construction Engineering Option	CCE 4001 Heavy Construction	3
	CCE 5036 Advanced Project Planning for Civil Engineers	3
	CES 4580 Hurricane Engineering and Global Sustainability	3
	CGN 4510 Sustainable Building Engineering	3
	CGN 4930 Special Topics: Intro to Construction Engineering Management	3
Transportation Engineering Option	CEG 4126 Fundamentals of Pavement Design	3
	CGN 4321 GIS Applications in Civil and Environmental Engineering	3
	TTE 4102 Urban Transportation Planning	3
	TTE 4202 Traffic Engineering	3
	TTE 4203 Highway Capacity Analysis	3
	TTE 4804 Geometric Design of Highways	3
General Civil Engineering Option	CGN 4930 Special Topics: Intro to the FEM in Civil Engineering	3

	CGN 4930 Special Topics: Intro to Numerical Methods in Engineering	3
	EGN 4070 Engineering for Global Sustainability and Environmental Protection	3

Note: The Civil Engineering electives can be chosen from the Civil and Environmental Engineering courses shown in the above list, as approved by the Departmental Advisor. Other electives may be chosen, as approved by the Departmental Advisor.

The Civil Engineering curriculum includes at least required one course in all six recognized major Civil Engineering areas: Structural, Geotechnical, Construction, Water Resources, Environmental, and Transportation Engineering. These 57 credit hours (45%) in Engineering Science and Civil Engineering are enough to fulfill the ABET Program Criteria for Civil Engineering Program Curriculum: *"The program must prepare graduates to:*
(1) apply knowledge of four technical areas appropriate to civil engineering;
(2) conduct civil engineering experiments and analyze and interpret the resulting data;
(3) design a system, component, or process in more than one civil engineering context;
(4) explain basic concepts in management, business, public policy, and leadership; and
(5) explain the importance of professional licensure."

ABET General Criteria: The credit hour requirements for one and one-half years (48 semester hours or 37.5 percent of the total credits required for graduation) of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study.

The minimum credit hours towards graduation are 128 credits, in addition to the following credits (not counted in the required 128 credits):

0 in Foreign Language (10 credit hours)
0 in EGN 1110C Engineering Drawing (3 credit hours)

The Department considers that *"one-half year of study is equivalent to 16 semester credit hours."* In accordance with this consideration, the curricular components and their equivalent times of study are as follows:

1. Mathematics and Basic Sciences Component:
   39 semester credit hours > one year of study
2. General Education and Other Components:
   32 semester credit hours = one year of study
3. Engineering Sciences and Engineering Topics Component:
   57 semester credit hours > one and one-half years of study

The curriculum further enhances the knowledge of the students in six technical areas of Civil Engineering. The program curriculum requires students to take technical courses in the areas of Geotechnical Engineering, Structural Engineering, Construction Engineering, Transportation Engineering, Environmental Engineering, and Water Recourses Engineering. Additionally, students are required to take at least four Civil Engineering Electives in technical area(s) that are of particular interest. These electives are to be selected from an approved list of courses.

The engineering sciences have their roots in mathematics and basic sciences but carry knowledge further toward creative application. These studies provide a bridge between mathematics and basic sciences on the one hand and engineering practice on the other. Engineering design is the process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic sciences, mathematics, and the engineering sciences are applied to convert resources optimally to meet these stated needs.

The curriculum includes a course on engineering ethics, which is required for all undergraduate students. This course, EGN 2030 - Ethics and Legal Aspects in Engineering, is intended to expand the students' understanding of professionalism, professional conduct, professional registration, legal terminology, famous engineers, and complex projects that address different aspects of engineering challenges and dilemmas. The course explores, through case studies, the interconnections and conflicts between ethical and legal considerations of engineering practice. This course has become very popular. The fundamental canon imparted to the students is that, "the engineer shall apply specialized knowledge and skill at all times in the public interest, with honesty, integrity, and honor." Other faculties also refer to and refresh this canon implicitly and explicitly in their design courses.

A special course, ENC 3213 – Technical Writing, is typically completed by the junior level (sixth semester). This course focuses only on the study and practice of technical writing in support of Student Learning Outcome #4 - On Communication. The course is included at this level so that writing skills are developed by the time the students reach their senior year and begin their senior design major experience.

The curriculum also incorporates a one-credit seminar-style course that prepares the students for the Fundamentals of Engineering (FE) exam. This course stresses to students the importance of licensure, and provides the students with a framework for preparing for the exam through review sessions and mock exams. The importance of licensure is also emphasized to students through the department's policy that does not allow students to graduate unless they have passed the FE exam or have taken and passed the FE Review seminar with its FE-style mock exam. Due to the change in the format of the FE Exam starting in January 2014, the course has undergone changes to better prepare students for the FE Exam. The course material has been revised to follow the new topics covered by the discipline-specific Civil Engineering FE exam. The details of the course revision are shown in section II.B.3.

All admitted students must have completed two years of credit in one foreign language at the high school level or 8-10 credits in one foreign language at the college level. (American Sign Language is acceptable.) If a student is admitted to the University without this requirement, the credits must be completed prior to graduation. In addition, applicants whose native language is not English and who have not taken any college level English courses must present a minimum score on the Test of English as a Foreign Language (TOEFL): 500 for the paper-based exam, 173 for the computer-based exam, and 63 for the internet-based (iBT) exam.

As previously described for the technical elective courses, the major areas of focus are: Structural Engineering, Water Resources Engineering, Geotechnical Engineering, Environmental Engineering, Construction Engineering, and Transportation Engineering. All recommended and other technical electives must be approved by the advisor and must focus on relevant applications of

Civil Engineering. Selection of a proper sequence allows the student to specialize within a focus area of interest, and a certificate of specialization is given if at least nine credits of technical electives are taken in one focus area.

Major Design Experience

Design concepts, methodology, and teamwork are incorporated throughout the Civil Engineering curriculum. This course of study culminates in a major engineering design experience offered in CGN 4802 - Civil Engineering Senior Design Project, which is mandatory for all Seniors. The course has been offered consistently every term in the academic year, including summer terms. It is regularly taught by the most experienced practitioners and registered professional engineers in the industry. Students are organized into teams and work both individually and collectively to provide a solution to a practical engineering problem. They have an opportunity to apply a broad spectrum of specific knowledge from the Civil Engineering curriculum, including computational techniques and constraints (i.e., environment, economics, safety, ethics, and social impact). The course also requires the presentation of results in the form of a written technical report and an oral presentation by the teams.

Beyond the Civil Engineering Senior Design experience, the design components of core curriculum courses are most typically presented in the classroom and then reinforced through hands-on laboratory experiences, homework, discussions during project assignments, and field trips, if applicable. The pedagogy encourages students to exercise initial unrestrained creativity, followed by a critical evaluation of alternatives, analysis of each reasonable choice, selection of an optimal solution, provision of a cost estimate, if applicable, and recommendation of an implementation approach.

Cooperative Education Opportunity

Cooperative education is offered as a course for interested undergraduate students. The cooperative education credits do not count towards the 128 credits necessary to fulfill the degree requirements. The students can find internships with local public and private organizations. These internships are often made available through the Industrial Advisory Board members (who advise the Department on teaching, research, and service issues that are relevant to all degree programs) and through special agreements with local government entities such as the U.S. Army Corps of Engineers, the South Florida Water Management District, Florida Department of Transportation, and Miami-Dade County agencies.

Table C.1 Curriculum of Bachelor of Science in Civil Engineering

Course (Department, Number, Title) List all courses in the program by term starting with the first term of the first year and ending with the last term of the final year.	Indicate Whether Course is Required, Elective or a Selected Elective by an R, an E or an SE.[1]	Subject Area (Credit Hours) Math & Basic Sciences	Engineering Topics Check if Contains Significant Design (√)	General Education	Maximum Section Enrollment for the Last Two Terms the Course was Offered[2]
First Semester					
SLS 1501: First Year Experience	R			*1*	*33, 23*
MAC 2311: Calculus I	R	*4*			*51, 50*
CHM 1045: General Chemistry I	R	*3*			*225, 297*
CHM 1045L: General Chemistry Lab I	R	*1*			*25, 23*
ENC 1101: Writing and Rhetoric I	R			*3*	*40, 58*
GLY 1010: Introduction to Earth Science	R	*3*			*92, 100*
GLY 1010L: Introduction to Earth Science Lab	R	*1*			*24, 24*
Second Semester					
MAC 2312: Calculus II	R	*4*			*51, 49*
PHY 2048: Physics with Calculus I	R	*4*			*120, 148*
PHY 2048L: General Physics Lab I	R	*1*			*30, 30*
ENC 1102: Writing and Rhetoric II	R			*3*	*34, 51*
Foundations of Social Inquiry/Social Science Requirement	SE			*3*	--
Third Semester					
Societies and Identities/Social Science Requirement	SE			*3*	--
EGN 1110C: Engineering Drawing	R			*0*	*48, 40*
CHM 1046: General Chemistry II	R	*3*			*311, 204*
CHM 1046L: General Chemistry Lab II	R	*1*			*23, 21*
MAC 2313: Multivariable Calculus	R	*4*			*44, 47*

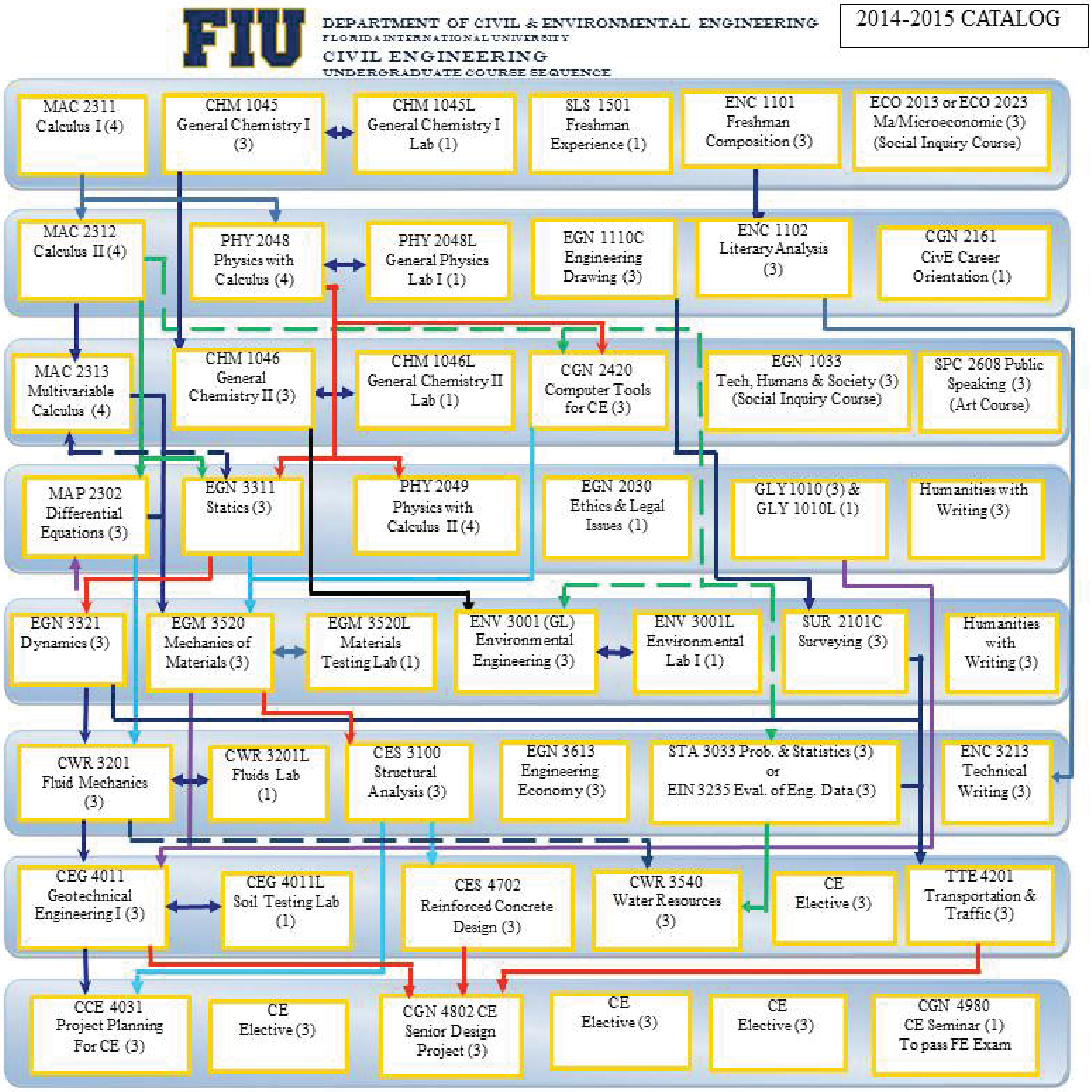
Fourth Semester					
PHY 2049: Physics with Calculus II	R	*4*			*147, 125*
CGN 2420: Computer Tools for Engineers	R			*3*	*40, 32*
MAP 2302: Differential Equations	R	*3*			*46, 46*
CGN 2161: Career Orientation in Civil Engineering	R		*1*		--
Humanities with Writing – Historical Requirement	SE			*3*	--
Fifth Semester					
EGN 3311: Statics	R		*3*		*61, 55*
SUR 2101C: Surveying	R		*3*		*41, 35*
ENC 3213: Professional and Technical Writing	R			*3*	*28, 28*
Humanities with Writing Requirement	SE			*3*	--
Arts Requirement	SE			*3*	--
Sixth Semester					
STA 3033: Probability and Statistics for CS or EIN 3235: Evaluation of Engineering Data	SE	*3*			*55, 56* *63, 55*
EGN 3321: Dynamics	R		*3*		*54, 60*
EGM 3520: Engineering Mechanics of Materials	R		*3*		*56, 43*
EGM 3520L: Materials Testing Lab	R		*1*		*25, 24*
EGN 2030: Ethics & Legal Aspects in Engineering	R			*1*	*42, 40*
EGN 3613: Engineering Economy	R			*3*	*78, 76*
Seventh Semester					
CWR 3201: Fluid Mechanics	R		*3*		*59, 30*
CWR 3201L: Fluid Mechanics Lab	R		*1*		*27, 18*
ENV 3001: Introduction to Environmental Engineering	R		*3*		*52, 60*
ENV 3001L: Environmental Laboratory I	R		*1*		*20, 20*
CES 3100: Structural Analysis	R		*3*		*50, 43*
TTE 4201: Transportation and Traffic Engineering	R		3√		*31, 16*

Eighth Semester					
CEG 4011: Geotechnical Engineering I	R		*3√*		*26, 41*
CEG 4011L: Geotechnical Testing Laboratory	R		*1*		*19, 24*
CES 4702: Reinforced Concrete Design	R		*3√*		*16, 41*
CWR 3540: Water Resources Engineering	R		*3*		*28, 44*
CE Technical Elective (see list below)**	SE		*3*		**
CE Technical Elective (see list below)**	SE		*3*		**
Ninth Semester					
CCE 4031: Project Planning for Civil Engineers	R		*3*		*29, 26*
CGN 4802: Civil Engineering Senior Design Project	R		*3√*		*33, 25*
CE Technical Elective (see list below)	SE		*3*		**
CE Technical Elective (see list below)	SE		*3*		**
CGN 4980: Civil Engineering Seminar	R		*0*		*23, 17*
****List of CE Technical Electives**					
CCE 4001 Heavy Construction	SE		*3*		*4, 23*
CCE 5036 Advanced Project Planning for Civil Engineers	SE		*3*		*15, 3*
CEG 4012 Geotechnical Engineering II	SE		*4√*		*11, 20*
CEG 4126 Fundamentals of Pavement Design	SE		*3√*		*25, 12*
CES 4320 Intro to the Design of Highway Bridges	SE		*3√*		*14, 11*
CES 4580 Hurricane Engineering and Global Sustainability	SE		*3*		
CES 4605 Steel Design	SE		*3√*		*30, 35*
CES 4711 Intro to Prestressed Concrete Structures	SE		*3√*		*9, 4*
CGN 4321 GIS Applications in Civil and Environmental Engineering	SE		*3*		*35, 40*
CGN 4510 Sustainable Building Engineering	SE		*3√*		*13, 20*
CGN 4930 Special Topics: Intro to the FEM in Civil Engineering	SE		*3*		*4,15*
CGN 4930 Special Topics: Intro to Numerical Methods in Engineering	SE		*3*		*9, 7*
CGN 4930 Special Topics: Intro to Construction Engineering Management	SE		*3*		*25, 28*
CWR 4204 Hydraulic Engineering	SE		*3√*		*22, 17*

CWR 4530 Modeling Application in Water Resources Engineering	SE		*3*		*4, 11*
EGN 4070 Engineering for Global Sustainability and Environmental Protection	SE		*3*		*16*
ENV 4005L Environmental Laboratory II	SE		*1*		*14, 12*
ENV 4024 Bioremediation Engineering	SE		*3√*		*19, 15*
ENV 4101 Fundamentals of Air Pollution Engineering	SE		*3√*		*7, 13*
ENV 4330 Hazardous Waste Assessment & Remediation	SE		*3√*		*1, 4*
ENV 4351 Solid and Hazardous Waste Management	SE		*3√*		*16, 20*
ENV 4401 Water Supply Engineering	SE		*3√*		*14, 12*
ENV 4513 Chemistry for Environmental Engineers	SE		*3*		*15, 12*
ENV 4551 Wastewater Treatment Engineering	SE		*3√*		*6, 11*
ENV 4560 Reactor Design	SE		*3√*		*11*
TTE 4202 Traffic Engineering	SE		*3*		*11, 27*
TTE 4203 Highway Capacity Analysis	SE		*3*		*39, 26*
TTE 4804 Geometric Design of Highways	SE		*3√*		*4, 15*
Add rows as needed to show all courses in the curriculum.					
TOTALS-ABET BASIC-LEVEL REQUIREMENTS		39	57	32	
OVERALL TOTAL CREDIT HOURS FOR COMPLETION OF THE PROGRAM					
PERCENT OF TOTAL		30.2%	45.0%	24.8%	
Total must satisfy either credit hours or percentage: Minimum Semester Credit Hours		32 Hours	48 Hours		
Total must satisfy either credit hours or percentage: Minimum Percentage		25%	37.5 %		

1. **Required** courses are required of all students in the program, **elective** courses (often referred to as open or free electives) are optional for students, and **selected elective** courses are those for which students must take one or more courses from a specified group.
2. For courses that include multiple elements (lecture, laboratory, recitation, etc.), indicate the maximum enrollment in each element. For selected elective courses, indicate the maximum enrollment for each option.

Figure C.1 Prerequisite and Course Sequence Flow Chart



Structures/Geotechnical/Construction Electives*

CCE 4001	Heavy Construction
CEG 4012	Geotechnical Engineering II
CEG 4126	Fundamentals of Pavement Design
CES 4320	Intro to the Design of Highway Bridges
CES 4580	Hurricane Engineering and Global Sustainability (GL)
CES 4600	Intro to the Design of Tall Buildings
CES 4605	Steel Design
CES 4711	Intro to Prestressed Concrete Structures
CGN 4510	Sustainable Building Engineering Intro.
CGN 4930	to Construction Management
EGN 4XXX	Introduction to the Finite Element Method

Transportation Electives*

CEG 4126	Fundamentals of Pavement Design
CGN 4321	GIS Applications in Civil and Env. Eng.
TTE 4102	Urban Transportation Planning
TTE 4202	Traffic Engineering
TTE 4203	Highway Capacity Analysis
TTE 4804	Geometric Design of Highways

Environmental and Water Resources Electives*

CGN 4321	GIS Applications in Civil and Env. Eng.
CWR 4204	Hydraulic Engineering
CWR 4620C	Ecohydrological Engineering
CWR 4530	Modeling Appl. In Water Resources Eng.
EGN 4070	Engineering for Global Sustainability and Environmental Protection (GL)
ENV 4024	Bioremediation Engineering
ENV 4101	Fundamentals of Air Pollution Engineering
ENV 4330	Hazardous Waste Assessment & Remediation
ENV 4351	Solid and Hazardous Waste Management
ENV 4401	Water Supply Engineering
ENV 4513	Chemistry for Environmental Engineers
ENV 4551	Wastewater Treatment Engineering
ENV 4560	Reactor Design

*If 3 electives are taken in 1 area, student will receive a certificate.

(GL) indicates Global Learning course. Students are required to take 2 GL courses, and at least 1 must be discipline-specific.

APPENDIX D: FACULTY

Faculty Qualifications

As documented in Table D.1, all 21 regular faculty members hold Ph.D. degrees in civil engineering, environmental engineering, or related fields and teach only in their areas of expertise. Their qualifications is based on both their educational background as well as on experience gained through years as practitioners or researchers in their respective fields. In addition, 11 (53%) of the faculty in the Department hold professional registration in at least one US state and several have achieved national specialty professional certifications.

All faculty hold membership in at least one professional society or organization, with the majority involved in several of these societies or organizations extending over the local, regional, national, and international levels. Professional activities include attending meetings/conferences, making presentations there, organizing conferences or conference sessions, serving on committees, serving as referees for technical journals, and reviewing proposals for funding agencies, among others.

The area faculty members and their areas of expertise are listed below:

***Construction Engineering*:**
- **None**

***Environmental and Water Resources Engineering*:**
- Dr. Hector R. Fuentes: Water resources, water quality, sustainable engineering, pollution prevention and control, water and wastewater reclamation, and experimental and modeling applications.
- Dr. Shonali Laha: Physicochemical and microbial processes, fate of contaminants, hazardous waste treatment technologies, and environmental protection in developing countries.
- Dr. Walter Zhonghong Tang: Physicochemical treatment, advanced oxidation processes, quantitative structure and activity relationships, health risk assessment, and ecosystem restoration
- Dr. Berrin Tansel: Hazardous and industrial waste management, membrane processes, site remediation, contaminant-surface interaction, and fate and transport modeling.
- Dr. Anna Bernardo Bricker (Instructor, Environmental Lab Coordinator): Air Pollution
- Dr. Cora Martinez (Instructor, Undergraduate Advisor): Hydrologic modeling and Computational Methods

***Geotechnical Engineering*:**
- Dr. Seung Jae Lee: Computational Geomechanics and nonlinear finite elements.

***Pavement Engineering*:**
- Dr. Hesham Ali (Half-line Professor of Practice): Green Pavement Engineering
- Dr. Michael Bienvenu (Half-line, Professor of Practice): Concrete Pavement Engineering

***Structural and Wind Engineering*:**

- Dr. Atorod Azizinamini (Chair of Civil and Environmental Engineering Department): Steel bridge and accelerated bridge construction (ABC)
- Dr. Arindam Chowdhury: Laboratory simulation of tornadoes and microbursts and their interaction with structures and instrumentation of wind tunnels.
- Dr. David Garber: Prestressed concrete, performance of reinforced concrete structures, bridge engineering, and accelerated bridge construction (ABC)
- Dr. Kingsley Lau: Corrosion Engineering
- Dr. Ton-Lo Wang: Railway and highway bridge vibration, impact, reliability, load distribution, and fatigue damage analysis.
- Dr. Ioannis Zisis: Wind Engineering

***Transportation Engineering*:**

- Dr. Priyanka Alluri: Transportation engineering and highway safety
- Dr. Albert Gan: Traffic and transit operations, traffic simulation and control, highway safety, and transportation information systems.
- Dr. Mohammed Hadi: ITS hardware and software, vehicle-infrastructure integration (VII), traffic control systems, freeway operations, traffic simulation, decision analysis, and highway safety.
- Dr. Xia Jin: Geographic information systems, travel demand modeling, public transit, and transportation and land use interactions.
- Dr. L. David Shen: Guideway transit, intermodel facilities, and airport planning and design.
- Dr. Khokiat Kengskool (Instructor): Economical analysis and transportation planning

Faculty Workload

Table D.2 provides information on the workload of each of our 21 regular faculty members. As indicated, the number of courses taught by each member ranges from one to three per semester. The course workload for each faculty is assigned by the Department Chair based on the faculty's level of research, graduate student supervision, and professional service activities. In general, faculty members with a high level of such activities are assigned one course per semester, followed by two for medium level and three for low level. Tenure-track faculty members are generally assigned only one course per semester to provide them with ample time to develop a successful research program. The Undergraduate Advisor, Dr. Cora Martinez, is generally assigned one course with two sections each semester. Dr. Cora Martinez also administers some co-op sections and an FE Review course that is team-taught by most of the faculty members each semester. Starting in Fall 2013, the Department hired the second undergraduate advisor, Mrs. JoAnna Sanabria, to assist Dr. Cora Martinez in undergraduate advising to further improve our advising service to more than 600 undergraduate students.

Table D.2 also indicates that a majority of our faculty members have been very active in research and scholarly activities. Last year, the faculty collectively attracted a total of $6.1M in new external research contracts—the highest among nine civil engineering departments (UF, USF, UCF, FIU, FAU, UM, UNF, FGCU, and FSU/FAMU) in the state of Florida in terms of funding per faculty.

Professional Development

Faculty professional development is planned for by the individual faculty members. Faculty members are encouraged to attend professional meetings, conferences, workshops, and seminars, etc., and an assessment of involvement in such activities for the past year is a part of the annual faculty evaluation by the Department Chair.

Many professional development opportunities, especially in the area of teaching and research administration, are available on campus free of charge. All faculty and staff are encouraged to take advantage of these campus resources and are informed of these opportunities via a University-wide email mailing list as well as hardcopy announcements.

Each year, faculty sabbaticals are awarded to selected faculty and funded by the University. Sabbatical requests are first submitted to the Chair for approval. Before granting a sabbatical request, the Chair makes sure the regular operations of the Department, especially its course offerings, will not be affected. Only one faculty member is usually approved for sabbatical each year to minimize its impact. This has worked out well given the size of the faculty.

Over the past few years, each faculty member has been provided with up to $1,000 each year to help compensate for the expenses of professional development activities. This funding has been provided by the Dean's Office.

Faculty members with research contracts have been able to supplement the above funding from three additional sources, as follows:

1) Travel budgets included in contracts.
2) Leftover funds at contract completion. A significant portion of our contracts and grants have been lump-sum. The university policy allows up to 25%, in an amount not to exceed $25,000, of the total budget of a lump-sum contract to remain unspent and be retained by the Principal Investigators (PIs).
3) Indirect cost return to the PIs. The University also returns a portion of the indirect cost to both the Department and the PIs.

Funds from the latter two sources are unrestricted and are generally used by PIs to support professional development activities, facility improvements, and student activities. In short, the funding for professional development activities for our faculty has been quite adequate.

Authority and Responsibility of Faculty

The authority of the faculty covers all of the curricular aspects of the programs. Most of the curricular initiatives are channeled through UPAC, including course creation, in order to ensure compliance with all applicable ABET criteria.

Course creation is generally initiated by individual faculty members. New faculty members are especially encouraged to submit new course proposals as part of their professional development and as a contribution to the program. New courses are also often created by other faculty members to keep up with emerging technologies and current trends.

Over the years, the faculty has been particularly enthusiastic about offering and developing more elective courses. Since the last ABET review in 2008, more than 10 new senior electives have been developed and offered to our undergraduate students. Some of these courses have been offered for evaluation of their potential success prior to consideration of their official inclusion as technical electives in the curriculum. In addition, a number of new graduate courses have also been made available as electives to good undergraduate students, especially those enrolled in our Combined B.S./M.S. Program. Currently, there are over 30 technical elective courses that students may choose from to meet the elective program requirements.

Course modification in terms of course content, delivery methods, learning objectives, etc., is a continuous process (see section on Criterion 4 for continuous improvements to the program), and it is a direct result of our faculty efforts to improve teaching based on previous course experiences as well as from feedback received from course evaluations. An assessment of efforts to improve faculty teaching for the past year is a part of the annual faculty evaluation by the Department Chair.

All changes to the program curriculum, including both new programs and new courses, are first discussed and voted on by UPAC. Changes approved by UPAC are then presented to the full faculty for further discussion and approval. Changes approved by the full faculty are then submitted to the College Curriculum Committee, which is made up of one representative from each department in the College. All changes must be approved by all members of the Committee and signed by the Academic Dean before submitting to the University Curriculum Committee for final approval during Faculty Senate meetings.

Table D.1 Faculty Qualifications

Bachelor of Science in Civil Engineering

Faculty Name	Highest Degree Earned- Field and Year	Rank [1]	Type of Academic Appointment[2] T, TT, NTT	FT or PT[3]	Years of Experience			Professional Registration/ Certification	Level of Activity[4] H, M, or L		
					Govt./Ind. Practice	Teaching	This Institution		Professional Organizations	Professional Development	Consulting/summer work in industry
Hesham Ali	Ph.D., 1997 Geotechnical and Pavement Engineering	O	NTT	FT				P.E., C.P.M	M	L	M
Priyanka Alluri	Ph.D., 2010 Transportation Engineering	AST	TT	FT		2		P.E.	M	L	L
Atorod Azizinamini	Ph.D., 1985 Structural and Bridge Engineering	P	T	FT				P.E.	H	H	M
Anna Bernardo-Bricker	Ph.D., 2008	I	NTT	FT	2	20	11		L	L	L

	Environmental Engineering											
Michael Bienvenu	Ph.D., 1997 Pavement Engineering	O	NTT	FT				P.E.	M	L	M
Arindam Gan Chowdhury	Ph.D., 2004 Structural and Wind Engineering	ASC	T	FT	3	8	8		M	M	L
Hector R. Fuentes	Ph.D., 1982 Environmental and Water Resources Engineering	P	T	FT	11	36	22	P.E., B.C.E.E.	M	L	L
Albert Gan	Ph.D., 1996 Transportation Engineering	P	T	FT	0	18	15	E.I.	M	M	L
David B. Garber	Ph.D., 2013 Structural Engineering	AST	TT	FT		2		E.I.	M	L	L
Mohammed Hadi	Ph.D., 1990 Transportation Engineering	ASC	T	FT	11	14	8	P.E.	H	H	M

Xia Jin	Ph.D., 2007 Transportation Engineering	AST	TT	FT	5	3	3	AICP	M	M	L
Khokiat Kengskool	Ph.D., 1986 Transportation Engineering	I	NTT	FT		28	28		L	L	L
Shonali Laha	Ph.D., 1992 Environmental Engineering	ASC	T	FT	2	20	20	P.E.	L	L	L
Kingsley Lau	Ph.D., 2010 Structural Engi-neering	AST	TT	FT	2	1	1	E.I.	M	L	L
Seung Jae Lee	Ph.D., 2013 Structural Engi-neering	AST	TT	FT		2		E.I.	M	L	L
Cora Martinez	Ph.D., 2009 Computational Methods	I	NTT	FT		21	4		L	L	L
L. David Shen	Ph.D., 1982 Transportation	P	T	FT	3	29	29	P.E., T.E.	L	L	L

	Engineering										
Walter Tang	Ph.D., 1993 Environmental and Water Resources Engineering	ASC	T	FT	0	23	23	P.E.	L	M	L
Berrin Tansel	Ph.D., 1985 Environmental Engineering	P	T	FT	6	23	23	P.E.	H	H	L
Ton-Lo Wang	Ph.D., 1984 Structural Engineering	P	T	FT	2	29	29	P.E.	L	L	L
Ioannis Zisis	Ph.D., 2011 Structural and Wind Engineering	AST	TT	FT	0	1	1		M	L	L

Instructions: Complete table for each member of the faculty in the program. Add additional rows or use additional sheets if necessary. Updated information is to be provided at the time of the visit.

1. Code: P = Professor ASC = Associate Professor AST = Assistant Professor I = Instructor A = Adjunct O = Other
2. Code: T = Tenured TT = Tenure Track NTT = Non Tenure Track
3. Code: FT = Full-time PT = Part-time Appointment at the institution.
4. The level of activity (high, medium or low) should reflect an average over the year prior to the visit plus the two previous years.

Table D.2 Faculty Workload Summary

Bachelor of Science in Civil Engineering

Faculty Member (name)	PT or FT[1]	Classes Taught (Course No./Credit Hrs.) Term and Year[2] (fall 2015), (spring 2016) All courses are 3-credit hours	Program Activity Distribution[3]			% of Time Devoted to the Program[5]
			Teaching	Research or Scholarship	Other[4]	
Hesham Ali[6]	FT	(CEG4011), (CEG4011, CGN6939[16])	30%	20%	50%[6]	30%
Priyanka Alluri[15]	FT	(TTE5805/TTE4804[18])	12.5%	37.5%	50%[15]	12.5%
Atorod Azizinamini[7]	FT	(CES5325), (CES5606)	25%	25%	50%[7]	50%
Anna Bernardo-Bricker[14]	FT	(ENV3001L, ENV4005L, ENV4101), (ENV3001L, ENV5105, EGN4070)	75%	12.5%	12.5%[14]	87.5%
Michael Bienvenu[6]	FT	(CGN4802, CCE4001/CCE5405[18]), (CGN4802, CCE 5035/CGN4930[18])	50%		50%[6]	50%
Arindam Gan Chowdhury[6]	FT	(CES4580)	12.5%	37.5%	50%[6]	12.5%
Hector R. Fuentes[9]	FT	(CWR5535C), (CWR3540, CWR6125)	37.5%	12.5%	50%[9]	37.5%
Albert Gan	FT	(TTE6257), (TTE5205)	25%	75%		25%
David B. Garber	FT	(CES6706), (CES4702, CES5715/CES4711[18])	37.5%	62.5%		37.5%
Mohammed Hadi[11]	FT	(TTE5215), (TTE5273)	25%	50%	25%[11]	25%
Xia Jin	FT	(CGN5320), (TTE5607)	25%	75%		25%
Khokiat Kengskool[16]	FT	(EGN3613), (EGN3613)	100%			100%
Shonali Laha	FT	(ENV3001, ENV5406/ENV4401[18], ENV5027/ENV4024[18]), (ENV3001, ENV4551, ENV5519/ENV4513[18])	75%	25%		75%
Kingsley Lau[12]	FT	(CES3100), (CES3100, CES5870)	37.5%	37.5%	25%[12]	37.5%
Seung Jae Lee	FT	(EGM5351, CEG4012), (CEG6105)	37.5%	62.5%		37.5%
Cora Martinez[13]	FT	(CGN2161, CGN2420, CGN4980[17]), (CGN2161, CGN2420, CGN4980[17])	50%		50%[13]	100%

L. David Shen[4]	FT				100%[4]	0%
Walter Tang	FT	(CWR3201, CWR5235), (CWR3201, CWR4204, ENV5559/ENV4560[18])	62.5%	37.5%		62.5%
Berrin Tansel[10]	FT	(ENV3081, CGN6939[16]), (ENV4891, ENV 5356/ENV4351[18], CGN6939[16])	50%	25%	25%[10]	75%
Ton-Lo Wang[8]	FT	(EGM3520), (CES5106, EGM3520)	37.5%	12.5%	50%[8]	87.5%
Ioannis Zisis	FT	(CES5587, CGN6939[16]), (EGN 1110C)	30%	70%		25%

1. FT = Full Time Faculty or PT = Part Time Faculty, at the institution
2. For the academic year for which the self-study is being prepared.
3. Program activity distribution should be in percent of effort in the program and should total 100%.
4. Indicate sabbatical leave, etc., under "Other."
5. Out of the total time employed at the institution.
6. Joint appointments (half-line positions)
7. Chair of Department of Civil and Environmental Engineering
8. Associate Chair of Undergraduate Studies of Civil and Environmental Engineering Department
9. Associate Chair of Graduate Studies of Civil and Environmental Engineering Department
10. Undergraduate Program Director
11. Graduate Program Director
12. Co-Graduate Program Director
13. Undergraduate Advisor
14. Environmental Lab Coordinator
15. Leave of Absence (LOV) for fall 2015
16. CGN 6939 Graduate Seminar (0-credit hour)
17. DGN4980 Civil Engineering Seminar – FE Review (0-credit hour)
18. Cross-listed with one undergraduate or graduate course

APPENDIX E: SLO and PO Assessment Results

1. Student Learning Outcome (SLO) Assessment Results

1.1. 2012-2013

Florida International University: Student Learning Outcome Assessment 2012-2013

Academic Unit: Civil & Environmental Engineering Page 1

Degree Program: BS – Civil Engineering – 140801

Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Student Learning Outcome (Stated in Measurable Terms)	Assessment Method	Results (Data Summary and Analysis)
Content: Graduates will demonstrate the ability to apply the integrated knowledge of mathematics, science, and engineering to solve civil engineering design problems.	The Undergraduate Program Advisory Committee (UPAC) identified Civil Engineering Senior Design Project (CGN 4802) as appropriate to assess this outcome. In the Senior Design course, students will propose, design, analyze, and present a comprehensive solution for a civil engineering design problem in a multidisciplinary team using concepts of mathematics, physics, and engineering. **Artifact** This outcome will be assessed with the detailed calculations and analysis in the technical report that each team submits for the senior design project. **Evaluation Process** The artifact will be assessed by a faculty panel consisting of the course instructor(s), a minimum of two additional faculty members, and the external panelists invited to the senior design presentations. **Sampling** All senior design team projects will be assessed every semester. **Minimum Criteria for Success** Student teams will achieve a minimum of "average" on a 3-point rubric where 1 corresponds to "weak", 2 with "average", and 3 with "excellent.	A total of 40 students were registered in the CE Senior Design Project (CGN 4802) in the Fall 2012 semester; 19 students were registered in CGN 4802 in the Spring 2013 semester. The students worked in teams of six to ten members for their design projects. Each team was assessed by a three person panel using a previously prepared rubric to score the content outcome that included development of alternate designs, QA/QC, construction schedule, and cost estimates. On average each team received a ranking of satisfactory to excellent for the content SLO, thereby meeting the minimum criteria for success. The average score was 2.3.

Use of Results for Improving Student Learning
Team projects allowed discussion and enhanced learning.

Florida International University: Student Learning Outcome Assessment 2012-2013

Academic Unit: Civil & Environmental Engineering

Degree Program: BS – Civil Engineering – 140801

Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Student Learning Outcome (Stated in Measurable Terms)	**Assessment Method**	**Results (Data Summary and Analysis)**
<u>Critical Thinking:</u> Graduates will collect information, analyze and interpret results, and apply these in a civil engineering design system.	Undergraduate Program Advisory Committee (UPAC) identified Senior Design Project (CGN 4802) as appropriate to assess this outcome. In the Senior Design course, students will propose, design, analyze, and present a comprehensive solution for a civil engineering design problem in a multidisciplinary team using concepts of mathematics, physics, and engineering. **Artifact** This outcome will be assessed with the discussion, conclusion, and justification sections of the technical report and corresponding oral presentation areas, including the overall reasonableness of the engineering solution proposed. **Evaluation Process** The artifact will be assessed by a faculty panel with a minimum of three members. **Sampling** All senior design team projects will be assessed every semester. **Minimum Criteria for Success** Student teams will achieve a minimum of "average" on a 3-point rubric where 1 corresponds to "weak", 2 with "average", and 3 with "excellent.	A total of 40 students were registered in the CE Senior Design Project (CGN 4802) in the Fall 2012 semester; 19 students were registered in CGN 4802 in the Spring 2013 semester. The students worked in teams of six to ten members for their design projects. Each team was assessed by a three person panel using a rubric to score the critical thinking outcome that included consideration of project impacts on the natural and social environment, maintaining professionally accepted standards, and exhibiting ethical behavior. On average each team received a ranking of satisfactory to excellent for the critical thinking SLO, thereby meeting the minimum criteria for success. The average score was 2.5.
Use of Results for Improving Student Learning		
Design software available allowed evaluation of design alternatives		

Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Student Learning Outcome (Stated in Measurable Terms)	**Assessment Method**	**Results (Data Summary and Analysis)**
Technology outcome: Graduates will utilize the techniques and skills of modern scientific and engineering technology (such as MathCad and AutoCad) for civil engineering practice.	Undergraduate Program Advisory Committee (UPAC) identified Senior Design Project (CGN 4802) as appropriate to assess this outcome. In the Senior Design course, students will propose, design, analyze, and present a comprehensive solution for a civil engineering design problem in a multidisciplinary team using concepts of mathematics, physics, and engineering. **Artifact** This outcome will be assessed with the AutoCad drawings and demonstration of use of appropriate software to assist in design calculations as evidenced in the technical report. **Evaluation Process** The artifact will be assessed by a faculty panel with a minimum of three members. **Sampling** All senior design team projects will be assessed every semester. **Minimum Criteria for Success** Student teams will achieve a minimum of "average" on a 3-point rubric where 1 corresponds to "weak", 2 with "average", and 3 with "excellent.	A total of 40 students were registered in the CE Senior Design Project (CGN 4802) in the Fall 2012 semester; 19 students were registered in CGN 4802 in the Spring 2013 semester. The students worked in teams of six to ten members for their design projects. Each team was assessed by a three person panel using a previously prepared rubric to score the technology outcome that included the use of computer-aided drafting and other appropriate software. On average each team received a ranking of satisfactory to excellent for the technology outcome, thereby meeting the minimum criteria for success. The average score was 2.7.
Use of Results for Improving Student Learning		
Design software available allowed evaluation of design alternatives.		

Degree Program: BS – Civil Engineering – 140801

Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Student Learning Outcome (Stated in Measurable Terms)	**Assessment Method**	**Results (Data Summary and Analysis)**
Communication: Graduates will communicate engineering ideas orally and in a written format by presenting their semester-long design efforts in a formal and professional manner.	Undergraduate Program Advisory Committee (UPAC) identified Senior Design Project (CGN 4802) as appropriate to assess this outcome. In the Senior Design course, students will propose, design, analyze, and present a comprehensive solution for a civil engineering design problem in a multidisciplinary team using concepts of mathematics, physics, and engineering. **Artifact** This outcome will be assessed with the oral presentation component and the overall written technical report. **Evaluation Process** The artifact will be assessed by a faculty panel with a minimum of three members. **Sampling** All senior design team projects will be assessed every semester. **Minimum Criteria for Success** Student teams will achieve a minimum of "average" on a 3-point rubric where 1 corresponds to "weak", 2 with "average", and 3 with "excellent.	A total of 40 students were registered in the CE Senior Design Project (CGN 4802) in the Fall 2012 semester; 19 students were registered in CGN 4802 in the Spring 2013 semester. The students worked in teams of six to ten members for their design projects. Each team was assessed by a three person panel using a previously prepared rubric to score the communication outcome that included the team's oral communication skills, written engineering reports, and effective marketing tools produced. On average each team received an average or above grade for the communication outcome, thereby meeting the minimum criteria for success. The average score was 2.6.

Use of Results for Improving Student Learning
Power point and video presentation allowed good feedback.

Summarize use of results for continuous improvement of learning:

Team projects allowed discussion and enhanced learning.

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Power point and video presentation allowed good feedback.

Design software available allowed evaluation of design alternatives.

Team projects allowed discussion and enhanced learning.

UPAC believes that it is critical that there is greater faculty participation in the outcomes assessment and want to encourage greater faculty attendance of the senior design projects.

1.2. 2013-2014

Florida International University: Student Learning Outcome Assessment 2013-2014

Academic Unit: Civil & Environmental Engineering

Degree Program: BS – Civil Engineering – 140801

Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Student Learning Outcome (Stated in Measurable Terms)	**Assessment Method**	**Results (Data Summary and Analysis)**
<u>Content:</u> Graduates will demonstrate the ability to apply the integrated knowledge of mathematics, science, and engineering to solve civil engineering design problems.	The Undergraduate Program Advisory Committee (UPAC) identified Civil Engineering Senior Design Project (CGN 4802) as appropriate to assess this outcome. In the Senior Design course, students will propose, design, analyze, and present a comprehensive solution for a civil engineering design problem in a multidisciplinary team using concepts of mathematics, physics, and engineering. **Artifact** This outcome will be assessed with the detailed calculations and analysis in the technical report that each team submits for the senior design project. **Evaluation Process** The artifact will be assessed by a faculty panel consisting of the course instructor(s), a minimum of two additional faculty members, and the external panelists invited to the senior design presentations. **Sampling** All senior design team projects will be assessed every semester. **Minimum Criteria for Success** Student teams will achieve a minimum of "average" on a 3-point rubric where 1 corresponds to "weak", 2 with "average", and 3 with "excellent.	A total of 33 students were registered in the CE Senior Design Project (CGN 4802) in the Fall 2013 semester; 25 students were registered in CGN 4802 in the Spring 2014 semester. The students worked in teams of six to ten members for their design projects. Each team was assessed by a three person panel using a previously prepared rubric to score the content outcome that included development of alternate designs, QA/QC, construction schedule, and cost estimates. On average each team received a ranking of satisfactory to excellent for the content SLO, thereby meeting the minimum criteria for success. The average score was 2.4.

Use of Results for Improving Student Learning
Team projects allowed discussion and enhanced learning.

Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Student Learning Outcome (Stated in Measurable Terms)	**Assessment Method**	**Results (Data Summary and Analysis)**
<u>Critical Thinking:</u> Graduates will collect information, analyze and interpret results, and apply these in a civil engineering design system.	Undergraduate Program Advisory Committee (UPAC) identified Senior Design Project (CGN 4802) as appropriate to assess this outcome. In the Senior Design course, students will propose, design, analyze, and present a comprehensive solution for a civil engineering design problem in a multidisciplinary team using concepts of mathematics, physics, and engineering. **Artifact** This outcome will be assessed with the discussion, conclusion, and justification sections of the technical report and corresponding oral presentation areas, including the overall reasonableness of the engineering solution proposed. **Evaluation Process** The artifact will be assessed by a faculty panel with a minimum of three members. **Sampling** All senior design team projects will be assessed every semester. **Minimum Criteria for Success** Student teams will achieve a minimum of "average" on a 3-point rubric where 1 corresponds to "weak", 2 with "average", and 3 with "excellent.	A total of 33 students were registered in the CE Senior Design Project (CGN 4802) in the Fall 2013 semester; 25 students were registered in CGN 4802 in the Spring 2014 semester. The students worked in teams of six to ten members for their design projects. Each team was assessed by a three person panel using a rubric to score the critical thinking outcome that included consideration of project impacts on the natural and social environment, maintaining professionally accepted standards, and exhibiting ethical behavior. On average each team received a ranking of satisfactory to excellent for the critical thinking SLO, thereby meeting the minimum criteria for success. The average score was 2.5.
Use of Results for Improving Student Learning		
Design software available allowed evaluation of design alternatives.		

Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Student Learning Outcome (Stated in Measurable Terms)	**Assessment Method**	**Results (Data Summary and Analysis)**
Technology outcome: Graduates will utilize the techniques and skills of modern scientific and engineering technology (such as MathCad and AutoCad) for civil engineering practice.	Undergraduate Program Advisory Committee (UPAC) identified Senior Design Project (CGN 4802) as appropriate to assess this outcome. In the Senior Design course, students will propose, design, analyze, and present a comprehensive solution for a civil engineering design problem in a multidisciplinary team using concepts of mathematics, physics, and engineering. **Artifact** This outcome will be assessed with the AutoCad drawings and demonstration of use of appropriate software to assist in design calculations as evidenced in the technical report. **Evaluation Process** The artifact will be assessed by a faculty panel with a minimum of three members. **Sampling** All senior design team projects will be assessed every semester. **Minimum Criteria for Success** Student teams will achieve a minimum of "average" on a 3-point rubric where 1 corresponds to "weak", 2 with "average", and 3 with "excellent.	A total of 33 students were registered in the CE Senior Design Project (CGN 4802) in the Fall 2013 semester; 25 students were registered in CGN 4802 in the Spring 2014 semester. The students worked in teams of six to ten members for their design projects. Each team was assessed by a three person panel using a previously prepared rubric to score the technology outcome that included the use of computer-aided drafting and other appropriate software. On average each team received a ranking of satisfactory to excellent for the technology outcome, thereby meeting the minimum criteria for success. The average score was 2.7.

Use of Results for Improving Student Learning

Design software available allowed evaluation of design alternatives.

Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Student Learning Outcome (Stated in Measurable Terms)	**Assessment Method**	**Results (Data Summary and Analysis)**
Communication: Graduates will communicate engineering ideas orally and in a written format by presenting their semester-long design efforts in a formal and professional manner.	Undergraduate Program Advisory Committee (UPAC) identified Senior Design Project (CGN 4802) as appropriate to assess this outcome. In the Senior Design course, students will propose, design, analyze, and present a comprehensive solution for a civil engineering design problem in a multidisciplinary team using concepts of mathematics, physics, and engineering. **Artifact** This outcome will be assessed with the oral presentation component and the overall written technical report. **Evaluation Process** The artifact will be assessed by a faculty panel with a minimum of three members. **Sampling** All senior design team projects will be assessed every semester. **Minimum Criteria for Success** Student teams will achieve a minimum of "average" on a 3-point rubric where 1 corresponds to "weak", 2 with "average", and 3 with "excellent.	A total of 33 students were registered in the CE Senior Design Project (CGN 4802) in the Fall 2013 semester; 25 students were registered in CGN 4802 in the Spring 2014 semester. The students worked in teams of six to ten members for their design projects. Each team was assessed by a three person panel using a previously prepared rubric to score the communication outcome that included the team's oral communication skills, written engineering reports, and effective marketing tools produced. On average each team received an average or above grade for the communication outcome, thereby meeting the minimum criteria for success. The average score was 2.6.
Use of Results for Improving Student Learning		
Power point and video presentation allowed good feedback.		

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Summarize use of results for continuous improvement of learning:

Power point and video presentation allowed good feedback.

Design software available allowed evaluation of design alternatives.

Team projects allowed discussion and enhanced learning.

UPAC believes that it is critical that there is greater faculty participation in the outcomes assessment and want to encourage greater faculty attendance of the senior design projects.

1.3. 2014-2015

Florida International University: Student Learning Outcome Assessment 2014-2015

Academic Unit: Civil & Environmental Engineering

Degree Program: BS – Civil Engineering – 140801

Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Student Learning Outcome (Stated in Measurable Terms)	**Assessment Method**	**Results (Data Summary and Analysis)**
Content: Graduates will demonstrate the ability to apply the integrated knowledge of mathematics, science, and engineering to solve civil engineering design problems.	The Undergraduate Program Advisory Committee (UPAC) identified Civil Engineering Senior Design Project (CGN 4802) as appropriate to assess this outcome. In the Senior Design course, students will propose, design, analyze, and present a comprehensive solution for a civil engineering design problem in a multidisciplinary team using concepts of mathematics, physics, and engineering. **Artifact** This outcome will be assessed with the detailed calculations and analysis in the technical report that each team submits for the senior design project. **Evaluation Process** The artifact will be assessed by a faculty panel consisting of the course instructor(s), a minimum of two additional faculty members, and the external panelists invited to the senior design presentations. **Sampling** All senior design team projects will be assessed every semester. **Minimum Criteria for Success** Student teams will achieve a minimum of "average" on a 3-point rubric where 1 corresponds to "weak", 2 with "average", and 3 with "excellent.	A total of 34 students were registered in the CE Senior Design Project (CGN 4802) in the Fall 2014 semester; 26 students were registered in CGN 4802 in the Spring 2015 semester. The students worked in teams of six to ten members for their design projects. Each team was assessed by a three person panel using a previously prepared rubric to score the content outcome that included development of alternate designs, QA/QC, construction schedule, and cost estimates. On average each team received a ranking of satisfactory to excellent for the content SLO, thereby meeting the minimum criteria for success. The average score was 2.4.
Use of Results for Improving Student Learning		
Team projects allowed discussion and enhanced learning.		

Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Student Learning Outcome (Stated in Measurable Terms)	**Assessment Method**	**Results (Data Summary and Analysis)**
<u>Critical Thinking:</u> Graduates will collect information, analyze and interpret results, and apply these in a civil engineering design system.	Undergraduate Program Advisory Committee (UPAC) identified Senior Design Project (CGN 4802) as appropriate to assess this outcome. In the Senior Design course, students will propose, design, analyze, and present a comprehensive solution for a civil engineering design problem in a multidisciplinary team using concepts of mathematics, physics, and engineering. **Artifact** This outcome will be assessed with the discussion, conclusion, and justification sections of the technical report and corresponding oral presentation areas, including the overall reasonableness of the engineering solution proposed. **Evaluation Process** The artifact will be assessed by a faculty panel with a minimum of three members. **Sampling** All senior design team projects will be assessed every semester. **Minimum Criteria for Success** Student teams will achieve a minimum of "average" on a 3-point rubric where 1 corresponds to "weak", 2 with "average", and 3 with "excellent.	A total of 34 students were registered in the CE Senior Design Project (CGN 4802) in the Fall 2014 semester; 26 students were registered in CGN 4802 in the Spring 2015 semester. The students worked in teams of six to ten members for their design projects. Each team was assessed by a three person panel using a rubric to score the critical thinking outcome that included consideration of project impacts on the natural and social environment, maintaining professionally accepted standards, and exhibiting ethical behavior. On average each team received a ranking of satisfactory to excellent for the critical thinking SLO, thereby meeting the minimum criteria for success. The average score was 2.5.
Use of Results for Improving Student Learning		
Design software available allowed evaluation of design alternatives.		

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Student Learning Outcome (Stated in Measurable Terms)	**Assessment Method**	**Results (Data Summary and Analysis)**
<u>Technology outcome:</u> Graduates will utilize the techniques and skills of modern scientific and engineering technology (such as MathCad and AutoCad) for civil engineering practice.	Undergraduate Program Advisory Committee (UPAC) identified Senior Design Project (CGN 4802) as appropriate to assess this outcome. In the Senior Design course, students will propose, design, analyze, and present a comprehensive solution for a civil engineering design problem in a multidisciplinary team using concepts of mathematics, physics, and engineering. **Artifact** This outcome will be assessed with the AutoCad drawings and demonstration of use of appropriate software to assist in design calculations as evidenced in the technical report. **Evaluation Process** The artifact will be assessed by a faculty panel with a minimum of three members. **Sampling** All senior design team projects will be assessed every semester. **Minimum Criteria for Success** Student teams will achieve a minimum of "average" on a 3-point rubric where 1 corresponds to "weak", 2 with "average", and 3 with "excellent.	A total of 34 students were registered in the CE Senior Design Project (CGN 4802) in the Fall 2014 semester; 26 students were registered in CGN 4802 in the Spring 2015 semester. The students worked in teams of six to ten members for their design projects. Each team was assessed by a three person panel using a previously prepared rubric to score the technology outcome that included the use of computer-aided drafting and other appropriate software. On average each team received a ranking of satisfactory to excellent for the technology outcome, thereby meeting the minimum criteria for success. The average score was 2.8.

Use of Results for Improving Student Learning
Design software available allowed evaluation of design alternatives.

Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Student Learning Outcome (Stated in Measurable Terms)	**Assessment Method**	**Results (Data Summary and Analysis)**
<u>Communication:</u> Graduates will communicate engineering ideas orally and in a written format by presenting their semester-long design efforts in a formal and professional manner.	Undergraduate Program Advisory Committee (UPAC) identified Senior Design Project (CGN 4802) as appropriate to assess this outcome. In the Senior Design course, students will propose, design, analyze, and present a comprehensive solution for a civil engineering design problem in a multidisciplinary team using concepts of mathematics, physics, and engineering. **Artifact** This outcome will be assessed with the oral presentation component and the overall written technical report. **Evaluation Process** The artifact will be assessed by a faculty panel with a minimum of three members. **Sampling** All senior design team projects will be assessed every semester. **Minimum Criteria for Success** Student teams will achieve a minimum of "average" on a 3-point rubric where 1 corresponds to "weak", 2 with "average", and 3 with "excellent.	A total of 34 students were registered in the CE Senior Design Project (CGN 4802) in the Fall 2014 semester; 26 students were registered in CGN 4802 in the Spring 2015 semester. The students worked in teams of six to ten members for their design projects. Each team was assessed by a three person panel using a previously prepared rubric to score the communication outcome that included the team's oral communication skills, written engineering reports, and effective marketing tools produced. On average each team received an average or above grade for the communication outcome, thereby meeting the minimum criteria for success. The average score was 2.7.

Use of Results for Improving Student Learning
Power point and video presentation allowed feedback and heighted skill for effective presentations.

Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Summarize use of results for continuous improvement of learning:

Power point and video presentation allowed good feedback.

Design software available allowed evaluation of design alternatives.

Team projects allowed discussion and enhanced learning.

UPAC believes that it is critical that there is greater faculty participation in the outcomes assessment and want to encourage greater faculty attendance of the senior design projects. This will allow improving feedback for student work

2. Program Outcome (PO) Assessment Results

2.1. 2012-2013

Florida International University: Program Outcome Assessment 2012-2013

Academic Unit: Civil & Environmental Engineering Page 1

Degree Program: BS – Civil Engineering – 140801

Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Program Outcome **(Stated in Measurable Terms)**	**Assessment Methods**	**Results** **(Data Summary and Analysis)**
Graduates will advance in their careers in civil engineering or related areas by demonstrating technical proficiency, communication skills, responsible citizenship, leadership, and ethical behavior.	**<u>Alumni Survey</u>** **<u>Procedure:</u>** Alumni surveys are conducted at the end of each Spring semester. The Undergraduate Program Director is responsible for conducting the surveys, as well as collecting and analyzing the results. The survey consists of 9 questions and will be sent via email to Civil Engineering alumni that have graduated during the last three years, i.e., for the 2012-2013 PO assessment we send the surveys to students who graduated during 2009-2012. The survey responses were recorded using rubric (above average, average, below average). The answers from the survey are used to determine the percentage of graduates who report that the program prepared them: 1. To advance in their careers by demonstrating technical proficiency. 2. To advance in their careers by demonstrat-	The survey was sent to more than 75 students via email. However, the majority of the email addresses were not valid and we received responses from only seven students. Therefore, telephone surveys were conducted by faculty. 1. 66% of the graduates reported above average and 34% reported average for the question that program prepared them to advance in their careers by demonstrating technical proficiency. 2. 45% of the graduates reported above average and 55% reported average for the question that program prepared them to advance in their careers by demonstrating communication skills. 3. 72% of the graduates reported above average and 28% reported average for the question that program prepared them to

Program Outcome (Stated in Measurable Terms)	Assessment Methods	Results (Data Summary and Analysis)
	ing communication skills. 3. To advance in their careers by demonstrating responsible citizenship. 4. To advance in their careers by demonstrating progress to maintain and enhance their professional competency. 5. To advance in their careers by demonstrating professional and ethical performance. The survey responses were recorded using rubric (above average, average, below average). <u>Minimum criteria for success:</u> The minimum criteria for success are to have a minimum of 80% of the alumni submitting the survey to either above average or average.	advance in their careers by demonstrating responsible citizenship. 4. 86% of the graduates reported above average and 14% reported average for the question that program prepared them to advance in their careers by demonstrating professional competency. 5. 91% of the graduates reported above average and 9% reported average for the question that program prepared them to advance in their careers by demonstrating professional and ethical performance. Since 100% of the respondents reported either above average or average, the minimum criterion for success has been met for Program Outcome 1.

Use of Results for Improving Program

Need to improve our database on contact information for students graduating from program. Using the results as a foundation, in consultation with faculty and Department Advisory Board, develop strategies that will lead to program improvements. Focus on strategies that are sustainable and feasible.

Degree Program: BS – Civil Engineering – 140801

Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Program Outcome (Stated in Measurable Terms)	**Assessment Methods**	**Results (Data Summary and Analysis)**
Graduates will make progress towards obtaining professional registration, special licensing, or certification.	**<u>Alumni Survey</u>** **<u>Procedure:</u>** Alumni surveys are conducted at the end of each Spring semester. The Undergraduate Program Director is responsible for conducting the surveys, as well as collecting and analyzing the results. The survey consists of 9 questions and will be sent via email to Civil Engineering alumni that have graduated three years back, i.e., for the 2010-2011 PO assessment we will send the surveys to students who graduated in 2007-2008. The answers from the survey are used to: 1. Determine the percentage of graduates who have passed the Fundamentals of Engineering (FE) exam. The survey responses were recorded using rubric (Yes or No). <u>Minimum criteria for success:</u> The minimum criterion for success is to have a minimum of 50% of the alumni that passing the EIT/FE exam.	The survey was sent to more than 75 students via email. However, the majority of the email addresses were not valid and we received responses from only seven students. Therefore, telephone surveys were conducted by faculty. 1. 51% of the respondents have passed the EIT/FE exam. 30% of the respondents have passed the PE exam. The minimum criterion for success has been met for program outcome 2.
Use of Results for Improving Program		
Action: Continue collection of information. Compare survey results with employer surveys.		

Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Program Outcome (Stated in Measurable Terms)	**Assessment Methods**	**Results (Data Summary and Analysis)**
Graduates will pursue continued life-long learning to become the problem solvers considering the global, economic, environmental, and social impact.	**<u>Alumni Survey Procedure:</u>** Alumni surveys are conducted at the end of each Spring semester. The Undergraduate Program Director is responsible for conducting the surveys, as well as collecting and analyzing the results. The survey consists of 9 questions and will be sent via email to Civil Engineering alumni that have graduated three years back, i.e., for the 2010-2011 PO assessment we send the surveys to students who graduated in 2007-2008. The answers from the survey are used to: 1. Determine the percentage of graduates who report that the program prepared them to advance in their careers by demonstrating progress lifelong learning to improve their skills. (progress to maintain and enhance their professional competency by continued professional development by attending training seminars, workshops, courses, or meetings organized by education institutes or professional organizations like ASCE, FES, WEF, AWWA, SWANA, NSPE, etc.)	The survey was sent to more than 75 students via email. However, the majority of the email addresses were not valid and we received responses from only seven students. Therefore, telephone surveys were conducted by faculty. 1. 97% of the graduates reported "Yes" for the question that program prepared them to advance in their careers by demonstrating progress lifelong learning to improve their skills. The minimum criterion for success has been met for Program Outcome 3.

Program Outcome **(Stated in Measurable Terms)**	**Assessment Methods**	**Results** **(Data Summary and Analysis)**
	The survey responses were recorded using rubric (Yes of No). Minimum criteria for success: The minimum criterion for success is to have a minimum of 80% of the alumni submitting the survey to “Yes”.	
Use of Results for Improving Program		
Action a) Collect information, and b) Evaluate measurability of this criterion.		

Summarize use of results for continuous improvement of the educational program:

Need to improve our database on contact information for students graduating from program. Using the results as a foundation, in consultation with faculty and Department Advisory Board, develop strategies that will lead to program improvements. Focus on strategies that are sustainable and feasible.

The Civil and Environmental Engineering Department needs to maintain more accurate contact information on their graduating seniors to improve alumni participation in the Program Outcomes Assessment. UPAC may consider the use of telephone surveys of the target alumni to increase participation.

2.2. 2013-2014

Florida International University: Program Outcome Assessment 2013-2014

Academic Unit: Civil & Environmental Engineering

Degree Program: BS – Civil Engineering – 140801

Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Program Outcome (Stated in Measurable Terms)	**Assessment Methods**	**Results (Data Summary and Analysis)**
Graduates will advance in their careers in civil engineering or related areas by demonstrating technical proficiency, communication skills, responsible citizenship, leadership, and ethical behavior.	**<u>Alumni Survey</u>** **<u>Procedure:</u>** Alumni surveys are conducted at the end of each Spring semester. The Undergraduate Program Director is responsible for conducting the surveys, as well as collecting and analyzing the results. The survey consists of 9 questions and will be sent via email to Civil Engineering alumni that have graduated during the last three years, i.e., for the 2012-2013 PO assessment we send the surveys to students who graduated during 2009-2012. The survey responses were recorded using rubric (above average, average, below average). The answers from the survey are used to determine the percentage of graduates who report that the program prepared them: 1. To advance in their careers by demonstrating technical proficiency. 2. To advance in their careers by demonstrating communication skills. 3. To advance in their careers by demon-	The survey was sent to more than 75 students via email. However, the majority of the email addresses were not valid and we received responses from only seven students. Therefore, telephone surveys were conducted by faculty. 1. 70% of the graduates reported above average and 30% reported average for the question that program prepared them to advance in their careers by demonstrating technical proficiency. 2. 49% of the graduates reported above average and 51% reported average for the question that program prepared them to advance in their careers by demonstrating communication skills. 3. 76% of the graduates reported above average and 24% reported average for the question that program prepared them to advance in their careers by demonstrating responsible citizenship.

Program Outcome (Stated in Measurable Terms)	Assessment Methods	Results (Data Summary and Analysis)
	strating responsible citizenship. 4. To advance in their careers by demonstrating progress to maintain and enhance their professional competency. 5. To advance in their careers by demonstrating professional and ethical performance. The survey responses were recorded using rubric (above average, average, below average). <u>Minimum criteria for success:</u> The minimum criteria for success are to have a minimum of 80% of the alumni submitting the survey to either above average or average.	4. 90% of the graduates reported above average and 10% reported average for the question that program prepared them to advance in their careers by demonstrating professional competency. 5. 95% of the graduates reported above average and 5% reported average for the question that program prepared them to advance in their careers by demonstrating professional and ethical performance. Since 100% of the respondents reported either above average or average, the minimum criterion for success has been met for Program Outcome 1.

Use of Results for Improving Program

Need to improve our database on contact information for students graduating from program. Using the results as a foundation, in consultation with faculty and Department Advisory Board, develop strategies that will lead to program improvements. Focus on strategies that are sustainable and feasible.

Degree Program: BS – Civil Engineering – 140801

Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Program Outcome **(Stated in Measurable Terms)**	**Assessment Methods**	**Results** **(Data Summary and Analysis)**
Graduates will make progress towards obtaining professional registration, special licensing, or certification.	**<u>Alumni Survey</u>** **<u>Procedure:</u>** Alumni surveys are conducted at the end of each Spring semester. The Undergraduate Program Director is responsible for conducting the surveys, as well as collecting and analyzing the results. The survey consists of 9 questions and will be sent via email to Civil Engineering alumni that have graduated three years back, i.e., for the 2010-2011 PO assessment we will send the surveys to students who graduated in 2007-2008. The answers from the survey are used to: 1. Determine the percentage of graduates who have passed the Fundamentals of Engineering (FE) exam. The survey responses were recorded using rubric (Yes or No). <u>Minimum criteria for success:</u> The minimum criterion for success is to have a minimum of 50% of the alumni that passing the EIT/FE exam.	The survey was sent to more than 75 students via email. However, the majority of the email addresses were not valid and we received responses from only seven students. Therefore, telephone surveys were conducted by faculty. 1. 55% of the respondents have passed the EIT/FE exam. 25% of the respondents have passed the PE exam. The minimum criterion for success has been met for program outcome 2.
Use of Results for Improving Program		
Action: Continue collection of information. Compare survey results with employer surveys.		

Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Program Outcome (Stated in Measurable Terms)	**Assessment Methods**	**Results (Data Summary and Analysis)**
Graduates will pursue continued life-long learning to become the problem solvers considering the global, economic, environmental, and social impact.	**<u>Alumni Survey</u>** **<u>Procedure:</u>** Alumni surveys are conducted at the end of each Spring semester. The Undergraduate Program Director is responsible for conducting the surveys, as well as collecting and analyzing the results. The survey consists of 9 questions and will be sent via email to Civil Engineering alumni that have graduated three years back, i.e., for the 2010-2011 PO assessment we send the surveys to students who graduated in 2007-2008. The answers from the survey are used to: 1. Determine the percentage of graduates who report that the program prepared them to advance in their careers by demonstrating progress lifelong learning to improve their skills. (progress to maintain and enhance their professional competency by continued professional development by attending training seminars, workshops, courses, or meetings organized by education institutes or professional organizations like ASCE, FES, WEF, AWWA, SWANA, NSPE, etc.)	The survey was sent to more than 75 students via email. However, the majority of the email addresses were not valid and we received responses from only seven students. Therefore, telephone surveys were conducted by faculty. 1. 100% of the graduates reported "Yes" for the question that program prepared them to advance in their careers by demonstrating progress lifelong learning to improve their skills. The minimum criterion for success has been met for Program Outcome 3.

Program Outcome (Stated in Measurable Terms)	Assessment Methods	Results (Data Summary and Analysis)
	The survey responses were recorded using rubric (Yes or No). <u>Minimum criteria for success:</u> The minimum criterion for success is to have a minimum of 80% of the alumni submitting the survey to "Yes".	
Use of Results for Improving Program		
Action a) Collect information, and b) Evaluate measurability of this criterion.		

Summarize use of results for continuous improvement of the educational program:

Need to improve our database on contact information for students graduating from program. Using the results as a foundation, in consultation with faculty and Department Advisory Board, develop strategies that will lead to program improvements. Focus on strategies that are sustainable and feasible.

The Civil and Environmental Engineering Department needs to maintain more accurate contact information on their graduating seniors to improve alumni participation in the Program Outcomes Assessment. UPAC may consider the use of telephone surveys of the target alumni to increase participation.

2.3. 2014-2015

Florida International University: Program Outcome Assessment 2014-2015

Academic Unit: Civil & Environmental Engineering Page 1

Degree Program: BS – Civil Engineering – 140801

Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Program Outcome **(Stated in Measurable Terms)**	**Assessment Methods**	**Results** **(Data Summary and Analysis)**
Graduates will advance in their careers in civil engineering or related areas by demonstrating technical proficiency, communication skills, responsible citizenship, leadership, and ethical behavior.	**<u>Alumni Survey</u>** **<u>Procedure:</u>** Alumni surveys are conducted at the end of each Spring semester. The Undergraduate Program Director is responsible for conducting the surveys, as well as collecting and analyzing the results. The survey consists of 9 questions and will be sent via email to Civil Engineering alumni that have graduated during the last three years, i.e., for the 2013-2014 PO assessment we sent the surveys to students who graduated during 2010-2013. The survey responses were recorded using rubric (above average, average, below average). The answers from the survey are used to determine the percentage of graduates who report that the program prepared them: 1. To advance in their careers by demonstrating technical proficiency. 2. To advance in their careers by demonstrating communication skills.	The survey was sent to more than 75 students via email. However, the majority of the email addresses were not valid and we received responses from only seven students. Therefore, telephone surveys were conducted by faculty. 1. 75% of the graduates reported above average and 25% reported average for the question that program prepared them to advance in their careers by demonstrating technical proficiency. 2. 50% of the graduates reported above average and 50% reported average for the question that program prepared them to advance in their careers by demonstrating communication skills. 3. 75% of the graduates reported above average and 25% reported average for the question that program prepared them to advance in their careers by demonstrating responsible citizenship.

Program Outcome (Stated in Measurable Terms)	**Assessment Methods**	**Results (Data Summary and Analysis)**
	3. To advance in their careers by demonstrating responsible citizenship. 4. To advance in their careers by demonstrating progress to maintain and enhance their professional competency. 5. To advance in their careers by demonstrating professional and ethical performance. The survey responses were recorded using rubric (above average, average, below average). <u>Minimum criteria for success:</u> The minimum criteria for success are to have a minimum of 80% of the alumni submitting the survey to either above average or average.	4. 90% of the graduates reported above average and 10% reported average for the question that program prepared them to advance in their careers by demonstrating professional competency. 5. 92% of the graduates reported above average and 8% reported average for the question that program prepared them to advance in their careers by demonstrating professional and ethical performance. Since 100% of the respondents reported either above average or average, the minimum criterion for success has been met for Program Outcome 1.

Use of Results for Improving Program
Need to improve our database on contact information for students graduating from program. Using the results as a foundation, in consultation with faculty and Department Advisory Board, develop strategies that will lead to program improvements. Focus on strategies that are sustainable and feasible.

Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Program Outcome (Stated in Measurable Terms)	**Assessment Methods**	**Results (Data Summary and Analysis)**
Graduates will make progress towards obtaining professional registration, special licensing, or certification.	**Alumni Survey** **Procedure:** Alumni surveys are conducted at the end of each Spring semester. The Undergraduate Program Director is responsible for conducting the surveys, as well as collecting and analyzing the results. The survey consists of 9 questions and will be sent via email to Civil Engineering alumni that have graduated three years back, i.e., for the for the 2013-2014 PO assessment we sent the surveys to students who graduated during 2010-2013. The answers from the survey are used to: 1. Determine the percentage of graduates who have passed the Fundamentals of Engineering (FE) exam. The survey responses were recorded using rubric (Yes or No). Minimum criteria for success: The minimum criterion for success is to have a minimum of 50% of the alumni that passing the EIT/FE exam.	The survey was sent to more than 75 students via email. However, the majority of the email addresses were not valid and we received responses from only seven students. Therefore, telephone surveys were conducted by faculty. 1. 50% of the respondents have passed the EIT/FE exam. 20% of the respondents have passed the PE exam. The minimum criterion for success has been met for program outcome 2.
Use of Results for Improving Program		
Action: Continue collection of information. Compare survey results with employer surveys.		

Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Program Outcome (Stated in Measurable Terms)	**Assessment Methods**	**Results (Data Summary and Analysis)**
Graduates will pursue continued life-long learning to become the problem solvers considering the global, economic, environmental, and social impact.	**Alumni Survey** **Procedure:** Alumni surveys are conducted at the end of each Spring semester. The Undergraduate Program Director is responsible for conducting the surveys, as well as collecting and analyzing the results. The survey consists of 9 questions and will be sent via email to Civil Engineering alumni that have graduated three years back, i.e., for the 2013-2014 PO assessment we sent the surveys to students who graduated during 2010-2013. The answers from the survey are used to: 1. Determine the percentage of graduates who report that the program prepared them to advance in their careers by demonstrating progress lifelong learning to improve their skills. (progress to maintain and enhance their professional competency by continued professional development by attending training seminars, workshops, courses, or meetings organized by education institutes or professional organizations like ASCE, FES, WEF, AWWA, SWANA, NSPE, etc.)	The survey was sent to more than 75 students via email. However, the majority of the email addresses were not valid and we received responses from only seven students. Therefore, telephone surveys were conducted by faculty. 1. 100% of the graduates reported "Yes" for the question that program prepared them to advance in their careers by demonstrating progress lifelong learning to improve their skills. The minimum criterion for success has been met for Program Outcome 3.

Program Outcome **(Stated in Measurable Terms)**	**Assessment Methods**	**Results** **(Data Summary and Analysis)**
	The survey responses were recorded using rubric (Yes or No). <u>Minimum criteria for success:</u> The minimum criterion for success is to have a minimum of 80% of the alumni submitting the survey to “Yes”.	
Use of Results for Improving Program		
Action a) Collect information, and b) Evaluate measurability of this criterion.		

Summarize use of results for continuous improvement of the educational program:

Need to update our database on contact information for students graduating from the program. Using the results as a foundation, in consultation with faculty and Department Advisory Board, develop strategies that will lead to program improvements. Focus on strategies that are sustainable and feasible.

The Civil and Environmental Engineering Department needs to maintain more accurate contact information (including social media) on the graduating seniors to improve alumni participation in the Program Outcomes Assessment. UPAC needs to develop a plan for conducting telephone surveys of the target alumni to increase participation.

APPENDIX F: ALUMNI SURVEY RESULTS

Table F.1 Alumni Survey Results (Fall 2013)

	Above average		Average		Below average		Total Number of Graduates
Student outcomes:	No.	(%)	No.	(%)	No.	(%)	No.
1) Technical proficiency?	32	55.17	24	41.38	2	3.45	58
2) Communication skills (i.e., written and oral)?	34	58.62	22	37.93	2	3.45	58
3) Responsible Citizenship: appreciation of the impact of engineering solutions on contemporary issues facing society?	27	46.55	31	53.45	0	0.00	58
4) Lifelong Learning: progress to maintain and enhance their professional competency?	44	75.86	12	20.69	2	3.45	58
5) Professional and ethical performance?	45	77.59	13	22.41	0	0.00	58

Program Educational Objectives:	Passed FE Exam only		Passed PE Exam		None		Total Number of Graduates
Program Educational Objective 2	No.	(%)	No.	(%)	No.	(%)	No.
Within the first three to five years of graduation, graduates will make progress towards obtaining professional registration, special licensing, or certification.	47	81.03	8	13.79	3	5.17	58

FIU

FLORIDA INTERNATIONAL UNIVERSITY
DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING
ALUMNI SURVEY OF PROGRAM EDUCATIONAL OBJECTIVES

A

Contact Information:

A.	Name		
B.	Title and Employer		
C.	Contact Information	Tel:	e-mail:

General:

1.	How many years have passed since your graduation from the FIU civil or environmental engineering program?	1 2 3 4 5 More

Learning Outcomes:
How do you rate your preparation in your BS degree program at FIU for ...

2.	technical proficiency?	above average	average	below average
3.	communication skills (i.e., written and oral)?	above average	average	below average
4.	appreciation of the impact of engineering solutions on contemporary issues facing society?	above average	average	below average
5.	understanding the need to maintain and enhance your professional competency?	above average	average	below average
6.	professional and ethical performance expectations?	above average	average	below average

Program Educational Objectives:

7.	Have you made any progress towards obtaining professional registration, licenses or certifications?	Yes No → If "Yes" go to No.8, if "No" go to No.9
8.	Have you a) passed the FE exam? b) obtained the PE registration?	 Yes No Yes No
9.	Are there areas of knowledge or skills that you should have had during your education at FIU?	

Other Comments:

Survey conducted by: ____________________ **Date:** ____________________

Department of Civil and Environmental Engineering, 2012

Figure F.1 Alumni Survey Form

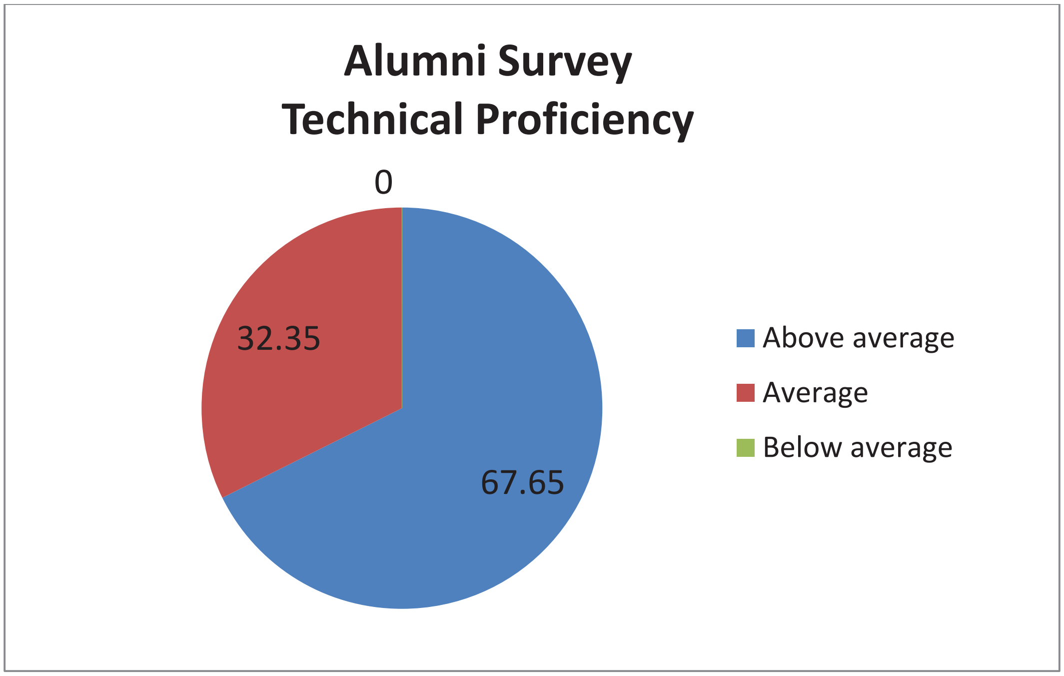

Figure F.2 Alumni Survey Results for Program Outcome in Technical Proficiency

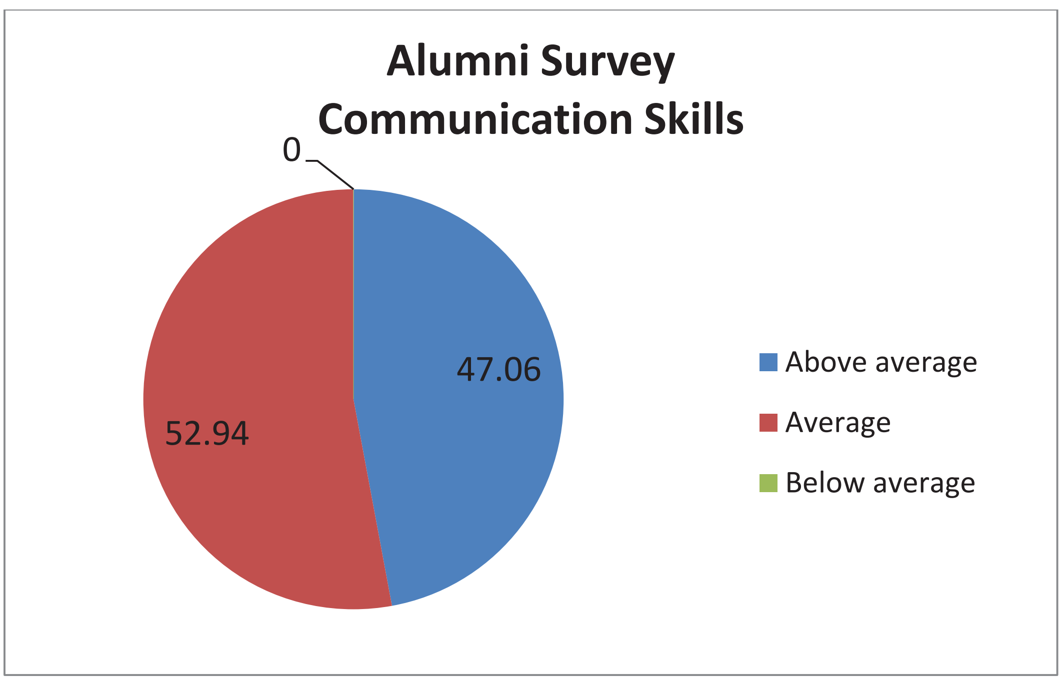

Figure F.3 Alumni Survey Results for Program Outcome in Communication

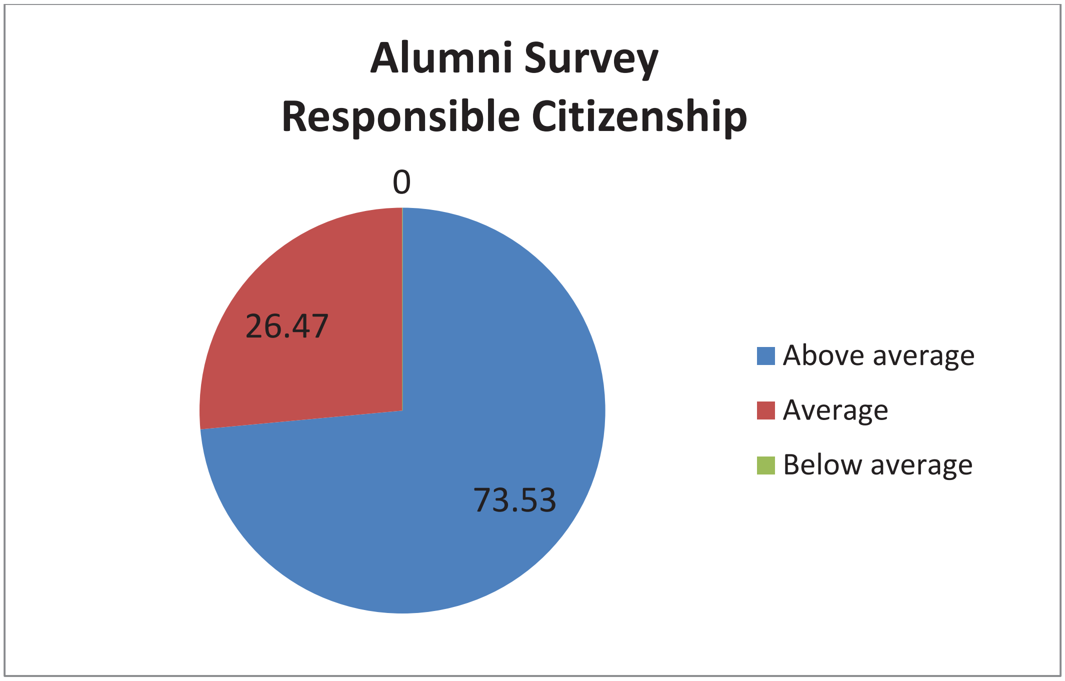

Figure F.4 Alumni Survey Results for Program Outcome in Responsible Citizenship

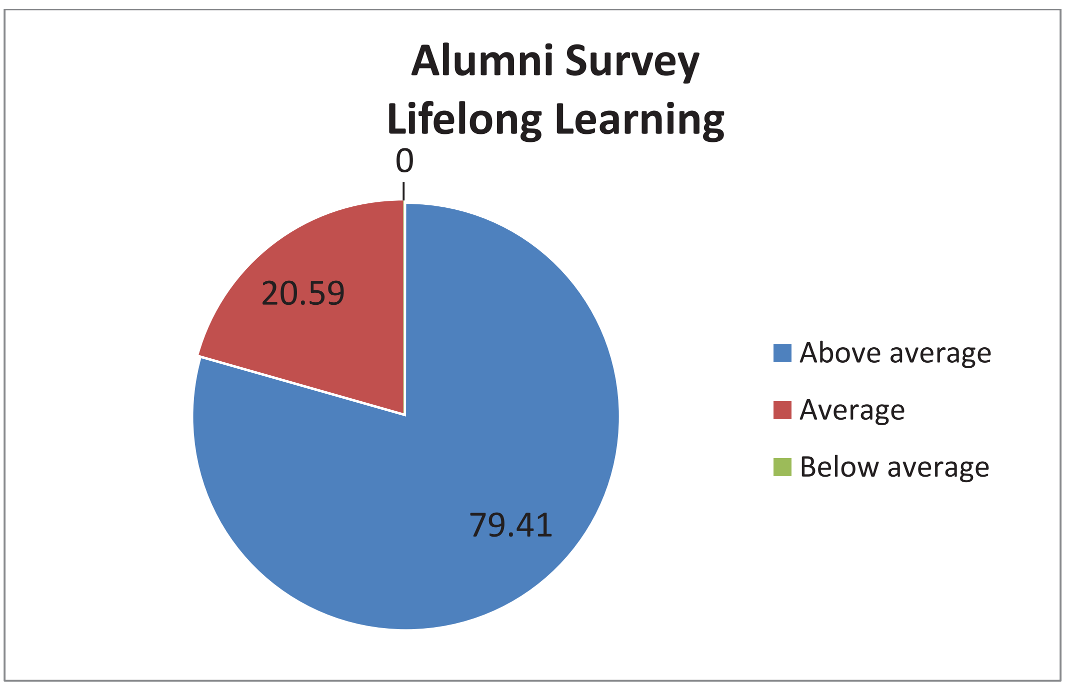

Figure F.5 Alumni Survey Results for Program Outcome in Lifelong Learning

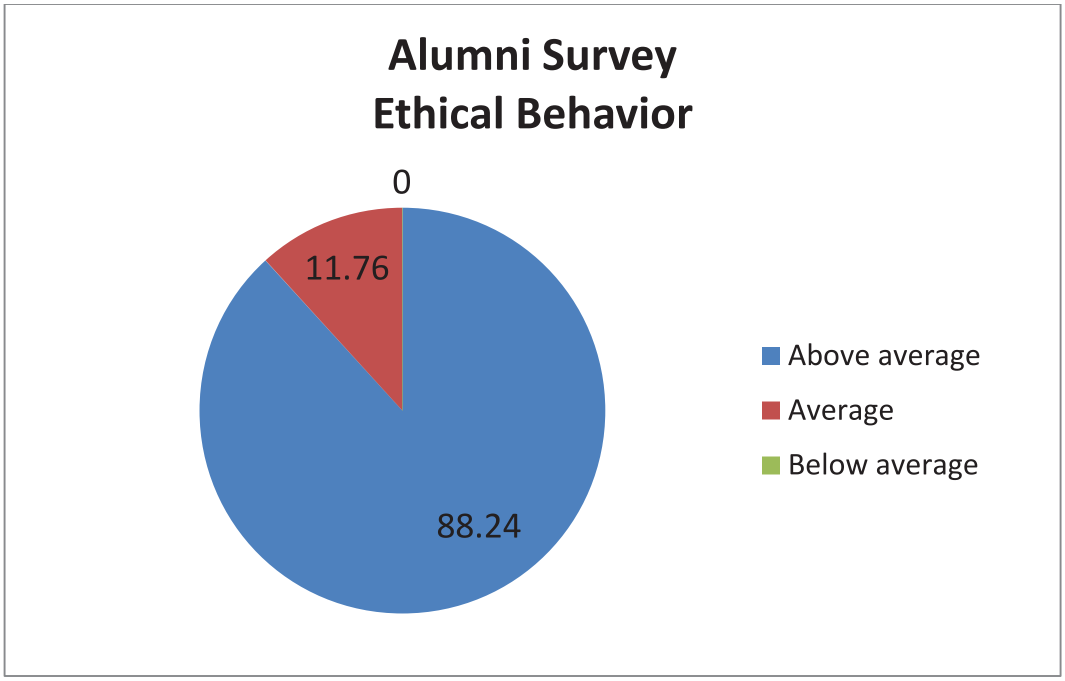

Figure F.6 Alumni Survey Results for Student Outcome in Ethical Behavior

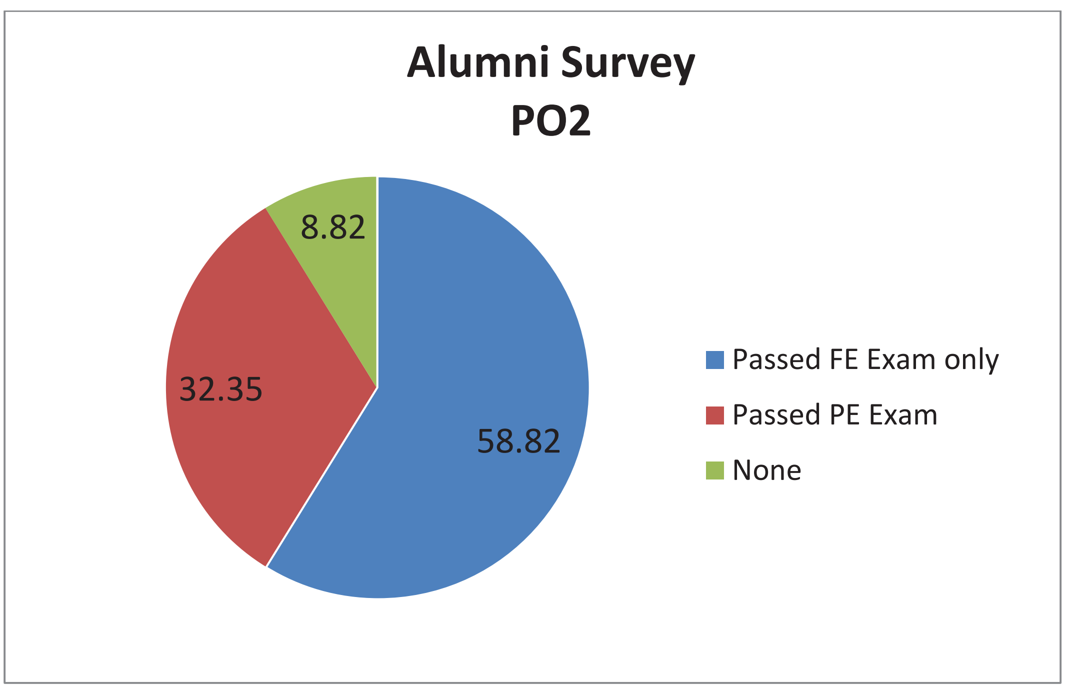

Figure F.7 Alumni Survey Results for Program Outcome – Professional Licensure

FIU Engineering & Computing
FLORIDA INTERNATIONAL UNIVERSITY

PROGRAM REVIEW

SELF-STUDY REPORT

FOR THE

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

ENVIRONMENTAL ENGINEERING UNDERGRADUATE PROGRAM SELF STUDY

September 2016

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

The Department offers the Bachelor of Science both in Civil Engineering (BSCE) and Environmental Engineering (BSEnvE). The BSCE degree was first accredited by the Accreditation Board of Engineering and Technology (ABET) in 1987, and accreditations were renewed in 1990, 1993, 1996, 2002, 2008 and most recently, fall 2014. The degree in Environmental Engineering was implemented in fall 2006 and received its first ABET accreditation after the ABET visit in fall 2008, and the last ABET visit was in 2014. The program ABET accreditation statement received in 2015 stated no shortcomings for the program.

The Department also offers advanced study for the Masters of Science and Doctor of Philosophy degrees that include Master of Science in Civil Engineering, Master of Science in Environmental Engineering, and Doctor of Philosophy in Civil Engineering. A total of 21faculty members are responsible for the various teaching, research, and service activities of the Department.

Since 2011, the department recruited a new department chair, seven new Assistant Professors with lines for an additional two positions, and three Professors of Practice. Together with a strong core of tenured faculty, the unit has strong expertise to address the technical challenges associated with the sustainability of civil engineering systems especially in emerging research areas. Laboratories and research capabilities have been recognized at the state and national level including Tier 1 UTC for Accelerated Bridge Construction, NSF EF designation for the NHERI program recognizing the Wall of Wind as well as State and local support of research in transportation, environmental, bridge, and corrosion engineering. New classes in emerging research areas in Sustainability, Ecohydrology, Hurricane Engineering, Wind Engineering, Corrosion Engineering, Building Diagnostics, and Geographic Information System (GIS) among others add to the already deep program curriculum in Civil and Environmental Engineering. The unit has seen tremendous growth in external research funding and laboratory research capabilities to support advanced research with recognition by state and national institutions. From 2013-2016, the unit has been awarded over $16.3 million in external funding.

The degree in Environmental Engineering was implemented in fall 2006 and received its first ABET accreditation after the ABET visit in fall 2008, and the last ABET visit was in 2014. The program ABET accreditation statement received in 2015 stated no shortcomings for the program. The program has gone through continuous improvement actions to the curriculum to integrate global learning component, improve design and communications skills, laboratory improvements, laboratory safety procedures, new faculty orientation, and teaching assistant training programs.

The Undergraduate Program Self-Study for the Environmental Engineering Program was prepared by Professor and Undergraduate Program Director Dr. Berrin Tansel and the Associate Chair of Undergraduate Programs Dr. Ton-Lo Wang, and reviewed by the program faculty, undergraduate program advisors, Under Graduate Program Committee (UPAC), and Department Chair Dr. Atorod Azizinamini.

II. PROGRAM OVERVIEW

II.A. History and evolution of the program

Florida International University (FIU) – Miami's public research university – is one of America's most dynamic institutions of higher learning. FIU was established by the Florida Legislature in 1965, and classes began in September 1972. In 1974, the School of Technology began offering both Bachelor of Science and Bachelor of Technology degrees in Civil Engineering Technology.

In 1984, the College of Engineering and Applied Sciences was established, which included the Department of Civil and Environmental Engineering (the Department). The Department is part of the College of Engineering and Computing of Florida International University. The Department offers the Bachelor of Science both in Civil Engineering (BSCE) and Environmental Engineering (BSEnvE). The BSCE degree was first accredited by the Accreditation Board of Engineering and Technology (ABET) in 1987, and accreditations were renewed in 1990, 1993, 1996, 2002, 2008 and most recently, fall 2014. The degree in Environmental Engineering was implemented in fall 2006 and received its first ABET accreditation after the ABET visit in fall 2008, and the last ABET visit was in 2014. The program ABET accreditation statement received in 2015 stated no shortcomings for the program.

The Department also offers advanced study for the Masters of Science and Doctor of Philosophy degrees that include Master of Science in Civil Engineering, Master of Science in Environmental Engineering, and Doctor of Philosophy in Civil Engineering. A total of 21 faculty members are responsible for the various teaching, research, and service activities of the Department.

The Environmental Engineering program has gone through significant changes since its implementation in fall 2006. The program has two ABET visits in fall 2008 and in fall 2014; at both times had no shortcomings. These have included changes in faculty, administrative leadership, committee organization, program outcomes (POs), student learning outcomes (SLOs), curricula, the advising process, and other program changes. The changes have occurred as a result of faculty departures and the normal evolution of program modifications brought about by efforts for continuous improvement. Starting with freshmen entering in 2010, the University implemented “Global Learning” initiative for all undergraduate programs. Capitalizing on FIU’s unique demographics and location in the gateway to the Americas, Global Learning for Global Citizenship enables students to achieve specific learning outcomes: global awareness, global perspective, and global engagement. Global Learning for Global Citizenship is a promise to every FIU student: graduates of the University will be empowered with the knowledge, skills, and attitudes they need to become informed and engaged citizens of the world.

Since the previous review in 2008, there are six new faculty members: Dr. Xia Jin in Transportation Engineering, Dr. Omar Abdul-Aziz and Dr. Lakshmi Reddy in Water Resources Engineering, Dr. Kingsley Lau in Structural Engineering, Dr. Ioannis Zisis in Wind Engineering, and Dr. Ralf Arndt in Structural Engineering. The Department also hired three Professors of Practice; Drs. Michael Bienvenu and Hesham Ali in Pavement Engineering, and Dr. Peter Irwin (part-time) in Wind Engineering.
Three instructors, Dr. Anna Bernardo Bricker, Dr. Khokiat Kengskool, and Dr. Cora Martinez joined the department in 2010-11. Dr. Anna Bernardo Bricker teaches the courses in air pollution

area and manages all environmental engineering labs. Dr. Khokiat Kengskool is responsible for teaching engineering economics and engineering drawing courses. Dr. Cora Martinez and Ms. Joanna Sanabria serve as the undergraduate advisors. The Department has a full-time lab manager, Mr. Edgar Polo, who oversees our teaching labs and assists with some of our research labs. Over the same period, the Department lost five faculty members to career moves as follows:

1) Dr. Girma Bitsuamlak, a tenured faculty, left to join Western University in Canada.
2) Dr. Fernando Miralles-Wilhelm, left to join University of Maryland
3) Dr. Nakin Suksawang, a tenure-track faculty, left to join Florida Institute of Technology.
4) Dr. Luis Prieto, a tenured faculty, retired.
5) Dr. Dr. Sylvan Jolibois, a tenured faculty, left.
6) Dr. Ralf Arndt, a tenured faculty, left.
7) Dr. Omar Abdul-Aziz, untenured, left.

The Program presently has a total of 8 full-time faculty members (in specialty areas of environmental engineering and water resources). The 8 full-time faculty positions include 6 tenured or tenure earning faculty. The current faculty members are listed in Table II.1, below, and their detailed qualifications as well as workload are shown in Appendix D.

For the undergraduate program in the Department, the Undergraduate Program Advisory Committee (UPAC) has been coordinating all ABET, SACS accreditation matters, program review and actions for continuous improvement related to the two undergraduate programs (Civil Engineering and Environmental Engineering) since its establishment in 2003. Keeping up with the university wide changes, CEE has been implementing a series of changes to its undergraduate advising to improve process. New PantherSoft queries were developed in the College in collaboration with PantherSoft developers to check course prerequisites. These new queries were customized for CEE requirements. These queries are now run every semester after the drop-and-add period is over. All students found not to have the required prerequisite(s) for a course are notified and administratively dropped from the course.

The curriculum consists of 127 credits: 47 credits for mathematics and basic sciences, 51 credits for engineering topics, and 29 credits for general education. Courses in the Environmental Engineering curriculum have varying laboratory components, oral/written communication activities, computer use, teamwork, and design projects. The detailed curriculum for BS in Civil Engineering is shown in Appendix C.

Table II.1 presents the list of faculty members in the CEE Department. Enrollment and degree data for the programs offered by the CEE Department are presented in Table II.2.

Figure II.1 presents the enrollment data for the BS in Environmental Engineering from 2012 to 2016. The data for the degrees awarded by the BS Program in Environmental Engineering from 2011 to 2016 are presents in Figure II.2.

Table II.1 List of Faculty members in the CEE Department

Area	Faculty Member	Rank
Environmental and Water Resources Engineering	Anna Bernardo-Bricker, Ph.D.*	Instructor
	Hector R. Fuentes, Ph.D., P.E. *	Professor
	Cora Martinez, Ph.D. *	Instructor
	Shonali Laha, Ph.D., P.E. *	Associate Professor
	Walter Tang, Ph.D., P.E. *	Associate Professor
	Berrin Tansel, Ph.D., P.E. *	Professor
Geotechnical Engineering	Seung Jae Lee, Ph.D.	Assistant Professor
Pavement Engineering	Hesham Ali, Ph.D., P.E., C.P.M.	Professor of Practice
	Michael Bienvenu, Ph.D., P.E.	Professor of Practice
Structural Engineering	Atorod Azizinamini, Ph.D., P.E.	Professor
	David Garber, Ph.D.	Assistant Professor
	Kingsley Lau, Ph.D. *	Assistant Professor
	Ton-Lo Wang, Ph.D., P.E.	Professor
Transportation Engineering	Priyanka Alluri, Ph.D., P.E.	Assistant Professor
	Albert Gan, Ph.D.	Professor
	Mohammed Hadi, Ph.D., P.E.	Professor
	Xia Jin, Ph.D., AICP*	Assistant Professor
	Khokiat Kengskool, Ph.D.	Instructor
	L. David Shen, Ph.D., P.E.	Professor
Wind Engineering	Arindam Gan Chowdhury, Ph.D. *	Associate Professor
	Ioannis Zisis, Ph.D.	Assistant Professor

* Faculty who teach courses (required/elective) in Environmental program.

Table II.2 Enrollment and Degree Data for Civil and Environmental Engineering Programs

Academic Year	Program	Enrollment	Enrollment Total	Degrees Awarded	Degrees Awarded Total	Faculty	Student-to-Faculty Ratio BS	Student-to-Faculty Ratio Department
2008-2009	BS in CE	525	557	63	66	17	33:1	41:1
	BS in EnvE	32		3				
	MS in CE	72	94	30	38			
	MS in EnvE	22		8				
	PhD in CE	43	43	8	8			
2009-2010	BS in CE	606	664	80	82	17	39:1	47:1
	BS in EnvE	58		2				
	MS in CE	65	93	21	32			
	MS in EnvE	28		11				
	PhD in CE	47	47	9	9			
2010-2011	BS in CE	627	699	85	94	16	44:1	52:1
	BS in EnvE	72		9				
	MS in CE	61	89	25	43			
	MS in EnvE	28		18				
	PhD in CE	50	50	6	6			
2011-2012	BS in CE	590	682	85	94	20	34:1	41:1
	BS in EnvE	92		9				
	MS in CE	50	74	30	42			
	MS in EnvE	24		12				
	PhD in CE	54	54	7	7			
2012-2013	BS in CE	542	648	98	107	23	28:1	34:1
	BS in EnvE	106		9				
	MS in CE	53	68	26	35			
	MS in EnvE	15		9				
	PhD in CE	61	61	9	9			
2013-2014	BS in CE	599	705	86	102	21	34:1	40:1
	BS in EnvE	106		16				
	MS in CE	47	62	25	36			
	MS in EnvE	15		11				
	PhD in CE	71	71	8	8			
2014-2015	BS in CE	643	750	85	95	23	33:1	38:1
	BS in EnvE	107		10				
	MS in CE	39	47	21	22			
	MS in EnvE	8		1				
	PhD in CE	74	74	11	11			
2015-2016	BS in CE	623	728	91	104	21	35:1	40:1
	BS in EnvE	105		13				
	MS in CE	31	41	19	25			
	MS in EnvE	10		6				
	PhD in CE	65	65	13	13			

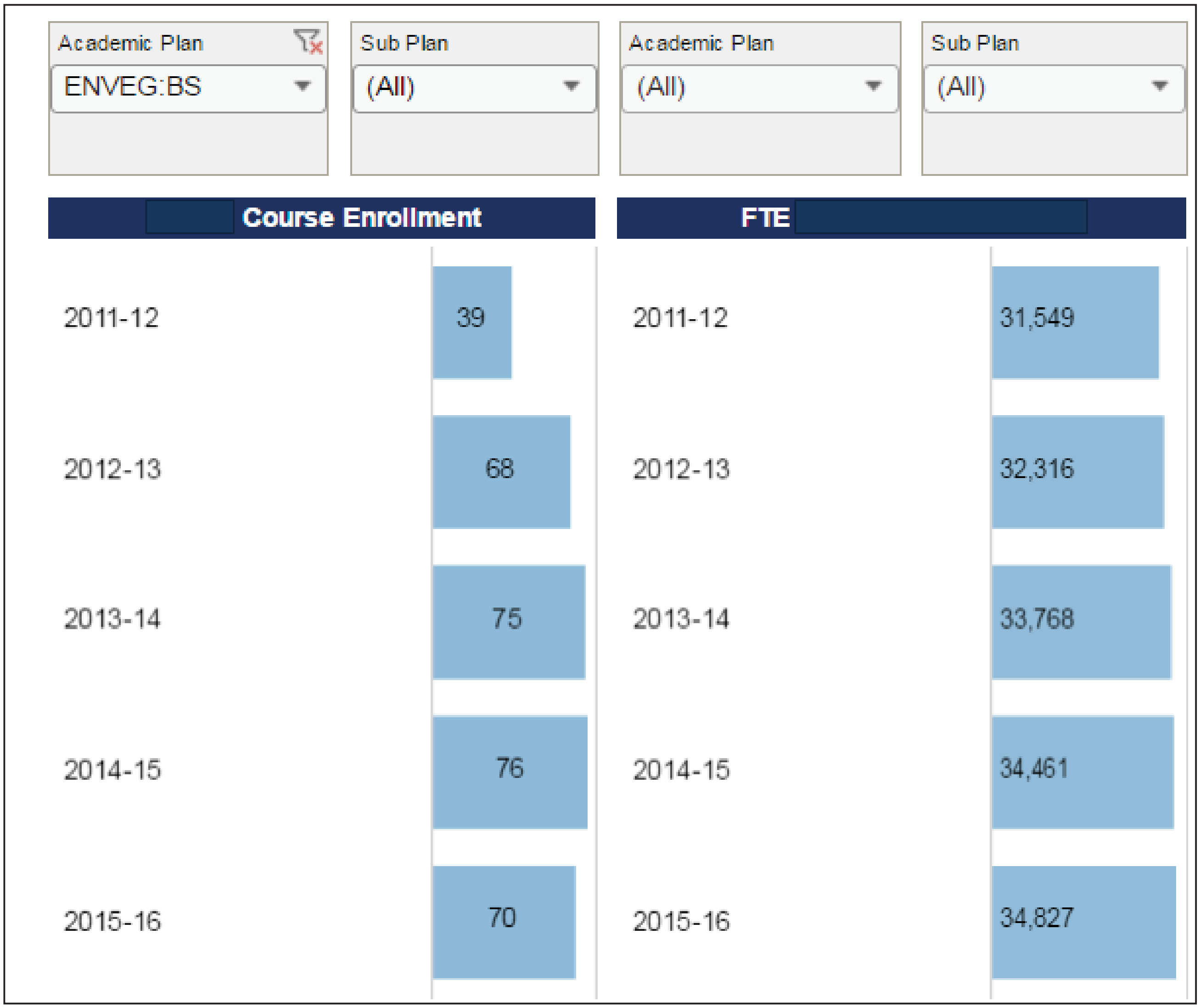

Figure II.1 Enrollment of BS in Environmental Engineering from 2012 to 2016
(Source: FIU Accountability dashboard)

Academic year	Degrees awarded
2011-2012	9
2012-2013	9
2013-2014	16
2014-2015	10
2015-2016	10

Figure II.2 Degrees Awarded for BS Program in Environmental Engineering from 2011 to 2016
(Source: FIU Accountability dashboard)

II.B. Goals developed and major changes as a result of last program review

II.B.1. Goals

The department is currently developing its new strategic plan for the period 2016-2020. The new strategic plan will be finalized by December 2016.

The last strategic plan was developed in 2010 for the period 2010-2015. Driving values for the last strategic plan were defined as:

- Freedom of thought and expression
- Respect for the dignity of the individual
- Honesty, integrity and truth
- Excellence in teaching and in the pursuit of generation, dissemination, and application of knowledge
- Global issues awareness
- Pursuit of sustainable solutions

The goals were developed in areas that relate to education, research, service and enhancement. The goals that relate to the graduate programs are not included here. The numbering of the goals is how they are numbered in the Department Strategic plan 2010-2015. The specific goals developed for each area that relate to the undergraduate programs are as follows.

I. Education (ED)

Goal ED-I. The CEE Department will comply with the ABET program educational objectives (PEOs) of its undergraduate degree programs in civil and environmental engineering.

Strategy A: Prepare graduates for jobs for which a civil or environmental engineering degree is used or required, or for graduate study

Metrics:

1. Percent of faculty members who regularly emphasize the societal impacts and related contemporary issues of civil and environmental projects (target: 100%)
2. Effectiveness of the Capstone Senior Design experiences in applying knowledge and techniques from at least four technical areas in both civil engineering and environmental engineering (target: use design projects with applications of at least 4 distinct technical areas)
3. Number of invited professional practitioners in the civil and environmental fields giving presentations to students on real-world projects (target: 10 in each area)

Strategy B. Help graduates make progress towards obtaining professional registration, special licensing, or certification

Metrics:

1. Percent of students who passed the Fundamentals of Engineering Fundamental of Engineering (FE) Exam (target: consistently exceeds the national average).
2. Minimum passing grade for FE course (target: requires a “C+” to pass the course).

3. A 30-credit-hour post-baccalaureate non-degree option established.

<u>Strategy C</u>: Help and encourage graduates to update and expand their knowledge through practice, educational venues, or graduate study.

Metrics:

1. Number of alumni subscriptions in mailing list (to be added to the department website; target: 2010).
2. Number of reported activities in an electronic survey (to be added to the departmental website; target: 2010).
3. Frequency of dissemination of information on educational and training opportunities through alumni mailing list (to be initiated through FIU alumni office and updated alumni database; target: 2010). .(target: X?)

Accomplishment:

The Department has a formalized process to conduct direct and indirect assessments periodically (with specific cycles), evaluate results and implement necessary changes. The ABET review of the program took place in fall 2014. The final statement received in summer 2015 stated no shortcomings for the program. The program accreditation was approved for 6-years until the next accreditation cycle. The next accreditation visit will occur in fall 2020.

Goal ED-II. This goal applies to graduate programs and not included here.

Goal ED-III. This goal applies to graduate programs and not included here.

Goal ED-IV. The CEE Department will increase the quality of our undergraduate students.

<u>Strategy A</u>: Increase entrance requirements to upper division

Metrics:

1. Approval of minimum requirement for mathematics and science courses of “C+” or higher
2. Establishment of an exam-based approach for all transferred courses
3. Implementation of a tutoring program run by senior and graduate students for all upper division courses
4. Participation of faculty members in an annually established or attended “teaching effectiveness” workshop for all faculty members
5. Implementation of additional effort to continuously increase the FE passing rate
6. Enhancement of curriculum by integrating sustainability and global issues aspects throughout the undergraduate upper division offerings

<u>Strategy B</u>*: Establish communication and new partnerships in Universities within the American Hemisphere and other unrepresented countries*

Metrics:

1. Number of CEE students of different geographic, ethnic and cultural origins enrolled on an annual basis (measured in FTE)
2. Number of CEE faculty of different geographic, ethnic and cultural origins enrolled on an annual basis (measured in FTE).

Accomplishment:

Department has implemented monitoring policies and procedures for student progress. The final report received from ABET in summer 2015 stated no shortcomings.

Goal ED-V. This goal applies to graduate programs and not included here.

Goal ED-VI. The CEE Department will embrace and modify the degree program curricula to the guidelines of the "Body of Knowledge" documents developed by the American Society of Civil Engineers and the American Academy of Environmental Engineers.

<u>Strategy</u>*: Appoint and support a BOK Faculty Committee to Assess and Implement BOK contents for both degree programs in civil engineering and environmental engineering at all levels*

Metrics:

1. Appointment of a committee in Spring 2010
2. Committee report on assessment of BOK's scope and proposed plan for full implementation
3. Committee report to adjust undergraduate curricula (also meeting ABET criteria)
4. ABET accreditation steps for the MS degrees in both civil engineering and environmental engineering

Accomplishment:

The CEE Department has formalized the review cycles and activities. UPAC continuously monitors the changes in the requirements in degree program curricula during periodic review of the national exam criteria changes; ABET accreditation requirements as well as professional society expectations. The curriculum is continuously reviewed and feedback is received and evaluated during UPAC meetings (monthly), student forums (once per semester), DAB meetings (once per year), faculty meetings (monthly), and faculty retreat (once per year).

II. Research (R)

Goal R-I. The CEE Department will increase research funding per faculty.

<u>Strategy A</u>*: Increase faculty size in strategic areas and foster practices conducive to research funding generation (Target: $0.5M/year in 5 years)*

Metrics:

1. Increase in new tenure-track or tenured faculty in strategic areas, e.g., sustainability, energy, green engineering, etc. *Target: 5 new tenure-track or tenured faculty in 5 years*.
2. Increase in non-tenure research faculty with high potential for fund generation. *Target: 5 new non-tenure research faculty in 5 years*.
3. Increase postdoctoral candidates with experience in grant writing to help faculty in proposal development. *Target: 4 postdoctoral candidates per year should be hired and supported for the next 5 years*.
4. Active participation in Grant Development workshops and Funding Opportunity workshops (such as workshop by Department of Homeland Security). *Target: 2 Grant Development workshops to be attended by each faculty per year.*
5. Application for new grant opportunities (resources: websites, OSRA updates, RFPs). Collaboration with intra- and inter-departmental faculty to develop multi-disciplinary proposals is highly encouraged. *Target: Minimum of 2 new proposals amounting to a minimum of $200,000 should be submitted per faculty per year.*
6. Collaboration with faculty in strategic areas from other universities to develop collaborative proposal. *Target: Minimum of 2 new collaborative proposals should be submitted by CEE per year*.
7. Networking with industry to develop joint proposals with faculty in strategic areas (e.g., NSF's GOALI, DOD's SBIR, STTR). *Target: Minimum of 2 new collaborative proposals with industry should be submitted by CEE per year*.

Accomplishment:

As shown in Figure II.3., below, from July 2013 to March 2016, the unit was awarded $16.3 million in external funding. A listing of awards is shown in Appendix C. Approximately 250 awards were granted to 18 separate Principal Investigators from the unit in this time period. The awards varied as the number of awards included initial awards, increases, and supplements. The highest initial award amount was $1.4 million for a Tier 1 UTC. The lowest initial amount was $2,000 for a fellowship program. The average initial award was $108,407. The faculty continues to well represent the university in its academic productivity and service in national and international organizations.

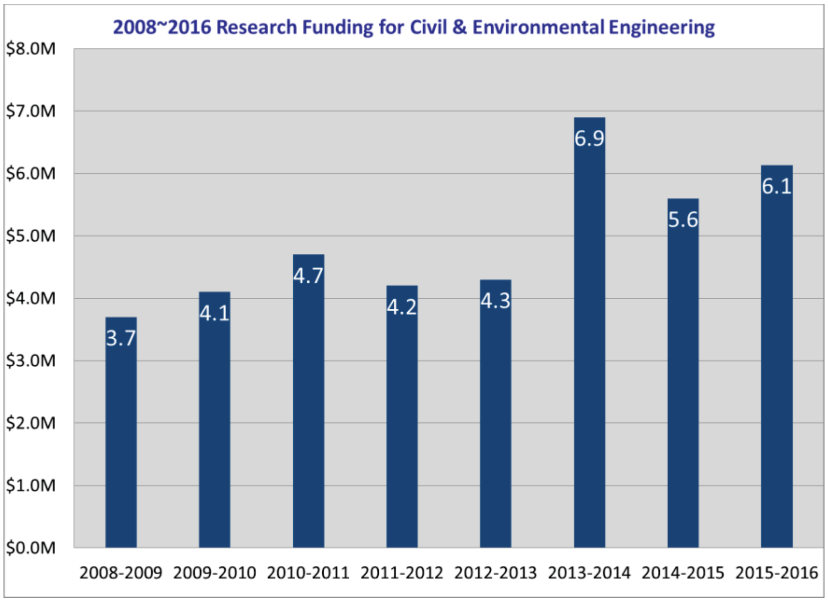

Figure II.3 Research Funding in Civil and Environmental Engineering from 2008 to 2016

GOAL R-II. The CEE Department will increase journal publications per faculty member.

<u>Strategy</u>: *Increase research activities and actively pursue dissemination of results through peer reviewed journal publications (Target: reach 3 Publications/faculty /year in 5 years)*

Metrics:

1. Number of quality PhD students capable of excellent research. *Target: Minimum of 1 new PhD student should be supervised by each faculty per year in addition to the current students.*
2. Increase in number of joint journal publications with students. This can be encouraged by motivating students to have PhD dissertation written in the form of several journal papers (Abstract, Paper 1, Paper 2, Paper 3, Conclusions). Peer-reviewed journals with <u>shorter turnaround time</u> should be targeted. *Target: Minimum of 2 journal publications coauthored with students by each faculty per year.*
3. Collaboration with intra- and inter-disciplinary faculty and faculty in other universities to perform multi-disciplinary research and publish the results. *Target: Minimum of 1 journal publication coauthored with other researchers by each faculty per year (in addition to the 2 publications per year with the students).*
4. Increase in high quality postdoctoral candidates with track record of several publications to help you in continuously publishing research results. *Target: 4 postdoctoral candidates per year should be hired and supported in the next 5 years.*
5. Increase in publications in national and international conferences and seek the opportunity to get invited in submitting extended versions of the papers in journals. *Target: Minimum of 1 international or national conference should be attended per*

faculty per year and minimum of 2 conference proceedings should be published per faculty per year.

Accomplishment:

With increasing funding and research activities, journal publications have also increased during the last 5 years. The details of the publications are shown in the Self-Study-Report for PhD program.

Goal R-III. The CEE Department will increase faculty and student participation in interdisciplinary research activities.

<u>Strategy</u>*: Promote, establish and expand collaborative research initiatives with other FIU academic units, other universities or research organizations*

Metrics:

1. Level of effort of CEE faculty and students involved in active funded research projects that involve multi/cross/interdisciplinary collaborations of faculty and students: faculty and student time will be measured in FTE on an annual basis.
2. Level of effort of CEE faculty and students involved in proposed pending research projects that involve multi/cross/interdisciplinary collaborations of faculty and students: faculty and student time will be measured in FTE on an annual basis presented in proposals pending.

Accomplishment:

With increasing funding and research activities, interdisciplinary research activities increased. The details of the publications are shown in the Self-Study-Report for PhD program.

III. Service (S)

Goal S-I. The CEE Department will provide a good customer service in support of FIU 3.0 objectives.

<u>Strategy</u>*: Provide a positive experience for FIU students, alumni, donors, and visitors with their academic and departmental needs as well as to create a strong sense of loyalty to the CEE department and FIU.*

Metrics:

1. The time for prospective and current students, alumni, donors, and visitors spending on the phone, waiting in line, or scheduling an appointment. Target: To fully shift from traditional one-on-one appointments to an easy-to-navigate departmental website, web-based registration and updated information.
2. Survey from student forums and department advisory board (DAB) meetings. Target: To achieve at a minimum 70% positive feedback.

Accomplishment:

The CEE Department has an active involvement with the community. Community engagement is one of the top priorities in FIUs mission. Faculty and students are actively involved with service activities (i.e., serving on the County boards, projects from the State and County, public service/volunteer activities).

Goal S-II. The CEE Department will raise the national standing of the department through professional and community services.

Strategy: Increase participation and reputation of the CEE department and FIU in professional societies, conventions, conferences, and editorial board as well as serving the local community.

Metrics:

1. Numbers of professional, technical, and/or standard committees serving by faculty as active members, secretary, and/or chair. Target: An average of 3 committees per faculty.
2. Numbers of editorial boards serving by faculty members. Target: An average of one editorial board per faculty.
3. Numbers of conferences and/or sessions organized or moderated by the faculty members. Target: A total of 2 conferences and/or sessions per year for the CEE department.
4. Numbers of publications submitted and presented by students and faculty annually at national and international conventions and conferences. Target: An average of 3 publications per faculty per year.
5. Number of faculty and students nominated for national and international awards, scholarship, and fellowships. Target: A total of 4 awards per year for the CEE department.
6. Student placement in regional and national competitions. Target: To place in the top 5 of every competition.
7. Number of community services participated by the faculty and students. Target: A total of 6 community services per year for the CEE department.

Accomplishment:

The CEE Department has been the home for two national research centers. In the 2017 Best Graduate School Rankings, the CEE Department was ranked 110th. This is the first time for the Department ranked by the U.S. News and World Report.

IV. Enhancement (EN)

Goal EN-I. The CEE Department will work to enhance the image of all its research and education programs.

Strategy A: Active participation in state and national conferences

Metrics:

1. At least two papers to be annually submitted/presented at well attended conferences by students and faculty members annually
2. Objective to get each faculty member in national committees of leading professional societies for our engineering programs (at least, 1 for assistant professor, 2 for associate professor and 3 for full professor)

3. Department will annually have a booth, with FIU and departmental information, at one state and one national conference and exhibitions

<u>Strategy B</u>: Establish a task force to study information and indicators that are used by US News & World Report specialty rankings of engineering programs and to implement a program to maintain and increase rankings

Metrics:

1. Data collection and number of indicators reported annually to the peer assessment survey of the US News & World Report
2. Ranking of the US News & World Report

Accomplishment:

Department has implemented monitoring policies and procedures aligned with the metrics used for national rankings.

Goal EN-II. The CEE Department will achieve a sustainable level of growth in its faculty size.

<u>Strategy</u>: Develop a recruiting plan to hire the best tenure-track and non-tenured track faculty to support both teaching and research in main technical areas of the civil and environmental engineering professions.

Metrics:

1. Rate of faculty growth per year, measured in FTE. All tenure track, research track and teaching track faculty will be accounted for in this metric.

Accomplishment:

Since the previous review in 2008, eleven new tenured or tenure-track faculty members: Dr. Xia Jin and Dr. Priyanka Alluri in Transportation Engineering, Dr. Omar Abdul-Aziz in Water Resources Engineering, Dr. Atorod Azizinamini, Dr. Kingsley Lau, Dr. Ralf Arndt, and Dr. David Garber in Structural Engineering, Dr. Ioannis Zisis in Wind Engineering, and Dr. Seung Jae Lee in Geotechnical Engineering. The Department also hired two Professors of Practice; Dr. Michael Bienvenu and Dr. Hesham Ali in the Pavement Engineering.

Three instructors, Dr. Anna Bernardo Bricker, Dr. Khokiat Kengskool, and Dr. Cora Martinez joined the department in 2010-11. Dr. Anna Bernardo Bricker teaches the courses in air pollution area and manages all environmental engineering labs. Dr. Khokiat Kengskool is responsible for teaching engineering economics. Dr. Cora Martinez and Ms. Joanna Sanabria serve as the undergraduate advisors. The Department has a full-time lab manager, Mr. Edgar Polo, who oversees our teaching labs and assists with some of our research labs. Over the same period, the Department lost ten faculty members to career moves. Among these ten faculty members, Dr. Omar Abdul-Aziz in Water Resources Engineering and Dr. Ralf Andt in Structural Engineering have joined and left the department.

The Department currently has 16 tenured and tenure-track faculty members, 2 professors of practice, and 3 instructors. Totally, there are 21 full-time faculty members. Eight years ago, the Department had 16 tenured and tenure-track faculty members and 1 instructor. These numbers represent an increase in the faculty size from 17 to 21 over the past decade.

Goal EN-III. The CEE Department will broaden its efforts in securing an endowment for the department.

Strategy: Identify and secure a number of contributors to an endowment and start the endowment within the coming year.

Metrics:

1. Consolidated amount of annual CEE endowment, expressed in monetary value ($) for all cash, infrastructure, equipment and in-kind contributions.

Accomplishment:

Department is actively engaged with alumni to increase funding from organizations for student scholarships, financial support for student competitions, and endowment funds.

Goal EN-IV. The CEE Department will expand its involvement in training and technology transfer (T^3) activities

Strategy: Expansion of current continuing education programs to serve the civil engineering and environmental engineering communities of the region.

Metrics:

1. Number of contact hours imparted through T^3 activities on an annual basis, discriminated by program areas: general CEE, structural/construction, environmental, water resources, transportation, and others of relevant priority.

Accomplishment:

The CEE faculty are actively engages in technology development and technology transfer. Department also conducts the Construction Training Qualification Program (CQP). In addition, workshops, seminars, webinars and conferences are routinely organized in areas that are of growing interest such as sea level rise, water quality, infrastructure, and human-environment-building interfaces.

Goal EN-V. The CEE Department will increase its impact on solving global problems.

Strategy: Encourage an active faculty and student participation in areas of research that address global problems and needs in cooperation with other disciplines and national and international institutions and organizations

Metrics:

1. Level of effort of CEE faculty and students involved in active funded research projects that involve collaborations of faculty and students on global problems: faculty and student time will be measured in FTE on an annual basis.
2. Level of effort of CEE faculty and students involved in proposed pending research projects that involve collaborations of faculty and students on global problems: faculty and student time will be measured in FTE on an annual basis presented in proposals pending.

Accomplishment:

Starting with freshmen entering in 2010, the University implemented "Global Learning" (GL) initiative for all undergraduate programs. Capitalizing on FIU's unique demographics and location in the gateway to the Americas, Global Learning for Global Citizenship enables students to achieve specific learning outcomes: global awareness, global perspective, and global engagement. Global Learning for Global Citizenship is a promise to every FIU student: graduates of the University will be empowered with the knowledge, skills, and attitudes they need to become informed and engaged citizens of the world. Global Learning courses are categorized as either Foundations or Discipline-Specific. Foundations courses are part of the University Core Curriculum. Discipline-Specific courses are offered within the context of an academic program. A few GL courses may count towards either category. However, no single course may count towards both categories. Each student must take at least two courses that are designated as Global Learning courses by the Office of Global Learning. The student must take at least one Global Learning Foundations (University Core Curriculum) Course and one Global Learning Discipline-Specific Course. The ENV 3001 Introduction to Environmental Engineering course is designated as the "Discipline-Specific" Global Learning course in the department. The faculty who teach the Global Learning courses must attend 4-hour training and must conduct activities and assessments each time the course is offered so that the students develop global awareness, global perspective, and global engagement. Global Learning courses must demonstrate team-based, interdisciplinary exploration of real-world problems.

II.B.2. Significant accomplishments reached as a result of continuous quality improvement and ability to capture emerging trends, needs and opportunities

The CEE Department had a formalized process and review cycles for evaluating Student Learning Outcomes, program needs, curriculum changes, and quality improvement. An accountability system, shown in Figure II.4 on the next page, was also adopted at that time to evaluate and continuously improve the program. The system primarily consists of outcome assessments using a combination of measures, an evaluation of those measures (by faculty, regularly every term, and the DAB, for major changes as needed), and to develop the decisions and actions to enhance achievement of the Student Learning Outcomes for continued program improvement. The Undergraduate Program Advisory Committee (UPAC) has led all program efforts related with the assessment, evaluation, and corrective actions to ensure that all students achieve the SLOs.

The UPAC, after review of the assessment results, is also responsible for coordinating with the faculty and the DAB, as needed, to achieve the periodic evaluation of all PIs and development and implementation of appropriate improvement actions as needed. The program has actively and continuously implemented the process presented in Figure 3.1 since its first accreditation visit in 2008. Over the past years, the student outcomes have been regularly assessed and evaluated by the UPAC and the faculty, with DAB input at times

In spring 2014, the UPAC reviewed the previous 12 Student Learning Outcomes (referred as SOs in the ABET Self Study) and made minor changes and combined 3i.1 and 3i.2 to student outcome (i). Then, the current 11 Student Learning Outcomes were thoroughly reviewed by the DAB via email communications by DAB. The Student Learning Outcomes were also reviewed by the entire CEE faculty during the monthly meeting on February 25, 2014. The entire CEE faculty agreed that the current 11 Student Learning Outcomes (a through k) fully comply with Clauses (a) through (k) of Criterion 3 of the ABET 2014-15 Criteria for Accrediting Engineering Programs. The 11 Student Learning Outcomes are thematically grouped under five categories: Technical Proficiency, Communication, Responsible Citizenship, Lifelong Learning, and Ethical Behavior. The relationship of 11 Student Learning Outcomes to three Program Outcomes (referred as Program Educational Objectives, PEOs, in the ABET Self Study Report) is shown Table II.3.

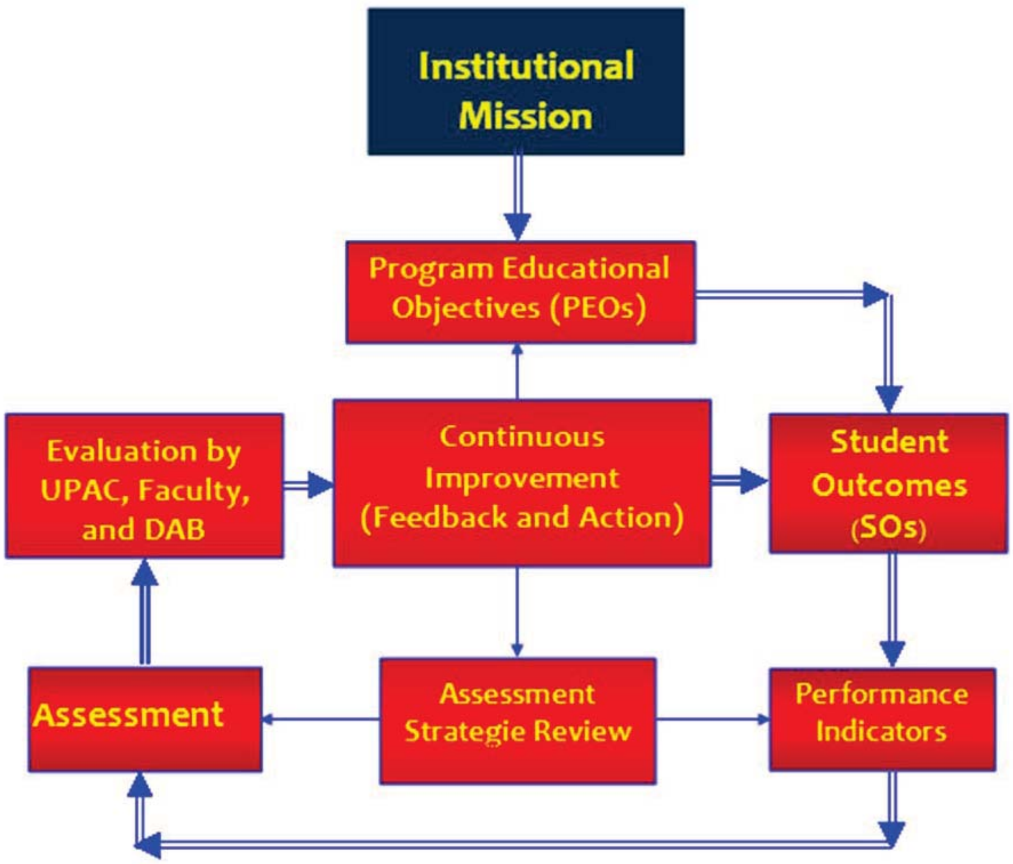

Figure II.4 Evaluation Process of SOs and Continuous Improvement of Program (as shown in the ABET Self Study Report, SO: Refers to Student outcomes and PEOs: Refers to Program Educational Objectives).

(Note: To align the terminology used by ABET with those used by the University for the purpose of this External review: SOs refer to the Student Learning Outcomes, and PEOs refer to the Program Objectives)

Table II.3. Relationship of Student Learning Outcomes (SLO) to Program Outcomes (PO)

Themes	Student Learning Outcomes		PO 1 **Career Success** Graduates will advance in their careers in environmental engineering or related areas by demonstrating technical proficiency, communication skills, responsible citizenship, leadership, and ethical behavior.	PO 2 **Professional Licensure** Graduates will make progress towards obtaining professional registration, special licensing, or certification.	PO 3 **Lifelong Learning** Graduates will pursue continued life-long learning to become the problem solvers considering the global, economic, environmental, and social impact.
1.Technical Proficiency	**(a)**	an ability to apply knowledge of mathematics, science, and engineering	√	√	
	(b)	an ability to design and conduct experiments, as well as to analyze and interpret data	√	√	
	(c)	an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	√	√	
	(e)	an ability to identify, formulate, and solve engineering problems	√	√	
	(k)	an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	√	√	
2. Communication	**(d)**	an ability to function on multidisciplinary teams	√	√	
	(g)	an ability to communicate effectively	√	√	
3. Responsible Citizenship	**(h)**	the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	√	√	√
	(j)	a knowledge of contemporary issues	√	√	√
4.Lifelong Learning	**(i)**	a recognition of the need for, and an ability to engage in life-long learning		√	√
5. Ethical Behavior	**(f)**	an understanding of professional and ethical responsibility	√	√	√

Note: ABET terminology is SOs for Student Learning Outcomes and PEOs for Program Educational Objectives.

Based on the systematic reviews, the following changes have been made in the program.

1. Corrective Actions to Improve FE Exam Performance (FE Review Class)

The student performance in the Fundamentals of Engineering (FE) exam provides an assessment method for SLOs (a), (e), and (k) (Technical Proficiency); Outcome (i) (Lifelong Learning); and Outcome (f) (Ethical Behavior). In order to improve the performance of the students in the FE exam the following corrective actions were taken in Spring 2013:

FE Review course improvement plan:

1) Require the FE Review course in the senior year rather than junior year (this is already implemented).
2) Prepare students for the morning exam and the general option for the afternoon exam. It is more efficient to study the same subjects for both, morning and afternoon exams.
3) Post FE review supporting material from PPI on Blackboard for students to view for free.
4) Make the students review the material and then come to class where the instructor does FE-style practice problems for 2 hours.
5) Administer two exams, one mid-term exam including Math, Chemistry, Statistics, Engineering Economy, Ethics, Statics and Dynamics; then a cumulative exam at the end of the course, including all the sections.
6) Count both, mid-term exam grade and cumulative exam grade in determining pass or fail for the course (60% final exam, 40% mid-term exam).
7) Do not sign the letter of good standing if students have not passed the FE Review course (Undergraduate Advisor).
8) Train faculty on how to conduct the review sessions. Provide them with the PPI FE Review Manual, NCEES FE Reference Handbook, PPI FE review notes.
9) Create a library available for students in our labs with web-based FE practice exams, for the morning and afternoon sessions. Encourage students to practice taking these exams.

After changes, the average passing rate improved from 33.3% for the October 2012 FE exam (30.3% below the national average) to 66.7% (12.5% below the national average) for the April 2013 FE exam and 68.3% (only 4.3% below the national average) for the October 2013 FE exam. Evidence of FE exam improvement is also illustrated in the average percent correct for each subject administered during the morning session, as shown in Figures 4.7, 4.8, 4.9, 4.10, 4.11, 4.12, 4.22, and 4.33 for Mathematics, Engineering Probability and Statistics, Statics, Dynamics, Strength of Materials, Fluid Mechanics, Ethics and Business Practices, as well as Computers, respectively. After April 2104, the performance of the Environmental Engineering program students in the FE exam is evaluated separately.

Based on the October 2013 FE exam results, besides Chemistry (3% below the national average), Computers (1% below the national average), Ethics and Business Practices (3% below the national average), Statics (1% below the national average), and Fluid (3% below the national average), the average percent correct for the other eight subjects touched on in the morning session are above the national average.

Since the FE exam format has been changed to a 6-hour computer-based test (CBT) starting in January 2014, the FE review class contents have been revised and updated for Fall 2013. The CEE department encourages now students to take the discipline-specific version in Civil Engineering or in Environmental Engineering, depending on the student's major, and the FE review class has been modified to prepare students for these exams in two different tracks.

Faculty, with recommendation from UPAC agreed to separate the FE Review course for the environmental engineering students as FE Review for Environmental Engineers for appropriate coverage of topics related to environmental engineering and to better align the topical coverage with those in the environmental FE exam (Proposed: Summer 2013; Implemented: Fall 2013, Catalog updated: Fall 2014).

Sections and topics covered in the FE review class include:

1) Mathematics
2) Probability and Statistics
3) Ethics and Professional Practice
4) Engineering Economics
5) Materials Science
6) Environmental Science and Chemistry
7) Thermodynamics
8) Fluid Mechanics
9) Hydraulics and Hydrologic Systems
10) Air Quality
11) Water Resources
12) Water and Wastewater
13) Solid and Hazardous Waste
14) Risk Assessment and Radiation

2. Improvements in Required Courses

Evidence of course improvement is demonstrated by the average scores of the student assessment of student outcomes. Corrective actions have been implemented to improve the student outcomes for the following courses:

CWR3201 Fluid Mechanics
EGN2030 Ethics & Legal Aspects in Engineering
ENV3001 Introduction to Environmental Engineering

3. General Course Improvements for Student Learning Outcomes (SLOs) (c), (d), (g), and (j)

Based on the average score of the SLOs student assessment measure, the following general course improvements have been successfully undertaken, increasing the achievement of SLOs (c), (d), (g), and (j).

SLO (c): an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

In Spring 2012, the faculty members teaching design courses were required to introduce additional practical design examples with realistic applications during class activities. The average scores of the student assessment for SO has been improved.

SLO (d): an ability to function on multidisciplinary teams

In Fall 2011, the Department chair discussed student outcome 3d with the corresponding instructors to improve teamwork in the classes. Team activities and projects have been incorporated into the courses with significant design content. Global Learning classes also require team projects. Implementation of the Global Learning initiative by the University has made a noticeable impact in general.

SLO (g): an ability to communicate effectively

Beginning in Spring 2012, in addition to the Senior Design Project course, the faculty members teaching 4000 level courses were advised to include a term paper, final project, and/or final presentation as a part of the course curriculum. The average score of the student assessment for improved from 3.24 for Fall 2011 to 3.61 for Summer 2012.

SLO (j): a knowledge of contemporary issues

Beginning in Spring 2012, the faculty members teaching design courses were required to introduce more practical design examples and contemporary issues. Global Learning classes also require projects and activities that expose the students to contemporary global issues. Implementation of the Global Learning initiative by the University has made a noticeable impact on the students' global awareness of the contemporary challenges.

4. Continuous improvement actions

1. Separated the FE Review course for the environmental engineering students as FE Review for Environmental Engineers for appropriate coverage of topics related to environmental engineering and to better align the topical coverage with those in the environmental FE exam (Proposed: Summer 2013; Implemented: Fall 2013, Catalog updated: Fall 2014). Starting April 2014, the students in the Environmental Engineering Program as tracked separately.
2. Added environmental ethics and professional ethics topics into topical coverage areas in the ENV4401 Water Supply and ENV4551Wastewater courses (taken primarily by environmental engineering students), as this topic was not addressed adequately in the EGN 2030 Ethics and Legal Aspects in Engineering course (Fall 2010)
3. Expanded the scope of the ENV 4891 Environmental Engineering Senior Design Project course to include projects and/or project tasks for addressing sustainability (i.e., renewable energy, recycling, natural processes) (Evaluated Fall 2010, Implemented Fall 2012)

4. Equipment updates for labs: All laboratories, including ENV 4005L, received funds for updating and replacing dated instruments (e.g., pH meters, gyratory shakers, conductivity meters with digital readouts) (Initiated the process in Fall 2012, Completed Fall 2013)
5. Hired a second advisor to the department to serve and address the needs of environmental engineering students (i.e., choice of electives, program curriculum) (Requested Fall 2011, Implemented Summer 2013)
6. Established of a second student society, student chapter for American Academy of Environmental Engineers and Scientists (AAEES) (in addition to the student chapter for Water Environmental Federation, WEF) to improve discipline specific lifelong learning, professional involvement and networking skills (Planned Fall 2012, Implemented Fall 2013).
7. Developed a formal process to ensure that all students enrolled in the Environmental Engineering Laboratories 3001L/4005L are informed about the hazards associated with wet laboratories. This process requires that students to show proof of completion of a basic laboratory safety training via our University Environmental Health and Safety division, and watch and discuss a series of videos filmed in our laboratory showing ways to avoid accidents and proper emergency response procedures specifically associated with the types of activities carried out in these courses (Need identified: Fall 2010; developed Fall 2012, implemented Spring 2013).
8. Revised the Program Outcomes after direct measures provided by the external review of the program (Initiated the process early Fall 2013, Completed Fall 2013)
9. Revised the direct assessment format and reporting by the instructor for the Student Learning Outcomes to include goals and corrective actions if goals are not achieved after the external review of the program (Initiated the process early Fall 2013, Completed Fall 2013)
10. Removed electrical engineering as a required course to better align the curriculum with the FE and PE exam scopes for environmental engineering and added discipline specific courses into the curriculum (Proposed: Fall 2013, Approved: Spring 2014, Catalog updated: Fall 2014)
11. Added CGN 2420 Computer Tools for Engineers course to the curriculum as a required course (Proposed: Fall 2009, Approved: Spring 2010, Catalog updated: Fall 2010).
12. Added ENC 3213 Professional and Technical Writing course to the curriculum as a required course (Proposed: Fall 2013, Approved: Spring 2014, Catalog updated: Fall 2014).
13. Added a new course for environmental engineering career advising and project management after direct measures provided by the external review of the program (Proposed: Fall 2013, Implemented: Spring 2015, Catalog updated: Fall 2014).
14. Combined solid waste and hazardous waste courses into one course (ENV4351 Solid and Hazardous Waste Management) to allow environmental engineering students to take an additional elective (Proposed: Fall 2009, Implemented: Fall 2010, Catalog updated: Fall 2011).

15. Revised the scope of the new combined course (ENV4351 Solid and Hazardous Waste Management) to address the relevant codes, regulations and treatment standards in development of design procedures for achieving the required treatment goals) (Proposed: Fall 2009; Approved and Implemented: Fall 2010, Catalog updated: Fall 2011)
16. Added new assignments and activities, as well as direct assessment rubrics for the ENV 3001 Introduction to Environmental Engineering course to be recognized as a university wide global learning course (Applied Fall 2010, Approved Fall 2011, Implemented Spring 2013).

II.B.3. Major changes in the Program as a result of changes in discipline, student demand, faculty feedback and labor dynamics

1. Improvement of Advising System

1.1. Graduation Success Initiative (GSI)

During the last three years, a university-wide Graduation Success Initiative (GSI) was implemented to help students to succeed academically. The objectives of the GSI are:

1) Help students find their appropriate major as early as possible.
2) Provide students with a clear path for timely graduation.
3) Give students immediate feedback and support if they get off their path to graduation.
4) Reach students proactively with guidance and not wait for them to contact the advisor.

1.2. Changes Implemented for the Advising System

To improve the advising process, the following actions have been implemented in response to GSI:

1) The Undergraduate Education Academic Advising Center, located in MMC, provides academic advising for exploratory students and those who need assistance in identifying or transitioning into an appropriate major. However, most of the freshman students are now placed in their corresponding majors since the first year of studies and receive advice from their corresponding department since the very first semester. For engineering students, advising is done centrally at the Engineering Advising Center. The Center is located at the Engineering Center and currently has 7 engineering advisors. The CEE Department recently hired a second full time Undergraduate Advisor to achieve the 300:1 advisor-to-student ratio that defines best practice nationally.

2) Advising holds are placed every semester only on engineering students having a GPA of 2.5 or less and on students who were not enrolled courses in the past academic term. Such students cannot register until the hold is lifted. An advising hold is only removed after a student has been properly advised as to the courses to register in that particular semester. Additionally, Panthersoft places low GPA, Warning/Probation holds on students with GPA less than 2.00 or that are in Academic Warning or Probation.

3) The UA uses Curriculum Flowcharts to illustrate the program's required coursework and pre-requisite chains in a graphical format. The CEE department updates its program flowcharts every year and makes them available at the Engineering Advising Center or online at the CEE advising website:
   http://www.cee.fiu.edu/wp-content/uploads/2012/12/CIVIL_FLOWCHART.pdf
   http://www.cee.fiu.edu/wp-content/uploads/2012/12/ENV_FLOWCHART.pdf
   In addition, the new tool Major Map, is used by the UA to provide students with a clear academic plan towards graduation. The Major Maps are term by term plans of study created for each program to help students select their courses while staying on track. The CEE department developed two, three, four and five year major maps for transfer and freshman students who plan to graduate in the corresponding amount of time. Three and five year maps are currently being implemented by the Advising Technology Office. The two and four year major maps can be seen in the following website: http://mymajor.fiu.edu
4) The UA also uses the My_eAdvisor system for monitoring student performance and progress. The new tool My_eAdvisor provides undergraduate students and advisors with immediate feedback with regard to the student's progress on interactive Major Maps. My_eAdvisor alerts students and advisors if a student is off track. High severity alerts are triggered when: 1) a student has a GPA of less than 2.00, and 2) a student did not pass a course. Medium severity alerts are triggered when: 1) a student has a GPA of less than 2.25, and 2) a student enrolled in a course out of sequence with the student's major map or 3) a student enrolled in a course outside his/her plan of study. Low severity alerts are triggered when: 1) earned a passing grade that is less than a threshold (critical indicator) grade set by the academic department to indicate student success in the major, and 2) a student did not meet full time enrollment status. When alerts are generated (at the end of the academic term), the UA reaches out to the student using intrusive advising via the eAdvisor dashboard.
5) The UA also utilizes the Panther Degree Audit (PDA) to observe the student academic progress. This new feature allows students and advisors to review the courses student have taken, including in-progress courses, and review and plan for courses needed to complete their degree. For continuing undergraduate students, the Panther Degree Audit replaces the SASS Report used in the past as the degree audit tool. In the PDA, requirements are arranged into groups/sections, as the student completes a requirement, the system updates the PDA (normally at the end of every term) and the different groups/sections are gradually closed. The Degree Audit is also used to record any transfer credits that are used to satisfy specific program requirements.
6) In order to enforce appropriate sequence of courses, the UA uses a customized engineering course prerequisite query, which is run immediately after current semester grades are posted and also during the first week of the following term. The query reports the names of students who have not met course pre-requisites. These students are notified by phone and email to contact their advisor as soon as possible to review their course registration. The advisor then works with the student to adjust his/her course enrollment. If the student does not respond and remains registered, he/she is dropped from the course for which a pre-requisite has been violated.

II.B.4. Curricular changes that have been implemented, including new course development

1. Revisions of Program Curriculum

The current curriculum for the BS in Environmental Engineering has undergone changes for students admitted as of the 2015-2016 academic year. These changes were made to strengthen the curriculum and better align the courses with the Student Outcomes. One of the proposed changes includes removing the requirement for EEL 3110 – Circuit Analysis from the engineering science requirements. These three credits will be removed and replaced with ENC 3213 – Professional and Technical Writing. Students are currently required to take this course as part of the degree requirements, but the three credits do not count in the total 127 credits required for the degree. Removing Circuit Analysis will allow students to include the three credits for Professional and Technical Writing as part of those required for their degree.

A second change to the curriculum will be to replace EGN 3311 – Statics (3 credits) and EGN 3321 – Dynamics (3 credits) with EGM 3503 – Applied Mechanics (4 credits). The Applied Mechanics course covers material for both statics and dynamics of solids and fluids, as well as science of engineering materials. The upper level coursework in the Environmental Engineering curriculum does not need as in-depth a study as that provided in two semesters of Statics and Dynamics. By combining the material of the two courses in a one-semester four-credit course, students are able to take more courses in Environmental Engineering and take upper level courses earlier in their degree program. Since Statics and Dynamics are each three credits and Applied Mechanics is a four-credit course, replacing Statics and Dynamics with Applied Mechanics allows for two additional credits to be added to the program to maintain the 127 credits required for completion of the program.

One of the available two credits in the program is filled by a course currently required in the Environmental Engineering curriculum – the FE Review Seminar (ENV 4960). This course is a preparatory course for the Fundamentals of Engineering (FE) Exam, as described previously in this section. By combining Statics and Dynamics into one course, the FE Review course is now counted as one-credit of the 127 credits required for the degree.

The second available credit was filled with a new course that was added to the curriculum. The new course, ENV 3081 Career Orientation and Project Management Skills, intended for Sophomore/Junior students and also required for all transfer students. This one-credit course was developed to provide students with an overview of the professional practice and project management skills for Environmental Engineering. Students are presented with the subfields within Environmental Engineering; various job opportunities, as well as project management concepts in both practice and research environments. The intent of the course is to assist the students in identifying and selecting area(s) of emphasis they may wish to pursue in their studies and professional careers. Students are introduced to professionals from the area and will be exposed to current environmental engineering projects, as well as their societal implications. Additionally, the course presents students with project management tools and skills needed to monitor progress and cost control of projects. The course also helps students gain a better understanding of the importance of lifelong learning and professional development.

The Undergraduate Electives Concentration Policy was developed to advise students to take electives in one of the areas concentration in environmental engineering (i.e., air, land, and water systems and associated environmental health impacts). The details of the Undergraduate Electives Concentration Policy are shown in Appendix D Curriculum. In order to offer enough electives for each concentration, the following new electives were developed and offered individually, without cross-listing with graduate courses as CEN4930 Special topics.

CES 4580 Hurricane Engineering and Global Sustainability	(3)
CGN 4510 Sustainable Building Engineering	(3)
CGN 4XXX Introduction to Numerical Methods in Engineering	(3)
CWR 4204 Hydraulic Engineering	(3)
CWR 4620C Ecohydrological Engineering	(3)
EGN 4070 Engineering for Global Sustainability and Environmental Protection	(3)
ENV 4101 Fundamentals of Air Pollution Engineering	(3)
TTE 4102 Urban Transportation Planning	(3)

2. Development of Undergraduate Electives Policy

In order to ensure full compliance with ABET Criterion, with regard to the application of knowledge in environmental engineering technical areas, UPAC and the program have worked to improve the curriculum for students, especially for development of meaningful electives in view of the local, national, and research needs.

II.C. Current annual goals (2015-2016)

Currently the university is in the midst of a profound transformation. In May 2013, FIU initiated a process to create this new strategic plan through the integrating Research, Engagement, Assessment and Learning (iREAL) Commission. FIUBeyondPossible2020 was developed as FIU's roadmap for the future. The university has implemented a number of initiates to monitor the progress and achieve these goals. The program adapted the goals that relate to the Department performance and graduates from the program as shown below (Table II.5).

Table II.5 20 FIU Beyond Possible 2020 Critical Performance Indicator Goals

2014	No	PERFORMANCE INDICATOR	2020	PROGRAM GOALS
79%	1	FTIC 2-year retention with GPA above 2.0	90%	x
53%	2	FTIC 6-year graduation rate	70%	x
64%	3	AA transfer 4-year graduation rate	70%	x
68%	4	Percent bachelor's degrees without excess hours	80%	x
77%	5	Percent of bachelor's graduates employed full-time or in continuing education	80%	x

46%	6	Bachelor's degrees in strategic areas	50%	x
52%	7	Graduate degrees in strategic areas	60%	x
$26K	8	Average cost per bachelor's degree	$20K	x
$36K	9	Median wage of bachelor's graduates	$40K	x
6,219	10	Bachelor's degrees awarded to minorities	7,200	x
1,982	11	Number of First Gen graduates	2,300	x
4,737	12	Number of students participating in internships	6,000	x
159	13	Research doctoral degrees per year	200	x
83	14	Research staff/post-doctoral Fellows	129	x
2	15	Number of patents per year	20	x
2:8	16	Number of startups-AUTM:SBDC definitions	5:20	
$176M	17	Private gifts - overall endowments	$300M	x
$53M	17a	Private gifts - annual gifts	$70M	x
$197M	18	Auxiliary revenue per year	$240M	x
$20M	18a	Auxiliary operating income	$25M	x
$133M	19	Research expenditures	$200M	x
$107M	19a	S&E expenditures	$165M	x
54,000	20	Total number of FIU students enrolled	65,000	
67:8:25	20a	Mode of delivery (face-to-face:hybrid:online)	30:30:40	x

Based on FIU Beyond Possible 2020 Critical Performance Indicators, the current goals and achievement of Civil Engineering programs are shown in Table II.6. For goal #1, FTIC 2nd Yr Retention with GPA above 2.0, the retention rate for BS in Environmental Engineering changed from 75.56% (2013-14) to 79.31% (2014-15). For goal #4, Percent of BS Degrees without Excess Hours, the data changed from 38.95% (2012-13) to 43.04% (2013-14), then 46.99% (2014-15). The results of other goals also have minor improvement.

Table II.6 Current Goals and Achievement of Programs in Environmental Engineering

FIU Beyond Possible 2020						
ENVIRONMENTAL ENGINEERING		**20 Critical Performance Indicator Goals**				
No	**Metric**	**PAST**	**CURRENT**	**PROJECTED**		
		2014-15	**2015-16**	**2016-17**	**2018-19**	**2019-20**
1	FTIC 2Yr Retention with GPA above 2.0 (2013-14)	**61.5% (Actual) (cohort = 13)**	**Goal: 82% Prelim: 85.7% (cohort = 7)**	**Goal: 83% * (projected)**	**Goal: 85% * (projected)**	**Goal: 87% * (projected)**
2	FTIC 6Yr graduation rate (2008-09)	**53.8% (Actual) (cohort = 13)**	**Prelim: 58.3% (cohort = 12)**	**Goal: 33%**	**Goal: 40%**	**Goal: 45%**
3	AA Transfer 4-year graduation rate (2010-11)	**0% (Actual) (cohort = 9)**	**Prelim: 57.1% (cohort = 7)**	**Goal: 44%**	**Goal: 46%**	**Goal: 48%**
4	Percent bachelor's degrees w/o excess hours (2013-14)	**29% (Actual)**	**Goal: 31%**	**Goal: 33%**	**Goal: 35%**	**Goal: 37%**
5	Percent of bachelor's graduates employed full-time or in continuing education (2012-13 Graduates)	**NA**	**Goal:74%**	**Goal:76%**	**Goal:78%**	**Goal:80%**
6	Bachelor's degrees in strategic areas (2013-14)*	**10**	**10**	**10**	**11**	**11**
7	Graduate degrees in strategic areas (2013-14)	**1**	**4**			
8	Average cost per bachelor's degree (2013-14)	**N/A**				
9	Median wage of bachelor's graduates (2011-2012 Graduates)	**$40,328***	**$41,135***	**$41,546**	**$41,961**	**$42,381**
10	Bachelor's degrees awarded to minorities (2013-14)	**6/10**	**7/10**	**7/10**	**7/11**	**7/11**
11	Number of First Gen graduates (2013-14)	**2**	**3**	**3**	**3**	**3**
12	Number of students participating in internships (2014-15)					
13	Research doctoral degrees per year (2013-14)	**NA**				
14	Research staff/post-doctoral Fellows					
15	Number of patents per year					
16	Number of startups-AUTM:SBDC definitions					
17	Private gifts-overall endowment (FY 2013-14)					
17a	Private gifts-annual gifts (FY 2013-14)					

18	Auxiliary revenue per year (FY 2014-15)					
18a	Auxiliary operating income					
19	Research expenditures in millions (FY 2013-14)					
19a	S&E expenditures					
20	Total number of FIU students enrolled	**107**	**105**	**91**	**98**	**107**
20a	Mode of delivery (face-to-face:hybrid:online) (2014-15)					**30:30:40**

*Data for Civil Engineering Program is used due to limited data available.

II.D. Recommendations of any specialized accreditation (ABET)

The program was reviewed by ABET in Fall 2014 (November 16-18, 2014). During the visit one shortcoming was identified as follows:

1. <u>Criterion 4. Continuous Improvement</u> This criterion requires that program regularly use appropriate, documented process for assessing and evaluating the extent to which the students outcomes are being attained. Many of the student outcomes are assessed using course portfolios common to both the environmental engineering and civil engineering programs. Because a high percentage of the students in these courses are from the civil engineering program, the data collected are mingled and better represent the civil engineering program than the environmental engineering program. As a result, it is difficult to determine the extent to which the students in the environmental engineering program are attaining student outcomes. While the program also uses a student survey to determine the attainment of the student outcomes, the heavy reliance on self-reported data does not provide an adequate basis for assessment and evaluation. Thus the program lacks strength of compliance with the criterion.

The environmental engineering program faculty have taken several corrective actions for immediate implementation (starting Fall 2014). These corrective actions were approved by the Undergraduate Program Committee (UPAC) during the meeting held on Nov 20, 2014.

These corrective actions are:

1. Revised direct assessment procedures so that environmental engineering students enrolled in classes that are jointly taken by both civil engineering and environmental engineering students are assesses separately.

2. Defined and documented appropriate rubrics aligned with each Student Learning Outcome for assessments of course portfolios.

3. Conducted Student Learning Outcomes assessments (a-k) for the portfolio analysis of environmental engineering students during Fall 2014 semester. In addition, data available for environmental engineering students for Spring 2013 and Fall 2013 were assessed and analyzed separately.

4. Revised exit interview questions for the environmental engineering students for improving assessment and documentation of SO: f and SO: i. Conducted the exit interviews with the revised questions in Fall 2014 and analyzed the results.

A formal 30-day response was provided to ABET with supporting documentation (including detailed documentation of FE exam scores and score analyses, course portfolio assessments, enrollment data from courses where students are majority and senior design project assessments) and have documented the assessment results after implementation of the new rubrics.

In summer 2015, the program received its 6-year accreditation decision with no shortcoming.

III. PROGRAM ANALYSIS

III.A. Program Description, Purpose, and Objectives

III.A.1. Mission Statement

III.A.1.1. University Mission Statement

Florida International University (FIU) – Miami's public research university – is one of America's most dynamic institutions of higher learning. FIU was established by the Florida Legislature in 1965 and classes began in September 1972. In 1984, FIU received authority to begin offering degree programs at the doctoral level. The Carnegie Foundation for the Advancement of Teaching ranks FIU as a Research University in the High Research Activity, Category. A member of the State University System (SUS) of Florida, FIU offers a diverse selection of undergraduate, graduate, and professional programs. Through its 12 colleges and schools, FIU offers more than 185 baccalaureate, master's, and doctoral degree programs and also conducts basic and applied research. All programs received Level IV accreditation from the Southern Association of Colleges and Schools (SACS) in 1986 and 2000. SACS reaffirmed FIU's accreditation on December 6, 2010. FIU has more than 50,000 students, 1,100 full-time faculty, and 191,000 degrees awarded, making it the largest university in South Florida and placing it among the nation's largest colleges and universities. Committed to both quality and access, FIU meets the educational needs of traditional students as well as those of part-time students and lifelong learners. Interdisciplinary centers and institutes conduct research and teaching that addresses economic and social concerns.

The following section from the FIU Mission Statement, which is located on the FIU Home » About Us » Vision & Mission web site (http://www.fiu.edu/about-us/vision-mission/) and on FIU Provost Office web site (http://academic.fiu.edu/provost_mission.html), has also been published in the yearly University Course Catalogs (http://catalog.fiu.edu/2013_2014/undergraduate/admissions-and-registration-information/university-information.pdf).

> *"Florida International University is an urban, multi-campus, public research university serving its students and the diverse population of South Florida. We are committed to high-quality teaching, state-of-the-art research and creative activity, and collaborative engagement with our local and global communities."*

III.A.1.2. College Mission Statement

The College of Engineering and Computing recognizes the importance of a quality engineering education, particularly in the rapidly growing South Florida region. Here, the challenges facing an urban, diversified community depend heavily on technical and innovative solutions to resolve the problems in our infrastructure. FIU's College of Engineering and Computing strives to serve the engineering and technology management needs of Florida, the nation, and the international community.

The following section is reproduced from the college mission statement that is posted on the college web site, http://www.cec.fiu.edu/about/strategic-plan/vision-and-mission/.

> *"As the research engine of the university, and as a strong force for Miami's economic development, the College is committed to providing quality education, problem-solving research, and community engagement through local relevance, national visibility, and global exposure. The College will strive to enhance the quality of life for its students, faculty, alumni, and the community. The College's research mission is the pursuit of the discovery and application of innovative engineering ideas and technologies that will continue to enhance the economic vitality and quality of life in our community, our region, and the nation."*

III.A.1.3. Department Mission Statement

The Department of Civil and Environmental Engineering (CEE) offers a Bachelor's Degree Program in Civil Engineering and a Bachelor's Degree Program in Environmental Engineering. It also offers advanced study for Master of Science and Doctor of Philosophy degrees that include Master of Science in Civil Engineering, Master of Science in Environmental Engineering, and Doctor of Philosophy in Civil Engineering. The following section from the Departmental mission statement has been posted on the departmental web site at http://www.cee.fiu.edu/about-cee/vision-mission/ and http://www.cee.fiu.edu/accreditation-and-assessment/ as well as was published in the FIU Course Catalogs (http://catalog.fiu.edu/2013_2014/undergraduate/college-of-engineering-and-computing/civil-and-environmental-engineering.pdf).

> *"The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence."*

III.A.2. Department Vision

The CEE Department will make meaningful progress over the coming decade as it strives to attain teaching, research and scholarly productivity, actively seeking performance levels of research universities and expanding recognition for excellence in the study of global issues and pursuit of sustainable solutions.

III.A.2. Consistency of the Program with the current State University System (SUS) Strategic Planning Goals

The State University System of Florida has experienced extraordinary changes and shifts in recent years, as economic challenges in Florida have compelled state universities to implement innovative strategies and efficiencies to respond to both increased enrollment demands and budget constraints. These changes are reflected in the 2014 update of the State University System 2025 Strategic Plan, which was originally approved in November of 2011.

The Board's Access and Attainment Commission conducted a supply–demand study of the State's projected occupations and current baccalaureate degree production, and was rewarded with a legislative appropriation to close those gaps in degree production. The Board's list of Programs of Strategic Emphasis was also revised in November 2013 to reflect changes in workforce demands. Two additional Board committees–the Innovation and Online Committee and the Health Initiatives Committee–were created to assist in System strategic planning. The University of Florida and Florida State University were designated as Preeminent Universities and rewarded with additional funding to raise their national rankings.
And perhaps most importantly, the Board of Governors worked with the Florida Legislature and the Governor to implement a Performance–Based Funding Model that is a dramatic change to how the System will receive funding. The Performance–Based Funding Model provides incentives to universities to meet the Board's benchmarks – which are largely based on the 2025 goals in this Strategic Plan.

Performance–Based Funding Model has opened up unprecedented opportunities for universities to rethink how best to educate the next generation of thought leaders. In May 2013, FIU initiated a process to create this new strategic plan through the integrating Research, Engagement, Assessment and Learning (iREAL) Commission. The commission was appointed by FIU President Mark B. Rosenberg and chaired by then-Dean of the College of Arts and Sciences Kenneth G. Furton). Since then, more than 150 students, faculty, staff, alumni and community leaders have analyzed numerous challenges and opportunities to develop a path forward for the next five years, laying the foundation for FIUBeyondPossible2020.

This is a plan of action, one that when fulfilled will ensure that our university and students continue to thrive. This plan is consistent with who we are – an urban public research university proudly committed to providing a state-of-the-art education for traditional and non-traditional learners – locally and globally; a university that understands its role as an anchor institution in one of the most dynamic and energized cities in the world, Miami. The plan’s key measurable goals include:

1. Improving the first-to-second-year retention rate of our first-time-in-college (FTIC) students from 76 to 90 percent
2. Boosting our six-year graduation rate among FTIC students from 53 to 70 percent

3. Improving our four-year graduation rate of state college (AA) transfer students from 64 to 70 percent
4. Strategically increasing our enrollment to 65,000 students and increasingly using digital technologies to enhance face-to-face and distance learning
5. Expanding experiential learning opportunities for our students, with special attention to growing available student internships from 4,637 to more than 6,000 annually
6. Raising research expenditures from $130 million annually to $200 million annually
7. Increasing by 30 percent the number of Ph.D. degrees granted to more than 200 annually
8. Nurturing an expansion in patents and startups from an average of two per year to 20 annually
9. Growing our philanthropic giving to achieve the Next Horizon capital campaign goal of $750 million

The program is consistent with the goals identified and provides benefit to the University, region, State, and global community. The fragile South Florida ecosystem is a major national point of research, study and concern. FIU enjoys unique opportunities to leverage our tropical location for learning and research that focuses on environmental issues. With the Florida Everglades in our backyard, FIU scientists at the Southeast Environmental Research Center have been at the forefront of Florida Everglades research for more than two decades and have made great strides to restore and build resiliency for this vital ecosystem. Additionally, the academic centers include the International Center for Tropical Botany at The Kampong (the only garden of the National Tropical Botanical Garden outside Hawaii) in Coconut Grove, the Aquarius Reef Base in the Florida Keys, the Wall of Wind at the Engineering Center and the Batchelor Environmental Center (in collaboration with the Patricia and Phillip Frost Museum of Science) at BBC. These initiatives will play an important role moving forward in the development of preeminent programs that directly address the needs of the community and enhance community sustainability.

III.A.3. Programmatic information

III.A.3.a. BOG metrics

1. Employment and Continuing Education Data for baccalaureate graduates
The data obtained from FIU Analysis and Information Management (AIM) office is shown as below. Data unavailable due to FETPIP's rule to exclude based on 10 or fewer full-time employees.

	2010-2011	2011-2012	2012-2013	2013-2014
# of Graduates	N/A	N/A	N/A	15
% Employed after 1 year	N/A	N/A	N/A	60.0%
Average of Annual Salary	N/A	N/A	N/A	N/A
Percent Continuing Education	N/A	N/A	N/A	13.3%

Source: FETPIP
Note: The years noted above represent the graduation years for FIU baccalaureate recipients. The salary and continuing education figures are based on outcomes from one year after graduation. Salary data are only for graduates who are employed full-time in Florida. Salary data are not provided for years with 10 or fewer full-time employees.

This indicator is related to FIU Beyond Possible 2020 Performance Indicator Goal #5, Percent of bachelor's graduates employed full-time or in continuing education. The improvement for the goal is to achieve achieve the projected target (80%) in 2019-20.

2. FTIC six-year graduation and retention rates **(**based on latest declared major**)**
The data obtained from FIU Analysis and Information Management (AIM) office is shown as below.

The six-year graduation rate for FTICs decreased by 22.2% over the last 3 cohort years. Cohort sizes are small for this program so trends on graduation and retention rates may be misleading.

LAST TERM PROGRAM	COHORT YEAR	COHORT HEADCOUNT	GRADUATION RATE	RETENTION RATE
Environmental Engineering	2007 - 2008	6	33.3%	66.7%
	2008 - 2009	3	33.3%	33.3%
	2009 - 2010	9	11.1%	55.6%

Note: The cohort years noted above represent the entering cohort year. Graduation rate represents the students from the particular cohort year who graduated within six years of entering the university. Retention rate includes students who graduated from the particular cohort years as well as those still enrolled at the university.

This indicator is related to FIU Beyond Possible 2020 Performance Indicator Goal #2, FTIC 6Yr graduation rate. The improvement for the goal is to maintain and achieve the Department projected target (40%) in 2019-20.

3. 2014 FTICs Academic Progress Rate: 2nd-year Retention with GPA above 2.0 (based on first declared major, includes full-time students only)
The data obtained from FIU Analysis and Information Management (AIM) office shown as below is for 2014. FTIC second year retention with GPA above 2.0 is a new metric in the program review. The second year retention is ~13% lower than the university-wide second year retention (80%).

FIRST TERM CIP DESCRIPTION	COHORT HEADCOUNT	2ND YEAR RETENTION WITH GPA ABOVE 2.0
Environmental Engineering	12	66.67%

This indicator is related to FIU Beyond Possible 2020 Performance Indicator Goal #1, FTIC 2Yr Retention with GPA above 2.0. The improvement for the goal is in the right trend and the program will achieve the Department projected target (83%) in 2019-20.

4. Bachelor’s without Excess Hours
The data obtained from FIU Analysis and Information Management (AIM) office shown as below is for 2014-2015. The percent of Bachelor’s degrees without excess hours is a new metric in the program review. Environmental Engineering’s percent of Bachelor’s degrees without excess hours is ~19% lower than the university-wide percent of Bachelor’s degrees without excess hours (69%).

CIP DESCRIPTION	% DEGREES WITHOUT EXCESS HOURS
Environmental Engineering	50.00%

This indicator is related to FIU Beyond Possible 2020 Performance Indicator Goal #4, Percent bachelor's degrees w/o excess hours. The improvement for the goal is in the right trend and the program will achieves the Department projected target (50%) in 2019-20.

5. Bachelor's Degrees awarded to Minorities (1st Majors)
The data obtained from FIU Analysis and Information Management (AIM) office is shown as below. The number of Bachelor's degrees in Environmental Engineering awarded to minorities decreased by 2 over the last 5 years. The percent of Bachelor's degrees in Environmental Engineering awarded to minorities fluctuated over last 5 years but peaked at 92.3% in the 2013-14 academic year.

	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015
Count	8	5	8	12	6
Percent	88.9%	71.4%	88.9%	92.3%	66.7%

Note: This report uses BOG Methodology which counts on Hispanic and African American students as underrepresented minorities, and excludes Non- resident Aliens and Not Reported from the totals used to calculate the percentages.

This indicator is related to FIU Beyond Possible 2020 Performance Indicator Goal #10, Bachelor's degrees awarded to minorities. The improvement for the goal is in the right trend and the program will achieve the Department projected target (72/92) in 2019-20.

III.A.3.b. FIU Metrics

1. Enrollment Data
The data obtained from FIU Analysis and Information Management (AIM) office is shown below. Enrollment at the Lower Level decreased by -21% from 173 to 136 students over the last 6 years. Enrollment at the Lower Level decreased by -29% over the last 6 years. Enrollment at the Upper Level increased by 76% over the last 6 years. Enrollment at the Grad I Level decreased by -64% over the last 6 years.

CIP Description	Student Level	Fall 2010	Fall 2011	Fall 2012	Fall 2013	Fall 2014	Fall 2015
Environmental Engineering	Lower	21	33	39	37	29	15
	Upper	51	59	67	69	78	90
	Grad I	28	24	15	15	8	10
Environ. Engineering Total		100	116	121	121	115	115

Note: Students are counted as enrolled if they are taking at least one class during the term specified above and their program is based on their declared major.

The enrollment is expected to continue to grow. However, due to changes in the criteria for admission to the program, the enrollment numbers are expected to drop due to changes in how the enrollment is counted.

2. Degree Production

The data obtained from FIU Analysis and Information Management (AIM) office is shown as below. Bachelor's degrees awarded increased by 8 over the last 6 years.
Master's degrees awarded fluctuated from 9-18 between 2009-10 and 2013-14, but decreased to 1 in 2014-15.

CIP Description	Student Level	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015
Environmental Engineering	Bachelors	2	9	9	9	16	10
	Masters	11	18	12	9	11	1
	Doctoral	N/A	N/A	N/A	N/A	N/A	N/A
Environ. Engineering Total		13	27	21	18	27	11

The trend is expected to continue to stabilize.

3. Instructional Efforts (Fall and Spring only)

The data obtained from FIU Analysis and Information Management (AIM) office is shown as below. At the Lower level, the percent of full-time faculty decreased by ~24% over the last 3 years. At the Upper level, the percent of full-time faculty decreased by ~12% over the last 3 years. At the Graduate level, the percent of full-time faculty remained relatively unchanged over the last 3 years.

Department	Acad. Year	Level	Percent Full-Time	Total Course Credits
Civil & Environmental Engineering	2012-2013	LOWER	63.79%	58
		UPPER	93.33%	270
		GRAD	99.17%	483
	2013-2014	LOWER	42.19%	64
		UPPER	72.30%	278
		GRAD	100.00%	507
	2014-2015	LOWER	39.68%	63
		UPPER	81.63%	294
		GRAD	98.61%	577

4. FTEs and Fundable Student Credit Hours (FSCH)

The data obtained from FIU Analysis and Information Management (AIM) office is shown as below.

Total FTE for Civil Engineering increased by 14% between 2010-2011 (278.7) and 2014-2015 (318.5). Total FSCH for Civil Engineering also increased by 16% between 2010-2011 (10,543) and 2014-2015 (12,241).

		2010-2011		2011-2012		2012-2013		2013-2014		2014-2015	
		FTE	FSCH	FTE	FSCH	FTE	FSCH	FTE	FSCH	FTE	FSCH
Civil Engineering	LOWER	59.3	2,373	59.5	2,379	56.2	2,249	63.0	2,518	68.7	2,749
	UPPER	143.7	5,746	139.2	5,567	169.2	6,766	187.0	7,481	187.6	7,504
	GRAD I	46.9	1,502	40.2	1,285	39.0	1,248	27.3	873	21.3	681
	GRAD II	28.8	922	32.4	1,036	32.0	1,024	41.6	1,330	40.8	1,307
	TOTAL	**278.7**	**10,543**	**271.2**	**10,267**	**296.4**	**11,287**	**318.8**	**12,202**	**318.5**	**12,241**

Note: Data for Civil Engineering is displayed since FTE and FSCH is not easily broken down for Environmental Engineering.

5. AA Transfer Four-Year Graduation and Retention Rates (based on latest declared major)
The data obtained from FIU Analysis and Information Management (AIM) office is shown as below.

LAST TERM PROGRAM	COHORT YEAR	COHORT HEADCOUNT	GRADUATION RATE	RETENTION RATE
Environmental Engineering	2009 - 2010	4	0.0%	50.0%
	2010 - 2011	5	40.0%	60.0%
	2011 - 2012	6	0.0%	16.7%

Note: The cohort years noted above represent the entering cohort year. Graduation rate represents the students from the particular cohort year who graduated within four years of entering the university. Retention rate includes students who graduated from the particular cohort years as well as those still enrolled at the university.

This indicator is related to FIU Beyond Possible 2020 Performance Indicator Goal #3, AA Transfer 4-year graduation rate. The improvement for the goal is to achieve the Department projected target (50%) in 2019-20.

6. Graduate Students' Time to Degree
The data obtained from FIU Analysis and Information Management (AIM) office is shown as below. The detailed analysis is shown in the self-study report for PhD in Civil Engineering program. The average time to degree for Master's students has slightly decreased to 1.67 in 2014-15.

Degree	2010-11	2011-12	2012-13	2013-14	2014-15
Masters	1.89	1.87	2.07	2.09	1.67
Doctoral	N/A	N/A	N/A	N/A	N/A

Source: UGS

7. First-Time Pass Rate on Licensure Exam(s)
The first-time passing rate on FE exam results are shown on the next page. (Table II.7). The detailed improvement on this indicator is presented in previous Section II.B.2. The passing rate of FE exam fluctuates due to small size of the program. The improvement goal for the indicator is that the program will achieve the department short term goal (65%) and the long term goal (70%) in 2019-20.

Table II.7 Summary of FE Exam Passing Rate (%) for Currently Enrolled Undergraduate Students (Environmental only).

Exam Date[a]	Environmental Program FE-Environmental			ABET Comparator[b]		
	Examinees		Passing Rate	Examinees		Passing Rate
	Taking	Passing		Taking	Passing	
Apr 2014 G	2	2	100.0%	186	146	78.0%
Oct 2014 E	2	2	100.0%	186	146	78.0%
Oct 2014 G	1	1	100.0%	4	3	75.0%
Apr 2015 E	1	0	0.0%	19	17	89.0%
Apr 2015 G	2	2	100.0%	432	334	77.0%
Oct 2015 E	1	0	0.0%	33	33	67.0%
Oct 2015 G	7	5	71.0%	269	197	73.0%
Apr 2016 E	1	0	0.0%	39	32	82.0%

a. E: Enrolled, G: Graduate
b. Comparator includes all examinees from program s accredited by the ABET commission noted.
Corrective Actions (Spring 2013 and 2015):
1. Revise the FE review course CGN4980 by adding more sections.
2. Rearrange the instructors and assign the most appropriate faculty for each session.
3. Conduct the students' evaluation and feedback for each section at the end of the course for future course improvement.
4. The short term goal is to improve our FE exam passing rate to 65% and the long term goal to 70%.

III.A.3.c. Academics analytics departmental data

The department data provided by AIM has been analyzed in the previous sections. In addition, in Table II.6 for the past (2014-15) and current (2015-16) AYs, the related Performance Indicator Goals listed in FIU Beyond Possible 2020 have been discussed. Overall, the data and the actions taken by the Department demonstrate the improvement of these goals in the right trend, and the program will achieve the Department projected targets in 2019-20. However, due to challenging curriculum and cutting-edge professional requirements in engineering programs, the Department targets of goals #1 to #4 are lower than FIU's targets for 2019-20. In order to reach FIU's targets, the following improvement action plan has been established.

Performance Indicator #1, FTIC 2-Yr Retention with GPA above 2.0
Performance Indicator #2, FTIC 6-Yr graduation rate
Performance Indicator #3, AA Transfer 4-year graduation rate

1. New Courses:
   CGN2161 Career Orientation in Civil Engineering and ENV3081 Career Orientation & Project Management Skills have been developed and offered since spring 2015. The CEE undergraduate students take one of these two courses (depending on their major) once they enter the programs. These courses will help the students understand clearly the degree requirements.

2. Acceptance Requirements:
   - For FTIC Students
     The students will be accepted into engineering majors only when they are ready to take Calculus I.
   - For Transfer Students with an AA Degree
     The students will be accepted into engineering majors only when they completed Calculus II, Physics I, and Chemistry I.

3. Critical Courses (Early alert will be sent to the students who are not performing well in the critical courses.):
   - Math courses

   The math department has implemented online tutoring which has shown excellent results.
   http://undergrad.fiu.edu/cas/learning-center/online-tutoring.html

   - CGN4980 FE Seminar
   - Problems:

   (1) Low Class Passing Rate
   More than 40% of the students fail the class each term and some students have to take it more than twice.
   (2) Skipping the FE Seminar Class
   Some students registered directly for the official FE exam, with the intention of skipping the FE Seminar course. Few of them successfully passed the exam, while the others failed and delayed their graduation.

   - Action Items

   (1) A better team of instructors has been selected and the contents of lectures have been modified.
   (2) Homework is mandatory and counted as 25% of the student grade.
   (3) Tutoring sessions will be offered to the students before each exam.
   (4) Attendance to the lectures and the tutoring sessions will be counted as 5% of the student grade.
   (5) Two exams will be counted as 35% each of the grade. The 1st exam covers General Engineering sections and the 2nd covers Civil Engineering specific sections. The 2nd exam will not be cumulative.

III.A.3.d. Goals and strategies to redress any deficiency(ies)

The BS degree in Environmental Engineering program is not considered a "Low Performing/Productivity Program." There is no need to develop goals and strategies to redress any deficiency.

III.A.4. Review of Common Prerequisites

The common prerequisites of all required courses in Mathematics and Basic Sciences components (39 credit hours) as well as in General Education components (32 credit hours) have been reviewed to ensure that the program is in compliance with State approved common prerequisites. The details of the common prerequisites of the required courses are shown in Appendix A: Undergraduate Catalog and Appendix C: Curriculum.

The overarching goal of this review is to be compliant with the State's common prerequisites, which supports the most seamless transition possible for transfer students. The review involves comparing the State Common Prerequisite Manual (CPM) with University resources and tools.

LOWER LEVEL COURSES

	Course	Cr. Hrs.
	MACX311	4
or–	MACX281	4
&	MACX312	4
or–	MACX282	4
&	MACX313	4
or–	MACX283	4
&	MAPX302	3
or–	MAPX305	3
&	CHMX045/X045L	4
or–	CHMX045C	4
or–	CHSX440/X440L	
&	CHMX046/X046L	4
or–	CHMX046C	4
&	PHYX048/X048L	4
or–	PHYX048C	4
or–	PHYX043	
&–	PHYX048L	
&	PHYX049/X049L (1)	4
or–	PHYX049C	4
or–	PHYX044	
&–	PHYX049L	

FOR ALL MAJORS: Students are strongly encouraged to select required lower division electives that will enhance their general education coursework and that will support their intended baccalaureate degree program. Students should consult with an academic advisor in their major degree area.

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(1) PHYX049L does not count toward the degree at FIU.

This area was assessed by Undergraduate Education. The minor discrepancies were noted, and corrective actions were taken as recommended by Undergraduate Education.

III.A.5. Evaluation of doctoral programs

Not applicable

III.A.6. Synthesis and Analysis of Student Learning and Program Outcomes

III.A.6.a. Student learning outcomes (SLOs)

Summary of Assessment Results

Four Student Learning Outcomes (SLOs) and the corresponding assessment methods are shown in Table III.2. The details of assessment results and improvement of SLOs are presented in Appendix E: SLOs and POs Assessment Results. Environmental Engineering Senior Design Project (ENV 4891). The assessments were recorded using a 3-point rubric scale where 1 corresponds to “weak”, 2 with “average”, and 3 with “excellent. Minimum Criteria for Success is “average (2 out of 3)”. The summary of assessment results of SLOs over the past three years (2012-2015) is displayed in Table III.1. The assessment results of four SLOs have met minimum criteria for success for the past three years (2012-2015).

Table III.1 Summary of Assessment Results of Student Learning Outcomes (SLOs) for BS in Environmental Engineering Program over the past three years (2012-2015)

Student Learning Outcome	2012-2013	2013-2014	2014-2015
#1 Content	Met (2.95 mean)	Met (2.95 mean)	Met (2.95 mean)
#2 Critical Thinking	Met (2.95 mean)	Met (2.90 mean)	Met (2.92 mean)
#3 Technology Outcome	Met (3.0 mean)	Met (3.0 mean)	Met (2.9 mean)
#4 Communication	Met (2.8 mean)	Met (2.9 mean)	Met (2.9 mean)

Note:
1. Engineering Senior Design Project (ENV 4891) is selected to assess the outcomes.
2. A 3-point rubric scale where 1 corresponds to “weak”, 2 with “average”, and 3 with “excellent” is adopted.
3. Minimum Criteria for Success is “average (2 out of 3)”.

Table III.2 Student Learning Outcomes (SLOs) and Assessment Methods for BS in Environmental Engineering Program

Program Outcome (Stated in Measurable Terms)	Assessment Methods
1. <u>Content:</u> Graduates will demonstrate the ability to apply the integrated knowledge of mathematics, science, and engineering to solve environmental engineering problems.	Undergraduate Program Advisory Committee (UPAC) identified Environmental Engineering Senior Design Project (ENV 4891) as appropriate to assess this outcome. In this Senior Design course, students will create team design projects involving applications of fundamental environmental engineering concepts to project design, specifications, contracts and implementation. . **Artifact** This outcome will be assessed with the detailed calculations and analysis in the technical report that each team submits for the senior design project. **Evaluation Process** The artifact will be assessed by a faculty panel consisting of the course instructor(s), a minimum of two additional faculty members, and the external panelists invited to the senior design presentations. **Sampling** All senior design team projects will be assessed every semester that the course is offered. **Minimum Criteria for Success** Student teams will achieve a minimum of “average” on a 3-point rubric where 1 corresponds to “weak”, 2 with “average”, and 3 with “excellent.
2. <u>Critical Thinking</u>: Graduates will collect information, consider and compare performance of competing options, analyze and interpret results, and propose solutions for an environmental engineering design problem.	Undergraduate Program Advisory Committee (UPAC) identified Environmental Engineering Senior Design Project (ENV 4891) as appropriate to assess this outcome. In this Senior Design course, students will create team design projects involving applications of fundamental environmental engineering concepts to project design, specifications, contracts and implementation. . **Artifact** This outcome will be assessed with the discussion, conclusion, and justification sections of the technical report and corresponding oral presentation areas, including the overall reasonableness of the engineering solution proposed. **Evaluation Process** The artifact will be assessed by a faculty panel with a minimum of three members. **Sampling** All senior design team projects will be assessed every semester that the

	course is offered. **Minimum Criteria for Success** Student teams will achieve a minimum of “average” on a 3-point rubric where 1 corresponds to “weak”, 2 with “average”, and 3 with “excellent.
3. <u>Technology outcome:</u> Graduates of the program will utilize the techniques and skills of modern scientific and engineering technology for environmental engineering practice, including the use of appropriate laboratory/field testing equipment and appropriate computer software.	Undergraduate Program Advisory Committee (UPAC) identified Environmental Engineering Senior Design Project (ENV 4891) as appropriate to assess this outcome. In this Senior Design course, students will create team design projects involving applications of fundamental environmental engineering concepts to project design, specifications, contracts and implementation. **Artifact** This outcome will be assessed with the AutoCad drawings and demonstration of use of appropriate software to assist in design calculations as evidenced in the technical report. **Evaluation Process** The artifact will be assessed by a faculty panel with a minimum of three members. **Sampling** All senior design team projects will be assessed every semester that the course is offered. **Minimum Criteria for Success** Student teams will achieve a minimum of “average” on a 3-point rubric where 1 corresponds to “weak”, 2 with “average”, and 3 with “excellent.
4. <u>Communication:</u> Graduates of the program will communicate engineering ideas orally and graphically by presenting their semester-long design efforts in a formal and professional manner.	Undergraduate Program Advisory Committee (UPAC) identified Environmental Engineering Senior Design Project (ENV 4891) as appropriate to assess this outcome. In this Senior Design course, students will create team design projects involving applications of fundamental environmental engineering concepts to project design, specifications, contracts and implementation. **Artifact** This outcome will be assessed with the oral presentation component and the overall written technical report. **Evaluation Process** The artifact will be assessed by a faculty panel with a minimum of three members. **Sampling** All senior design team projects will be assessed every semester that the course is offered. **Minimum Criteria for Success** Student teams will achieve a minimum of “average” on a 3-point rubric where 1 corresponds to “weak”, 2 with “average”, and 3 with “excellent.

Past Improvements Based on Results

The UPAC has regularly reviews all undergraduate courses based on student course evaluations and course surveys. As deemed necessary by the UPAC improvements in courses have been implemented (e.g., CGN4980 FE Review) have been improved. The details of improvement are presented in Section II.B.3. The Curriculum of BS in Environmental Engineering program has been annually reviewed by the UPAC. The revisions of Program Curriculum are displayed in Section II.B.5.

Future Directions

Based on the assessment results of SLOs, the UPAC will regularly review the program curriculum and all courses in the program. The current improvement action plan shown in Section III.A.3.c has been established.

III.A.6.b. Program Outcomes (POs)

Summary of Assessment Results

Three Program Outcomes (POs) and the corresponding assessment methods are shown in Table III.4. The details of assessment results and improvement of POs are presented in Appendix E: SLOs and POs Assessment Results. The Alumni survey is selected to assess the outcomes. The assessments were recorded using a rubric scale based on "above average", "average", and "below average" for PO #1 and "Yes" and "No" for POs #2 and #3. The minimum criteria for success are to have a minimum of 80% of the alumni submitting the survey to either above average or average for PO #1, 50% of the alumni that passing the EIT/FE exam for PO #2, and 80% of the alumni submitting the survey to "yes" for PO #3. The summary of assessment results of POs over the past three years (2012-2015) is displayed in Table III.3. The assessment results of three POs have met minimum criteria for success for the recent years. Over 90% of the students from the Environmental Engineering program returned the surveys.

Table III.3 Summary of Assessment Results of Program Outcomes (POs) for BS in Environmental Engineering Program over the past three years (2012-2015)

Program Outcome	2012-2013	2013-2014	2014-2015
#1 Technical Proficiency, Communication Skills, Responsible Citizenship, Leadership, and Ethical Behavior.	Met (100% mean)	Met (100% mean)	Met (100% mean)
#2 Professional Registration	Met (50% mean)	Met (75% mean)	Met (100% mean)
#3 Life-long Learning	Met (97% mean)	Met (100% mean)	Met (100% mean)

Note:
1. Alumni survey is selected to assess the outcomes.
2. A rubric scale based on "above average", "average", and "below average" for PO #1 and "Yes" and "No" for POs #2 and #3 is adopted.
3. The minimum criteria for success are to have a minimum of 80% of the alumni submitting the survey to either above average or average for PO #1.
4. The minimum criterion for success is to have a minimum of 50% of the alumni that passing the EIT/FE exam for PO #2.

5. The minimum criterion for success is to have a minimum of 80% of the alumni submitting the survey to "yes" for PO #3

Table III.4 Program Outcomes (POs) and Assessment Methods for BS in Environmental Engineering

Program Outcome (Stated in Measurable Terms)	Assessment Methods
1. Graduates will advance in their careers in environmental engineering or related areas by demonstrating technical proficiency, communication skills, responsible citizenship, leadership, and ethical behavior.	**<u>Alumni Survey</u>** **<u>Procedure:</u>** Alumni surveys are conducted at the end of each Spring semester. The Undergraduate Program Director is responsible for conducting the surveys, as well as collecting and analyzing the results. The survey consists of 9 questions and sent via email to Civil Engineering alumni that have graduated during the last three years. The survey responses were recorded using rubric (above average, average, below average). The answers from the survey are used to determine the percentage of graduates who report that the program prepared them: 1. To advance in their careers by demonstrating technical proficiency. 2. To advance in their careers by demonstrating communication skills. 3. To advance in their careers by demonstrating responsible citizenship. 4. To advance in their careers by demonstrating progress to maintain and enhance their professional competency. 5. To advance in their careers by demonstrating professional and ethical performance. <u>Minimum criteria for success:</u> The minimum criteria for success are to have a minimum of 80% of the alumni submitting the survey to either above average or average.
2. Graduates will make progress towards obtaining professional registration, special licensing, or certification.	Alumni survey is used to assess this outcome. The survey responses were recorded using rubric (Yes, No). The answers from the survey are used to: 1. Determine the percentage of graduates who have passed the Fundamentals of Engineering (FE) exam. <u>Minimum criteria for success:</u> The minimum criterion for success is to have a minimum of 50% of the alumni that passing the EIT/FE exam.
Graduates will pursue continued life-long	Alumni survey is used to assess this outcome. The survey responses were recorded using rubric (Yes, No). The answers from the survey

learning to become the problem solvers considering the global, economic, environmental, and social impact.	are used to: 1. Determine the percentage of graduates who report that the program prepared them to advance in their careers by demonstrating progress lifelong learning to improve their skills. (progress to maintain and enhance their professional competency by continued professional development by attending training seminars, workshops, courses, or meetings organized by education institutes or professional organizations like ASCE, FES, WEF, AWWA, SWANA, NSPE, etc.) <u>Minimum criteria for success:</u> The minimum criterion for success is to have a minimum of 80% of the alumni submitting the survey to "yes".

Past Improvements Based on Results
The UPAC has regularly reviews all undergraduate courses based on student course evaluations and course surveys. Some courses (e.g., CGN4980 FE Review) have been improved. The details of course improvements are presented in Section II.B.3. The Curriculum of BS in Environmental Engineering program has been annually reviewed by the UPAC. The revisions of Program Curriculum are provided in Section II.B.5.

Future Directions
Based on the assessment results of POs, the UPAC will regularly review the program curriculum and all courses in the program. The current improvement action plan shown in Section III.A.3.c has been established.

III.B. Research Productivity

III.B.1. Grant Support
From July 2013 to June 2016, the unit was awarded $18.6 million in external funding. Approximately 250 awards were granted to 18 separate Principal Investigators from the unit in this time period. The awards varied as the number of awards included initial awards, increases, and supplements. The highest initial award amount was $1.4 million for a Tier 1 UTC. The lowest initial amount was $2,000 for a fellowship program. The average initial award was $108,407. The faculty continues to well represent the university in its academic productivity and service in national and international organizations.

III.B.2. Publications
A listing of peer-reviewed publications is shown in the Self-Study-Report for PhD in Civil Engineering program.

III.C. Partnerships/Entrepreneurial/Community Engagement Activities

III.C.1. Foundation and auxiliary entrepreneurial activities

The CEE Department is actively engaged with alumni to increase funding from organizations for student scholarships, financial support for student competitions, and endowment funds. The Department has an active involvement with the community. Community engagement is one of the top priorities in FIUs mission. Faculty and students are actively involved with service activities (i.e., serving on the County boards, projects from the State and County, public service/volunteer activities). Furthermore, the CEE faculty are actively engages in technology development and technology transfer. Department also conducts the Construction Training Qualification Program (CTQP) and Maintenance of Traffic (MOT) training programs for Florida Department of Transportation (FDOT). In addition, workshops, seminars, webinars and conferences are routinely organized in areas that are of growing interest such as sea level rise, resilient and sustainable engineering solutions, water quality, infrastructure, and human-environment-building interfaces. Moreover, the CEE Department has been the home for two national research centers.

III.D. SWOC Preparation

III.D.1. SWOC analysis

Strengths

- FIU is located in the significant geographical location which is the gateway to rest of continent with strong economic connectivity and among communities.

- The department has been nationally recognized in terms of recognition of faculty's contribution in White House, acceptance of Wall of Wind (WOW) as NSF NHERI Experimental Facility, and establishing the national Accelerated Bridge Construction (ABC) center. The department constantly conducts seminars, workshops, sessions, and webinars.

- Faculty is committed to department success, for both undergraduate and graduate programs.

- The department has been able to increase the faculty size and the number of active researchers. The faculty size has increased from 17 in 2008 to 21 today.

- The BS and PhD programs have grown significantly. During the past seven years, the students increases from 525 to 647 in BS in Civil Engineering, 32 to 103 in BS in Environmental Engineering, and 43 to 63 in PhD in Civil Engineering programs. The yearly degrees awarded also increases from 63 to 91 BS in Civil Engineering, 3 to 13 in BS in Environmental Engineering, and 8 to 13 in PhD in Civil Engineering programs.

- Support to researchers has been increased with a differential teaching assignment policy implemented. Faculty has also been provided funding for professional development consistently in the last seven years.

- The department has been successful in increasing external support from $3.7M in 2008 to an average of $6.1M the last seven years.

- A number of research areas have gained regional, national, and international attention and are supported by State-of-the-art experimental facilities such as WOW, Titan America Structures Lab, ITS Lab, and Driving Simulator. The laboratories are visited during the career orientation course.

- Student body of the department represents the diversity of the population of south Florida.

- The involvement of undergraduates in faculty research and high interests among undergraduate students in the combined 4+1 BS/MS programs.

- Large alumni body is employed in the region and has been recognized in many sectors of the south Florida community, including the private and government sector.

- The department has developed and operated several successful training programs, like Construction Training Qualification Program (CTQP) and Maintenance of Traffic (MOT), which have served the community needs for continuing education and job training as well as have provided additional revenues for the Department.

- The department has stretch goals and high faculty expectations.

Weaknesses

- The student to faculty ratio is extremely high, making it difficult to grow enrollment at either the undergraduate or graduate level.

- Some of the areas lack faculty, such as construction, geotechnical, and water resources.

- The equipment in the Materials and Geotechnical Testing laboratories is dated. The laboratory space is not enough to accommodate all equipment used in the experiments and students' book bags.

- The department does not have enough qualified staffs to support administrative needs, teaching, and streamline research activities (e.g. purchases, travel, hiring, etc.)

- The serious space limitations have affected both teaching and research performance.

Opportunities

- The regional demographic pattern is favorable for it involves a group of diverse, large, to different extents, underrepresented minority students in advanced degrees and cutting edge research activities.

- Demand for enrollment is expected to continue to grow in the region with diversified growing population that have family and commercial ties and relationships with the rest of the American continent.

- With increasing attention to global warming (sea level rise), hurricane hazards, transportation infrastructure, environment impacts in South Florida, resilient and sustainable infrastructure, water quality, and human-environment-building interfaces which are closely related to civil and environmental engineering, there will be opportunities for both innovative research and new federal funding initiatives.

- The Wall-of-Wind research program has gained momentum, as well as recognition nationally and internationally. This is an area where significant funding can be expected.

Challenges/Threats

- The student to faculty ratio is extremely high, making it difficult to grow enrollment at either the undergraduate or graduate level.

- The size of the faculty is inadequate to achieve both of teaching and research agenda, especially in the areas of construction, geotechnical, and water resources.

- It has been a challenge to recruit quality graduate students, especially doctoral and MS in Environmental Engineering students, given the decline in the number of graduate applicants in recent years.

- The serious space limitations have affected both of teaching and research performance.

- The shortage of department budget and staff support could hamper the growth of the department and its ability to attract students or research funding.

- The need to improve faculty salaries may not be met based on the current limited budget.

IV. CONCLUSIONS

(This segment is to be completed after the consultant visits FIU and submits report.)

IV.A. Strategic Planning and Improvement Action Plan

To be developed after the consultant visits.

IV.B. Program Review Summary Report

To be developed after the consultant visits.

APPENDIX A: UNDERGRADUATE CATALOG

Civil and Environmental Engineering

Atorod Azizinamini, Ph.D., P.E., *Professor and Chair*
Omar I. Abdul-Aziz, Ph.D., *Assistant Professor*
Hesham Ali, Ph.D., P.E., *Professor of Practice*
Priyanka Alluri, Ph.D., P.E., *Assistant Professor*
Michael Bienvenu, Ph.D., P.E., *Professor of Practice*
Anna Bernardo Bricker, Ph.D., *Instructor and Environmental Lab Manager*
Arindam G. Chowdhury, Ph.D., *Associate Professor and Director, Laboratory for Wind Engineering Research*
Hector R. Fuentes, Ph.D., P.E., D.E.E., *Professor and Associate Chair of Graduate Studies*
Albert Gan, Ph.D., *Professor*
David Garber, Ph.D., P.E., T.E., *Assistant Professor*
Lawrence Griffis, P.E., *Professor of Practice, Member of the National Academy of Engineering*
Mohammed Hadi, Ph.D., P.E., *Associate Professor*
Peter A. Irwin, Ph.D., P.Eng., *Professor of Practice*
Xia Jin, Ph.D., *Assistant Professor*
Khokiat Kengskool, Ph.D., *Instructor*
Shonali Laha, Ph.D., P.E., *Associate Professor*
Kingsley Lau, Ph.D., *Assistant Professor*
Seung J. Lee, Ph.D., *Assistant Professor*
Cora Martinez, Ph.D., *Instructor and Undergraduate Advisor*
Lakshmi Reddi, Ph.D., P.E., *Professor and Dean, University Graduate School*
L. David Shen, Ph.D., P.E., T.E., *Professor and Graduate Program Director, and Director, LCTR*
Lambert Tall, Ph.D., P.E., *Professor Emeritus*
Walter Z. Tang, Ph.D., P.E., *Associate Professor*
Berrin Tansel, Ph.D., P.E., *Professor and Undergraduate Program Director*
LeRoy E. Thompson, Ph.D., P.E., *Professor Emeritus*
Oktay Ural, Ph.D., *Professor Emeritus*
Ton-Lo Wang, Ph.D., P.E., *Professor and Associate Chair of Undergraduate Studies*
Ioannis Zisis, Ph.D., *Assistant Professor*

Affiliated Faculty
Assefa M. Melesse, Ph.D., P.E., *Department of Earth and Environment*
Fernando Miralles-Wilhelm, Ph.D., P.E., *Department of Earth and Environment*

Lehman Center for Transportation Research

L. David Shen, Ph.D., P.E., T.E., *Professor, Director*
Fabian Cevallos, Ph.D., *Transit Program Director*

Accelerated Bridge Construction University Transportation Center (ABC-UTC)

(www.abc-utc.fiu.edu)
Atorod Azizinamini, Ph.D., P.E., *Director*
David Garber, Ph.D., P.E., T.E., *Co-Director*

Civil and Environmental Engineering Mission Statement

The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Bachelor of Science in Civil Engineering

Program Educational Objectives

The Department of Civil and Environmental Engineering of Florida International University offers the Program in Civil Engineering with three main objectives that broadly describe the professional and career accomplishments that our graduates are prepared to achieve. These three objectives are:

Objective 1:
Graduates will advance their careers in civil engineering or related areas by demonstrating technical proficiency, communication skills, responsible citizenship, leadership, and ethical behavior.

Objective 2:
Graduates will make progress towards obtaining professional registration, special licensing, or certification.

Objective 3:
Graduates will pursue continued life-long learning to become the problem solvers considering the global, economic, environmental, and social impact.

Common Prerequisite Courses and Equivalencies

FIU Course(s)	Equivalent Course(s)
CHM 1045, CHM 1045L	CHMX045/X045L or CHM045C or CHSX440 and CHMX045L
MAC 2311	MACX311 or MACX281
MAC 2312	MACX312 or MACX282
MAC 2313	MACX313 or MACX283
MAP 2302	MAPX302 or MAPX305
PHY 2048, PHY 2048L	PHYX048/X048L or PHYX048C or PHYX043 and PHYX048L
PHY 2049	PHYX049/X049L[1] or PHYX049C or PHYX044 and PHYX049L

[1]PHYX049L does not count toward the degree at FIU.

Courses which form part of the statewide articulation between the State University System and the Florida College System will fulfill the Lower Division Common Prerequisites.

For generic course substitutions/equivalencies for Common Program Prerequisites offered at community colleges, state colleges, or state universities, visit: http://www.flvc.org, See Common Prerequisite Manual.

Common Prerequisites

CHM 1045	General Chemistry I
CHM 1045L	General Chemistry Lab I
MAC 2311	Calculus I
MAC 2312	Calculus II
MAC 2313	Multivariable Calculus
MAP 2302	Differential Equations
PHY 2048	Physics with Calculus
PHY 2048L	General Physics Lab I
PHY 2049	Physics with Calculus II

Additional lower-division courses required for the degree:

CHM 1046	General Chemistry II
CHM 1046L	General Chemistry Lab II
GLY 1010	Physical Geology
GLY 1010L	Physical Geology Lab

Degree Program Hours: Minimum 128

The Civil Engineering curriculum provides a program of interrelated technical areas of Civil Engineering with their fundamental core subjects of the engineering program. The technical interdisciplinary courses are in the areas of construction, geotechnical, environmental, structural, surveying, transportation, and water resources engineering.

Civil engineers play an essential role in serving people and the environmental needs of society. These needs relate to shelter, mobility, water, air and development of land and physical facilities.

The academic program is designed to meet the State of Florida's articulation policy as well as to satisfy criteria outlined by the Accreditation Board for Engineering and Technology (ABET), among others.

Lower Division Preparation

Students admitted to the university are admitted directly to their chosen major. Students are expected to make good progress based on critical indicators, such as GPA in specific courses or credits earned. In cases where students are not making good progress, a change of major may be required. Advisors work to redirect students to more appropriate majors when critical indicators are not met.

Lower division preparation includes completion of pre-engineering courses which include Engineering Drawing with CAD application (required unless previously taken and does not count towards the 128 credits required for graduation), Calculus I & II, Multivariable Calculus, Differential Equations, Chemistry I & II and Labs, Physics I with Calculus and Lab, Physics II with Calculus, and Introduction to Earth Sciences and Lab, all with a grade of 'C' or better. See the example semester by semester program in the following pages.

Effective pursuit of engineering studies requires careful attention to both the sequence and the type of courses taken. It is therefore important, and the college requires, that each student plan a curriculum with the departmental faculty advisor.

All students must comply with the University Core Curriculum Requirements for the University for Social Science, Humanities, Arts and English. The department requires a minimum of 15 semester hours in the area of Humanities, Arts and Social Science. All transfer students should refer to the Undergraduate Education section of this catalog to determine if they have met the requirements for Humanities, Social Science, Arts, and English at their previous institution.

A minimum grade of 'C' is required in all writing, physics, chemistry, and mathematics courses.

A minimum grade of 'C' is required of all Civil Engineering courses and prerequisite courses.

Students who have been dismissed for the first time from the University due to low grades may appeal to the Dean for reinstatement. A second dismissal will result in no possibility of reinstatement.

Other Requirements

Students must have a minimum 2.0 GPA, must complete all required classes, and must otherwise meet all of the state and university requirements in order to graduate.

Students who enter the university with fewer than 60 transferred credits must take 9 summer credits. Refer to the appropriate sections in the Catalog's for more information.

Courses are to be taken in the proper sequence. Any course taken without the required prerequisites and corequisites will be dropped automatically before the end of the term, resulting in a 'DR' or 'DF'.

Upper Division Course Objectives

The program of study encourages the development of a broadly educated civil engineering graduate, who can succeed as a productive engineer with continued professional growth. The courses listed as requirements for the BS degree not only provide the students with mathematical and scientific knowledge, but also include other essential areas necessary for a successful engineering career. The courses have been designed to increase student competence in written and oral communication skills as well as to develop critical thinking and creative problem solving strategies. Course projects are designed to teach engineering science fundamentals and their applications while providing enriching opportunities for laboratory and computer-based experiences. Furthermore, students are supplied with an understanding of the economic, social, ethical and professional responsibilities of engineers in our society and are encouraged to include sustainable development in all project designs.

Foreign Language Requirement

Students must meet the University Foreign Language Requirement. Refer to the appropriate sections in the Catalog's General Information for Admission and Registration and Records.

Upper Division Program

The basic upper division requirements for the BSCE degree are as follows:

Applied Mathematics (3)

STA 3033	Intro to Probability and Statistics	3
	or	
EIN 3235	Evaluation of Engineering Data	3

Engineering Sciences (17)

CGN 2420	Computer Tools for Engineers	3
CWR 3201	Fluid Mechanics	3

CWR 3201L	Fluid Mechanics Laboratory	1
EGM 3520	Engineering Mechanics of Materials	3
EGM 3520L	Materials Testing Lab	1
EGN 3311	Statics	3
EGN 3321	Dynamics	3

General Engineering Courses (8)

CGN 2161	Career Orientation in Civil Engineering	1
EGS 2030	Ethics and Legal Aspects in Engineering	1
EGN 3613	Engineering Economy	3
ENC 3213	Professional and Technical Writing	3

Civil Engineering Curriculum (42)

CCE 4031	Project Planning for CE	3
CEG 4011	Geotechnical Engineering I	3
CEG 4011L	Geotechnical Testing Laboratory	1
CES 3100	Structural Analysis	3
CES 4702	Reinforced Concrete Design	3
CGN 4802	Civil Engineering Senior Design Project	3
CWR 3540	Water Resources Engineering	3
ENV 3001	Introduction to Environmental Engineering – *GL*	3
ENV 3001L	Environmental Laboratory I	1
SUR 2101C	Surveying	3
TTE 4201	Transportation and Traffic Engineering	3
CGN 4980	Civil Engineering Seminar	1
C.E. Elective	(min)	3
C.E. Elective	(min)	3
C.E. Elective	(min)	3
C.E. Elective	(min)	3

Note: Students may be eligible to select some graduate level civil engineering technical electives as approved by the instructor and the undergraduate advisor.

Professional Graduation Requirement

Civil Engineering students must take and pass CGN 4980 (FE Seminar). Students showing evidence of passing the state FE (EIT) examination will have this requirement waived.

Civil Engineering Program

Students may have a different sequence of courses as arranged with their advisor. For complete program information, students should refer to the Program Summary Sheet available at the Department.

First Semester: (16)

MAC 2311	Calculus I	4
CHM 1045	General Chemistry I	3
CHM 1045L	General Chemistry I Lab	1
ENC 1101	Writing and Rhetoric I	3
GLY 1010	Physical Geology	3
GLY 1010L	Physical Geology Lab	1
SLS 1501	Freshman Experience	1

Second Semester: (13)

MAC 2312	Calculus II	4
ENC 1102	Writing and Rhetoric II	3
PHY 2048	Physics with Calculus	4
PHY 2048L	General Physics Lab I	1
CGN 2161	Career Orientation in Civil Engineering	1

Third Semester: (14)

UCC Humanities Group 1		3
MAC 2313	Multivariable Calculus	4
CHM 1046	General Chemistry II	3
CHM 1046L	General Chemistry Lab II	1
UCC Social Science Group 1		3

Fourth Semester: (16)

PHY 2049	Physics with Calculus II	4
MAP 2302	Differential Equations	3
CGN 2420	Computer Tools for Engineers	3
UCC Arts		3
UCC Humanities Group 2		3

Fifth Semester: (13)

EGN 3311	Statics	3
SUR 2101C	Surveying	3
ENC 3213	Professional and Technical Writing	3
EGS 2030	Ethics and Legal Aspects in Engineering	1
UCC Social Science Group 2		3

Sixth Semester: (13)

STA 3033	Introduction to Probability and Statistics for CS	3
	or	
EIN 3235	Evaluation of Engineering Data	3
EGN 3321	Dynamics	3
EGM 3520	Engineering Mechanics of Materials	3
EGM 3520L	Engineering Mechanics of Material Lab	1
EGN 3613	Engineering Economy	3

Seventh Semester: (14)

CWR 3201	Fluid Mechanics	3
CWR 3201L	Fluid Mechanics Lab	1
CES 3100	Structural Analysis	3
ENV 3001	Introduction to Environmental Engineering – *GL*	3
ENV 3001L	Environmental Laboratory I	1
TTE 4201	Transportation & Traffic Engineering	3

Eighth Semester: (16)

CEG 4011	Geotechnical Engineering I	3
CEG 4011L	Soil Testing Laboratory	1
CWR 3540	Water Resources	3
CES 4702	Reinforced Concrete Design	3
CE Elective		3
CE Elective		3

Ninth Semester: (13)

CCE 4031	Project Planning for Civil Engineers	3
CGN 4802	Civil Engineering Senior Design Project	3
CGN 4980	Civil Engineering Seminar	1
CE Elective		3
CE Elective		3

Suggested Electives for Structural Engineering Option**

CES 4320	Intro to the Design of Highway Bridges	3
CES 4580	Hurricane Engineering and Global Sustainability – *GL*	3
CES 4605	Steel Design	3
CES 4711	Introduction to Prestressed Concrete Structures	3
CGN 4510	Sustainable Building Engineering	3
CES 5106	Advanced Structural Analysis	3
EGM 5421	Structural Dynamics	3

Suggested Electives for Water Resources Engineering Option**

CWR 4204	Hydraulic Engineering	3
CWR 4530	Modeling Applications in Water Resources Engineering	3
CWR 4620C	Ecohydrological Engineering	3
CWR 5235	Open Channel Hydraulics	3
ENV 4401	Water Supply Engineering	3

Suggested Electives for Geotechnical Engineering Option**

CEG 4012	Geotechnical Engineering II	4
CEG 4126	Fundamentals of Pavement Design	3
CEG 5065	Geotechnical Dynamics	3
CES 4580	Hurricane Engineering and Global Sustainability – *GL*	3

Suggested Electives for Environmental Engineering Option**

ENV 4005L	Environmental Laboratory II	1
ENV 4024	Bioremediation Engineering	3
ENV 4101	Fundamentals of Air Pollution Engineering	3
ENV 4330	Hazardous Waste Site Assessment	3
ENV 4351	Solid and Hazardous Waste Management	3
ENV 4401	Water Supply Engineering	3
ENV 4513	Chemistry for Environmental Engineers	3
ENV 4551	Wastewater Treatment Engineering	3
ENV 4560	Reactor Design	3

Suggested Electives for Construction Engineering Option**

CCE 4001	Heavy Construction	3
CES 4580	Hurricane Engineering and Global Sustainability – *GL*	3
CGN 4510	Sustainable Building Engineering	3
CGN 4930	Special Topics in Civil Engineering	1-4
CCE 5035	Construction Engineering Management	3
CCE 5036	Adv Project Planning for Civil Engineers	3

Suggested Electives for Transportation Engineering Option**

CEG 4126	Fundamentals of Pavement Design	3
CGN 4321	GIS Applications in Civil & Environmental Engineering	3
TTE 4102	Urban Transportation Planning	3
TTE 4202	Traffic Engineering	3
TTE 4203	Highway Capacity Analysis	3
TTE 4804	Geometric Design of Highways	3

**All recommended and other technical electives must be approved by the advisor and must concentrate on relevant applications of civil engineering design. Selection of a proper sequence would allow the student to specialize within a focus area of interest (e.g., structural, geotechnical, construction, water, environmental, or transportation).

Bachelor of Science in Environmental Engineering

Program Educational Objectives

The Department of Civil and Environmental Engineering of Florida International University offers the Program in Environmental Engineering with three main objectives that broadly describe the professional and career accomplishments that our graduates are prepared to achieve. These three objectives are:

Objective 1:

Graduates will advance their careers in environmental engineering or related areas by demonstrating technical proficiency, communication skills, responsible citizenship, leadership, and ethical behavior.

Objective 2:

Graduates will make progress towards obtaining professional registration, special licensing, or certification.

Objective 3:

Graduates will pursue continued life-long learning to become the problem solvers considering the global, economic, environmental, and social impact.

Common Prerequisite Courses and Equivalencies

FIU Course(s)	Equivalent Course(s)
CHM 1045, CHM 1045L	CHMX045/X045L or CHM045C or CHSX440 and CHMX045L
CHM 1046, CHM 1046L	CHMX046/X046L or CHMX046C
MAC 2311	MACX311 or MACX281
MAC 2312	MACX312 or MACX282
MAC 2313	MACX313 or MACX283
MAP 2302	MAPX302 or MAPX305
PHY 2048, PHY 2048L	PHYX048/X048L or PHYX048C or PHYX043 and PHYX048L
PHY 2049	PHYX049/X049L[1] or PHYX049C or PHYX044 and PHYX049L

[1]PHYX049L does not count toward the degree at FIU.

Courses which form part of the statewide articulation between the State University System and the Florida College System will fulfill the Lower Division Common Prerequisites.

For generic course substitutions/equivalencies for Common Program Prerequisites offered at community colleges, state colleges, or state universities, visit: http://www.flvc.org, See Common Prerequisite Manual.

Common Prerequisites

CHM 1045	General Chemistry I
CHM 1045L	General Chemistry Lab I
CHM 1046	General Chemistry II
CHM 1046L	General Chemistry Lab II
MAC 2311	Calculus I
MAC 2312	Calculus II
MAC 2313	Multivariable Calculus
MAP 2302	Differential Equations
PHY 2048	Physics with Calculus
PHY 2048L	General Physics Lab I
PHY 2049	Physics with Calculus II

Additional lower-division courses required for the degree:

BSC 1010	General Biology I
BSC 1010L	General Biology Lab I

Degree Program Hours: 127

The Environmental Engineering curriculum provides a background of interrelated subdisciplines of Environmental Engineering and related science subjects with the fundamental core subjects of the engineering program. The technical interdisciplinary courses are in the areas of biology, geology, chemistry, ecology, atmospheric sciences, geotechnical engineering, urban planning, water resources engineering, pollution prevention and waste management. Environmental engineers play an essential role in serving people and the environmental needs of society. These needs relate to water, air and development of land and physical facilities.

The academic program is designed to meet the State of Florida's articulation policy as well as to satisfy criteria outlined by the Accreditation Board for Engineering and Technology (ABET).

Lower Division Preparation

Students admitted to the university are admitted directly to their chosen major. Students are expected to make good progress based on critical indicators, such as GPA in specific courses or credits earned. In cases where students are not making good progress, a change of major may be required. Advisors work to redirect students to more appropriate majors when critical indicators are not met.

The lower division requirements include pre-engineering courses which include the common prerequisites listed above, and Engineering Drawing with CAD application (required unless previously taken and does not count towards the 127 credits required for graduation).

Effective pursuit of engineering studies requires careful attention to both the sequence and the type of courses taken. It is therefore important, and the college requires, that each student plan a curriculum with the departmental academic advisor.

All students must comply with the University Core Curriculum Requirements for the University for Social Science, Humanities, Arts and English. The department requires a minimum of 15 semester hours in the area of Humanities, Arts and Social Science. All transfer students should refer to the Undergraduate Education section of this catalog to determine if they have met the requirements for Humanities, Social Science, Arts, and English at their previous institution.

A minimum grade of "C" is required in all writing courses, physics, chemistry, biology, and mathematics courses. A minimum grade of 'C' is required of all Environmental Engineering courses and prerequisite courses.

In addition, all students must meet the University Foreign Language Requirement and meet all of the state and university requirements for graduation.

Students who have been dismissed for the first time from the University due to low grades may appeal to the Dean for reinstatement. A second dismissal will result in no possibility of reinstatement.

Other Requirements

Students must have a minimum 2.0 GPA, must complete all required classes, and must otherwise meet all of the state and university requirements in order to graduate.

Students who enter the university with fewer than 60 transferred credits must take 9 summer credits. Refer to the appropriate sections in the Catalog for more information.

Courses are to be taken in the proper sequence. Any course taken without the required prerequisites and corequisites will be dropped automatically before the end of the term, resulting in a 'DR' or 'DF'.

Upper Division Program

The upper division program of study encourages the development of a broadly educated environmental engineering graduate, who can succeed as a productive engineer with continued professional growth. The courses listed as requirements for the BS degree not only provide the students with mathematical and scientific knowledge, but also include other essentials necessary for a successful engineering career. The courses have been designed to increase student competence in written and oral communication skills as well as develop critical thinking and creative problem solving strategies. Course projects are designed to teach engineering science fundamentals and their applications while providing enriching opportunities for laboratory and computer-based experiences. Furthermore, students are supplied with an understanding of the economic, social and ethical responsibilities of engineers in our society and are encouraged to include sustainable development in all project designs.

The basic upper division requirements for the BSENVE degree are as follows:

Applied Mathematics: (3)

STA 3033	Intro to Probability and Statistics	3

Engineering Sciences: (22)

Science Elective (Biological Science)**		4
Science Elective (Earth Science)**		4
CGN 2420	Computer Tools for Engineers	3
EGM 3503	Applied Mechanics	4
EGN 3343	Thermodynamics I	3
CWR 3201	Fluid Mechanics	3
CWR 3201L	Fluid Mechanics Lab	1

General Engineering Courses: (7)

EGS 2030	Ethics and Legal Aspects in Engineering	1
EGN 3613	Engineering Economy	3
ENC 3213	Professional and Technical Writing	3

Environmental Engineering Curriculum: (37)

CWR 3540	Water Resources Engineering	3
ENV 3001	Introduction to Environmental Engineering – *GL*	3
ENV 3001L	Environmental Laboratory I	1
ENV 3081	Career Orientation and Project Management Skills	1
ENV 4005L	Environmental Laboratory II	1
ENV 4513	Chemistry for Environmental Engineers	3
ENV 4351	Solid and Hazardous Waste Management	3
ENV 4101	Fundamentals of Air Pollution Engineering	3
ENV 4401	Water Supply Engineering	3
ENV 4551	Wastewater Treatment Engineering	3
ENV 4891	Environmental Eng. Senior Design Project	3
ENV 4960	Environmental Engineering Seminar	1
ENV Technical Elective		3
ENV Technical Elective		3
ENV Technical Elective		3

Professional Graduation Requirement

Environmental Engineering students must take and pass ENV 4960 (FE Seminar). Students showing evidence of passing the state FE (EIT) examination will have this requirement waived.

Course & Credit Hours Listing

The curriculum includes a sequence of courses which complies with the ABET requirements for mathematics and basic sciences, engineering science, engineering design, and general engineering degree requirements including humanities and social sciences. A typical nine semester sequence is shown below. Students may complete the program, by specific selection of science and technical elective courses, as arranged with the undergraduate program advisor and based on personal interests in a specialization area.

First Semester: (13)

MAC 2311	Calculus I	4
CHM 1045	General Chemistry I	3
CHM 1045L	General Chemistry I Lab	1
SLS 1501	Freshman Experience	1
ENC 1101	Writing and Rhetoric I	3
EGS 2030	Ethics & Legal Aspects in Engineering	1

Second Semester: (16)

MAC 2312	Calculus II	4
ENC 1102	Writing and Rhetoric II	3
PHY 2048	Physics with Calculus I	4
PHY 2048L	General Physics Laboratory I	1
BSC 1010	General Biology I	3
BSC 1010L	General Biology Lab I	1

Third Semester: (14)

UCC Social Science Group 1		3
MAC 2313	Multivariable Calculus	4
CHM 1046	General Chemistry II	3
CHM 1046L	General Chemistry II Lab	1
UCC Humanities Group 1		3

Fourth Semester: (13)

PHY 2049	Physics with Calculus II	4
MAP 2302	Differential Equations	3
CGN 2420	Computer Tools for Engineers	3
UCC Social Science Group 2		3

Fifth Semester: (16)

ENV 3001	Introduction to Environmental Engineering – *GL*	3
ENV 3001L	Environmental Laboratory I	1
EGM 3503	Applied Mechanics	4
Science Elective	(Earth Science)*	4
STA 3033	Introduction to Probability and Statistics for CS or equivalent	3
ENV 3081	Career Orientation and Project Management Skills	1

Sixth Semester: (15)

EGN 3343	Thermodynamics I	3
ENC 3213	Professional and Technical Writing	3
EGN 3613	Engineering Economy	3
ENV 4513	Chemistry for Environmental Engineers	3
Art Elective		3

Seventh Semester: (14)

CWR 3201	Fluid Mechanics	3
CWR 3201L	Fluid Mechanics Lab	1
ENV 4351	Solid and Hazardous Waste Management	3
Science Elective	(Biological Science)*	4
UCC Humanities Group 2		3

Eighth Semester: (13)

ENV 4101	Fundamentals of Air Pollution Engineering	3
ENV 4401	Water Supply Engineering	3
ENV 4551	Wastewater Treatment Engineering	3
ENV 4005L	Environmental Laboratory II	1
CWR 3540	Water Resources Engineering	3

Ninth Semester: (13)

ENV 4891	Environmental Engineering Senior Design Project	3
ENV 4960	Environmental Engineering Seminar	1
ENV	Technical Elective	3
ENV	Technical Elective	3
ENV	Technical Elective	3

*One Science Elective should be in Earth Sciences and the other should be in Biological Sciences. Electives must be selected from the following:

Earth Science electives: (one required)

GLY 1010/L	Physical Geology	4
GLY 2072/L	Earth Climate and Global Change	4
GLY 3039/L	Environmental Geology	4
GLY 3202/L	Earth Materials	4
GLY 4822/L	Hydrogeology	4
MET 2010/L	Meteorology & Atmospheric Physics	4

Biological Science electives (one required):

MCB 2000	Introductory Microbiology – *GL*	3
MCB 2000L	Introductory Micro Lab	1
OCB 2003	Introductory Marine Biology – *GL*	3
OCB 2003L	Introductory Marine Biology Lab	1
PCB 3043/L	Ecology	4
EVR 3013/L	Ecology of South Florida	4

ENV technical electives must be selected from the following:

CEG 4011	Geotechnical Engineering	3
CGN 4321	GIS Applications in Civil Environmental Engineering	3
CGN 4510	Sustainable Building Engineering	3
CWR 5235	Open Channel Hydraulics	3
CWR 4204	Hydraulic Engineering	3
CWR 4530	Modeling Applications in Water Resources Engineering	3
CWR 4620C	Ecohydrological Engineering	3
EGN 4070	Engineering for Global Sustainability and Environmental Protection – *GL*	3
ENV 4330	Hazardous Waste Site Assessment	3
ENV 5062	Environmental Health	3
ENV 4560	Reactor Design	3
ENV 4024	Bioremediation Engineering	3
ENV 4930	Special Topics in Environmental Engineering	1-4
ENV 5104	Indoor Air Quality	3
ENV 5666	Water Quality Management	3
EVR 3010	Energy Flow in Natural and Man-made Systems	3
EVR 3011	Environmental Resources and Pollution	3
EVR 4321	Sustainable Resource Development	3
EVR 4592	Soils and Ecosystems	3
EVR 4026	Ecology of Biotic Resources	3
EVR 4323	Restoration Ecology	3

All recommended and other technical electives must be approved by the advisor and must concentrate on relevant applications of environmental engineering design. Selection of a proper sequence would allow the student to specialize within a focus area of interest (e.g., air, water, or land resources).

Combined BS/MS in Civil Engineering

Students who pursue a BS degree in Civil Engineering and have completed 75-90 credits and have at least a 3.3 GPA on both overall and upper division courses may apply to enroll in the combined BS/MS program in Civil Engineering upon recommendation from three CEE faculty members. In addition to the admission requirements of the combined BS/MS program, students must meet all the admission requirements of both the department and the University Graduate School. Students need only apply once to the combined degree program, but the application must be submitted to Graduate Admissions before the student starts the last 30 credits of the bachelor's degree program. A student admitted to the combined degree program will be considered to have undergraduate status until the student applies for graduation from their bachelor's degree program. Upon conferral of the bachelor's degree, the student will be granted graduate status and be eligible for graduate assistantships.

Students enrolled in the program may count up to nine credit hours of CEE graduate courses as credits for both the BS and MS degrees. The combined BS/MS program has been designed to be a continuous program. However, upon completion of all the requirements of the undergraduate program, students will receive their BS degrees. Students in this program have up to one year to complete the master's degree after receipt of the bachelor's degree. Students who fail to meet this one year post BS requirement or who elect to leave the combined program at any time and earn only the BS degree will have the same access requirements to regular graduate programs as any other student, but will not be able to use the nine credits in both the bachelor's and master's degrees.

For each of the graduate courses counted as credits for both BS and MS degree, a minimum grade of B is required. All double counted courses must be at 5000 level or higher. Students enrolled in the program may count up to nine credit hours of CEE graduate courses toward the elective engineering BS requirements as well as toward the MS degree. Only graduate courses with formal lectures can be counted for both degrees. The students are responsible for confirming the eligibility of each course with the Undergraduate Advisor.

Students interested in the program should consult with the Undergraduate Advisor on their eligibility for the program. The students should also meet the Graduate Program Director to learn about the graduate program and available courses before completing the application form and submitting it to the Undergraduate Advisor. Applicants will be notified by the department and the University Graduate School of the decision on their applications.

Undergraduate students enrolled in the program are encouraged to seek employment with a department faculty to work as student assistants on sponsored research projects. The students will be eligible for graduate assistantships upon full admission into the graduate school.

Combined BS in Civil Engineering/MS in Environmental Engineering

Students who pursue a BS degree in Civil Engineering and are in their senior year and have at least a 3.3 GPA on both overall and upper division courses may apply to the department to enroll in the combined BS (Civil)/MS program in Environmental Engineering upon recommendation from three CEE faculty members. To be considered for admission to the combined bachelor's/masters degree program in Environmental Engineering, students must have completed at least 75-90 credits in the bachelor's degree program in Civil Engineering at FIU and meet the admissions criteria for the graduate degree program at FIU and meet the admissions criteria for the graduate degree program to the which they are applying. Students need only apply once to the combined degree program, but the application must be submitted to the Graduate Admissions before the student starts the last 30 credit of the bachelor's degree program. A student admitted to the combined degree program will be considered to have undergraduate status until the student applies for graduation from their bachelor's degree program. Upon conferral of the bachelor's degree, the student will be granted graduate status and will be eligible for graduate assistantships. Only 5000-level or higher courses, and no more than the credits specified by the program catalog, may be applied toward both degrees. In addition to the admission requirements of the combined BS/MS program, students must meet all the admission requirements of both the department and the University Graduate School.

Students enrolled in the program may count up to nine credit hours of CEE graduate courses as credits for both the BS and MS degrees. The combined BS/MS program has been designed to be a continuous program. However, upon completion of all the requirements of the undergraduate program, students will receive their BS degrees. Students in this program have up to one year to complete the master's degree after receipt of the bachelor's degree. Students who fail to meet this one year post BS requirement or who elect to leave the combined program at any time and earn only the BS degree will have the same access requirements to regular graduate programs as any other student, but will not be able to use the nine credits in both the bachelor's and master's degrees.

For each of the graduate courses counted as credits for both BS and MS degree, a minimum grade of B is required. All double counted courses must be at 5000 level or higher. Students enrolled in the program may count up to nine credit hours of CEE graduate courses toward the elective engineering BS requirements as well as toward the MS degree. Only graduate courses with formal lectures can be counted for both degrees. The students are responsible for confirming the eligibility of each course with the Undergraduate Advisor.

Students interested in the program should consult with the Undergraduate Advisor on their eligibility for the program. The students should also meet the Graduate Program Director to learn about the graduate program and available courses before completing the application form and submitting it to the Undergraduate Advisor. Applicants will be notified by the department and the University Graduate School of the decision on their applications.

Undergraduate students enrolled in the program are encouraged to seek employment with a department faculty to work as student assistants on sponsored research projects. The students will be eligible for graduate assistantships upon full admission into the graduate school.

Combined BS/MS in Environmental Engineering

Students who pursue a BS degree in Environmental Engineering and are in their senior year and have at least a 3.3 GPA on both overall and upper division courses may apply to the department to enroll in the combined BS/MS program in Environmental Engineering upon recommendation from three CEE faculty members. To be considered for admission to the combined bachelor's/masters degree program in Environmental Engineering, students must have completed at least 75-90 credits in the bachelor's degree program in Environmental Engineering at FIU and meet the admissions criteria for the graduate degree program at FIU and meet the admissions criteria for the graduate degree program to the which they are applying. Students need only apply once to the combined degree program, but the application must be submitted to the Graduate Admissions before the student starts the last 30 credit of the bachelor's degree program. A student admitted to the combined degree program will be considered to have undergraduate status until the student applies for graduation from their bachelor's degree program. Upon conferral of the bachelor's degree, the student will be granted graduate status and will be eligible for graduate assistantships. Only 5000-level or higher courses, and no more than the credits specified by the program catalog, may be applied toward both degrees. In addition to the admission requirements of the combined BS/MS program, students must meet all the admission requirements of both the department and the University Graduate School.

Students enrolled in the program may count up to nine credit hours of CEE graduate courses as credits for both the BS and MS degrees. The combined BS/MS program has been designed to be a continuous program. However, upon completion of all the requirements of the undergraduate program, students will receive their BS degrees. Students in this program have up to one year to complete the master's degree after receipt of the bachelor's degree. Students who fail to meet this one year post BS requirement or who elect to leave the combined program at any time and earn only the BS degree will have the same access requirements to regular graduate programs as any other student, but will not be able to use the nine credits in both the bachelor's and master's degrees.

For each of the graduate courses counted as credits for both BS and MS degree, a minimum grade of "B" is required. All double counted courses must be at 5000 level or higher. Students enrolled in the program may count up to nine credit hours of CEE graduate courses toward the elective engineering BS requirements as well as toward the MS degree. Only graduate courses with formal lectures can be counted for both degrees. The students are responsible for confirming the eligibility of each course with the Undergraduate Advisor.

Students interested in the program should consult with the Undergraduate Advisor on their eligibility for the program. The students should also meet the Graduate Program Director to learn about the graduate program and available courses before completing the application form and submitting it to the Undergraduate Advisor. Applicants will be notified by the department and the University Graduate School of the decision on their applications.

Undergraduate students enrolled in the program are encouraged to seek employment with a department faculty to work as student assistants on sponsored research projects. The students will be eligible for graduate assistantships upon full admission into the graduate school.

Course Descriptions

Definition of Prefixes

CCE-Civil Construction Engineering; CEG-Engineering, General; CES-Civil Engineering Structures; CGN-Civil Engineering; CWR-Civil Water Resources; EES-Environmental Engineering Science; EGM-Engineering, Mechanics; EGN-Engineering, General; EGS-Engineering Support; ENV-Engineering, Environmental; SUR-Surveying and Related Areas; TTE-Transportation and Traffic Engineering; URP-Urban and Regional Planning

Courses that meet the University's Global Learning requirement are identified as GL.

CCE 4001 Heavy Construction (3). Contractor's organization, contracts, services, safety, planning and scheduling. Equipment and their economics. Special project applications, coffer-dams, dewatering, river diversions, tunneling. Prerequisites: CES 4702 and CEG 4011.

CCE 4031 Project Planning for Civil Engineers (3). Introduction to techniques for planning activities, operations, finance, budget, workforce, quality, safety. Utilize case studies as learning tools for students aspiring to superintendent positions. Prerequisite: CES 3100. Corequisite: CEG 4011.

CCE 5035 Construction Engineering Management (3). Course will cover construction organization, planning and implementation; impact and feasibility studies; contractual subjects; liability and performance; the responsibility of owner, contractor and engineer. Prerequisites: CES 3100 or equivalent and CEG 4011 or equivalent.

CCE 5036 Advanced Project Planning for Civil Engineers (3). Advanced techniques and methods for planning activities, operations, finance, budget, workforce, quality, safety. Utilize case studies as learning tools for students aspiring to management positions. Prerequisite: CCE 4031 or equivalent.

CCE 5405 Advanced Heavy Construction Techniques (3). Heavy construction methods and procedures involved in large construction projects such as bridges, cofferdams, tunnels, and other structures. Selection of equipment based on productivity and economics. Prerequisite: CCE 4001.

CCE 5505 Computer Integrated Construction Engineering (3). Course covers the discussion of available software related to construction engineering topics; knowledge based expert systems and their relevance to construction engineering planning and management. Prerequisite: CCE 4031 or equivalent.

CEG 4011 Geotechnical Engineering I (3). Engineering 3 geology, soil properties; stresses in soils; failures; criteria; consolidation and settlement; compaction, soil improvement and slope stabilization. Prerequisites: GLY 1010 and GLY 1010L, CWR 3201 and CWR 3201L, EGM 3520, and EGM 3520L.

CEG 4011L Soil Testing Laboratory (1). Laboratory experiments to identify and test behavior of soils and rocks. Prerequisites: CWR 3201, CWR 3201L, EGM 3520, EGM 3520L. Corequisite: CEG 4011. (Lab fees assessed).

CEG 4012 Geotechnical Engineering II (4). Principles of foundation analysis and design: site improvement for bearing and settlement, spread footings, mat foundations, retaining walls, cofferdams, piles, shafts, caissons, tunnels, and vibration control. Computer applications. Prerequisites: CEG 4011 and CEG 4011L.

CEG 4126 Fundamentals of Pavement Design (3). This course is designed to provide the student with a basic understanding of the fundamental principles underlying pavement structural analysis and design. Asphalt Institute, Portland Cement Association and AASHTO methods will be covered. Prerequisites: CEG 4011, CEG 4011L, TTE 4201.

CEG 5065 Geotechnical Dynamics (4). Analytical, field, and laboratory techniques related to vibration problems of foundations, wave propagations, behavior of soils and rocks, earth dams, shallow and deep foundations. Earthquake engineering. Prerequisite: CEG 4011.

CES 3100 Structural Analysis (3). To introduce the student to the basic concepts and principles of structural theory relating to statically determinate beams, arches, trusses and rigid frames, including deflection techniques. Prerequisite: EGM 3520 and EGM 3520L.

CES 4320 Introduction to the Design of Highway Bridges (3). The course covers the different types of modern highway bridges, and systematically analyzes all the components of the superstructures. Design procedures are based on AASHTO codes and specialized software. Prerequisites: CEG 4011, CES 4605, CES 4702.

CES 4580 Hurricane Engineering and Global Sustainability – *GL* (3). This course examines the impacts of hurricanes and explores the role of engineers in achieving sustainable coastal communities around the globe. This course serves as a global learning course. Prerequisites: CWR 3201, CWR 3201L.

CES 4600 Introduction to the Design of Tall Buildings (3). The course reviews the different modern high-rise structural systems, a simple analysis of wind and seismic loading to efficiently design very tall buildings. Prerequisites: CEG 4011, CES 4702.

CES 4605 Steel Design (3). The analysis and design of structural elements and connections for buildings, bridges, and specialized structures utilizing structural steel. Both elastic and plastic designs are considered. Prerequisite: CES 3100.

CES 4702 Reinforced Concrete Design (3). The analysis and design of reinforced concrete beams, columns, slabs, retaining walls and footings; with emphasis corresponding to present ACI Building Code. Introduction to prestressed concrete is given. Prerequisite: CES 3100 with a grade of 'C' or better.

CES 4711 Introduction to Prestressed Concrete Structures (3). The fundamental principles of design for prestressed concrete structures. Understanding of the behavior of prestressed concrete structures, material properties, and the detailed considerations in limit state design. Prerequisite: CES 4702.

CES 5106 Advanced Structural Analysis (3). Extension of the fundamental topics of structural analysis with emphasis on energy methods and methods best suited for nonprismatic members. Prerequisite: CES 3100.

CES 5325 Design of Highway Bridges (3). Structural analysis and design for highway bridge systems which includes design criteria, standards of practice and AASHTO specifications for designing super-structures and substructure elements of various types of bridges. Prerequisites: CES 4605, CES 5715, and CEG 4011.

CES 5565 Computer Applications in Structures (3). Discussion and application of available computer programs, techniques and equipment for the analysis, design and drafting of structures. Graduate students have to do a project. Prerequisites: CES 4605 and CES 4702.

CES 5587 Topics in Wind Engineering (3). The course will cover the nature of wind related to wind-structure interaction and design loads for extreme winds, tornadoes and hurricanes. Prerequisites: CES 3100 and CWR 3201.

CES 5606 Advanced Structural Steel Design (3). Extension of the analysis and design of structural elements and connections for buildings, bridges, and specialized structures utilizing structural steel. Prerequisite: CES 4605.

CES 5715 Prestressed Concrete Design (3). The behavior of steel and concrete under sustained load. Analysis and design of pre-tensioned and post-tensioned reinforced concrete members, and designing these members into the integral structure. Prerequisite: CES 4702.

CES 5800 Timber Design (3). The analysis and design of modern wood structures. Effect of plant origin and physical structure of wood on its mechanical strength; fasteners and their significance in design. Prerequisite: CES 3100.

CGN 2161 Career Orientation in Civil Engineering (1). Course provides an overview of the Civil Engineering profession, including understanding of the discipline subfields, to assist students in determining the area(s) of emphasis they might want to follow for their professional career.

CGN 2420 Computer Tools for Engineers (3). Introduction to common civil engineering software such as MathCad, VBA, and others. Prerequisites: MAC 2312 and PHY 2048.

CGN 3949 Co-Op Work Experience (1-3). Supervised full-time work experience in engineering field. Limited to students admitted to the Co-op program with consent of advisor. Evaluation and reports required.

CGN 4321 GIS Applications in Civil and Environmental Engineering (3). Introduction to the basics of geographic information systems and their applications in civil and environmental engineering, landscape architecture, and other related fields. Prerequisites: TTE 4201 or ENV 3001 or CWR 3540 or the equivalents.

CGN 4510 Sustainable Building Engineering (3). Introduces students to the basic concepts of designing building materials and complimentary systems in such a way that the enclosures control heat, air and moisture so that a durable, energy efficient, healthy building is provided without using excess materials and energy. Students from different backgrounds will learn principles and methodologies to enhance the environmental performance of buildings, including all applicable regulatory and sustainability frameworks. Prerequisites: CWR 3201, CWR 3201L.

CGN 4802 Civil Engineering Senior Design Project (3). Mandatory course for all senior students, to experience the design of a practical project by utilizing knowledge learned from previous courses for presenting a solution. Done under the supervision of a faculty member and professional engineer. Prerequisites: CEG 4011, CEG 4011L, TTE 4201, CES 4702.

CGN 4911 Undergraduate Research Experience (1-3). Participate in research activities in the areas of structures, geotechnical, transportation, construction and environmental engineering. Prerequisite: Permission of a faculty advisor.

CGN 4930 Special Topics in Civil Engineering (1-4). A course designed to give groups of students an opportunity to pursue special studies not otherwise offered.

CGN 4949 Co-Op Work Experience (1-3). Supervised full-time work experience in engineering field. Limited to students admitted to the Co-op program with consent of advisor. Evaluation and report required.

CGN 4980 Civil Engineering Seminar (1). Basic principles and applications of civil engineering, including structural, transportation, environmental, geotechnical, construction, and water resources engineering for civil engineering students. Prerequisites: EGS 2030, EGN 3613, ENV 3001, CES 3100, CWR 3540. Corequisites: CEG 4011, TTE 4201.

CGN 5315 Civil Engineering Systems (3). Application of systems analysis techniques to large scale civil engineering problems. Prerequisites: ESI 3314 or equivalent.

CGN 5320 GIS Applications in Civil and Environmental Engineering (3). Introduction to the basics of geographic information systems, their software and hardware, and their applications in Civil and Environmental Engineering, landscape architecture, and other related fields. Corequisites: TTE 4201 or CWR 3540 or ENV 3001.

CGN 5870 Corrosion Control in Civil Engineering (3). The course provides understanding of principles of corrosion phenomena with emphasis on its application to materials in civil engineering including testing methods, corrosion control, and durability. Prerequisite: Permission of the instructor.

CGN 5874 Building Diagnostics (3). This course will give an introduction into building diagnostics with a focus on non-destructive testing (NDT) techniques used to investigate Civil Engineering materials and structures. Prerequisites: Graduate standing, enrolled in engineering curriculum.

CGN 5930 Special Topics in Civil Engineering (1-3). A course designed to give groups of students an opportunity to pursue special studies not otherwise offered. Prerequisite: Permission of the instructor.

CGN 5935 Professional Engineering (Civil) Review (4). Prepares qualified candidates to take the P.E. written examination in the field of Civil Engineering. Reviews hydraulics, hydrology, water supply and wastewater, geotechnics, structures, concrete and steel design, etc.

CWR 3201 Fluid Mechanics (3). A study of the properties of fluids and their behavior at rest and in motion. Continuity, momentum, and energy principles of fluid flow. Prerequisites: MAP 2302, and EGN 3321 or EGM 3503. Corequisite: CWR 3201L.

CWR 3201L Fluid Mechanics Laboratory (1). Application of fluid mechanics principles in the laboratory. Experiments in surface water, ground-water and pipe flow. Prerequisites: MAP 2302, and EGN 3321 or EGM 3503. Corequisite: CWR 3201. (Lab fees assessed).

CWR 3540 Water Resources Engineering (3). Hydrologic and hydraulic engineering fundamentals and applications: water resources issues, hydrologic cycle and processes, measurements, hyetographs, hydrographs, probability and design, groundwater flow and well hydraulics. Prerequisites: CWR 3021, CWR 3201L, STA 3033 or EIN 3235.

CWR 4204 Hydraulic Engineering (3). Design and analysis applications to systems and facilities, such as open channels, culverts, storm water control, flood control, pumps, and hydroelectric power. Prerequisite: CWR 3201.

CWR 4530 Modeling Applications in Water Resources Engineering (3). Model applications in hydrology, hydraulics, hydrosystems engineering and environmental interconnections. Prerequisite: CWR 3201. Corequisite: CWR 3540.

CWR 4620C Ecohydrological Engineering (3). Introduction and incorporation of the fundamental concepts of ecohydrology into hydrologic and water resources engineering principles and designs. Prerequisite: CWR 3540.

CWR 5140C Ecohydrology (3). Hydrology of ecosystems, interaction between the hydrologic cycle and vegetative processes. Prerequisite: Permission of the instructor.

CWR 5235 Open Channel Hydraulics (3). Theoretical treatment and application of hydraulics. Flow in open channels with special reference to varied flow, critical state hydraulic jump, and wave formation. Prerequisite: CWR 3103.

CWR 5251 Environmental Hydraulics (3). Application of fluid mechanics in the study of physical mixing in surface water bodies, dispersion of materials, and design of hydraulic systems. Prerequisite: Permission of the instructor.

CWR 5305 Surface Hydrology (3). Principles of Hydrology with a particular focus on surficial processes of interest to engineering design. Emphasizes applications to flood prevention and mitigation and stormwater management issues. Prerequisites: CWR 3201, CWR 3540 (or equivalent).

CWR 5535C Advanced Modeling Applications in Water Resources Engineering (3). Complex model applications in hydrology, hydraulics, hydrosystems engineering and environmental interconnections. Prerequisite: Permission of the instructor.

EES 5135 Water Quality Indicators (3). Ecological studies of micro and macro organisms which are indicators of water quality. Emphasis of bioassays and early warning systems. Prerequisite: Permission of the instructor.

EES 5137 Biological Monitoring of Freshwater Ecosystems (3). The use of aquatic insects and other invertebrates to monitor changes in the aquatic environment. The ecological aspects of aquatic insects in relation to pollution stress are assessed. Prerequisites: EES 5135 or permission of the instructor.

EES 5506 Occupational Health (3). Effects, assessments, and control of physical and chemical factors in man's environment, including chemical agents, electromagnetic radiation, temperature, humidity, pressures, illumination, noise, and vibration. Prerequisite: Admission to graduate program.

EES 5605 Noise Control Engineering (3). Fundamentals of sound and noise. Health hazards and other effects. Measurement and noise control in transportation, construction, and other environments. Prerequisite: Admission to graduate program.

EGM 3520 Engineering Mechanics of Materials (3). Analysis of axial, torsional, bending, combined stresses, and strains. Plotting of shear, moment and deflection diagram with calculus applications and interpretations. Prerequisites: CGN 2420, MAC 2313, MAP 2302 and EGN 3311 with a grade of 'C' or better.

EGM 3520L Materials Testing Laboratory (1). Introduction to measurements of basic mechanical properties of materials. Experiments include axial tension, compression, torsion, flexure, and the response of simple structural elements. Prerequisites or Corequisites: EGM 3520, MAC 2312 and EGN 3311. (Lab fees assessed).

EGM 5111 Experimental Stress Analysis (3). Course covers the necessary theory and techniques of experimental stress analysis and the primary methods employed: brittle coating, strain gauges, photo-elasticity and Moire. Prerequisites: EGM 3520, EGM 5653.

EGM 5351 Finite Element Methods in Mechanics (3). Matrix techniques and variational methods in solid mechanics; single element, assemblage and generalized theory; non-linear analysis; applications in structural and soil mechanics, torsion, heat conduction and hydro-elasticity, etc. Prerequisite: CES 5106.

EGM 5421 Structural Dynamics (3). Fundamentals of free, forced, and transient vibration of singles and multidegree of freedom structures, including damping of lumped and distributed parameters systems. Graduate students have to do a project. Prerequisite: CES 3100 and MAP 2302.

EGN 1110C Engineering Drawing (3). Introduction to elementary design concepts in engineering, principles of drawing, descriptive geometry, pictorials and perspectives and their computer graphics counterpart.

EGN 3311 Statics (3). Forces on particles, equilibrium of forces, moments, couples, centroids, section properties, and load analysis of structures. Prerequisites: MAC 2312 and PHY 2048. Corequisite: MAC 2313.

EGN 3613 Engineering Economy (3). Assist students to develop competency in the fundamentals of engineering economics for all engineering disciplines. The methods of economic analysis in general engineering applications include: decision analysis techniques, time value of money calculations, essential techniques in economic analysis of alternatives, depreciation, corporate income tax considerations, and criteria for decisions under various constraints.

EGN 4070 Engineering for Global Sustainability and Environmental Protection – *GL* (3). This course examines the effects of modern humans on the environment and explores the role of engineers in creating an environmentally sustainable future. Also serves as a global learning course. Prerequisites: ENV 3001 or PHY 2049 and CHM 1046.

EGN 5439 Design of Tall Buildings (3). The course analyzes different modern high-rise structural systems, and includes the dynamics of wind and earthquakes to efficiently design very tall buildings and their ancillary structures. Prerequisite: Permission of the instructor.

EGN 5455 Numerical Methods in Engineering (3). Study of procedures that permit rapid approximate solutions, within limits of desired accuracy, to complex structural analysis. Graduate students have to do a project. Prerequisite: CES 3100.

EGN 5990 Fundamentals of Engineering (FE) Review (4). Prepares upper level engineering students to take the Fundamentals of Engineering (FE) State Board examinations. Reviews chemistry, computers, statics, dynamics, electrical circuits, fluid mechanics, mechanic of materials, material science and thermodynamics.

EGS 2030 Ethics and Legal Aspects in Engineering (1). Codes of ethics, professional responsibilities and rights, law and engineering, contracts, torts, evidence.

ENV 3001 Introduction to Environmental Engineering – *GL* (3). Introduction to environmental engineering problems; water and wastewater treatment, air pollution, noise, solid and hazardous wastes. Prerequisites: CHM 1046, CHM 1046L, and MAC 2312. Corequisite: ENV 3001L.

ENV 3001L Environmental Laboratory I (1). A corequisite to ENV 3001. Practical applications of the theory learned in the course and experience in detecting and measuring some environmental problems. Prerequisites: CHM 1046 and CHM 1046L, MAC 2312 and permission of undergraduate advisor. Corequisite: ENV 3001. (Lab fees assessed).

ENV 3081 Career Orientation and Project Management Skills (1). Course provides an overview of the professional practice and project management skills for Environmental Engineering. Topics focus on understanding of the discipline subfields, job opportunities, and research environments. Prerequisites: MAC 2312 and PHY 2049.

ENV 3949 Co-Op Work Experience (3). Supervised full-time work experience in engineering field. Limited to students admitted to the Co-op program with consent of advisor.

ENV 4005L Environmental Laboratory II (1). Experiments involving use of analysis and instrumental techniques for the evaluation of environmental samples, and hands-on design aspects associated to environmental engineering treatment processes. Prerequisites: ENV 3001L, CWR 3201L, and EGN 3343.

ENV 4024 Bioremediation Engineering (3). Biotransformation of sub-surface contaminants in gaining recognition as a viable treatment tool. This course provides students with quantitative methods required to design bioremediation systems. Prerequisites: ENV 3001 and ENV 3001L.

ENV 4101 Fundamentals of Air Pollution Engineering (3). Factors contributing to air pollution: pollutants and their effects, sources, chemical transformations, and meteorology. Regulatory framework and design principles of emissions control technology. Prerequisites: CWR 3201 and CWR 3201L or EML 3126 and 3126L, ENV 3001 and ENV 3001L.

ENV 4330 Hazardous Waste Site Assessment (3). Hazardous waste site assessment, remedial investigation, design of site monitoring strategies and remediation plans. Prerequisites: CHM 1046 and CHM 1046L.

ENV 4351 Solid and Hazardous Waste Management (3). Generation, transport, treatment and disposal of solid and hazardous wastes; risk assessment and treatment of contaminated media. Prerequisites: CHM 1046 and CHM 1046L.

ENV 4401 Water Supply Engineering (3). Quantity, quality, treatment, and distribution of drinking water. Prerequisites: CWR 3201, CWR 3201L, ENV 3001, ENV 3001L.

ENV 4401L Water Laboratory (1). Laboratory exercises in the physical, chemical, and bacteriological quality of potable water. Prerequisites: CWR 3201, ENV 3001 and ENV 3001L. Corequisite: ENV 4401. (Lab fees assessed).

ENV 4513 Chemistry for Environmental Engineers (3). A practical basis for applying microbial and physiochemical principles to understand reactions occurring in natural and engineered systems including water/wastewater treatment processes. Prerequisites: CHM 1046 and CHM 1046L.

ENV 4551 Wastewater Treatment Engineering (3). Collection and transportation of wastewater, design of sanitary and storm sewers. Physical, chemical, and biological principles of wastewater treatment. Prerequisites: CWR 3201, CWR 3201L, ENV 3001, ENV 3001L.

ENV 4551L Wastewater Laboratory (1). Laboratory exercises in the physical, chemical, and bacteriological quality of raw and treated wastewaters. Prerequisites: CWR 3201 and CRW 3201L, ENV 3001 and ENV 3001L, Corequisite: ENV 4551. (Lab fees assessed).

ENV 4560 Reactor Design (3). A theoretical and practical basis for reaction kinetics to understand multi-phase reactions, analysis and design of batch and continuous flow reactors. Prerequisites: CHM 1046, CHM 1046L.

ENV 4891 Environmental Engineering Senior Design Project (3). Team design project involving applications of fundamental environmental engineering concepts to project design, specifications, contracts and implementation. Emphasis on written and oral communication. Prerequisites: CWR 3540, ENV 4351, and ENV 4401 or ENV 4551. Corequisites: ENV 4101, ENV 4401, ENV 4551.

ENV 4910 Undergraduate Research Experience (1-3). Participate in research activities in the areas of air, land and water systems and associated environmental health impacts. Prerequisites: Permission of a faculty advisor.

ENV 4930 Special Topics in Environmental Engineering (1-4). A course designed to give groups of students an opportunity to pursue special studies not otherwise offered.

ENV 4949 Co-Op Work Experience (3). Supervised full-time work experience in engineering field. Limited to students admitted to the Co-op program with consent of advisor. Evaluation and reports required.

ENV 4960 Environmental Engineering Seminar (1). Basic principles and applications of environmental engineering, including environmental science, solid and hazardous waste, water resources, water supply, wastewater, and air quality for environmental engineering students. Prerequisites: EGS 2030, EGN 3613, ENV 3001, EGN 3343, CWR 3540, ENV 4351. Corequisites: ENV 4101, ENV 4401, ENV 4551.

ENV 5002C Fundamentals for Environmental Engineers (3). Laws and principles of the physical, chemical and biological phenomena that define and control the fate of chemical species in natural and engineered systems. Prerequisite: Permission of the instructor.

ENV 5007 Environmental Planning (3). Environmental laws and regulations, ecological principles, planning policies and processes, risk assessment, environmental impact due to growth, and environmental indicators.

ENV 5008 Appropriate Technology for Developing Countries (3). Appropriate environmental technologies and associated factors. Topics include water, air, soil and waste management. Low cost and energy alternatives are emphasized. Prerequisite: Permission of the instructor.

ENV 5027 Bioremediation Processes (3). Bio-transformation of subsurface contaminants is gaining recognition as a viable treatment tool. This course provides students with quantitative methods required to design bioremediation systems. Project required. Prerequisite: Permission of the instructor.

ENV 5062 Environmental Health (3). Study of the control and prevention of environmental-related diseases, both communicable and non-communicable, injuries, and other interactions of humans with the environment. Prerequisite: Permission of the instructor.

ENV 5104 Indoor Air Quality (3). Sources and causes of poor indoor air quality (IAQ). Protocols for IAQ investigations; problem evaluation and solution proposals. Approaches to sustainable construction; best IAQ and energy savings.

ENV 5105 Air Quality Management (3). Technical and regulatory aspects of air quality management. Emissions inventories, ambient monitoring, and models used to evaluate the impact of pollutants on local, regional and global air quality.

ENV 5116 Air Sampling Analysis (3). Practical laboratory work and theoretical aspects involved in a wide range of air sampling and analysis systems. Critical comparison and examination of methods and instrumentation. Source testing, instrumental sensitivity, applicability and remote sensing systems. Prerequisites: ENV 5105 or ENV 4101.

ENV 5126 Particulate Air Pollution Control (3). Particulate pollution control devices, principles, design, costs. Cyclones, electrostatic precipitators, filters, bag houses, scrubbers, noval control devices.

ENV 5127 Gaseous Air Pollution Control (3). Gaseous pollution control devices, principles, design, costs. Gaseous pollutants control using adsorption, absorption, incineration, and other novel control systems.

ENV 5334 Spill Response and Hazardous Materials Transport (3). Consequence analysis of accident scenarios covering the release and dispersion of toxic substances during transport into air, soil, or aquifer and fast response to spills and toxics recovery. Prerequisite: Permission of the instructor.

ENV 5335 Advanced Hazardous Waste Treatment Processes (3). Hazardous waste site assessment, remedial investigation, design of site monitoring strategies and remediation plans. Prerequisites: CHM 1046 and CHM 1046L.

ENV 5347 Waste Incineration (3). Domestic and industrial waste incineration and pollutant stream control of aqueous and airborne pollutants. Design of incineration's.

ENV 5356 Solid and Hazardous Waste (3). Generation, transport, treatment and disposal of solid and hazardous wastes; risk assessment and treatment of contaminated media. Prerequisites: CHM 1046 and CHM 1046L.

ENV 5406 Water Treatment Systems and Design (3). Course emphasizes water quality, quantities, treatment, and distribution systems particularly as relates to municipal water supply. Requires laboratory project. Prerequisite: Permission of the instructor.

ENV 5512 Water and Wastewater Analysis (3). Relevance of the main quality parameters and their measurements by wet chemistry and analytical equipment. Includes BOD, COD, TOC, CO, TSS, VSS, alkalinity, acidity, pH hardness, ammonia, TKN, NO2, NO3, PO4, etc. Prerequisites: ENV 5666, CHM 1046, and CHM 1046L. Corequisite: ENV 5512L.

ENV 5512L Water and Wastewater Analysis Laboratory (1). Experiments are conducted which measure gross organic pollution indicators, suspended solids, conductivity, alkalinity, acidity, pH, nitrate, nitrite, TKN, ammonia, total phosphates, chlorine residual and chlorine breakpoint. Prerequisites: ENV 5666, CHM 1046, and CHM 1046L. Corequisite: ENV 5512.

ENV 5517 Design of Wastewater Treatment Plants (3). Wastewater collection systems. Integration of unit operations into the planning and design of treatment plants, including sludge handling and disposal. Prerequisite: Permission of the instructor.

ENV 5519 Chemistry for Environmental Engineers (3). Basis for applying microbial and physicochemical principles to understand reactions occurring in natural and engineered systems including water/wastewater treatment processes. Includes laboratory project. Prerequisite: Permission of the instructor.

ENV 5559 Reactor Design (3). A theoretical and practical basis for reaction kinetics to understand multiphase reactions, analysis and design of batch and continuous flow reactors. Projects on analysis of reactor design and operating data.

ENV 5613 Environmental Entrepreneurship (3). Application of environmental engineering concepts in the development of innovative ideas, products or services; interactive experiences with environmental businesses. Prerequisites: ENV 3001 or permission of the instructor.

ENV 5659 Regional Planning Engineering (3). Theories of urban and regional growth; collective utility analysis; input-output models in planning; application of linear programming to regional social accounting; economic base analysis. Prerequisites: Computer Programming or permission of the instructor.

ENV 5666 Water Quality Management (3). Predicting and evaluating the effect of human activities on streams, lakes, estuaries, and ground waters; and the relation of human activities to water quality and protection of water resources. Prerequisite: Permission of the instructor.

ENV 5905 Independent Study (1-3). Individual research studies available to academically qualified students on graduate status.

ENV 5930 Special Topics in Environmental Engineering (1-3). Specific aspects of environmental technology and urban systems not available through formal course study. Open to academically qualified students only.

SUR 2101C Surveying (3). Computations and field procedures associated with the measurement of distances and angles using tape, level, transit, EDMs, and total station. Laboratory is included with field measurements. Prerequisite: EGN 1110C.

TTE 4102 Urban Transportation Planning (3). Introduces the fundamental concepts, theory, and history in transportation planning, the connections between transportation system and other components in the society, and basic planning methods. Prerequisite: TTE 4201.

TTE 4201 Transportation and Traffic Engineering (3). Transportation characteristics; transportation planning, traffic control devices, intersection design, network design, research. Prerequisites: STA 3033 or EIN 3235, EGN 3321, and SUR 2101C.

TTE 4202 Traffic Engineering (3). Speed and volume studies, traffic operations and characteristics, traffic flow theory, accident characteristics. Prerequisite: TTE 4201.

TTE 4203 Highway Capacity Analysis (3). Procedures involved in the capacity analysis of interrupted and uninterrupted flow highway facilities. Applications of highway capacity analysis software. Prerequisite: TTE 4201.

TTE 4804 Geometric Design of Highways (3). Parameters governing geometric design of highways; curve superelevation, widening of highway curves, intersection design; highway interchanges, use of AASHTO design guidelines. Prerequisite: TTE 4201.

TTE 4930C Transportation Seminar (1-3). Oral presentations made by students, guests, and faculty members on current topics and research activities in traffic and transportation engineering. Prerequisite: TTE 4201.

TTE 5007 Transportation Systems in Developing Nations (3). Transportation systems in the Developing Nations. Role of international organizations, technology transfer/choices, orientation of transport networks, socio-economic and environmental impacts. Prerequisites: Graduate standing or permission of the instructor.

TTE 5015 Applied Statistics in Traffic and Transportation (3). Civil and Environmental Engineering statistics methods as applied to traffic and transportation are covered. Topics include: significance tests, standard distributions, analysis of variance, and regression analysis. Prerequisite: Graduate standing.

TTE 5100 Transportation and Growth Management (3). Theory and principles of transportation and growth management, including the growth phenomena and regional impact planning. Design projects required. Prerequisite: TTE 4201.

TTE 5205 Advanced Highway Capacity Analysis (3). Parameters involved in calculating highway capacity and level of service on different highway and transportation facilities. Computer application will be also discussed. Prerequisite: TTE 4201.

TTE 5215 Fundamentals of Traffic Engineering (3). Speed and volume studies, stream characteristics, traffic flow theory, accident characteristics. Prerequisite: TTE 4201.

TTE 5273 Intelligent Transportation Systems (3). ITS functional areas, planning architecture, standards, and evaluation. Implementation of selected ITS technologies and strategies. Prerequisites: TTE 4201 or equivalent.

TTE 5315 Highway Safety Analysis (3). Influencing factors (roadway characteristics, vehicle characteristics, and human factors), safety data, network screening, identification and diagnosis of safety problems, selection of countermeasures, evaluation studies, accident reconstruction. Prerequisites: STA 3033, TTE 4201.

TTE 5606 Transportation Systems Modeling and Analysis (3). Modeling and analysis techniques in transportation. Linear Programming, queueing theory, decision making techniques. Prerequisite: TTE 4201.

TTE 5607 Transportation Demand Analysis (3). Travel demand analysis and forecasting. Modeling techniques including trip generation and distribution, mode split, and trip assignment. Practical applications. Prerequisite: TTE 4201.

TTE 5805 Advanced Geometric Design of Highways (3). Parameters governing the geometric design of highways; curve super-elevation; widening on highway curves; elements of intersection design; design of interchanges; use of AASHO design guidelines. Design project required. Prerequisites: SUR 3101C and TTE 4201.

TTE 5835 Pavement Design (3). Analysis and design of sub-base, base, and pavement of a roadway. Discussions of flexible pavement and rigid pavement as structural units. Boussinesq's approach. Westergaard's theory. Beams on Elastic Foundations. Prerequisites: CEG 4011 and CES 4702.

TTE 5925 Urban Traffic Workshop (3). Selected laboratory problems related to urban traffic. Prerequisite: TTE 4201.

TTE 5930 Transportation Seminar (1-3). Oral presentations made by students, guests, and faculty members on current topics and research activities in traffic and transportation engineering. Prerequisite: TTE 4201.

URP 5312 Urban Land Use Planning (3). Elements of the general land use plan, location and space requirements; the use of models in planning; development of the land use plan; policy plan, implementation. Prerequisite: Permission of the instructor.

URP 5316 Environmental and Urban Systems (3). Overview of basic issues and principles of environmental and urban planning/design systems. Emphasis will be placed on multidisciplinary linkages.

URP 5912 Research Methods (3). Methods of information search, data interpretation, and hypotheses formulation used in the field.

APPENDIX B: PROGRAM CONSTITUENCIES

The main constituencies of the environmental engineering program, that is, the most direct beneficiaries of the contributions of its graduates, have primarily been defined as the various sectors of the South Florida community that are directly served by our graduates and these graduates' professions. Most graduates stay in the community after their graduation, which directly adds to the human resources of the region. The faculty of the program identified the following three main external (to the institution) constituencies:

1) The profession (private sector)
2) The profession (public sector)
3) The alumni (i.e., graduates themselves)

The faculty also recognized that the following two internal groups (from the institution) were also directly or indirectly impacted by the success or failure of the graduates. This is because their success or failure may affect the job opportunities offered to other students after graduation, as well as the reputation of the faculty and program, amongst others:

4) The students
5) The faculty

To facilitate the input from the external constituencies, a Departmental Advisory Board (DAB) was established in 2001. The diverse membership of DAB represents alumni (junior and senior), environmental engineering professionals, practitioners in the private sector, practitioners in the public sector, and parents of our students and alumni. The DAB membership of the constituencies is presented in Table 2.1.

The DAB developed its own bylaws in 2003 as an advisory body to the program, having the objective of being the main vehicle for the periodic evaluation of the PEOs. The Board may also provide, as needed, periodic evaluations of program outcomes, assessment indicators of outcomes, and corrective actions. The nine (9) members of the DAB were selected by the faculty and appointed by the Chair in August 2001. The DAB members are appointed for a period of three (3) years on a rotating basis, and 1/3 of the members are either reelected or reappointed each year. The DAB has meeting regularly, on average, twice a year, once in the spring and once in the fall, since 2001. The names of the current DAB members and the constituencies that they represent are provided below:

1) Ms. Mary D. Benitez, P.E., DAB Chair, Senior Project Manager, CDM
Private Sector and Civil/Environmental Engineering Profession

2) Dr. Ben H. Chen, P.E., DAB Co-Chair, Chairman, Chen Moore and Associates
Private Sector and Civil/Environmental Engineering Profession

3) Ms. Jacquelyn Caro, E.I.
Private Sector, Civil/Environmental Engineering Profession, and Junior Alumna

4) Mr. Bruno Sanabria, P.E., Director, Baxter Export Corporation
Parents of Students/Alumni, Private Sector, and Civil/Environmental Engineering Profession

5) Mr. Dat T. Huynh, P.E., Project Development Engineer, District VI, Florida Department of Transportation
Public Sector, Civil/Environmental Engineering Profession, and Senior Alumnus

6) Mr. Rashid Z. Istambouli, P.E., Miami-Dade County Department of Regulatory and Economic Resources, Pollution Regulation Division
Public Sector, Civil/Environmental Engineering Profession, and Senior Alumnus

7) Ms. Layla Llewelyn, P.E., Project Manager/Environmental Engineer, CDM Smith
Private Sector, Civil/Environmental Engineering Profession, and Senior Alumna

8) Dr. Rena Chen, P.E., Manager, Miami-Dade Water and Sewer Department (WASD)
Public Sector, Civil/Environmental Engineering Profession, and Senior Alumna

9) Mr. Franklin A. Torrealba, P.E. Director, 300 Engineering Group, P.A.
Private Sector and Civil/Environmental Engineering Profession

APPENDIX C: CURRICULUM

Plan of study

The Environmental Engineering curriculum at Florida International University is comprised of 127 credits in the areas of mathematics, basic sciences, engineering topics, and general education requirements. A full list of all required courses and selective electives, as well as a suggested schedule of courses semester-by-semester, can be found in Table 5.1. Additional information, including the maximum section enrollment for the last two semesters each course has been offered, is also included in Table 5.1. Further information about the courses and requirements for the program are included in the sections below.

Prerequisite Structure and Flow Chart for Required Courses

The program's assurance that students will comply with all curricular requirements is founded on a well-organized and established advising process. The process was previously introduced in the section on Criterion 1. The program curriculum is carefully implemented by the faculty through an advising system that ensures that each student complies with the required level of attention to, and time of study for, each professional component. The curriculum is designed as a sequence of courses that include pre-requisites and technical electives. The Department has two appointed Undergraduate Advisors, Dr. Cora Martinez and Ms. JoAnna Sanabria, whose primary responsibility is to work with each student on fulfilling all of the requirements of the program curriculum in the proper sequence.

A detailed summary of the curriculum by semester (or term) can be found in Table 5.1. Table 5.2 presents the prerequisite flow chart for the Environmental Engineering program. This course flow chart is strictly enforced by the undergraduate advisors using the Department's computerized registration system. For example, if a student did not take CWR 3201 Fluid Mechanics, the registration system will automatically reject the attempt to enroll in CWR 3540, Water Resources Engineering.

Additional advising guides are included in Tables 5.3 and 5.4. Table 5.3 is an example of an add/drop advising sheet, and Table 5.5 is an example of an advising card often used to track students' progress and sequence of courses. These tools are used in conjunction with the Panther Degree Audit described in Criterion 1.

Description of Credit Hours and Depth of Study for Each Subject Area

The Environmental Engineering program requires 127 credit hours for graduation. As shown in Table 5.1, the curriculum includes 47 credits for mathematics and basic sciences, 51 credits for engineering topics, and 29 credits for general education. Courses in the Environmental Engineering curriculum have varying laboratory components, oral/written communication activities, computer usage, teamwork, and design projects. Detailed course syllabi can be found in Appendix A. The course and section size summary for the Environmental Engineering program is shown in Table 5-1.

The Environmental Engineering curriculum is designed to provide adequate coverage of mathematics, basic sciences, engineering sciences, and general education, as well as in-depth education in all areas of Environmental Engineering. The curriculum is designed to educate and train the students for graduate school and for employment in industry, government, and consulting. Laboratory experiences are integrated throughout the curriculum to give students hands-on experience in various areas of study. Students are also encouraged to gain additional laboratory exposure through undergraduate research experiences with faculty and research centers, such as the Applied Research Center and International Hurricane Research Center. Students are also encouraged to pursue summer internships for additional laboratory experience.

Included in the lower division requirements are several courses specified in the University Core Curriculum. These include two English composition courses, an Arts course, two Humanities with Writing courses (at least one being historically oriented), and two Social Science courses. All students must comply with the University Core Curriculum Requirements for the University as well as comply with departmental requirements for Social Science, Arts, Humanities, and English.

The upper division program of study encourages the development of a broadly educated Environmental Engineering graduate, who can succeed as a productive engineer with continued professional growth. The courses listed as requirements for the BS degree not only provide the students with mathematical and scientific knowledge, but also include other essentials necessary for a successful engineering career. The courses have been designed to increase student competence in written and oral communication skills, as well as develop critical thinking and creative problem solving strategies. Course projects are designed to teach engineering science fundamentals and their applications while providing enriching opportunities for laboratory and computer-based experiences. Furthermore, students are supplied with an understanding of the economic, social, and ethical responsibilities of engineers in our society and are encouraged to include sustainable development in project designs.

The program curriculum can be accomplished in a sequence of nine semesters as shown in Figure 5-1. The curriculum is designed to prepare the student for engineering practice in the context of technical proficiency. It provides students with a foundation in mathematics and sciences during the first four semesters, and then leads to a core of engineering science courses and their applications in engineering design during the last five semesters. During the first half of the curriculum students also complete courses in English, humanities, arts, and social sciences, which complement the technical content of the curriculum beyond engineering.

The program thus requires 127 credit hours consisting of the following groups of courses and specific courses:

18 credit hours in Mathematics:

4 in MAC 2311 Calculus I
4 in MAC 2312 Calculus II
4 in MAC 2313 Multivariable Calculus
3 in MAP 2302 Differential Equations

3 in STA 3033 Introduction to Probability & Statistics for Computer Science

17 credit hours in Physical Science:

3 in CHM 1045 General Chemistry I
1 in CHM 1045L General Chemistry I Lab
3 in CHM 1046 General Chemistry II
1 in CHM 1046L General Chemistry Lab II
4 in PHY 2048 Physics with Calculus I
1 in PHY 2048L General Physics Laboratory I
4 in PHY 2049 Physics with Calculus II

8 credit hours in Biological Science:

3 in BSC 1010 General Biology I
1 in BSC 1010/L General Biology Lab I
4 in Science Elective (Biological Science): 1 course from the following:
MCB 2000/L Introductory Microbiology, or
OCB 2003/L Introductory Marine Biology, or
PCB 3043/L Ecology, or
EVR 3013/L Ecology of South Florida

4 credit hours in Earth Science:

4 in Science Elective (Earth Science): 1 course from the following:
GLY 1010/L Introduction to Earth Science, or
GLY 3039/L Environmental Geology, or
GLY 3202/L Earth Materials, or
GLY 4822/L Hydrogeology

These 47 credit hours (37%) in Mathematics, Physical Science, Biological Science, and Earth Science are enough to fulfill the ABET Program Criteria for Environmental Engineering Program Curriculum:

"The curriculum must prepare graduates to apply knowledge of mathematics through
(1) differential equations,
(2) probability and statistics,
(3) calculus-based physics,
(4) chemistry (including stoichiometry, equilibrium, and kinetics),
(5) an earth science, and
(6) a biological science."

ABET General Criteria: The credit hour requirements for one year (32 semester hours or one-fourth of the total credits required for graduation) of a combination of college level mathematics and basic sciences (some with experimental experience) appropriate to the discipline. Basic sciences are defined as biological, chemical, and physical sciences.

In addition to the Mathematics, Physical Science, Biological Science, and Earth Science, the curriculum also includes:

6 credit hours in English:

3 in ENC 1101 Freshman Composition
3 in ENC 1102 Literary Analysis

16 credit hours in Humanities-Social Science:

1 in SLS 1501 Freshman Experience
3 in Societies & Identities, EGN 1033 Technology, Humans, and Society (suggested)
3 in Arts, SPC 2608 Public Speaking (suggested)
3 in Humanities with Writing I*
3 in Humanities with Writing II*
3 in Social Science,
ECO 2013 Macro Economics or ECO 2023 Micro Economics (suggested)

*Humanities with Writing: Choose 2 courses from the following (at least one of the courses must have a history component):

PHI 2600 Introduction to Ethics (3)
ARC 2701 History of Design from Antiquity to the Middle Ages (3)
HUM 3306 History of Ideas (3)
WOH 2001 World Civilization (3)
EUH 2030 Western Civilization: Europe in the Modern Era (3)
AMH 2041 Origins of American Civilization (3)
AMH 2042 Modern American Civilization (3)
LAH 2020 Latin American Civilization (3)

4 credit hours in General Core Courses:

1 in EGN 2030 Ethics & Legal Aspects in Engineering
3 in EGN 3613 Engineering Economy

16 credit hours in Engineering Science:

3 in EGN 3311 Statics
3 in EGN 3321 Dynamics
3 in EGN 3343 Thermodynamics I
3 in CWR 3201 Fluid Mechanics
1 in CWR 3201L Fluid Mechanics Lab
3 in EEL 3110 Circuit Analysis

35 credit hours in Environmental Engineering Curriculum:

3 in CWR 3540 Water Resources Engineering
3 in ENV 3001 Introduction to Environmental Engineering
1 in ENV 3001L Environmental Laboratory I
3 in ENV 4513 Chemistry for Environmental Engineers
3 in ENV 4351 Solid and Hazardous Waste Management
3 in ENV 4101 Elements of Atmospheric Pollution
3 in ENV 4401 Water Supply Engineering
3 in ENV 4551 Wastewater Treatment Engineering
1 in ENV 4005L Environmental Laboratory II

3 in ENV 4891 Environmental Eng. Senior Design Project
3 in ENV Technical Elective**
3 in ENV Technical Elective**
3 in ENV Technical Elective**

**Note: The ENV Technical Electives can be chosen from the courses in the following list, as approved by the Departmental Advisor.

List of Suggested Technical Electives

Courses	**Credit Hours**
CGN 4321 GIS Applications in Civil and Environmental Engineering	3
CWR 4204 Hydraulic Engineering	3
CWR 4530 Modeling Application in Water Resources Engineering	3
CWR 4620C Ecohydrological Engineering	3
EGN 4070 Engineering for Global Sustainability and Environmental Protection	3
ENV 4024 Bioremediation Engineering	3
ENV 4330 Hazardous Waste Site Assessment	3
ENV 4560 Reactor Design	3

Note: Other electives may be chosen, as approved by the Departmental Advisor

The Environmental Engineering curriculum includes at least one course in all four recognized major Environmental Engineering areas: Air, Land (Solid Waste), Water Systems (Wastewater and Water Supply) and Environmental Health Impacts.

These 51 credit hours (40.2%) in Engineering Science and Environmental Engineering are sufficient to fulfill the ABET Program Criteria for Environmental Engineering Program Curriculum:

"The curriculum must prepare graduates to

(1) apply knowledge of mathematics through fluid mechanics

(2) formulate material and energy balances, and analyze the fate and transport of substances in and between air, water, and soil phases;

(3) conduct laboratory experiments, and analyze and interpret the resulting data in more than one major environmental engineering focus area, e.g., air, water, land, environmental health;

(4) design environmental engineering systems that include considerations of risk, uncertainty, sustainability, life-cycle principles, and environmental impacts; and

(5) apply advanced principles and practice relevant to the program objectives.

The curriculum must prepare graduates to understand concepts of professional practice, project management, and the roles and responsibilities of public institutions and private organizations pertaining to environmental policy and regulations."

ABET General Criteria: The credit hour requirements for one and one-half years (48 semester hours or 37.5 percent of the total credits required for graduation) of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study.

The minimum credit hours towards graduation are 127 credits, in addition to the following credits (not counted in the required 127 credits):

Foreign Language Requirement (10 credit hours)
EGN 1110C Engineering Drawing (3 credit hours)
CGN 4980 CE Seminar: FE Review (1 credit hour)
ENC 3213 Professional and Technical Writing (3 credit hours)

The Department considers that "one-half year of study is equivalent to 16 semester credit hours." In accordance with this consideration, the curricular components and their equivalent times of study are as follows:

1. Mathematics and Basic Sciences Component:
   47 semester credit hours > one year of study
2. Engineering Topics Component:
   51 semester credit hours > one and one-half years of study
3. General Education and Other Components:
   29 semester credit hours > one-half year of study

The engineering sciences have their roots in mathematics and basic sciences but carry knowledge further toward creative applications. These studies provide a bridge between mathematics and basic sciences on the one hand and engineering practice on the other. Engineering design is the process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic sciences, mathematics, and the engineering sciences are applied to convert resources optimally to meet these stated needs.

The curriculum also assures that each student is able to demonstrate competency in the fundamentals of probability and statistics by including the course STA 3033 - Probability & Statistics as a requirement of the mathematics and science professional component. The course is recommended to be taken during the fifth semester, so that students can start applying techniques they are learning in lectures that reflect the core of engineering science (e.g., CWR 3201L - Fluid Mechanics Laboratory) and, later, engineering design. Courses that incorporate the use of probability and statistics include the following:

ENV 4891 - Environmental Engineering Senior Design Project: The use of both probability and statistical parameters are needed, depending on the particular engineering problem; for instance, the use of hydrological data is normally based on probability criteria and expressed in statistical form.

CWR 3201- Fluid Mechanics: Selected homework assignments include the use of statistics concepts.

CWR 3201L - Fluid Mechanics Laboratory: Statistical methods are used for the estimation of errors.

CWR 3540 - Water Resources Engineering: Probabilistic methods and statistical parameters are taught with problem exercises for the analysis of hydrological data.

ENV 3001 - Introduction to Environmental Engineering: Statistical interpretation of field data and system performance data are involved.

ENV 3001L - Environmental Laboratory I: Use of statistical methods in data management.

ENV 4005L - Environmental Laboratory II: Use of statistical methods in data management.

The curriculum includes a course on engineering ethics, which is required for all undergraduate students. This course, EGN 2030 - Ethics and Legal Aspects in Engineering, is intended to expand the students' understanding of professionalism, professional conduct, professional registration, legal terminology, famous engineers, and complex projects that address different aspects of engineering challenges and dilemmas. The course explores, through case studies, the interconnections and conflicts between ethical and legal considerations of engineering practice. This course has become very popular. The fundamental canon imparted to the students is that, "the engineer shall apply specialized knowledge and skill at all times in the public interest, with honesty, integrity, and honor." Other faculties also refer to and refresh this canon implicitly and explicitly in their design courses.

The general education component of the program includes 16 semester credit hours of Arts, Humanities and Social Sciences, plus an additional 6 credit hours of English. That number of credit-hours represents nearly a fifth of the total 127 credit hours. Courses in humanities are chosen from literature, art, drama, music, or history.

A special course, ENC 3213 – Technical Writing, has recently been added to the curriculum. It is typically completed by the junior level (sixth semester). This course focuses on the study and practice of technical writing in support of program outcome category 2 - On Communication (i.e., 3d and 3g). The course is included at this level so that writing skills are developed by the time the students reach their senior year and begin their senior design major experience. At this time, the three-credit course does not count in the total 127 credits required for the BS degree. However, as discussed below, the curriculum will undergo changes in the 2015-2016 academic year that will incorporate the three-credits for ENC 3213 into the general education component of the program. The course assists in developing important writing skills for the students and has been well received in the curriculum.

The curriculum incorporates a one-credit seminar-style course that prepares the students for the Fundamentals of Engineering (FE) exam. This course stresses to students the importance of licensure, and provides the students with a framework for preparing for the exam through review sessions and mock exams. The importance of licensure is also emphasized to students through the department's policy that does not allow students to graduate unless they have passed the FE exam or have taken and passed the FE Review seminar with its FE-style mock exam. Due to the change in the format of the FE Exam starting in January 2014, the course has undergone changes to better prepare students for the FE Exam. The course material has been revised to follow the new topics covered by the discipline-specific exam. A new FE Review course has been developed specifically for Environmental Engineering students, ENV 4960. This course will follow the same format as the current FE Seminar, but the course material will include the specific Environmental Engineering FE Exam topics.

All admitted students must have completed two years of credit in one foreign language at the high school level or 8-10 credits in one foreign language at the college level. (American Sign Language is acceptable.) If a student is admitted to the University without this requirement, the credits must be completed prior to graduation. In addition, applicants whose native language is not English and who have not taken any college level English courses must present a minimum score on the Test of English as a Foreign Language (TOEFL): 500 for the paper-based exam, 173 for the computer-based exam, and 63 for the internet-based (iBT) exam.

For the three required technical elective courses, the major areas of focus are: Air, Land (Solid Waste), Water Systems (Wastewater and Water Supply) and Environmental Health Impacts. In addition to the list of approved technical elective courses listed above, students are also permitted to take the cross listed graduate level courses within Environmental Engineering MS program. This enables the undergraduate students to expand their view of the discipline. All recommended and other technical electives must be approved by the advisor and must focus on relevant applications of environmental engineering design. Selection of a proper sequence would allow the student to specialize within a focus area of interest (e.g., air, water, or land resources). The well-established advising system (exemplified by the forms in Figures 5-3, 5-4, and 5-5) ensures an appropriate selection of technical electives for all students.

The current curriculum for the BS in Environmental Engineering will undergo changes for students admitted as soon as the 2015-2016 academic year. These changes are made to strengthen the curriculum and better align the courses with the Student Outcomes. One of the proposed changes includes removing the requirement for EEL 3110 – Circuit Analysis from the engineering science requirements. These three credits will be removed and replaced with ENC 3213 – Professional and Technical Writing. Students are currently required to take this course as part of the degree requirements, but the three credits do not count in the total 127 credits required for the degree. Removing Circuit Analysis will allow students to include the three credits for Professional and Technical Writing as part of those required for their degree.

A second change to the curriculum will be to replace EGN 3311 – Statics (3 credits) and EGN 3321 – Dynamics (3 credits) with EGM 3503 – Applied Mechanics (4 credits). The Applied Mechanics course covers material for both statics and dynamics of solids and fluids, as well as science of engineering materials. The upper level coursework in the Environmental Engineering curriculum does not need as in-depth a study as that provided in two semesters of Statics and Dynamics. By combining the material of the two courses in a one-semester four-credit course, students are able to take more courses in Environmental Engineering and take upper level courses earlier in their degree program. Since Statics and Dynamics are each three credits and

Applied Mechanics is a four-credit course, replacing Statics and Dynamics with Applied Mechanics allows for two additional credits to be added to the program to maintain the 127 credits required for completion of the program.

One of the available two credits in the program will be filled by a course currently required in the Environmental Engineering curriculum – the FE Review Seminar (ENV 4960). At this time, the credits do not count in the total required 127 credits for the BS degree. This course is a preparatory course for the Fundamentals of Engineering (FE) Exam, as described previously in this section. By combining Statics and Dynamics into one course, the FE Review course will now be counted as one-credit of the 127 credits required for the degree.

The second available credit will be filled with a new course that will be added to the curriculum. This course will be a 3000-level upper level engineering course entitled Career Orientation and Project Management Skills, intended for Sophomore/Junior students and will also be required for all transfer students. This one-credit course has been developed to provide students with an overview of the professional practice and project management skills for Environmental Engineering. Students will be presented with the subfields within Environmental Engineering, various job opportunities, as well as project management concepts in both practice and research environments. The intent of the course will be to assist the students in identifying and selecting area(s) of emphasis they may wish to pursue in their studies and professional careers. Students will be introduced to professionals from the area and will be exposed to current environmental engineering projects, as well as their societal implications. Additionally, the course will present students with project management tools and skills needed to monitor progress and cost control of projects. The course will also help students gain a better understanding of the importance of lifelong learning and professional development.

The proposed changes to the BS in Environmental Engineering described above maintain the current 127 credits required for graduation. As previously mentioned, these changes are anticipated to be implemented for students admitted to the program during the 2015-2016 school year. The changes are meant to improve the curriculum and provide better career guidance for the students enrolled in the program. The changes are also meant to encourage students to pursue licensure and understand the importance of lifelong learning.

Major Design Experience

Design concepts, methodology, and teamwork are incorporated throughout the Environmental Engineering curriculum. ENV 3001 Introduction to Environmental Engineering introduces students to this concept. The design experiences are provided through the curriculum in relevant courses dealing with air, water, and solid and hazardous waste topics (i.e., ENV 4101, ENV 4401, CWR 3540, ENV 4351, ENV 4551).

The capstone course (ENV 4891 – Environmental Engineering Senior Design Project) culminates in a major engineering design experience. This course is mandatory for all Seniors and has been regularly offered during the fall and spring terms in the academic year. The Environmental Engineering Senior Design Project course addresses a practitioner-guided, real-world design problem within a team comprised of Environmental Engineering students. Prior to enrolling in ENV 4891, students must have completed or be currently enrolled in courses that offer significant design experiences (i.e., ENV 4351 Solid Waste Management, ENV 4401 Water Supply Engineering, ENV 4551 Wastewater Treatment Engineering, CWR 3540 Water Resources Engineering, and/or ENV 4101 Elements of Atmospheric Pollution). The ENV 4891 course is regularly taught by a team of experienced faculty, practitioners, and registered professional engineers in the department. The team includes a faculty member and a practitioner specifically trained in Environmental Engineering. Students are organized into teams. Each team member is given specific responsibilities to work on individually, while also working as a member of that team, to provide a solution to a practical engineering problem. The students have an opportunity to apply a broad spectrum of specific knowledge from the Environmental Engineering curriculum, including computational techniques and constraints (i.e., environment, sustainability, economics, safety, ethics, and social impacts). The course also requires the presentation of results in the form of a written technical report and an oral presentation by the teams.

Beyond the Environmental Engineering Senior Design experience, the design components of core curriculum courses are most typically presented in the classroom and then reinforced through hands-on laboratory experiences, homework, and discussions during project assignments and field trips, if applicable. The pedagogy encourages students to exercise initial unrestrained creativity, followed by critical evaluation of alternatives, analysis of each reasonable choice, selection of an optimal solution, provision of a cost estimate, if applicable, and recommendation of an implementation approach.

Cooperative Education Opportunity

Cooperative education is offered as a course for undergraduate students. The cooperative education credits do not count towards the 127 credits for the degree requirements. The students can find internships with local public and private organizations. These internships are made available either through the Industrial Advisory Board members (which advises the Department on all kinds of teaching, research, and service issues that are relevant to all degree programs) and through special agreements with local government such as the Miami-Dade Water and Sewer Department, the U.S. Army Corps of Engineers, South Florida Water Management District, Department of Transportation and Miami-Dade County agencies.

APPENDIX D: FACULTY

Faculty Qualifications

All regular faculty members hold Ph.D. degrees in civil engineering, environmental engineering, or related fields and teach only in their areas of expertise. Their qualifications is based on both their educational background as well as on experience gained through years as practitioners or researchers in their respective fields. In addition, 12 (57%) of the faculty in the department hold professional registration in at least one US state and several have achieved national specialty professional certifications.

All faculty hold membership in at least one professional society or organization, with the majority involved in several of these societies or organizations extending over the local, regional, national, and international levels. Professional activities include attending meetings/conferences, making presentations there, organizing conferences or conference sessions, serving on committees, serving as referees for technical journals, and reviewing proposals for funding agencies, among others.

The following faculty members directly support the environmental engineering program:

***Environmental and Water Resources Area*:**

- Dr. Hector R. Fuentes: Water resources, water quality, sustainable engineering, pollution prevention and control, water and wastewater reclamation, and experimental and modeling applications.
- Dr. Shonali Laha: Physicochemical and microbial processes, fate of contaminants, hazardous waste treatment technologies, and environmental protection in developing countries.
- Dr. Lakshmi Reddi (Dean of University Graduate School): Geo-environmental engineering.
- Dr. Walter Zhonghong Tang: Physicochemical treatment, advanced oxidation processes, quantitative structure and activity relationships, health risk assessment, and ecosystem restoration.
- Dr. Berrin Tansel: Hazardous and industrial waste management, membrane processes, site remediation, contaminant-surface interaction, and fate and transport modeling.
- Dr. Anna Bernardo Bricker (Instructor, Environmental Lab Coordinator): Air pollution, experimental design, fate and transport modeling.
- Dr. Cora Martinez (Instructor, Undergraduate Advisor): Hydrologic modeling and computational methods

***Wind Engineering and Corrosion Engineering*:**

- Dr. Arindam Chowdhury: Laboratory simulation of tornadoes and microbursts and their interaction with structures and instrumentation of wind tunnels.
- Dr. Kingsley Lau: Corrosion engineering
- Dr. Ioannis Zisis: Wind engineering

***Transportation, Land Use, GIS*:**

- Dr. Xia Jin: Geographic information systems, infrastructure demand modeling, and transportation and land use interactions

Faculty Workload

Table D-1 provides information on the workload of each regular faculty member. As indicated, the number of courses taught by each member ranges from one to three per semester. The course workload for each faculty is assigned by the Department Chair based on the faculty's level of research, graduate student supervision, and professional service activities. In general, faculty members with a high level of such activities are assigned one course per semester, followed by two for medium level and three for low level. Tenure-track faculty members are generally assigned only one course per semester to provide them with ample time to develop a successful research program. The Undergraduate Advisor, Dr. Cora Martinez, is generally assigned one course with two sections each semester. Dr. Cora Martinez also administers some co-op sections and an FE Review course that is team-taught by most of the faculty members each semester. Starting in Fall 2013, the Department hired the second undergraduate advisor, Mrs. JoAnna Sanabria, to assist Dr. Cora Martinez in undergraduate advising to further improve our advising service to more than 600 undergraduate students in the Department.

Table D-2 also indicates that a majority of our faculty members have been very active in research and scholarly activities. Last year, the faculty collectively attracted about $6.0M in new external research contracts—the highest among nine civil engineering departments (UF, USF, UCF, FIU, FAU, UM, UNF, FGCU, and FSU/FAMU) in the state of Florida in terms of funding per faculty.

Faculty Size

The junior and senior student enrollment for the past six fall semesters is given in Table E-3. The table shows that the overall student/faculty ratios for the past six years have ranged from 17.0 to 28.3, with a six-year average of 21.1, which is adequate to ensure a good level of interaction between faculty and students.

As noted, undergraduate advising is coordinated by two undergraduate advisors, Dr. Cora Martinez and Mrs. JoAnna Sanabria, whose primary responsibilities include general and specific guidance to students, reviewing their progress toward the completion of the program, recommending course selections, processing the transfer of credits, and referring students to other faculty members or University offices for any further advice or assistance. All faculty members participate in the advising of students by counseling them on coursework scope, careeropportunities, and professional issues. Faculty members also assist the undergraduate advisor in the selection of courses, evaluation of transfer credits, and curriculum changes. Faculty members, who are also advisors of Student Chapters, provide additional mentorship in the professional and citizenship areas. Examples of cases of faculty-student advising, counseling, and mentorship include:

1) Advising on course work: A student falling behind is usually invited to discuss the matter with the instructor to identify problems that are hindering the performance of the student. When the problem goes beyond the faculty's responsibilities, such as

involving marital or family matters, students are referred to the University Student Counseling Services.

2) Meeting with Chairman: The Department chairman has an open-door policy for students to discuss their concerns with class scheduling, curriculum, instructors, opportunities for co-op work experience, etc.

3) Attending technical presentations: The Student Chapters regularly schedule guest speakers on a variety of technical themes of local, regional, and national interest.

4) Participating in research programs: Since the inception of the B.S./M.S. combined program, faculty members have been encouraged to involve undergraduate students in their research projects. As a result, the number of undergraduates that have participated in research projects over the last years has increased. As such, these students begin to discuss their career aspirations and plans with faculty members before they graduate; a fraction of them become full-time graduate students working as research assistants.

The level of scholarship of the faculty is very high. In fact, most faculty conduct both funded and unfunded engineering research that results in publications in journals and books, technical presentations, and research opportunities for undergraduate students of the program.

Faculty-student ratios are also acceptable, averaging 24.0:1 over the last six years. The competency of the faculty members is also well-grounded in their educational credentials, their research and scholar productivity, and the published contributions in journals and other professional publications.

Professional Development

Faculty professional development is planned for by the individual faculty members. Faculty members are encouraged to attend professional meetings, conferences, workshops, and seminars, etc., and an assessment of involvement in such activities for the past year is a part of the annual faculty evaluation by the Department Chair.

Many professional development opportunities, especially in the area of teaching and research administration, are available on campus free of charge. All faculty and staff are encouraged to take advantage of these campus resources and are informed of these opportunities via a University-wide email mailing list as well as hardcopy announcements.

Each year, faculty sabbaticals are awarded to selected faculty and funded by the University. Sabbatical requests are first submitted to the Chair for approval. Before granting a sabbatical request, the Chair makes sure the regular operations of the Department, especially its course offerings, will not be affected. Only one faculty member is usually approved for sabbatical each year to minimize its impact. This has worked out well given the size of the faculty.

Over the past few years, each faculty member has been provided with up to $1,000 each year to help compensate for the expenses of professional development activities. This funding has been provided by the Dean's Office.

Faculty members with research contracts have been able to supplement the above funding from three additional sources, as follows:

1) Travel budgets included in contracts.
2) Leftover funds at contract completion. A significant portion of our contracts and grants have been lump-sum. The university policy allows up to 25%, in an amount not to exceed $25,000, of the total budget of a lump-sum contract to remain unspent and be retained by the Principal Investigators (PIs).
3) Indirect cost return to the PIs. The University also returns a portion of the indirect cost to both the Department and the PIs.

Funds from the latter two sources are unrestricted and are generally used by PIs to support professional development activities, facility improvements, and student activities. In short, the funding for professional development activities for our faculty has been quite adequate. The detailed professional development activities from each faculty member over the past six years were shown in Appendix B – Faculty Vitae. As can be seen, most of our faculty members have been active participants in such activities to keep them abreast of the latest developments in their respective professions.

Authority and Responsibility of Faculty

The authority of the faculty covers all of the curricular aspects of the programs. Most of the curricular initiatives are channeled through UPAC, including course creation, in order to ensure compliance with all applicable ABET criteria.

Course creation is generally initiated by individual faculty members. New faculty members are especially encouraged to submit new course proposals as part of their professional development and as a contribution to the program. New courses are also often created by other faculty members to keep up with emerging technologies and current trends.

Over the years, the faculty has been particularly enthusiastic about offering and developing more elective courses. Since the last ABET review in 2008, more than 10 new senior electives have been developed and offered to our undergraduate students. Some of these courses have been offered for evaluation of their potential success prior to consideration of their official inclusion as technical electives in the curriculum. In addition, a number of new graduate courses have also been made available as electives to good undergraduate students, especially those enrolled in our Combined B.S./M.S. Program. Currently, there are over 30 technical elective courses that students may choose from to meet the elective program requirements.

Course modification in terms of course content, delivery methods, learning objectives, etc., is a continuous process (see section on Criterion 4 for continuous improvements to the program), and it is a direct result of our faculty efforts to improve teaching based on previous course experiences as well as from feedback received from course evaluations. An assessment of efforts to improve faculty teaching for the past year is a part of the annual faculty evaluation by the Department Chair.

Department currently conducts two separate student evaluations for every undergraduate course. The level of achievement of the instructor's declared outcomes in the syllabi is assessed by the students at the 2/3 mark of the term, when they are asked to evaluate the level of achievement of all outcomes that were declared by instructors in their course syllabi. Another evaluation, conducted near the end of semester by the Departmental Chairperson, is a uniform course evaluation used by the University to evaluate the course contents and the teaching effectiveness of instructors. In cases in which a course is taught by multiple instructors, the instructors share their teaching materials and experiences with each other to the greatest extent possible. When a course is assigned to an adjunct faculty or a graduate student instructor, one of our full-time faculty members assumes responsibility for providing guidance and support to him/her throughout the semester. Course evaluation results are part of the annual faculty report submitted to the Department Chair for annual faculty evaluation.

All changes to the program curriculum, including both new programs and new courses, are first discussed and voted on by UPAC. Changes approved by UPAC are then presented to the full faculty for further discussion and approval. Changes approved by the full faculty are then submitted to the College Curriculum Committee, which is made up of one representative from each department in the College. All changes must be approved by all members of the Committee and signed by the Academic Dean before submitting to the University Curriculum Committee for final approval during Faculty Senate meetings.

To further ensure the consistency and quality of the courses taught, the draft policy DCEE1-031805 – On the Value of Teaching Quality and procedure DCEE1A-031805 – On Teaching Skills for Junior Faculty, Adjunct Professors, Teaching Assistants, and Non-tenure Track Members were developed by the UPAC in fall 2004 and were officially approved of by the CEE faculty in a monthly faculty meeting on March 18, 2005. The details of this policy and procedure are shown in Section 4.4.4.

Table D.1 Faculty Qualifications
Bachelor of Science in Environmental Engineering

Faculty Name	Highest Degree Earned- Field and Year	Rank [1]	Type of Academic Appointment[2] T, TT, NTT	FT or PT[3]	Years of Experience			Professional Registration/ Certification	Level of Activity[4] H, M, or L		
					Govt./Ind. Practice	Teaching	This Institution		Professional Organizations	Professional Development	Consulting/summer work in industry
Omar I. Abdul-Aziz	Ph.D., 2008 Ecological and Water Resources Engineering	AST	TT	FT				E.T.	M	M	L
Anna Bernardo-Bricker	Ph.D., 2008 Environmental Engineering and Air Pollution	I	NTT	FT	2	20	11		L	L	L
Arindam Gan Chowdhury	Ph.D., 2004 Structural and Wind Engineering	ASC	T	FT	3	8	8		M	M	L
Hector R. Fuentes	Ph.D., 1982 Environmental and Water Resources Engineering	P	T	FT	11	36	22	P.E., BCEE	M	L	L

Xia Jin	Ph.D., 2007 Transportation Engineering	AST	TT	FT	5	3	3	AICP	M	M	L
Shonali Laha	Ph.D., 1992 Environmental Engineering	ASC	T	FT	2	20	20	P.E.	L	L	L
Kingsley Lau	Ph.D., 2010 Structural Engineering	AST	TT	FT	2	1	1	E.I.	M	L	L
Cora Martinez	Ph.D., 2009 Computational Methods	I	NTT	FT		21	4		L	L	L
Lakshmi Reddi	Ph.D., 1988 Geo- Environmental Engineering	P	T	FT	1	22	4	P.E.	M	M	L
Walter Tang	Ph.D., 1993 Environmental and Water Resources Engineering	ASC	T	FT	0	23	23	P.E.	L	M	L
Berrin Tansel	Ph.D., 1985 Environmental Engineering	P	T	FT	6	23	23	P.E., BCEE	H	H	L
Ioannis Zisis	Ph.D., 2011 Structural and Wind Engineering	AST	TT	FT	0	1	1		M	L	L

Updated information is to be provided at the time of the visit.

1. Code: P = Professor ASC = Associate Professor AST = Assistant Professor I = Instructor A = Adjunct O = Other
2. Code: T = Tenured TT = Tenure Track NTT = Non Tenure Track
3. Code: FT = Full-time PT = Part-time Appointment at the institution.
4. The level of activity (high, medium or low) should reflect an average over the year prior to the visit plus the two previous years.

Table D.2 Faculty Workload Summary

Bachelor of Science in Environmental Engineering

Faculty Member (name)	PT or FT[1]	Classes Taught (Course No./Credit Hrs.) Term and Year[2] (fall 2013), (spring 2014) All courses are 3-credit hours	Program Activity Distribution[3]			% of Time Devoted to the Program[5]
			Teaching	Research or Scholarship	Other[4]	
Omar I. Abdul-Aziz (until 2015)	FT	(CWR 3540), (CWR 3201)	25%	75%		25%
Anna Bernardo-Bricker[11]	FT	(ENV 3001L, ENV 4005L, ENV 4101), (ENV 3001L, ENV 5105, EGN4070)	75%	12.5%	12.5%[11]	87.5%
Arindam Gan Chowdhury[6]	FT	(CES 5587, CGN6939[12]), (CGN 4510/CGN 5930[14], CGN6939[12])	25%	25%	50%[6]	25%
Hector R. Fuentes[8]	FT	(CWR 6126), (CWR 3540, CWR 5535C)	37.5%	12.5%	50%[8]	37.5%
Xia Jin	FT	(CGN 5320), (TTE 5607)	25%	75%		25%
Shonali Laha	FT	(ENV 3001, ENV 4401, ENV 5027/ENV 4024[14]), (ENV 3001, ENV 4551, ENV 5519/ENV 4513[14])	75%	25%		75%
Kingsley Lau	FT	(CES 3100), (CES 3100, CES5870)	37.5%	62.5%		37.5%
Cora Martinez[10]	FT	(CGN 2420, CGN 4980[13]), (CGN 2420, CGN 4980[13])	45%	5%	50%	100%
Lakshmi N. Reddi[7] (until Fall 2016)	FT				100%	0%
Walter Tang	FT	(CWR 3201, CWR 5235), (CWR 4204, ENV 5559/ENV 4560[14], ENV 6516)	62.5%	37.5%		62.5%
Berrin Tansel[9]	FT	(ENV 4891, ENV 6558, CGN 6939[9]), (ENV 4891, ENV 5356/ENV 4351[14], CGN 6939[9])	50%	25%	25%	75%
Ioannis Zisis	FT	(EGN 1110C), (EGN 1110C)	25%	75%		25%

1. FT = Full Time Faculty or PT = Part Time Faculty, at the institution
2. For the academic year for which the self-study is being prepared. **Confirmed that this is for 2013 – 2014.**
3. Program activity distribution should be in percent of effort in the program and should total 100%.
4. Indicate sabbatical leave, etc., under "Other."
5. Out of the total time employed at the institution.
6. Joint appointments (half-line positions)
7. Dean of University Graduate School
8. Associate Chair of Graduate Studies of CEE Department
9. Undergraduate Program Director
10. Undergraduate Advisor
11. Environmental Lab Coordinator
12. CGN 6939 Graduate Seminar (o-credit hour)
13. CGN4980 Civil Engineering Seminar – FE Review (o-credit hour)
14. Cross-listed with one undergraduate or graduate course

APPENDIX E: SLO AND PO ASSESSMENT RESULTS

Program - CEC Environmental Engineering SLO (BS)

Assessment Results Summary
The program assesses the following learning outcomes. Each year, assessment results are gathered for each outcome. The following table summarizes the assessment results for the program.

Past Improvements Based on Results
The results described below have led to significant improvements over the past years. Based on the outcomes below, the following data-driven improvements have been made:

<u>Content Knowledge</u>: *Graduates will demonstrate the ability to apply the integrated knowledge of mathematics, science, and engineering to solve environmental engineering problems.*

Reporting Period	Criterion Status	Use of Results for Improvement
2010 - 2011	Met	This is the first year of a two-year cycle of data collection. No use of results required.
2011 - 2012	Met	Using real life project enhanced the student learning. Focus on strategies to maintain support from local professional societies. 1. Using real life project enhanced the student learning. Focus on strategies to maintain support from local professional societies. 2. Using real life project enhanced the student learning. 3. Using computer based design tools enhanced the student learning. 4. Panel of judges and student feedback after project presentations were beneficial. Presentations were videotaped for further critique. 5. UPAC believes that it is critical that there is greater faculty participation in the outcomes assessment and will encourage greater faculty attendance of the senior design project presentations.
2012 - 2013	Met	This is the first year of a two-year cycle of data collection. No use of results required.
2013 - 2014	Met	Using real life project enhanced the student learning. Focus on strategies to maintain support from local professional societies.

		1. Using real life project enhanced the student learning. Focus on strategies to maintain support from local professional societies. 2. Using real life project enhanced the student learning. 3. Using computer based design tools enhanced the student learning. 4. Panel of judges and student feedback after project presentations were beneficial. Presentations were videotaped for further critique. 5. UPAC believes that it is critical that there is greater faculty participation in the outcomes assessment and will encourage greater faculty attendance of the senior design project presentations.
2014 - 2015	Met	This is the first year of a two-year cycle of data collection. No use of results required.
2015 - 2016		

<u>Critical Thinking</u>: *Graduates will collect information, consider and compare performance of competing options, analyze and interpret results, and propose solutions for an environmental engineering design problem.*

Reporting Period	Criterion Status	Use of Results for Improvement
2010 - 2011	Met	This is the first year of a two-year cycle of data collection. No use of results required.
2011 - 2012	Met	Using real life project enhanced the student learning. 1. Using real life project enhanced the student learning. Focus on strategies to maintain support from local professional societies. 2. Using real life project enhanced the student learning. 3. Using computer based design tools enhanced the student learning. 4. Panel of judges and student feedback after project presentations were beneficial. Presentations were videotaped for further critique. 5. UPAC believes that it is critical that there is greater faculty participation in the outcomes assessment and will encourage greater faculty attendance of the senior design project presentations.

2012 - 2013	Met	This is the first year of a two-year cycle of data collection. No use of results required.
2013 - 2014	Met	Using real life project enhanced the student learning. 1. Using real life project enhanced the student learning. Focus on strategies to maintain support from local professional societies. 2. Using real life project enhanced the student learning. 3. Using computer based design tools enhanced the student learning. 4. Panel of judges and student feedback after project presentations were beneficial. Presentations were videotaped for further critique. 5. UPAC believes that it is critical that there is greater faculty participation in the outcomes assessment and will encourage greater faculty attendance of the senior design project presentations.
2014 - 2015	Met	This is the first year of a two-year cycle of data collection. No use of results required.
2015 - 2016		

<u>Oral & Written Communication</u>: *Graduates of the program will communicate engineering ideas orally, graphically and in written form by presenting their semester-long design efforts in a formal and professional manner.*

Reporting Period	Criterion Status	Use of Results for Improvement
2010 - 2011	Met	This is the first year of a two-year cycle of data collection. No use of results required.
2011 - 2012	Met	Panel of judges and student feedback after project presentations were beneficial. Presentations were videotaped for further critique. 1. Using real life project enhanced the student learning. Focus on strategies to maintain support from local professional societies. 2. Using real life project enhanced the student learning.

	3. Using computer based	design tools enhanced the student learning. 4. Panel of judges and student feedback after project presentations were beneficial. Presentations were videotaped for further critique. 5. UPAC believes that it is critical that there is greater faculty participation in the outcomes assessment and will encourage greater faculty attendance of the senior design project presentations.
2012 - 2013	Met	This is the first year of a two-year cycle of data collection. No use of results required.
2013 - 2014	Met	Panel of judges and student feedback after project presentations were beneficial. Presentations were videotaped for further critique. 1. Using real life project enhanced the student learning. Focus on strategies to maintain support from local professional societies. 2. Using real life project enhanced the student learning. 3. Using computer based design tools enhanced the student learning. 4. Panel of judges and student feedback after project presentations were beneficial. Presentations were videotaped for further critique. 5. UPAC believes that it is critical that there is greater faculty participation in the outcomes assessment and will encourage greater faculty attendance of the senior design project presentations.
2014 - 2015	Met	This is the first year of a two-year cycle of data collection. No use of results required.
2015 - 2016		

Technology: *Graduates of the program will utilize the techniques and skills of modern scientific and engineering technology for environmental engineering practice, including the use of appropriate laboratory/field testing equipment and appropriate computer software.*

Reporting Period	Criterion Status	Use of Results for Improvement
2010 - 2011	Met	This is the first year of a two-year cycle of data collection. No use of results required.
2011 - 2012	Met	Using computer based design tools enhanced the student learning. 1. Using real life project enhanced the student learning. Focus on strategies to maintain support from local professional societies. 2. Using real life project enhanced the student learning. 3. Using computer based design tools enhanced the student learning. 4. Panel of judges and student feedback after project presentations were beneficial. Presentations were videotaped for further critique. 5. UPAC believes that it is critical that there is greater faculty participation in the outcomes assessment and will encourage greater faculty attendance of the senior design project presentations.
2012 - 2013	Met	This is the first year of a two-year cycle of data collection. No use of results required.
2013 - 2014	Met	Using computer based design tools enhanced the student learning. 1. Using real life project enhanced the student learning. Focus on strategies to maintain support from local professional societies. 2. Using real life project enhanced the student learning. 3. Using computer based design tools enhanced the student learning. 4. Panel of judges and student feedback after project presentations were beneficial. Presentations were videotaped for further critique. 5. UPAC believes that it is critical that there is greater faculty participation in the outcomes assessment and will encourage greater faculty attendance of the senior design project presentations.

2014 - 2015	Met	This is the first year of a two-year cycle of data collection. No use of results required.
2015 - 2016		

Future Directions

To be completed by program.

Program - CEC Environmental Engineering PO (BS)

Assessment Results Summary
The program assesses the following learning outcomes. Each year, assessment results are gathered for each outcome. The following table summarizes the assessment results for the program.

Past Improvements Based on Results
The results described below have led to significant improvements over the past years. Based on the outcomes below, the following data-driven improvements have been made:

Knowledge Expansion 1: *Graduates will update and expand their knowledge through practice, educational venues or graduate study.*

Reporting Period	Criterion Status	Use of Results for Improvement
2010 - 2011	Met	This is the first year of a two-year cycle of data collection. No use of results required.
2011 - 2012	Not met	Actions: a) Collection of information, and b) Evaluating the measurability of this criterion. A new survey will be developed by the Graduate Program Advisory Committee, with faculty input, and then implemented beginning with alumni who graduated in the last 4-6 years.
2012 - 2013	Met	This is the first year of a two-year cycle of data collection. No use of results required.
2013 - 2014	Not met	Actions: a) Collection of information, and b) Evaluating the measurability of this criterion.
2014 - 2015	Not met	This is the first year of a two-year cycle of data collection. No use of results required.

2015 - 2016		

Post-Graduation: *Our graduates will find jobs or pursue further graduate study within the first year after graduation.*

Reporting Period	Criterion Status	Use of Results for Improvement
2010 - 2011	N/A	This is the first year of a two-year cycle of data collection. No use of results required.
2011 - 2012	Not met	Action: The department will work with interested parties to make sure we have updated contact information from our alumni and alumni survey can be conducted successfully. a) Continue collection of information, and b) Improving survey contents.
2012 - 2013	Met	This is the first year of a two-year cycle of data collection. No use of results required.
2013 - 2014	Met	Action: a) Continue collection of information, and b) Improving survey contents.
2014 - 2015	Met	This is the first year of a two-year cycle of data collection. No use of results required.
2015 - 2016		

Student Program Satisfaction: *Graduates will be satisfied with the curriculum and supporting educational resources and program.*

Reporting Period	Criterion Status	Use of Results for Improvement
2010 - 2011	Met	This is the first year of a two-year cycle of data collection. No use of results required.

2011 - 2012	Met	Action: The department will work with interested parties to make sure we have updated contact information from our alumni and alumni survey can be conducted successfully. a) Continue collection of information, and b) improving survey contents.
2012 - 2013	Met	This is the first year of a two-year cycle of data collection. No use of results required.
2013 - 2014	Met	Action: a) Continue collection of information, and b) Improving survey contents.
2014 - 2015	Met	This is the first year of a two-year cycle of data collection. No use of results required.
2015 - 2016		

Future Directions

To be completed by program.

1. Student Learning Outcome (SLO) Assessment Results

1.1. 2012-2013

Florida International University: Student Learning Outcome Assessment 2012-2013
Academic Unit: Civil & Environmental Engineering Page 1
Degree Program: BS – Civil Engineering – 140801
Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Program Outcome **(Stated in Measurable Terms)**	**Assessment Methods**	**Results** **(Data Summary and Analysis)**
1. Graduates will advance in their careers in environmental engineering or related areas by demonstrating technical proficiency, communication skills, responsible citizenship, leadership, and ethical behavior.	**<u>Alumni Survey</u>** **<u>Procedure:</u>** Alumni surveys are conducted at the end of each Spring semester. The Undergraduate Program Director is responsible for conducting the surveys, as well as collecting and analyzing the results. The survey consists of 10 questions and will be sent via email to Environmental Engineering alumni that have graduated three years back, i.e., for the 2012-2013 PO assessment we will send the surveys to students who graduated in 2009-2010 (2 students). The answers from the survey are used to: 6. Determine the percentage of graduates who currently hold a job in Environmental Engineering and require an Environmental Engineering degree or knowledge of Environmental Engineering for their jobs. 7. Determine the percentage of graduates who have ever worked in an Environmental Engineering job since they graduated. 8. Determine the percentage of graduates who have enrolled in graduate school. 9. Determine the overall percentage graduates who are neither employed nor in graduate school.	The BS degree in Environmental Engineering is received the first time ABET accreditation in 2009. Nine students graduated from the program during 2012-2013. Program outcomes are periodically and systematically (i.e., during DAB semi-annual meetings, monthly faculty meetings, and periodically conducted – every other year) - alumni and employee surveys). The survey was sent via email to the students, all have completed the survey. 50% of the respondents currently hold jobs that require a degree in environmental engineering. The same 80% have worked at least at some point in an Environmental Engineering job since they graduated. 50% of respondents enrolled in graduate school. 0% of the respondents are neither in graduate school nor employed.

Program Outcome (Stated in Measurable Terms)	Assessment Methods	Results (Data Summary and Analysis)
	Minimum criteria for success: The minimum criteria for success are to have a minimum of 80% of the alumni submitting the survey to either be employed in the field or be enrolled in graduate school (i.e., have answered "yes" to either one of items 1 through 3 above), and no more than 20% answering "yes" to item 4 above.	The minimum criteria for success are met for the first Program Outcome.

Use of Results for Improving Program

Need to improve our database on contact information for students graduating from the BS degree in Environmental Engineering. Using the results as a foundation, in consultation with faculty and Department Advisory Board, develop strategies that will lead to program improvements. Focus on strategies that are sustainable and feasible.

Program Outcome (Stated in Measurable Terms)	Assessment Methods	Results (Data Summary and Analysis)
2. Graduates will make progress towards obtaining professional registration, special licensing, or certification.	**Alumni Survey** **Procedure:** Alumni surveys are conducted at the end of each Spring semester. The Undergraduate Program Director is responsible for conducting the surveys, as well as collecting and analyzing the results. The survey consists of 10 questions and will be sent via email to Environmental Engineering alumni that have graduated three years back, i.e., for the 2012-2013 PO assessment we will send the surveys to students who graduated in 2009-2010 (2 students). The answers from the survey are used to: 2. Determine the percentage of graduates who have taken the Fundamentals of Engineering (FE) exam.	The BS degree in Environmental Engineering is received the first time ABET accreditation in 2009. Nine students graduated from the program during 2012-2013. Program outcomes are periodically and systematically (i.e., during DAB semi-annual meetings, monthly faculty meetings, and periodically conducted – every other year) - alumni and employee surveys). The survey was sent via email to the students, all have completed the survey.

Program Outcome (Stated in Measurable Terms)	Assessment Methods	Results (Data Summary and Analysis)
	3. Determine the percentage of those who passed the FE exam. 4. Determine the percentage of graduates who have worked under a licensed engineer. 5. Determine the percentage of graduates who have earned at least one license or certificate since graduation. <u>Minimum criteria for success:</u> The minimum criteria for success is to have a minimum of 80% of the alumni that answered yes to Program Outcome 1 answering "yes" to items 1 through 4 above.	1. 100% respondents have taken the FE exam. 2. 0% of the respondents have passed the FE. 3. 50% of the respondents have worked under a licensed engineer. 4. None of the respondents have earned at least one license or certificate since graduation. Because the sample size is small it is difficult to say that the minimum criteria for success are met for Program Outcome 2.

Use of Results for Improving Program

The new BS degree program in Environmental Engineering (EnvE) was ABET accredited for the first time in Fall 2008. The CEE Department officially received ABET accreditation only in late summer 2009. Therefore, we could not mandate EnvE students to clear the FE/EIT exam until after the Fall 2010 semester. We have now updated our undergraduate catalog stating the requirement for EnvE students to take the FE/EIT exam, but it is not possible to retroactively require former graduates to comply with the new requirements. The Department is confident that subsequent EnvE cohorts will show better compliance in meeting the second Program Outcome, i.e., making progress toward professional registration, special licensing or certification – particularly those graduating after Fall 2011.

Action: Continue collection of information.

Summarize use of results for continuous improvement of learning:

1. Using real life project enhanced the student learning. Focus on strategies to maintain support from local professional societies.
2. Using real life project enhanced the student learning.
3. Using computer based design tools enhanced the student learning.
4. Panel of judges and student feedback after project presentations were beneficial. Presentations were videotaped for further critique.
5. UPAC believes that it is critical that there is greater faculty participation in the outcomes assessment and will encourage greater faculty attendance of the senior design project presentations.

1.2. 2013-2014

Florida International University: Student Learning Outcome Assessment 2013-2014
Academic Unit: Civil & Environmental Engineering
Degree Program: BS – Civil Engineering – 140801
Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Program Outcome (Stated in Measurable Terms)	**Assessment Methods**	**Results (Data Summary and Analysis)**
2. Graduates will advance in their careers in environmental engineering or related areas by demonstrating technical proficiency, communication skills, responsible citizenship, leadership, and ethical behavior.	**<u>Alumni Survey</u>** **<u>Procedure:</u>** Alumni surveys are conducted at the end of each Spring semester. The Undergraduate Program Director is responsible for conducting the surveys, as well as collecting and analyzing the results. The survey consists of 10 questions and will be sent via email to Environmental Engineering alumni that have graduated three years back, i.e., for the 2013-2014 PO assessment we will send the surveys to students who graduated in 2010-2011 (9 students). The answers from the survey are used to: 10. Determine the percentage of graduates who currently hold a job in Environmental Engineering and require an Environmental Engineering degree or knowledge of Environmental Engineering for their jobs. 11. Determine the percentage of graduates who have ever worked in an Environmental Engineering job since they graduated. 12. Determine the percentage of graduates who have enrolled in graduate school. 13. Determine the overall percentage graduates who are neither employed nor in graduate school.	The BS degree in Environmental Engineering is received the first time ABET accreditation in 2009. Nine students graduated from the program during 2013-2014. Program outcomes are periodically and systematically (i.e., during DAB semi-annual meetings, monthly faculty meetings, and periodically conducted – every other year) - alumni and employee surveys). The survey was sent via email to the students, all have completed the survey. 1. 60% of the respondents currently hold jobs that require a degree in environmental engineering. 2. The same 60% have worked at least at some point in an Environmental Engineering job since they graduated. 3. 40% of respondents enrolled in graduate school. 4. 0% of the respondents are neither in graduate school nor employed.

Program Outcome (Stated in Measurable Terms)	Assessment Methods	Results (Data Summary and Analysis)
	Minimum criteria for success: The minimum criteria for success are to have a minimum of 80% of the alumni submitting the survey to either be employed in the field or be enrolled in graduate school (i.e., have answered "yes" to either one of items 1 through 3 above), and no more than 20% answering "yes" to item 4 above.	The minimum criteria for success are met for the first Program Outcome.

Use of Results for Improving Program

Using the results as a foundation, in consultation with faculty and Department Advisory Board, develop strategies that will lead to program improvements. Focus on strategies that are sustainable and feasible.

Program Outcome (Stated in Measurable Terms)	Assessment Methods	Results (Data Summary and Analysis)
3. Graduates will make progress towards obtaining professional registration, special licensing, or certification.	**Alumni Survey Procedure:** Alumni surveys are conducted at the end of each Spring semester. The Undergraduate Program Director is responsible for conducting the surveys, as well as collecting and analyzing the results. The survey consists of 10 questions and will be sent via email to Environmental Engineering alumni that have graduated three years back, i.e., for the 2013-2014 PO assessment we will send the surveys to students who graduated in 2010-2011 (9 students). The answers from the survey are used to: 6. Determine the percentage of graduates who have taken the Fundamentals of Engineering (FE) exam. 7. Determine the percentage of those who passed the	The BS degree in Environmental Engineering is received the first time ABET accreditation in 2009. Nine students graduated from the program during 2013-2014. Program outcomes are periodically and systematically (i.e., during DAB semi-annual meetings, monthly faculty meetings, and periodically conducted – every other year) - alumni and employee surveys). The survey was sent via email to the students, all have completed the survey.

Program Outcome (Stated in Measurable Terms)	Assessment Methods	Results (Data Summary and Analysis)
	FE exam. 8. Determine the percentage of graduates who have worked under a licensed engineer. 9. Determine the percentage of graduates who have earned at least one license or certificate since graduation. <u>Minimum criteria for success:</u> The minimum criteria for success is to have a minimum of 80% of the alumni that answered yes to Program Outcome 1 answering "yes" to items 1 through 4 above.	5. 100% respondents have taken the FE exam. 6. 0% of the respondents have passed the FE. 7. 50% of the respondents have worked under a licensed engineer. 8. None of the respondents have earned at least one license or certificate since graduation. The minimum criteria for success are met for Program Outcome 2.

Use of Results for Improving Program

The new BS degree program in Environmental Engineering (EnvE) was ABET accredited for the first time in Fall 2008. The CEE Department officially received ABET accreditation only in late summer 2009. Therefore, we could not mandate EnvE students to clear the FE/EIT exam until after the Fall 2010 semester. We have now updated our undergraduate catalog stating the requirement for EnvE students to take the FE/EIT exam, but it is not possible to retroactively require former graduates to comply with the new requirements. The Department is confident that subsequent EnvE cohorts showed better compliance in meeting the second Program Outcome, i.e., making progress toward professional registration, special licensing or certification – particularly those graduating after Fall 2011.

Action: Continue collection of information.

Program Outcome (Stated in Measurable Terms)	Assessment Methods	Results (Data Summary and Analysis)
4. Graduates will pursue continued life-long learning to become the problem solvers considering the global, economic, environmental, and social impact.	**<u>Alumni Survey</u>** **<u>Procedure:</u>** Alumni surveys are conducted at the end of each Spring semester. The Undergraduate Program Director is responsible for conducting the surveys, as well as collecting and analyzing the results. The survey consists of 10 questions and will be sent via email to Environmental Engineering alumni that have graduated three years back, i.e., for the 2013-2014 PO assessment we will send the surveys to students who graduated in 2010-2011 (9 students). The answers from the survey are used to: 2. Determine the percentage of graduates who have continued their professional development by attending meetings organized by ASCE, FES, WEF, AWWA, SWANA, NSPE, etc. 3. Determine the percentage of graduates who have written at least one paper or technical report per year. 4. Determine the percentage of graduates who have attended training seminars, workshops, or courses to improve their skills. 5. Determine the percentage graduates who are taking or have completed at least one graduate course since their graduation. <u>Minimum criteria for success:</u> The minimum criteria for success is to have a minimum of 80% of the alumni submitting the survey “yes” to at least one of items 1 through 4 above.	The BS degree in Environmental Engineering is received the first time ABET accreditation in 2009. Nine students graduated from the program during 2013-2014. Program outcomes are periodically and systematically (i.e., during DAB semi-annual meetings, monthly faculty meetings, and periodically conducted – every other year) - alumni and employee surveys). The survey was sent via email to the students, all have completed the survey. 1. 50% of the respondents have continued their professional development by attending meetings organized by ASCE, FES, etc. 2. 50% of the respondents have written at least one technical paper or report a year. 3. 50% have attended training seminars, workshops, or courses to improve their skills. 4. 100% of the respondents are taking or have completed at least one graduate course since their graduation. The minimum criteria for success are met for Program Outcome 3.
Use of Results for Improving Program Action: a) Collect information, and b) Evaluate measurability of this criterion.		

Summarize use of results for continuous improvement of the educational program:

Our Environmental Engineering undergraduate degree program is successful based on alumni surveys, graduates are satisfied with education they received at FIU. The department will work with interested parties to make sure we have updated contact information from our alumni and alumni surveys can be conducted successfully.

1. Continue to improve our database on contact information for students graduating from the BS degree in Environmental Engineering. The email addresses, telephone numbers, and mailing addresses recorded with the University appear outdated. We initiated that effort in the Fall 2010 semester.
2. UPAC now has put greater emphasis on professional registration for the environmental engineering students as well. Now all EnvE students are required to pass the FE Review class and strongly encouraged to clear the FE/EIT exam while still in school.
3. The environmental laboratories are updated with new equipment. Student in the EnvE program have a more comprehensive laboratory experience while at FIU; this together with efforts to provide internship opportunities should further their success in securing jobs in environmental engineering area.
4. Refine criteria to evaluate measurability of Program Outcome 3.

1.3. 2014-2015

Florida International University: Student Learning Outcome Assessment 2014-2015

Academic Unit: Civil & Environmental Engineering

Degree Program: BS – Civil Engineering – 140801

Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Program Outcome (Stated in Measurable Terms)	**Assessment Methods**	**Results (Data Summary and Analysis)**
5. Graduates will advance in their careers in environmental engineering or related areas by demonstrating technical proficiency, communication skills, responsible citizenship, leadership, and ethical behavior.	**<u>Alumni Survey</u>** **<u>Procedure:</u>** Alumni surveys are conducted at the end of each Spring semester. The Undergraduate Program Director is responsible for conducting the surveys, as well as collecting and analyzing the results. The survey consists of 10 questions and will be sent via email to Environmental Engineering alumni that have graduated three years back, i.e., for the 2014-2015 PO assessment we will send the surveys to students who graduated in 2011-2012 (8 students). The answers from the survey are used to: 14. Determine the percentage of graduates who currently hold a job in Environmental Engineering and require an Environmental Engineering degree or knowledge of Environmental Engineering for their jobs. 15. Determine the percentage of graduates who have ever worked in an Environmental Engineering job since they graduated. 16. Determine the percentage of graduates who have enrolled in graduate school. 17. Determine the overall percentage graduates who are neither employed nor in graduate school.	The BS degree in Environmental Engineering is received the first time ABET accreditation in 2009. Eight students graduated from the program during 2014-2015. Program outcomes are periodically and systematically (i.e., during DAB semi-annual meetings, monthly faculty meetings, and periodically conducted – every other year) - alumni and employee surveys). The survey was sent via email to the students, all have completed the survey. 5. 60% of the respondents currently hold jobs that require a degree in environmental engineering. 6. The same 60% have worked at least at some point in an Environmental Engineering job since they graduated. 7. 40% of respondents enrolled in graduate school. 8. 0% of the respondents are neither in graduate school nor employed.

Program Outcome (Stated in Measurable Terms)	Assessment Methods	Results (Data Summary and Analysis)
	Minimum criteria for success: The minimum criteria for success are to have a minimum of 80% of the alumni submitting the survey to either be employed in the field or be enrolled in graduate school (i.e., have answered "yes" to either one of items 1 through 3 above), and no more than 20% answering "yes" to item 4 above.	The minimum criteria for success are met for the first Program Outcome.

Use of Results for Improving Program

Using the results as a foundation, in consultation with faculty and Department Advisory Board, develop strategies that will lead to program improvements. Focus on strategies that are sustainable and feasible.

Program Outcome (Stated in Measurable Terms)	Assessment Methods	Results (Data Summary and Analysis)
6. Graduates will make progress towards obtaining professional registration, special licensing, or certification.	**Alumni Survey** **Procedure:** Alumni surveys are conducted at the end of each Spring semester. The Undergraduate Program Director is responsible for conducting the surveys, as well as collecting and analyzing the results. The survey consists of 10 questions and will be sent via email to Environmental Engineering alumni that have graduated three years back, i.e., for the 2014-2015 PO assessment we will send the surveys to students who graduated in 2011-2012 (8 students). The answers from the survey are used to: 10. Determine the percentage of graduates who have taken the Fundamentals of Engineering (FE) exam. 11. Determine the percentage of those who passed the	The BS degree in Environmental Engineering is received the first time ABET accreditation in 2009. Eight students graduated from the program during 2014-2015. Program outcomes are periodically and systematically (i.e., during DAB semi-annual meetings, monthly faculty meetings, and periodically conducted – every other year) - alumni and employee surveys). The survey was sent via email to the students, all have completed the survey.

Program Outcome (Stated in Measurable Terms)	Assessment Methods	Results (Data Summary and Analysis)
	FE exam. 12. Determine the percentage of graduates who have worked under a licensed engineer. 13. Determine the percentage of graduates who have earned at least one license or certificate since graduation. <u>Minimum criteria for success:</u> The minimum criteria for success is to have a minimum of 80% of the alumni that answered yes to Program Outcome 1 answering "yes" to items 1 through 4 above.	9. 100% respondents have taken the FE exam. 10. 0% of the respondents have passed the FE. 11. 50% of the respondents have worked under a licensed engineer. 12. None of the respondents have earned at least one license or certificate since graduation. The minimum criteria for success are met for Program Outcome 2.

Use of Results for Improving Program

The new BS degree program in Environmental Engineering (EnvE) was ABET accredited for the first time in Fall 2008 (retroactively). The CEE Department officially received ABET accreditation only in late summer 2009. Therefore, at the time we could not mandate EnvE students to clear the FE/EIT exam until after the Fall 2010 semester.

We have now updated our undergraduate catalog stating the requirement for EnvE students to take the FE/EIT exam, but it is not possible to retroactively require former graduates to comply with the new requirements.

The EnvE cohorts showed better compliance in meeting the second Program Outcome, i.e., making progress toward professional registration, special licensing or certification – particularly those graduating after Fall 2012.

Action: Continue collection of information.

Program Outcome (Stated in Measurable Terms)	Assessment Methods	Results (Data Summary and Analysis)
7. Graduates will pursue continued life-long learning to become the problem solvers considering the global, economic, environmental, and social impact.	<u>**Alumni Survey**</u> <u>**Procedure:**</u> Alumni surveys are conducted at the end of each Spring semester. The Undergraduate Program Director is responsible for conducting the surveys, as well as collecting and analyzing the results. The survey consists of 10 questions and will be sent via email to Environmental Engineering alumni that have graduated three years back, i.e., for the 2014-2015 PO assessment we will send the surveys to students who graduated in 2011-2012 (8 students). The answers from the survey are used to: 6. Determine the percentage of graduates who have continued their professional development by attending meetings organized by ASCE, FES, WEF, AWWA, SWANA, NSPE, etc. 7. Determine the percentage of graduates who have written at least one paper or technical report per year. 8. Determine the percentage of graduates who have attended training seminars, workshops, or courses to improve their skills. 9. Determine the percentage graduates who are taking or have completed at least one graduate course since their graduation. <u>Minimum criteria for success:</u> The minimum criteria for success is to have a minimum of 80% of the alumni submitting the survey "yes" to at least one of items 1 through 4 above.	The BS degree in Environmental Engineering is received the first time ABET accreditation in 2009. Eight students graduated from the program during 2014-2015. Program outcomes are periodically and systematically (i.e., during DAB semi-annual meetings, monthly faculty meetings, and periodically conducted – every other year) - alumni and employee surveys). The survey was sent via email to the students, all have completed the survey. 5. 50% of the respondents have continued their professional development by attending meetings organized by ASCE, FES, etc. 6. 50% of the respondents have written at least one technical paper or report a year. 7. 50% have attended training seminars, workshops, or courses to improve their skills. 8. 100% of the respondents are taking or have completed at least one graduate course since their graduation. The minimum criteria for success are met for Program Outcome 3.
Use of Results for Improving Program Action: a) Collect information, and b) Evaluate measurability of this criterion.		

2. Program Outcome (PO) Assessment Results

2.1. 2012-2013

Florida International University: Program Outcome Assessment 2012-2013
Academic Unit: Civil & Environmental Engineering Page 1
Degree Program: BS – Civil Engineering – 140801

Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Student Learning Outcome (Stated in Measurable Terms)	**Assessment Method**	**Results (Data Summary and Analysis)**
8. Content: Graduates will demonstrate the ability to apply the integrated knowledge of mathematics, science, and engineering to solve environmental engineering problems.	Undergraduate Program Advisory Committee (UPAC) identified Environmental Engineering Senior Design Project (ENV 4891) as appropriate to assess this outcome. In this Senior Design course, students will create team design projects involving applications of fundamental environmental engineering concepts to project design, specifications, contracts and implementation. **Artifact** This outcome will be assessed with the detailed calculations and analysis in the technical report that each team submits for the senior design project. **Evaluation Process** The artifact will be assessed by a faculty panel consisting of the course instructor(s), a minimum of two additional faculty members, and the external panelists invited to the senior design presentations. **Sampling** All senior design team projects will be assessed every semester that the course is offered. **Minimum Criteria for Success** Student teams will achieve a minimum of 2 on a 3-point rubric where 1 corresponds to weak and 3 to excellent.	There were a total of 5 students enrolled in the Environmental Engineering Senior Design Project (ENV 4891) in the Fall 2012 and 8 students Spring 2013 semester. Because of the small class sizes (5 and 8), students worked as a team of 5 (Fall 2012) or two 4-member teams (Spring 2013) in executing their senior design projects during each semester. A panel of at least five members assessed each team using a previously prepared rubric to score the content outcome that included technical accuracy, methodology, comprehensive approach, and affordability. The average score received by the team effort over the two semesters was 2.95 out of 3, thereby meeting the minimum criteria for success for the content outcome.

Use of Results for Improving Student Learning
Using real life project enhanced the student learning. Focus on strategies to maintain support from local professional societies.

Student Learning Outcome (Stated in Measurable Terms)	Assessment Method	Results (Data Summary and Analysis)
3. Critical Thinking: Graduates will collect information, consider and compare performance of competing options, analyze and interpret results, and propose solutions for an environmental engineering design problem.	Undergraduate Program Advisory Committee (UPAC) identified Environmental Engineering Senior Design Project (ENV 4891) as appropriate to assess this outcome. In this Senior Design course, students will create team design projects involving applications of fundamental environmental engineering concepts to project design, specifications, contracts and implementation. **Artifact** This outcome will be assessed with the discussion, conclusion, and justification sections of the technical report and corresponding oral presentation areas, including the overall reasonableness of the engineering solution proposed. **Evaluation Process** The artifact will be assessed by a faculty panel with a minimum of three members. **Sampling** All senior design team projects will be assessed every semester that the course is offered. **Minimum Criteria for Success** Student teams will achieve a minimum of 2 on a 3-point rubric where 1 corresponds to weak and 3 to excellent.	There were a total of 5 students enrolled in the Environmental Engineering Senior Design Project (ENV 4891) in the Fall 2012 and 8 students Spring 2013 semester. Because of the small class sizes (5 and 8), students worked as a team of 5 (Fall 2012) or two 4-member teams (Spring 2013) in executing their senior design projects during each semester. A panel of at least five members assessed each team using a previously prepared rubric to score the critical thinking outcome that included analysis and interpretation of results and their application. The average score received by the team effort over the two semesters was 2.95 out of 3, thereby meeting the minimum criteria for success for the critical thinking outcome.
Use of Results for Improving Student Learning Using real life project enhanced the student learning.		

Student Learning Outcome (Stated in Measurable Terms)	Assessment Method	Results (Data Summary and Analysis)
5. Technology outcome: Graduates of the program will utilize the techniques and skills of modern scientific and engineering technology for	Undergraduate Program Advisory Committee (UPAC) identified Environmental Engineering Senior Design Project (ENV 4891) as appropriate to assess this outcome. In this Senior Design course, students will create team design projects involving applications of fundamental environmental engineering concepts to project design, specifications, contracts and implementation. **Artifact** This outcome will be assessed with the AutoCad drawings and demonstration of use	There were a total of 5 students enrolled in the Environmental Engineering Senior Design Project (ENV 4891) in the Fall 2012 and 8 students Spring 2013 semester. Because of the small class sizes (5 and 8), students worked as a team of 5 (Fall 2012) or two 4-member teams (Spring 2013) in executing their senior design projects during

Student Learning Outcome (Stated in Measurable Terms)	Assessment Method	Results (Data Summary and Analysis)
environmental engineering practice, including the use of appropriate laboratory/field testing equipment and appropriate computer software.	of appropriate software to assist in design calculations as evidenced in the technical report. **Evaluation Process** The artifact will be assessed by a faculty panel with a minimum of three members. **Sampling** All senior design team projects will be assessed every semester that the course is offered. **Minimum Criteria for Success** Student teams will achieve a minimum of 2 on a 3-point rubric where 1 corresponds to weak and 3 to excellent.	each semester. A panel of at least five members assessed each team using a previously prepared rubric to score the technology outcome that included the use of AutoCAD and appropriate software. The average score received by the team effort over the two semesters was 3 out of 3, thereby meeting the minimum criteria for success for the technology outcome.

Use of Results for Improving Student Learning
Using computer based design tools enhanced the student learning.

Student Learning Outcome (Stated in Measurable Terms)	Assessment Method	Results (Data Summary and Analysis)
6. <u>Communication:</u> Graduates of the program will communicate engineering ideas orally and graphically by presenting their semester-long design efforts in a formal and professional manner.	UPAC identified Environmental Engineering Senior Design Project (ENV 4891) as appropriate to assess this outcome. In this Senior Design course, students will create team design projects involving applications of fundamental environmental engineering concepts to project design, specifications, contracts and implementation. **Artifact** This outcome will be assessed with the oral presentation component and the overall written technical report. **Evaluation Process** The artifact will be assessed by a faculty panel with a minimum of three members. **Sampling** All senior design team projects will be assessed every semester that the course is offered. **Minimum Criteria for Success**	There were a total of 5 students enrolled in the Environmental Engineering Senior Design Project (ENV 4891) in the Fall 2012 and 8 students Spring 2013 semester. Because of the small class sizes (5 and 8), students worked as a team of 5 (Fall 2012) or two 4-member teams (Spring 2013) in executing their senior design projects during each semester. The panel assessed each team using a previously prepared rubric to score the communication outcome that included oral and written communication skills. The average score received by the team effort over the two semesters

Student Learning Outcome (Stated in Measurable Terms)	Assessment Method	Results (Data Summary and Analysis)
	Student teams will achieve a minimum of 2 on a 3-point rubric where 1 corresponds to weak and 3 to excellent.	was 2.8 out of 3, thereby meeting the minimum criteria for success.
Use of Results for Improving Student Learning Panel of judges and student feedback after project presentations were beneficial. Presentations were videotaped for further critique.		

Summarize use of results for continuous improvement of learning:

1. Using real life project enhanced the student learning. Focus on strategies to maintain support from local professional societies.
2. Using real life project enhanced the student learning.
3. Using computer based design tools enhanced the student learning.
4. Panel of judges and student feedback after project presentations were beneficial. Presentations were videotaped for further critique.
5. UPAC believes that it is critical that there is greater faculty participation in the outcomes assessment and will encourage greater faculty attendance of the senior design project presentations.

2.2. 2013-2014

Florida International University: Program Outcome Assessment 2013-2014

Academic Unit: Civil & Environmental Engineering

Degree Program: BS – Civil Engineering – 140801

Link to Unit's Mission: The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

Student Learning Outcome (Stated in Measurable Terms)	Assessment Method	Results (Data Summary and Analysis)
6. <u>Content:</u> Graduates will demonstrate the ability to apply the integrated knowledge of mathematics, science, and engineering to solve environmental engineering problems.	Undergraduate Program Advisory Committee (UPAC) identified Environmental Engineering Senior Design Project (ENV 4891) as appropriate to assess this outcome. In this Senior Design course, students will create team design projects involving applications of fundamental environmental engineering concepts to project design, specifications, contracts and implementation. **Artifact** This outcome will be assessed with the detailed calculations and analysis in the technical report that each team submits for the senior design project. **Evaluation Process** The artifact will be assessed by a faculty panel consisting of the course instructor(s), a minimum of two additional faculty members, and the external panelists invited to the senior design presentations. **Sampling** All senior design team projects will be assessed every semester that the course is offered. **Minimum Criteria for Success** Student teams will achieve a minimum of 2 on a 3-point rubric where 1 corresponds to weak and 3 to excellent.	There were a total of 7 students enrolled in the Environmental Engineering Senior Design Project (ENV 4891) in the Fall 2013 and 6 students Spring 2014 semester. Students worked as teams of 3 and 4 (Fall 2013) or two 3-member teams (Spring 2014) in executing their senior design projects during each semester. A panel of at least five members assessed each team using a previously prepared rubric to score the content outcome that included technical accuracy, methodology, comprehensive approach, and affordability. The average score received by the team effort over the two semesters was 2.95 out of 3, thereby meeting the minimum criteria for success for the content outcome.

Use of Results for Improving Student Learning

Using real life project enhanced the student learning. Focus on strategies to maintain support from local professional societies.

Student Learning Outcome (Stated in Measurable Terms)	Assessment Method	Results (Data Summary and Analysis)
4. Critical Thinking: Graduates will collect information, consider and compare performance of competing options, analyze and interpret results, and propose solutions for an environmental engineering design problem.	Undergraduate Program Advisory Committee (UPAC) identified Environmental Engineering Senior Design Project (ENV 4891) as appropriate to assess this outcome. In this Senior Design course, students will create team design projects involving applications of fundamental environmental engineering concepts to project design, specifications, contracts and implementation. **Artifact** This outcome will be assessed with the discussion, conclusion, and justification sections of the technical report and corresponding oral presentation areas, including the overall reasonableness of the engineering solution proposed. **Evaluation Process** The artifact will be assessed by a faculty panel with a minimum of three members. **Sampling** All senior design team projects will be assessed every semester that the course is offered. **Minimum Criteria for Success** Student teams will achieve a minimum of 2 on a 3-point rubric where 1 corresponds to weak and 3 to excellent.	There were a total of 7 students enrolled in the Environmental Engineering Senior Design Project (ENV 4891) in the Fall 2013 and 6 students Spring 2014 semester. Students worked as teams of 3 and 4 (Fall 2013) or two 3-member teams (Spring 2014) in executing their senior design projects during each semester. A panel of at least five members assessed each team using a previously prepared rubric to score the critical thinking outcome that included analysis and interpretation of results and their application. The average score received by the team effort over the two semesters was 2.9 out of 3, thereby meeting the minimum criteria for success for the critical thinking outcome.
Use of Results for Improving Student Learning Using real life project enhanced the student learning.		

Student Learning Outcome (Stated in Measurable Terms)	Assessment Method	Results (Data Summary and Analysis)
7. Technology outcome: Graduates of the program will utilize the techniques and skills of modern scientific and engineering technology for	Undergraduate Program Advisory Committee (UPAC) identified Environmental Engineering Senior Design Project (ENV 4891) as appropriate to assess this outcome. In this Senior Design course, students will create team design projects involving applications of fundamental environmental engineering concepts to project design, specifications, contracts and implementation. **Artifact** This outcome will be assessed with the AutoCad drawings and demonstration of use	There were a total of 7 students enrolled in the Environmental Engineering Senior Design Project (ENV 4891) in the Fall 2013 and 6 students Spring 2014 semester. Students worked as teams of 3 and 4 (Fall 2013) or two 3-member teams (Spring 2014) in executing their senior design projects during each semester.

Student Learning Outcome (Stated in Measurable Terms)	Assessment Method	Results (Data Summary and Analysis)
environmental engineering practice, including the use of appropriate laboratory/field testing equipment and appropriate computer software.	of appropriate software to assist in design calculations as evidenced in the technical report. **Evaluation Process** The artifact will be assessed by a faculty panel with a minimum of three members. **Sampling** All senior design team projects will be assessed every semester that the course is offered. **Minimum Criteria for Success** Student teams will achieve a minimum of 2 on a 3-point rubric where 1 corresponds to weak and 3 to excellent.	A panel of at least five members assessed each team using a previously prepared rubric to score the technology outcome that included the use of AutoCAD and appropriate software. The average score received by the team effort over the two semesters was 3 out of 3, thereby meeting the minimum criteria for success for the technology outcome.

Use of Results for Improving Student Learning

Using computer based design tools enhanced the student learning.

Student Learning Outcome (Stated in Measurable Terms)	Assessment Method	Results (Data Summary and Analysis)
8. <u>Communication:</u> Graduates of the program will communicate engineering ideas orally and graphically by presenting their semester-long design efforts in a formal and professional manner.	UPAC identified Environmental Engineering Senior Design Project (ENV 4891) as appropriate to assess this outcome. In this Senior Design course, students will create team design projects involving applications of fundamental environmental engineering concepts to project design, specifications, contracts and implementation. **Artifact** This outcome will be assessed with the oral presentation component and the overall written technical report. **Evaluation Process** The artifact will be assessed by a faculty panel with a minimum of three members. **Sampling** All senior design team projects will be assessed every semester that the course is offered. **Minimum Criteria for Success**	There were a total of 7 students enrolled in the Environmental Engineering Senior Design Project (ENV 4891) in the Fall 2013 and 6 students Spring 2014 semester. Students worked as teams of 3 and 4 (Fall 2013) or two 3-member teams (Spring 2014) in executing their senior design projects during each semester. The panel assessed each team using a previously prepared rubric to score the communication outcome that included oral and written communication skills. The average score received by the team effort over the two semesters

Student Learning Outcome (Stated in Measurable Terms)	Assessment Method	Results (Data Summary and Analysis)
	Student teams will achieve a minimum of 2 on a 3-point rubric where 1 corresponds to weak and 3 to excellent.	was 2.9 out of 3, thereby meeting the minimum criteria for success.
Use of Results for Improving Student Learning Panel of judges and student feedback after project presentations were beneficial. Presentations were videotaped for further critique.		

Summarize use of results for continuous improvement of learning:

1. Using real life project enhanced the student learning. Focus on strategies to maintain support from local professional societies.
2. Using real life project enhanced the student learning.
3. Using computer based design tools enhanced the student learning.
4. Panel of judges and student feedback after project presentations were beneficial. Presentations were videotaped for further critique.
5. UPAC believes that it is critical that there is greater faculty participation in the outcomes assessment and will encourage greater faculty attendance of the senior design project presentations.

2.3. 2014-2015

Florida International University: Program Outcome Assessment 2013-2014

Academic Unit: Civil & Environmental Engineering

Degree Program: BS – Civil Engineering – 140801

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Program Outcome (Stated in Measurable Terms)	**Assessment Methods**	**Results (Data Summary and Analysis)**
6. Graduates will advance in their careers in environmental engineering or related areas by demonstrating technical proficiency, communication skills, responsible citizenship, leadership, and ethical behavior.	**Alumni Survey** **Procedure:** Alumni surveys are conducted at the end of each Spring semester. The Undergraduate Program Director is responsible for conducting the surveys, as well as collecting and analyzing the results. The survey consists of 10 questions and will be sent via email to Environmental Engineering alumni that have graduated three years back, i.e., for the 2014-2015 PO assessment we will send the surveys to students who graduated in 2011-2012 (8 students). The answers from the survey are used to: 18. Determine the percentage of graduates who currently hold a job in Environmental Engineering and require an Environmental Engineering degree or knowledge of Environmental Engineering for their jobs. 19. Determine the percentage of graduates who have ever worked in an Environmental Engineering job since they graduated. 20. Determine the percentage of graduates who have	The BS degree in Environmental Engineering is received the first time ABET accreditation in 2009. Eight students graduated from the program during 2014-2015. Program outcomes are periodically and systematically (i.e., during DAB semi-annual meetings, monthly faculty meetings, and periodically conducted – every other year) - alumni and employee surveys). The survey was sent via email to the students, all have completed the survey. 9. 60% of the respondents currently hold jobs that require a degree in environmental engineering. 10. The same 60% have worked at least at some point in an Environmental Engineering job since they graduated. 11. 40% of respondents enrolled in

Program Outcome (Stated in Measurable Terms)	Assessment Methods	Results (Data Summary and Analysis)
	enrolled in graduate school. 21. Determine the overall percentage graduates who are neither employed nor in graduate school. Minimum criteria for success: The minimum criteria for success are to have a minimum of 80% of the alumni submitting the survey to either be employed in the field or be enrolled in graduate school (i.e., have answered "yes" to either one of items 1 through 3 above), and no more than 20% answering "yes" to item 4 above.	graduate school. 12. 0% of the respondents are neither in graduate school nor employed. The minimum criteria for success are met for the first Program Outcome.

Use of Results for Improving Program
Using the results as a foundation, in consultation with faculty and Department Advisory Board, develop strategies that will lead to program improvements. Focus on strategies that are sustainable and feasible.

Program Outcome (Stated in Measurable Terms)	Assessment Methods	Results (Data Summary and Analysis)
7. Graduates will make progress towards obtaining professional registration, special licensing, or certification.	**Alumni Survey** **Procedure:** Alumni surveys are conducted at the end of each Spring semester. The Undergraduate Program Director is responsible for conducting the surveys, as well as collecting and analyzing the results. The survey consists of 10 questions and will be sent via email to Environmental Engineering alumni that have graduated three years back, i.e., for the 2014-2015 PO assessment we will send the surveys to students who graduated in 2011-2012 (8 students). The answers from the survey are used to: 14. Determine the percentage of graduates who have	The BS degree in Environmental Engineering is received the first time ABET accreditation in 2009. Eight students graduated from the program during 2014-2015. Program outcomes are periodically and systematically (i.e., during DAB semi-annual meetings, monthly faculty meetings, and periodically conducted – every other year) - alumni and employee surveys). The survey was sent via email to the students, all have completed the survey.

Program Outcome (Stated in Measurable Terms)	Assessment Methods	Results (Data Summary and Analysis)
	taken the Fundamentals of Engineering (FE) exam. 15. Determine the percentage of those who passed the FE exam. 16. Determine the percentage of graduates who have worked under a licensed engineer. 17. Determine the percentage of graduates who have earned at least one license or certificate since graduation. <u>Minimum criteria for success:</u> The minimum criteria for success is to have a minimum of 80% of the alumni that answered yes to Program Outcome 1 answering "yes" to items 1 through 4 above.	13. 100% respondents have taken the FE exam. 14. 0% of the respondents have passed the FE. 15. 50% of the respondents have worked under a licensed engineer. 16. None of the respondents have earned at least one license or certificate since graduation. The minimum criteria for success are met for Program Outcome 2.

Use of Results for Improving Program

The new BS degree program in Environmental Engineering (EnvE) was ABET accredited for the first time in Fall 2008 (retroactively). The CEE Department officially received ABET accreditation only in late summer 2009. Therefore, at the time we could not mandate EnvE students to clear the FE/EIT exam until after the Fall 2010 semester.

We have now updated our undergraduate catalog stating the requirement for EnvE students to take the FE/EIT exam, but it is not possible to retroactively require former graduates to comply with the new requirements.

The EnvE cohorts showed better compliance in meeting the second Program Outcome, i.e., making progress toward professional registration, special licensing or certification – particularly those graduating after Fall 2012.

Action: Continue collection of information.

Program Outcome (Stated in Measurable Terms)	Assessment Methods	Results (Data Summary and Analysis)

Program Outcome (Stated in Measurable Terms)	Assessment Methods	Results (Data Summary and Analysis)
8. Graduates will pursue continued life-long learning to become the problem solvers considering the global, economic, environmental, and social impact.	**Alumni Survey** **Procedure:** Alumni surveys are conducted at the end of each Spring semester. The Undergraduate Program Director is responsible for conducting the surveys, as well as collecting and analyzing the results. The survey consists of 10 questions and will be sent via email to Environmental Engineering alumni that have graduated three years back, i.e., for the 2014-2015 PO assessment we will send the surveys to students who graduated in 2011-2012 (8 students). The answers from the survey are used to: 10. Determine the percentage of graduates who have continued their professional development by attending meetings organized by ASCE, FES, WEF, AWWA, SWANA, NSPE, etc. 11. Determine the percentage of graduates who have written at least one paper or technical report per year. 12. Determine the percentage of graduates who have attended training seminars, workshops, or courses to improve their skills. 13. Determine the percentage graduates who are taking or have completed at least one graduate course since their graduation. Minimum criteria for success: The minimum criteria for success is to have a minimum of 80% of the alumni submitting the survey “yes” to at least one of items 1 through 4 above.	The BS degree in Environmental Engineering is received the first time ABET accreditation in 2009. Eight students graduated from the program during 2014-2015. Program outcomes are periodically and systematically (i.e., during DAB semi-annual meetings, monthly faculty meetings, and periodically conducted – every other year) - alumni and employee surveys). The survey was sent via email to the students, all have completed the survey. 9. 50% of the respondents have continued their professional development by attending meetings organized by ASCE, FES, etc. 10. 50% of the respondents have written at least one technical paper or report a year. 11. 50% have attended training seminars, workshops, or courses to improve their skills. 12. 100% of the respondents are taking or have completed at least one graduate course since their graduation. The minimum criteria for success are met for Program Outcome 3.
Use of Results for Improving Program Action: a) Collect information, and b) Evaluate measurability of this criterion.		

Summarize use of results for continuous improvement of the educational program:

1. Our Environmental Engineering undergraduate degree program is successful based on alumni surveys, graduates are satisfied with education they received at FIU. The department will work with interested parties to make sure we have updated contact information from our alumni and alumni surveys can be conducted successfully.
2. Continue to improve our database on contact information for students graduating from the BS degree in Environmental Engineering. The email addresses, telephone numbers, and mailing addresses recorded with the University appear outdated. We initiated that effort in the Fall 2010 semester and have been continuing since then.
3. UPAC now has put greater emphasis on professional registration for the environmental engineering students as well. Now all EnvE students are required to pass the FE Review class and strongly encouraged to clear the FE/EIT exam while still in school.
4. The environmental laboratories are updated with new equipment. Student in the EnvE program have a more comprehensive laboratory experience while at FIU; this together with efforts to provide internship opportunities should further their success in securing jobs in environmental engineering area.
5. The program had and ABET visit in Fall 2015 and received full accreditation with no shortcomings.
6. Refine criteria to evaluate measurability of Program Outcome 3.

APPENDIX F: ALUMNI AND EMPLOYER SURVEY RESULTS

F.1 Alumni Survey

This survey is used to collect direct feedback from recent graduates (1 to 5 years) with regard to how they perceive their educational experiences in the program. The survey data and comments from our alumni (constituents) are also used as inputs to trigger the PEOs' review. This survey has been conducted every two to three years. During this review cycle (2008 to 2014), the first alumni survey was conducted in fall 2011 and was focused on PEOs' evaluation based on the 2011-12 ABET Criteria. Since the PEOs were not necessary to be evaluated in 2014-15 ABET Criteria, the results of this survey were not included in this report and will be available for review during the time of the visit. The survey was conducted in fall 2013 again based on the new form which was focused on SOs' assessment and the achievement of PEO 2 – Professional Licensure. The latest alumni survey form is included as Figure E.1. The form consists of two parts, student outcomes and program educational objectives. In order to simplify the survey, 12 SOs have been summarized as five themes: (1) Technical Proficiency (SOs (a), (b), (c), (e), and (k)), (2) Communication (SOs (d) and (g)), (3) Responsible Citizenship (SOs (h) and (j)), (4) Lifelong Learning (SO (i)), and (5) Ethical Behavior (SO (f)). The achievement of PEO 2 – Professional Licensure and PEO 3 – Lifelong Learning has also been surveyed.

A total of 53 responses have been obtained as of the time of the writing of this document. The results of each question are graphically illustrated in Figures E.3 through E.8. A summary of the quantitative data, as a percentage, of the attainment level for each question is shown in Table E.1. 96% of surveyed graduates rated their preparation in their BS degree in Civil Engineering program at FIU as average or above average in Technical Proficiency (SOs (a), (b), (c), (e), and (k)), Communication (SOs (d) and (g)), and Lifelong Learning (SO (i)). While, 100% of them rated their preparation in their BS degree in Civil Engineering program at FIU as average or above average in Responsible Citizenship (SOs (h) and (j)) and Ethical Behavior (SO (f)).

Based on the aforementioned alumni survey results, all 11 SOs in five themes are well attained. Evidence and details of the survey results will be available for review during the time of the visit.

F.2 Employer Survey

The form of the employer survey is similar to that of alumni survey, but this form was evaluated by the employers of our recent graduates (1 to 5 years). The survey form is shown in Figure E.2. 11 SOs was evaluated by employers in the five themes. Besides SOs, the achievement of PEOs was assessed by both public and private sections in the CEE professions. Similarly, this survey data and comments from external program constituency is also using as inputs to trigger the PEOs' review. This survey has been conducted for every five years.

The latest employer evaluation of our SOs and PEOs was conducted in Fall 2013. This evaluation is hereby presented to demonstrate the continued assessment and evaluation that the program has undertaken since the last accreditation visit in 2008. Based on 15 employers in the South Florida area, 36 alumni who had graduated within the past five years were evaluated. The results of each question are graphically illustrated in Figures E.9 through E.14. A summary of the quantitative data, as a percentage, of the attainment level for each question is shown in Table E.2. The surveyed employers evaluated all our recent graduates (100%) as average or above average on all 11 SOs in five themes, (1) Technical Proficiency (SOs (a), (b), (c), (e), and (k)), (2) Communication (SOs (d) and (g)), (3) Responsible Citizenship (SOs (h) and (j)), (4) Lifelong Learning (SO (i)), and (5) Ethical Behavior (SO (f)).

In addition, 86.12% of evaluated graduates have passed FE exam and 30.56% of them have obtained their PE registrations.

Based on the aforementioned employer survey results, all 11 SOs in five themes are well attained and PEO 2 – Professional Licensure has also been achieved. Evidence and details of the survey results will be available for perusal during the time of the visit.

Table F.1 Alumni Survey Results (Fall 2013)

	Above average		Average		Below average		Total Number of Graduates
Student outcomes:	No.	(%)	No.	(%)	No.	(%)	No.
1) Technical proficiency?	32	55.17	24	41.38	2	3.45	58
2) Communication skills (i.e., written and oral)?	34	58.62	22	37.93	2	3.45	58
3) Responsible Citizenship: appreciation of the impact of engineering solutions on contemporary issues facing society?	27	46.55	31	53.45	0	0.00	58
4) Lifelong Learning: progress to maintain and enhance their professional competency?	44	75.86	12	20.69	2	3.45	58
5) Professional and ethical performance?	45	77.59	13	22.41	0	0.00	58

Program Educational Objectives:	Passed FE Exam only		Passed PE Exam		None		Total Number of Graduates
PEO 2	No.	(%)	No.	(%)	No.	(%)	No.
Within the first three to five years of graduation, graduates will make progress towards obtaining professional registration, special licensing, or certification.	47	81.03	8	13.79	3	5.17	58

FIU

FLORIDA INTERNATIONAL UNIVERSITY

DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING

ALUMNI SURVEY OF PROGRAM EDUCATIONAL OBJECTIVES

A

Contact Information:

A.	Name		
B.	Title and Employer		
C.	Contact Information	Tel:	e-mail:

General:

1.	How many years have passed since your graduation from the FIU civil or environmental engineering program?	1	2	3	4	5	More

Learning Outcomes:

How do you rate your preparation in your BS degree program at FIU for ...

2.	technical proficiency?	above average	average	below average
3.	communication skills (i.e., written and oral)?	above average	average	below average
4.	appreciation of the impact of engineering solutions on contemporary issues facing society?	above average	average	below average
5.	understanding the need to maintain and enhance your professional competency?	above average	average	below average
6.	professional and ethical performance expectations?	above average	average	below average

Program Educational Objectives:

7.	Have you made any progress towards obtaining professional registration, licenses or certifications?	Yes No → If "Yes" go to No.8, if "No" go to No.9
8.	Have you a) passed the FE exam? b) obtained the PE registration?	 Yes No Yes No
9.	Are there areas of knowledge or skills that you should have had during your education at FIU?	

Other Comments:

Survey conducted by:

Date:

Department of Civil and Environmental Engineering, 2012

Figure F.1 Alumni Survey Form

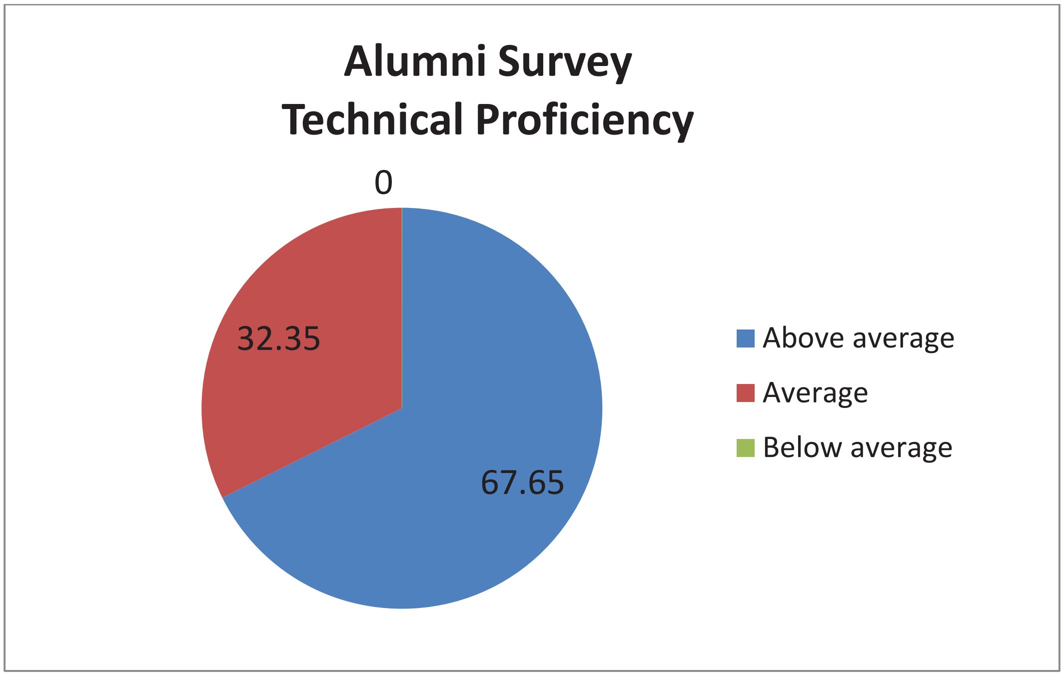

Figure F.2 Alumni Survey Results for Program Outcome in Technical Proficiency

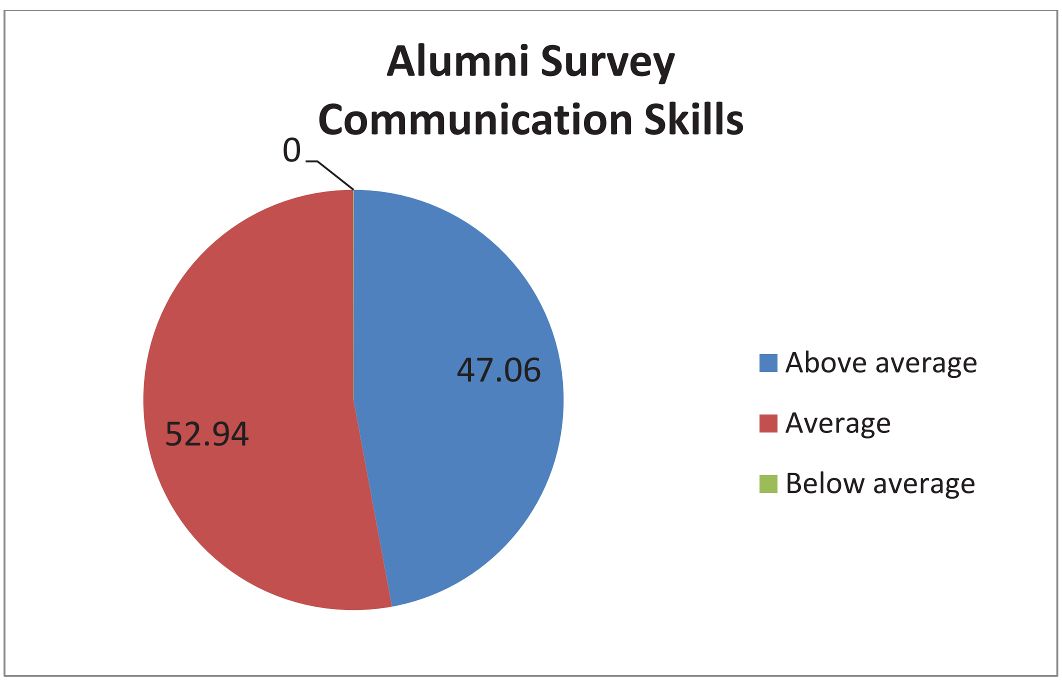

Figure F.3 Alumni Survey Results for Program Outcome in Communication

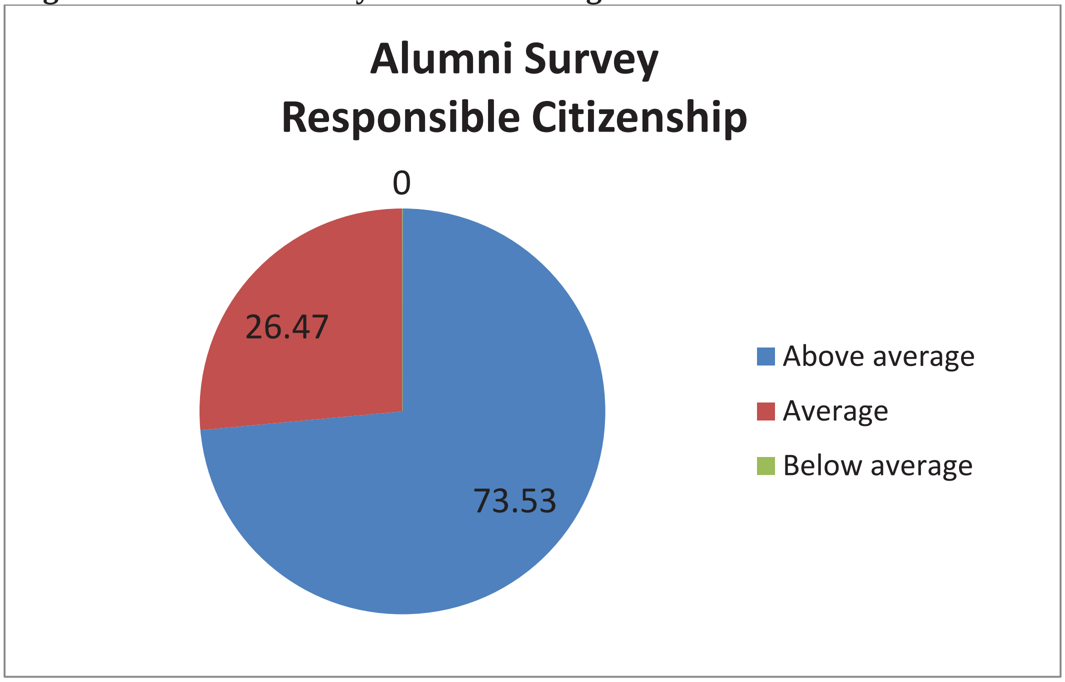

Figure F.4 Alumni Survey Results for Program Outcome in Responsible Citizenship

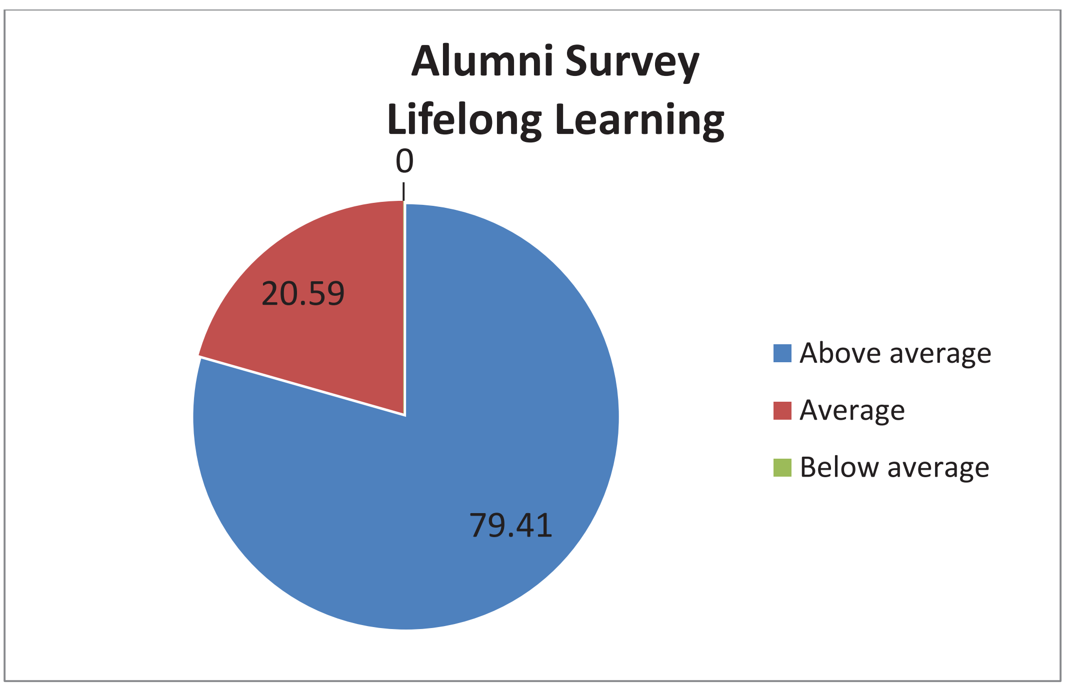

Figure F.5 Alumni Survey Results for Program Outcome in Lifelong Learning

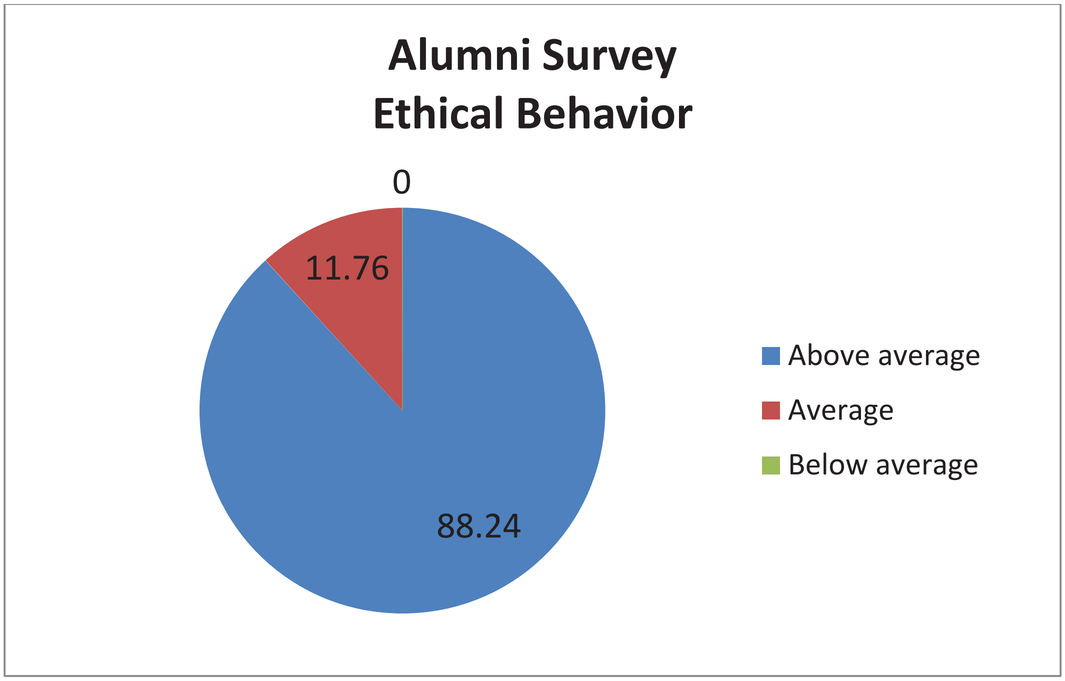

Figure F.6 Alumni Survey Results for Student Outcome in Ethical Behavior

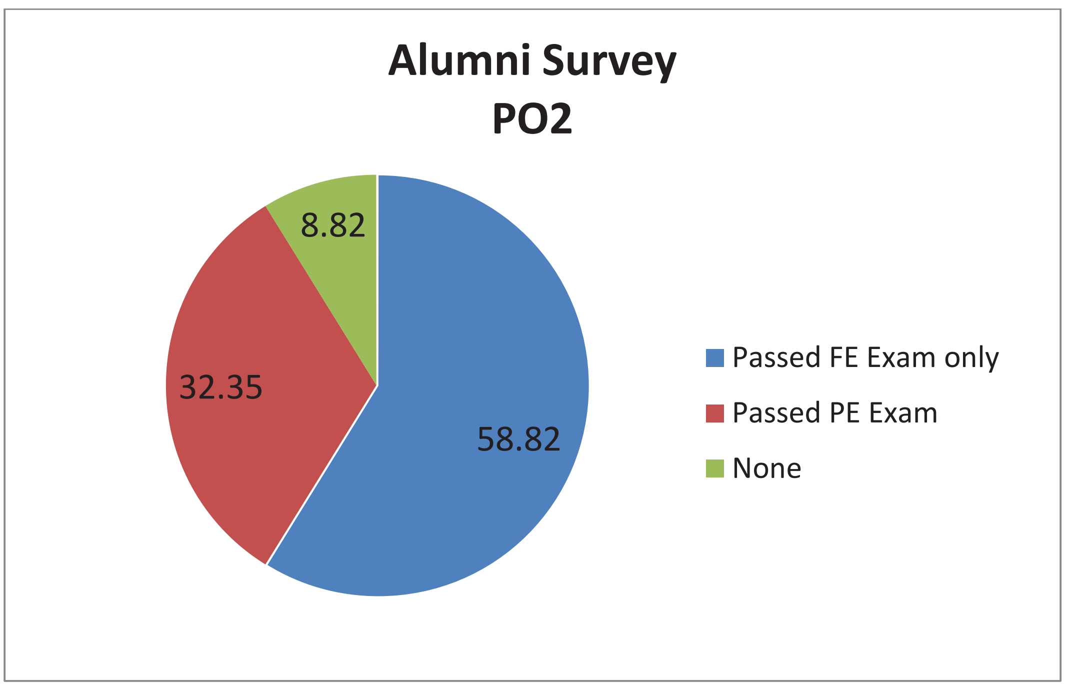

Figure F.7 Alumni Survey Results for Program Outcome – Professional Licensure