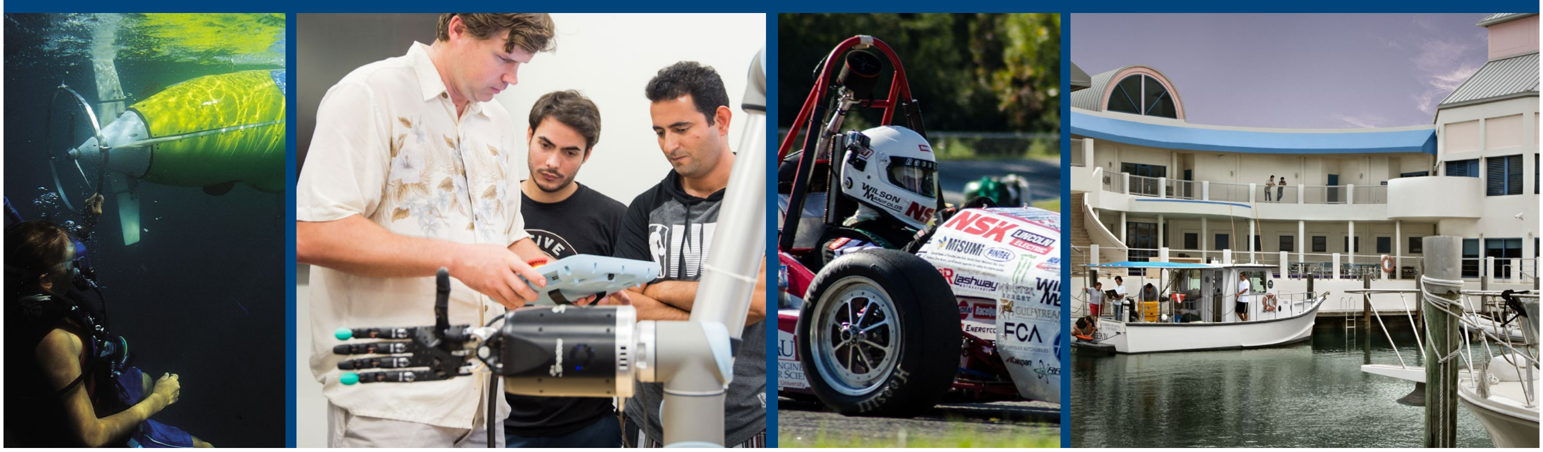
FLORIDA ATLANTIC UNIVERSITY
SELF-STUDY REPORT FOR ACADEMIC PROGRAMS IN THE DEPARTMENT OF OCEAN AND MECHANICAL ENGINEERING

SPRING 2018



DEPARTMENT OF OCEAN & MECHANICAL ENGINEERING

College of Engineering & Computer Science
Florida Atlantic University

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The Department of Ocean and Mechanical Engineering (OME) at Florida Atlantic University

The Department of Ocean and Mechanical Engineering (OME) offers the following programs:

MECHANICAL ENGINEERING (CIP:141901)

- Bachelor of Science in Mechanical Engineering
- Master of Science in Mechanical Engineering
- Ph.D. in Mechanical Engineering

OCEAN ENGINEERING (CIP: 142401)

- Bachelor of Science in Ocean Engineering
- Master of Science in Ocean Engineering
- Ph.D. in Ocean Engineering

A. Mission and Purpose of the Programs

The missions of the Ocean and Mechanical Engineering programs at Florida Atlantic University are:

Ocean Engineering (OE) Program: To provide an outstanding educational experience for learning and research and to prepare individuals to meet national and international engineering challenges in the ocean environment.

The purpose or objectives of the OE program are summarized as follows:

- Demonstrate an ability to carry out engineering tasks in the multi-disciplinary field of ocean engineering.
- Make meaningful contributions in terms of design, development and integration of engineering systems, particularly for applications in the ocean environment.
- Pursue further study for the graduate degree and/or participate in professional societies.
- Develop and exhibit leadership qualities in their engineering work.
- Understand various complexities and issues of the contemporary society and make professional contributions in the larger and long-term interest of the society.

Mechanical Engineering (ME) Program: The overall mission of the Mechanical Engineering program is to provide students with the fundamental background necessary for an active career in mechanical engineering, and to continue their education through post-graduate studies; to conduct basic and applied research; and to provide service to the engineering profession and to the community.

The purpose or objectives of the ME program are summarized as follows:

- Career Contribution and Advancement: Through their ability to solve engineering problems, meaningful design and hands-on experiences, critical thinking skills, and training in teamwork and communication, graduates will make significant contributions to their chosen field and advance professionally in mechanical engineering or allied disciplines.
  Demonstrate an ability to carry out engineering tasks in the multi-disciplinary field of ocean engineering.
- Professionalism: Graduates will act with both professional and social responsibility in their career field, including a commitment to protect both occupational and public health and safety, and apply ethical standards related to the practice of engineering.

- Life-Long Learning: Graduates will understand that their undergraduate education was just the beginning of their training, and will continue to develop their knowledge and skills through progress toward or completion of graduate education, and/or professional development through short courses or seminars, and/or professional certification, and/or participation in professional societies.

Conformity with the University and the College Mission and Strategic Plans: Both programs' missions and Objectives are in direct alignment with those of the College of Engineering and Computer Science (CECS) and the Florida Atlantic University (FAU) at large (http://www.eng.fau.edu/vision.php). Specifically, the mission of the CECS is to:

- Educate those who will contribute to the advancement of technical knowledge and who will be leaders in their profession;
- Conduct basic and applied research in engineering, computer science, and related interdisciplinary areas; and
- Provide service to the engineering and computer science professions, to the State of Florida, to the nation, and to the community at large.

Both OME and CECS are in conformity with the University mission statement (http://www.flbog.edu/pressroom/strategicplan.php) and that of the Board of Governors of the State of Florida (https://www.fau.edu/provost/files/approved.plan2015.pdf) as related to pursuing excellence in research, scholarship, creative activity, teaching, and active engagement with its communities. The ocean and mechanical engineering programs contribute to achieving the university goal of creating value for all its institutional stakeholders (http://www.fau.edu/strategicplan/goals.php), particularly in promoting quality, synergy, engagement with community, performing high quality research related to pillars and platforms, and a bold approach toward achieving excellence. Specifically, in terms of our programs' mission objectives, we strive to

- Recruit and retain nationally competitive students
- Become a model for diversity
- Provide academic support structure for timely student graduation
- Elevate the levels of student success beyond graduation by promoting lifelong learning and undergraduate research

In terms of our programs' research, scholarship, and creative activity mission objectives, we strive to

- Establish prominent areas of research in our department including Ocean Engineering, Biomedical Engineering, and Multiscale Modeling and Simulations
- To work within the university model of pillars and platforms and connect our researchers to those in sciences, medicine, and education
- Perform state of the art research in state of the art facilities

In terms of our programs' active engagement with community, we strive to

- Engage local and state industry leaders in our curriculum planning and educational delivery through our Industrial Advisory Board
- Engage local industry in research and development efforts

- Engage in STEM promotion activities through joint activities with local schools, museums, and businesses

B. Date and Description of the Last Program Review

Over the past six years, the following reviews of the university and our specific programs were performed:

SACS Accreditation/Reaffirmation. Florida Atlantic University was accredited by the Southern Association of Colleges and Schools (SACS) in 1967. The accreditation was reaffirmed in 2013. The next SACS accreditation review is scheduled in 2023.

ABET Accreditation of the undergraduate Mechanical and Ocean Engineering programs. Both Ocean and Mechanical Engineering undergraduate programs were reviewed by ABET in the Fall of 2014. No concerns or weaknesses were identified for either the OE or the ME programs. Both programs have received ABET accreditation. The next ABET accreditation review is scheduled for the Fall 2020.

C. Instruction

C.1 Baccalaureate Programs

C.1.1 Departmental educational goals. Over the past six years, the department (faculty, staff, and students) has embarked on achieving the following goals:

- Goal 1. Improve the overall quality of education, graduation rates, and student satisfaction in undergraduate education.

Enablers: Promote the importance of quality education among faculty. Update the curriculum to reflect current and future industrial needs. Focus on hands on and extra-curricular activities. Communicate with students to assess their needs and how we can improve our programs. Provide consistent teaching assignments so faculty can focus on a few specific courses. Offer student-oriented summer course options. Create a reliable course offering schedule.

- Goal 2. Increase scholarly activities among undergraduate students.

Enabler: Promote faculty supervision of undergraduate research by using undergraduate research supervision as a criterion in faculty evaluation.

- Goal 3: Improve educational facilities to increase our capacity to deliver high quality instruction.

Enabler: Invest departmental funds to upgrade the equipment in the laboratories and machine shop.

- Goal 4: Increase the visibility of the undergraduate program nationally and internally

Enabler: Support student clubs for extracurricular activities and encourage participation in national and international competitions. Provide an opportunity for the students to compete with the best engineers from around the world and showcase their skills.

C.1.2 Current state of the department. This report is prepared based on the information extracted from the Institutional Effectiveness Analysis (IEA) data base and the 2015-16 Department Dashboard Indicator (DDI) given in http://www.fau.edu/iea/data/deptreview.php. The report highlights the state of the programs in the department of Ocean and Mechanical Engineering, their strengths, weaknesses, and concerns related to the instructional, research and service activities of its great faculty.

C.1.3 Faculty size. Currently, the total headcount of tenured and tenure earning faculty is 25 in the spring of 2017. The number has improved by 2 from the data related to 2011-12 (23). Of the current number of OME faculty, 10 faculty members are specifically designated as Ocean Engineering faculty, 14 are designated as ME faculty, and 1 designated as both. There has been serious recent faculty attrition in the Ocean engineering program due to relocation (2) and retirement (1) however there are current efforts to hire multiple new faculty members for the OE program jointly with ISENSE and HBOI pillars at FAU.

C.1.4 Faculty diversity. In terms of gender and ethnicity, the faculty of the department is diverse consisting of Asian (10), Hispanic (2) and various White ethnicities (13). During our recent hiring efforts, we were able to recruit two outstanding female professors. We hope to grow the diversity in the department further during our next round of hiring.

C.1.5 Undergraduate student enrollment. The enrollment in the Mechanical Engineering programs shows a healthy increase from 242 in the Fall of 2012 to 341 in the Spring of 2017, Figure 1. The students presented in Figure 1 include only those students who have successfully passed the requirement of the pre-professional program. Therefore, the actual total enrollment in the ME program in Spring of 2017, including the students in the pre-professional program with the intention to join the ME program (estimated 200 students in Spring of 2017), would be 541 students.

The enrollment increase in the ME program is especially impressive as during this period, the university's admission requirements have become more stringent: for instance, the entrance GPA has gradually increased from a 3.0 in 2011-12 to a GPA of 3.9-4.0 (accompanied with ACT-21-36, SATR-1060-1600, SAT-1450-2400) in Fall of 2018. The numbers indicate that we are recruiting more and better prepared students to our program.

The Ocean Engineering program is a State of Florida designated program of Distinction. This program is a specialty program and is the first such program with the Ocean Engineering focus in the nation. There are a limited number of undergraduate OE programs in the nation including those at MIT, Texas A&M, Virginia Tech, University of Rhode Island, University of New Hampshire, Florida Institute of Technology, and University of Hawaii. Thus the demand for, and size of, such programs is significantly smaller than for other more popular programs such as Mechanical Engineering. The recent enrollment history for the OE program is presented in Figure 2. The enrollment in the Ocean Engineering programs has remained steady although a slight drop from 131 in the Fall of 2012 to 115 in the Spring of 2017 can be observed. It is important to note the enrollment data presented in Figure 2 include those students who have successfully passed the requirement of the pre-professional program. Therefore, the actual total enrollment in the OE program in the spring of 2017, including the students enrolled in the pre-professional program with the intention to join the OE program (Estimated 70 students in spring of 2017), would be 185 students.

C.1.6 Class size and student to faculty ratio. In terms of the average course section size, the average lecture section has increased from 27.3 students per course in 2009-2010 to 36.7 in 2014-15 indicating a significant increase in enrollment. This is less than the respective university average of 38.8 students per lecture session. The average laboratory section has increased from 17-18 students per section in 2009-10 to 20.6 in 2014-15. We have made a concentrated effort to keep the lab sections small because this is important for the student's hands-on experiences. Based on the total number of students in the ME program (341 students) and the OE program (115 students) programs in Spring of 2017 and the total number of the faculty in the department (25 faculty; 10.5 OE and 14.5 ME), the average student to faculty ratio for the overall department is approximately 11 to one for the OE program and 23 to one for the ME program. The overall student to faculty ratio is approximately 18 to one. If we include the pre-professional students (~200 in ME program and 70 in OE program), the student to faculty ratio will be 37.4 to one and 17.6 to one for the ME and OE programs respectively.

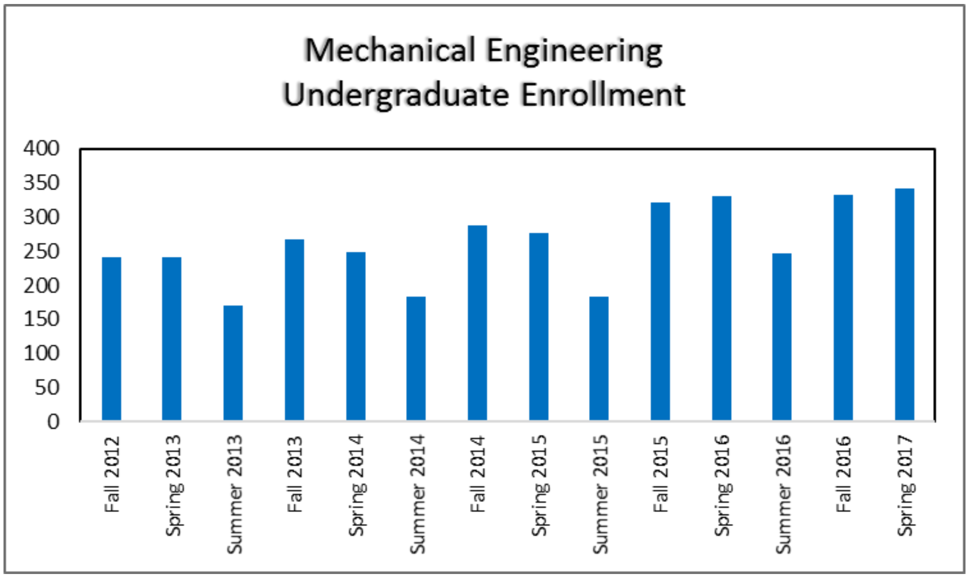


Figure 1. Five year history of student enrollment in the ME program excluding the number of students in the pre-professional program. (Source: Nicholas P. Kelly http://www.fau.edu/iea/data/deptreview.php)

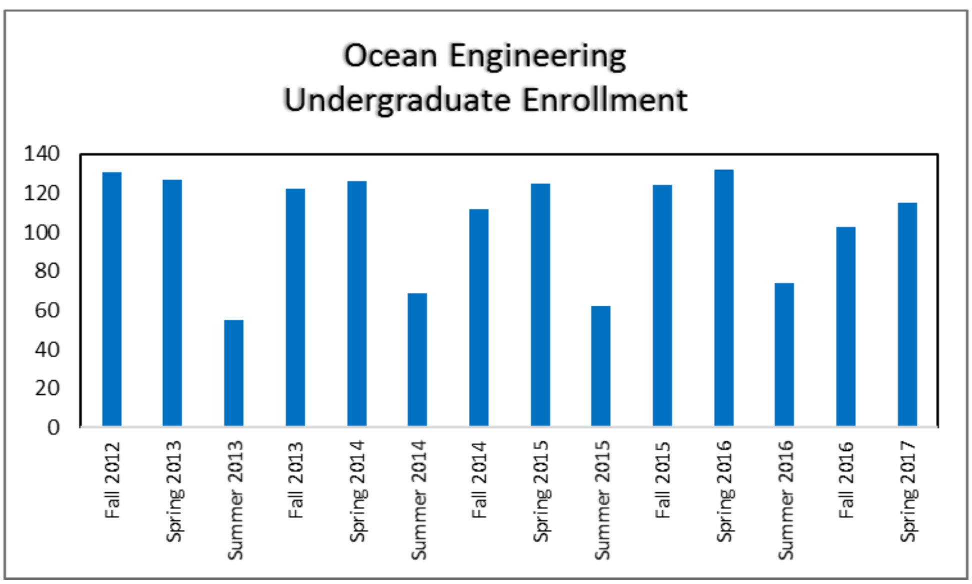


Figure 2. Five year history of student enrollment in the OE program excluding the number of students in the pre-professional program. (Source: Nicholas P. Kelly http://www.fau.edu/iea/data/deptreview.php)

C.1.7Undergraduate degrees awarded. In terms of BS degrees awarded, the Mechanical Engineering program has improved the number of BS degrees awarded from a total of 47 in 2012 to 72 in 2016, Figure

3; this includes graduates in the fall, spring, and summer terms. In the Same period the Ocean Engineering program has improved the number of BS degrees awarded from a total of 27 in 2012 to 37 in 2016, Figure 4. It is important to note that while there are Fall, Spring, and Summer cohorts that graduate from the ME department, The OE program only has a Spring graduation cohort.

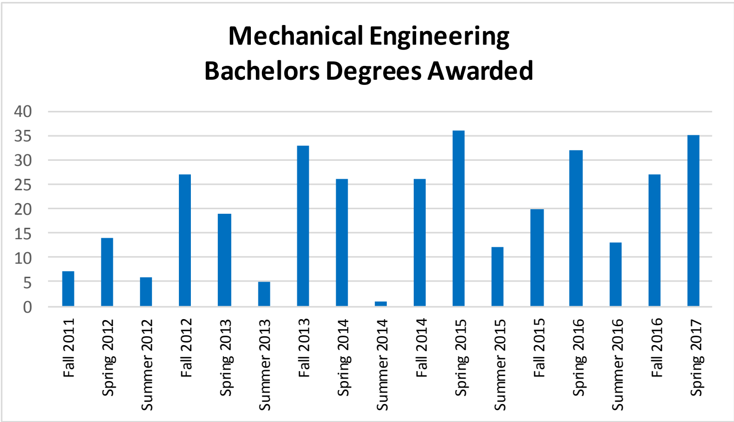


Figure 3. Undergraduate (BS) degree productivity for the ME program. (Source: Nicholas P. Kelly http://www.fau.edu/iea/data/deptreview.php)

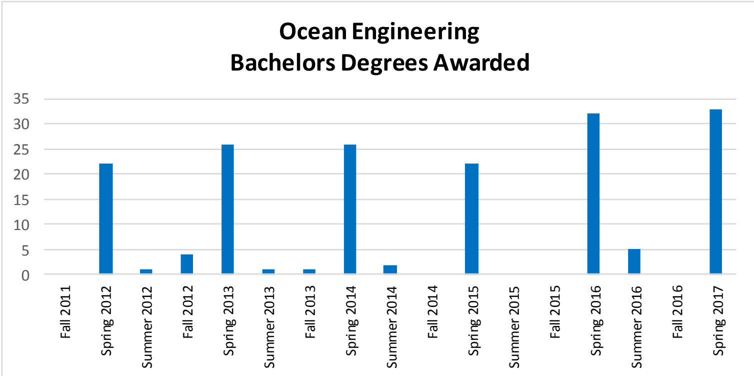
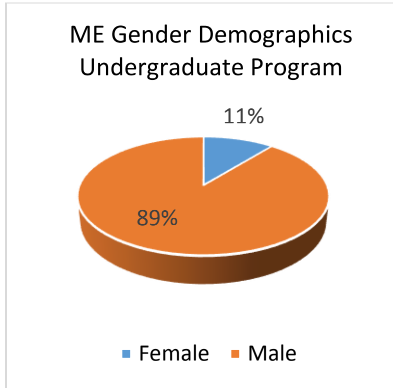


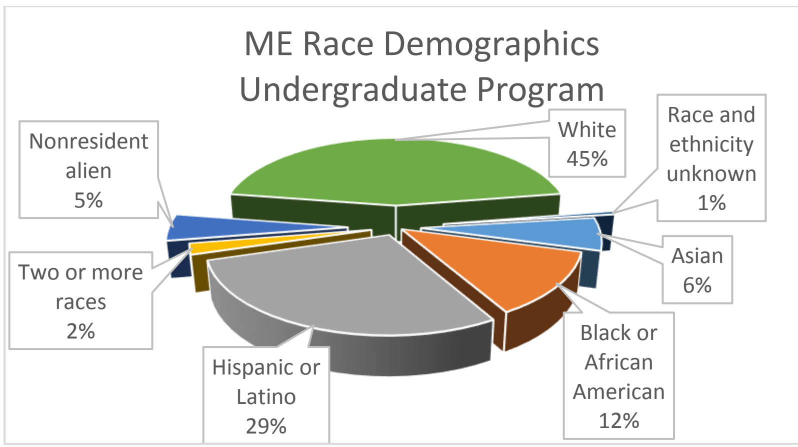
Figure 4. Undergraduate (BS) degree productivity for the OE program. (Source: Nicholas P. Kelly http://www.fau.edu/iea/data/deptreview.php)

C.1.8 Undergraduate program diversity. In Figure 5, we present the current diversity of the students in each program (excluding the students in the pre-professional rank) based on gender followed by race. The Mechanical Engineering program currently maintains 11% female in its undergraduate program (not including those in the pre-professional ranks) Figure 5a. The race and ethnic diversity of the program is presented in Figure 5b, including 29% Hispanic or Latino and 12% African American.

The Ocean engineering program currently maintains extensive diversity in its undergraduate population of 17% female, Figure 6a, and in its ethnic diversity of 18% Hispanic or Latino and 2% African American, Figure 6b. It is important to note that the undergraduate data does not include the students that are currently in pre-professional stage. A detailed breakdown based on the five year trends for both programs in terms of participation of the underrepresented groups is shown in Table 1 for Mechanical Engineering and Table 2 for Ocean Engineering programs. It is important to note that the undergraduate data does not include the students that are currently in pre-professional stage.



(a) Gender Diversity of the ME Program

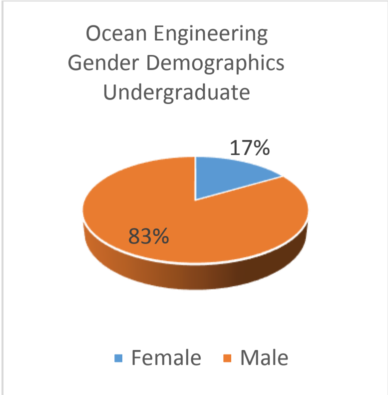


(b) Race and Ethnic Diversity of the ME program

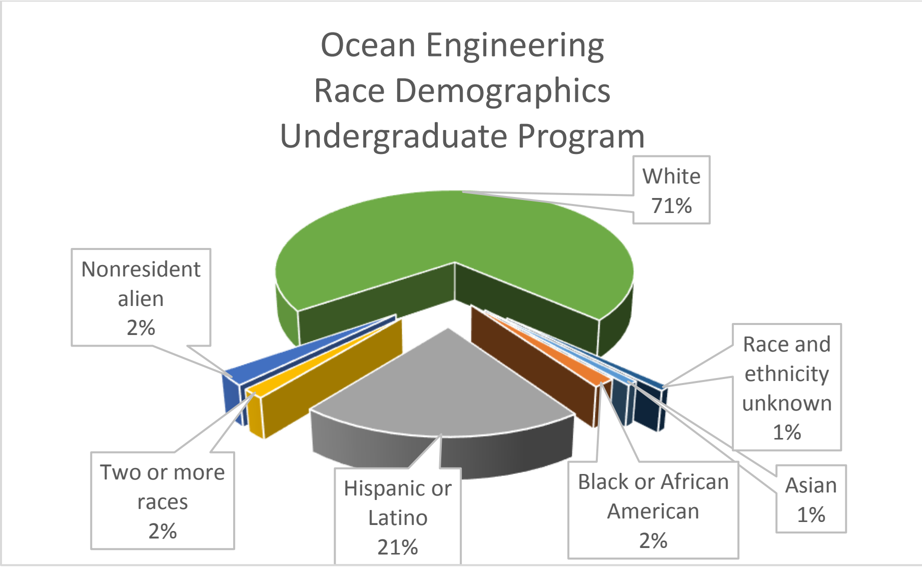
Figure 5. Current Mechanical Engineering Enrollment Distribution Based on (a) Gender, and (b) Race and Ethnicity at Various Levels. (Source: Nicholas P. Kelly http://www.fau.edu/iea/data/deptreview.php)

C.1.9. Establishment of goals for student learning, assessment, and continuous improvement. Consistent with our educational goal of improving the overall quality of education and engaging in continuous improvement, we have established goals for student learning, methods to achieve these goals, and a process to assess our approaches. Below, is a detailed discussion of the goals and the process for each program.

C.1.9.1 Undergraduate mechanical engineering program goals for student learning. The Student Learning Outcome Assessment (SLOA) for the BSME program is published on the following website (please refer to the link below) and is presented below. The compact provides detailed statements on the achievement of declarative knowledge and skills related to analysis, communication, teamwork and creativity and how the outcomes will be assessed.



(a) Gender Diversity of the OE program



(b) Race and Ethnic Diversity of the OE Program

Figure 6. Current Ocean Engineering Enrollment Distribution Based on (a) Gender, and (b) Race and Ethnicity at Various Levels. (Source: Nicholas P. Kelly http://www.fau.edu/iea/data/deptreview.php)

The 4 year curriculum is presented in Figure 7 with a total of 128 required credits. The pre-requisites have been reviewed and the program is in compliance with state approved prerequisites. For full time and well-prepared students, the program can be completed in 4 years if pursued aggressively. However, the program can comfortably be completed in 9 semesters (for instance 8 semesters and one summer). This curriculum in consistent with other Mechanical Engineering programs in peer institutions in terms of subject matter, number of credits (some peer programs are at 126 credits), and duration of the program. For comparison, the four year plan for the ME curriculum for the University of South Carolina is presented in Figure 8 (126 credits total). The ME curriculum for selected programs are provided below for comparison purposes:

University of Buffalo: http://engineering.buffalo.edu/home/academics/undergrad/advisement/flowsheets.html?plan=ME-2017
Georgia Tech: http://www.me.gatech.edu/undergraduate/ug-curr
University of South Carolina: http://www.me.sc.edu/academic%20programs/bs%20curriculum/2012.pdf

Table 1. Historical Upper Level Enrollment of Undergraduate Students in the Mechanical Engineering Program (Spring Data). (Source: Nicholas P. Kelly http://www.fau.edu/iea/data/deptreview.php)

		Spring, 2012	Spring, 2013	Spring, 2014	Spring, 2015	Spring, 2016
Female	**Asian**	2	5	3	4	4
	Black or African American	1	.	.	.	2
	Hispanic or Latino	6	6	8	6	10
	Two or more races	.	.	1	2	1
	Nonresident alien	.	1	1	2	1
	White	13	14	12	13	16
	Total	**22**	**26**	**25**	**27**	**34**
Male	**Asian**	11	17	20	19	18
	Black or African American	21	22	23	27	37
	Hispanic or Latino	55	45	44	62	86
	American Indian or Alaska Native	1	1	1	1	1
	Two or more races	2	3	7	11	11
	Nonresident alien	8	8	7	8	15
	White	118	117	116	117	127
	Race and ethnicity unknown	2	3	6	5	2
	Total	**218**	**216**	**224**	**250**	**297**

Table 2. The Historical Upper Level Enrollment of Undergraduate Students in the Ocean Engineering Program (Spring Data). (Source: Nicholas P. Kelly http://www.fau.edu/iea/data/deptreview.php)

		Spring, 2012	Spring, 2013	Spring, 2014	Spring, 2015	Spring, 2016
Female	**Asian**	.	.	1	1	1
	Black or African American	.	.	.	.	1
	Hispanic or Latino	4	3	2	2	5
	Two or more races	2	1	1	2	1
	Nonresident alien	1	.	.	.	.
	White	26	16	19	13	16
	Total	**33**	**20**	**23**	**18**	**24**
Male	**Asian**	8	3	1	1	.
	Black or African American	1	2	2	4	5
	Hispanic or Latino	15	19	14	15	15
	Two or more races	.	1	2	1	2
	Nonresident alien	5	5	3	2	4
	Native Hawaiian or Pacific Islander	1	.	.	.	.
	White	94	76	80	82	82
	Race and ethnicity unknown	.		1	2	.
	Total	**124**	**107**	**103**	**107**	**108**

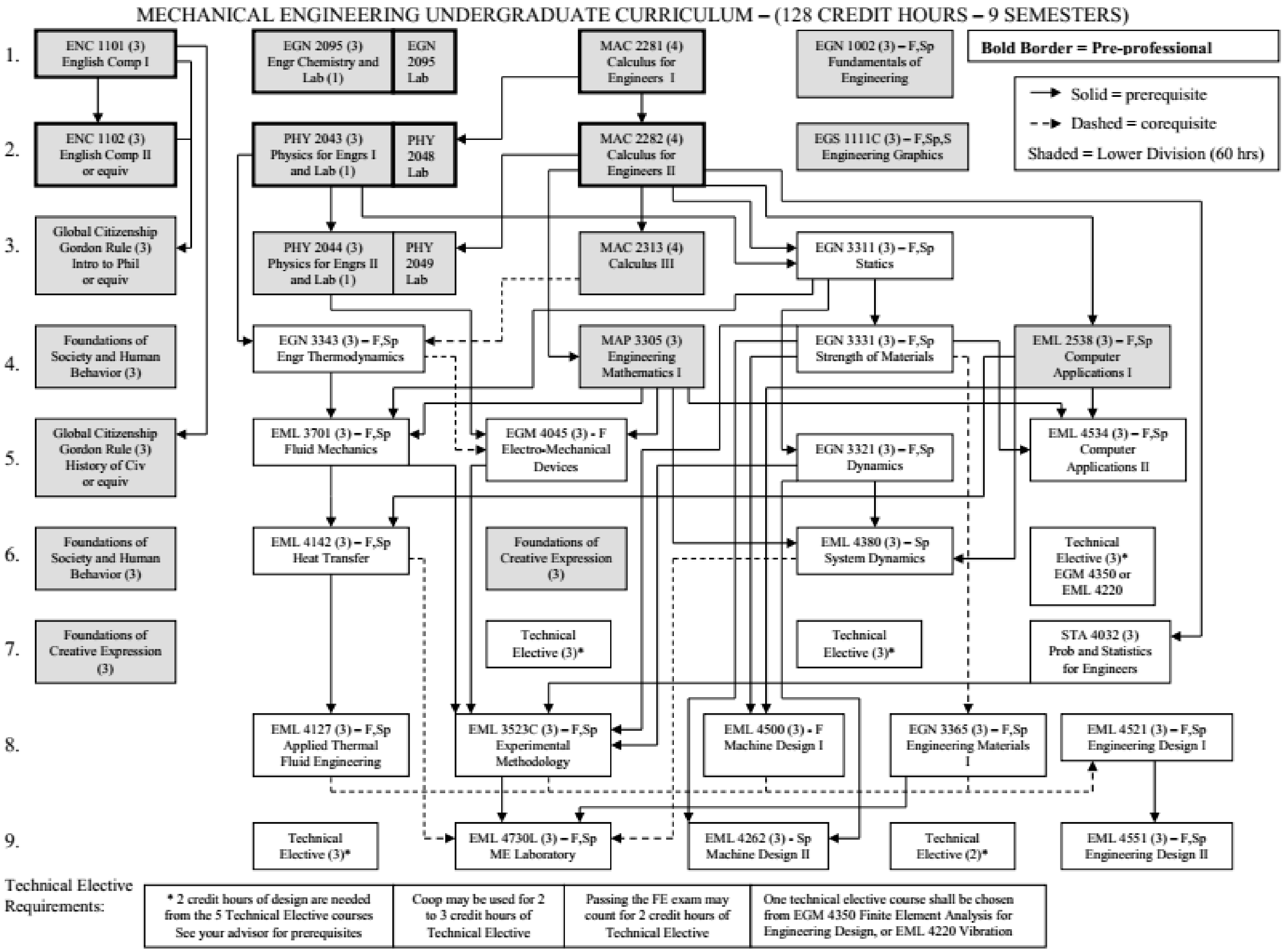


Figure 7. The ME curriculum presented in 9 semesters (8 academic and 1 summer terms).

Year One

First Semester			Second Semester		
Number	**Title**	**Credits**	**Number**	**Title**	**Credits**
MATH 141	Calculus I	4	MATH 142	Calculus II	4
CHEM 111	General Chemistry I	4	CHEM 112	General Chemistry II	4
ENGL 101	Critical Reading and Comprehension	3	ENCH 102	Composition and Literature	3
ENCP 101	Introduction to Engineering	3	EMCH 111	Graphics and Visualization	3
ELECTIVE	Aesthetic and Interpretive Understanding Elective	3	PHYS 211	Essentials of Physics I and Lab (211L)	4
	Total Hours for Semester	**17**		**Total Hours for Semester**	**18**

Year Two

First Semester			Second Semester		
Number	**Title**	**Credits**	**Number**	**Title**	**Credits**
MATH 241	Vector Calculus	3	MATH 242	Differential Equations	3
PHYS 212	Essentials of Physics II and Lab (212L)	4	ELCT 220	Electrical Engineering	3
EMCH 200	Statics	3	EMCH 260	Mechanics of Solids	3
EMCH 201	Numerical Methods	3	EMCH 290	Thermodynamics	3
STAT 509	Statistics for Engineers	3	EMCH 361	ME Lab I	3
	Total Hours for Semester	**16**		**Total Hours for Semester**	**15**

Year Three

First Semester			Second Semester		
Number	**Title**	**Credits**	**Number**	**Title**	**Credits**
EMCH 327	Design of Mechanical Elements	3	EMCH 330	Mechanical Vibration	3
EMCH 394	Thermodynamics Design and Analysis	3	EMCH 332	Kinematics and Dynamics of Mechanics	3
EMCH 360	Fluids	3	EMCH 354	Heat Transfer	3
EMCH 310	Dynamics	3	EMCH 371	Engineering Materials	3
EMCH 362	ME Lab II	3	EMCH 363	ME Lab II	3
	Total Hours for Semester	**15**		**Total Hours for Semester**	**15**

Year Four

First Semester			Second Semester		
Number	**Title**	**Credits**	**Number**	**Title**	**Credits**
EMCH 427	Mechanical Design I	3	EMCH 428	Capstone Design Project II	3
EMCH 377	Manufacturing	3	ELECTIVE	EMCH Elective	3
ELECTIVE	EMCH Elective	3	ELECTIVE	EMCH Elective	3
ELECTIVE	Technical Elective	3	ELECTIVE	Values, Ethics and Social Responsibilities Elective	3
ELECTIVE	Social Science Elective	3	ELECTIVE	Historical Thinking Elective	3
	Total Hours for Semester	**15**		**Total Hours for Semester**	**15**

Figure 8. Four Year ME program at University of South Carolina.

I. <u>Student Learning Outcome Assessment (SLOA).</u> For graduation, students must obtain a grade of "C" or better in each mathematics course, each physics course, and each Mechanical Engineering core course. Students must obtain a 2.0 GPA in all Mechanical Engineering courses attempted.

The department maintains a flow chart that lists all of the coursework required in the program which is reviewed with the student on a regular basis by the Undergraduate advisor. The students are required to meet with their advisor each semester before registration for classes. Failure to maintain satisfactory progress in the program will initiate review by the Department.

For students participating in the Cooperative Education Program, industry supervisors will evaluate students on *content knowledge, communication skills, and critical thinking skills*. Possible outcomes for a student who receives an unsatisfactory evaluation include repeating an industrial placement or portion of the placement, tutoring, additional coursework, or removal from the Cooperative Education Program with no credit given.

Content knowledge. Students will formulate and analyze problems, and synthesize and develop appropriate solutions based on fundamental principles. Students will recognize and apply concepts, principles, and theories in mathematics (including differential and integral calculus, differential equations, and matrix theory); Physics; Chemistry; the core Mechanical Engineering courses (statics, dynamics, strength of materials, thermodynamics, fluid mechanics, heat transfer, machine design I and II, engineering materials, electro-mechanical devices, dynamic systems, vibration synthesis and analysis, finite element analysis, and applied thermal/fluid engineering); and Probability and Statistics.

In the required senior design sequence (EML 4521C Engineering Design and EML 4551 Design Project) teams of students will design, build and demonstrate a workable project to be evaluated by a team of three faculty appointed by the chair. The performance of the project will require the team to research their project in the technical literature and for the possibility of patent applications. The faculty evaluates the students for their technical, research and critical thinking skills using an evaluation instrument developed for this purpose. This is done for both courses in the design sequence. Students receiving an unsatisfactory evaluation in EML 4521C Engineering Design will not be allowed to continue into EML 4551 Design Project and will be required to restart the sequence in a following semester.

Communication. Students will communicate effectively in writing, convey technical material through oral presentations and function effectively in multidisciplinary teams.

In EGN 1002 Fundamentals of Engineering (freshman level), students are required write reports, make oral presentations and function in teams to perform design projects which are evaluated by the faculty member in charge of the course. In the laboratory sequence (EML 3523C Experimental Methodology and EML 4730L Mechanical Engineering Laboratory) student's work in teams to perform experiments and prepare individual technical reports. In the required senior design sequence (EML 4521C Engineering Design and EML 4551 Design Project) student teams will prepare a technical report documenting the performance of the design project. This project will be presented to a group of three supervising faculty and their class peers in an oral presentation. Evaluations of the written report and the oral presentation will be performed by the faculty. Each student is the design team will complete a Peer Evaluation Report evaluating the contribution of the other team members to the project using an evaluation instrument developed for this purpose.

Critical Thinking. Students will:

- Use modern engineering techniques, skills, and tools, including computer-based tools for analysis and design of mechanical components and systems.
- Identify, formulate and solve mechanical engineering problems
- Design and conduct engineering experiments including analysis and interpretation of data.
- Deliver engineering results that meet performance standards for cost, safety, and quality.
- Describe the ethical and professional responsibilities of the mechanical engineer.
- Make and defend ethical judgments in keeping with professional standards.

In the required senior design sequence (EML 4521C Engineering Design and EML 4551 Design Project) student teams will perform design projects which will incorporate the above criteria. A team of three faculty will evaluate these Capstone Design Project reports and oral presentations to these criteria. In performing the evaluations, the faculty members use their professional judgment and an assessment instrument developed for this purpose to evaluate communication skills and critical thinking skills, with respect to both individual students and student teams. Students receiving an unsatisfactory evaluation in EML 4521C Engineering Design will not be allowed to continue into EML 4551 Design Project and will be required to restart the sequence in a following semester.

II. <u>Outcomes, Assessment, Criteria for Performance, and Continuous Improvement.</u> The Mechanical Engineering program has identified the following three outcomes related to the compact. The assessment method, the criterion for success, the results for fall 2016-spring 2017, and the program improvement are presented for each. This information is available on the FAU assessment database website.

The results from the assessment of the faculty evaluations of student performance are analyzed each semester and changes are made as necessary to insure continuous improvement in the program.

Outcome 1. Formulate and analyze problems, and synthesize and develop appropriate solutions based on fundamental principles. Students will recognize and apply concepts, principles, and theories in Mathematics, Physics, Chemistry, the core Mechanical Engineering courses (statics, dynamics, strength of materials, thermodynamics, fluid mechanics, heat transfer, machine design I and II, engineering materials, electro-mechanical devices, dynamic systems, vibration synthesis and analysis, finite element analysis, and applied thermal/fluid engineering), and Probability and Statistics.

Assessment Method. Senior design project group report and performance in engineering classes. Each student team will design, build and demonstrate a workable project. Criteria for success will be the evaluation of the senior design projects by a team of three faculty responsible for the course to determine if the appropriate level of engineering analysis and design has been achieved. An evaluation instrument has been developed for this purpose and is in use. The students are also evaluated on their overall performance on course assignments in engineering classes and this information is related to the department program outcomes to assure that they are achieved (Appendix A). These data are reviewed by the department SACS/ABET committee and a summary report is forwarded to the Chair. The report is reviewed at a faculty meeting with any recommendations for changes forwarded to the appropriate faculty course review group responsible for that course. The review group makes the decision to implement any course changes.

Criterion for success. The criterion for this outcome will judge performance of the team in the technical approach to the design problem. The criterion for assessment will be that at least 70% of the design teams will score a 7.5 on a 10-point scale based on the results from the faculty evaluations of technical performance. Three faculty members will evaluate each of the projects and presentations and rate technical performance. Additionally, each department program outcome will achieve a rating of 3.5 or higher on a 5.0 scale based on student academic performance in their engineering classes.

Results. Fall 2016: In EML 4521 Engineering Design 90% of the student teams scored above a 7.5 on a 10-point scale and 80% scored higher than 8.0 in technical content of their design project as rated by the faculty. In EML 4551 Design Project 100% of the student teams scored above 8.5 on a 10-point scale in technical content of their design project as rated by the faculty. This is well above the criterion for success and although the results vary from semester to semester, this shows that the emphasis on technical content of the design projects is showing results. Program outcomes associated with technical content are assessed by student surveys (Appendix A – Form 1), faculty course comments (Appendix A- Form 2) and student outcome performance (Appendix A – Form 3). For Student surveys all outcomes rated higher than 4.03 on a 5-point scale, faculty comments on student outcome performance rated higher than 3.8 on a 5-point scale, and student outcome performance on all outcomes rated higher than 3.83 on a 5-point scale (Appendix A – Form 4). These all meet the criterion established for the program.

Spring 2017: In EML 4521 Engineering Design 83% of the student teams scored above a 7.5 on a 10-point scale in technical content of their design project as rated by the faculty. For Student surveys of outcome performance all outcomes rated higher than 4.23 on a 5-point scale, faculty comments on student outcome performance rated higher than 3.79 on a 5-point scale, and for student outcome performance all outcomes rated higher than 3.74 on a 5-point scale. These all meet the criterion established for the program.

Program Improvement. The criteria for success were met in all cases. The three faculty responsible for the senior design sequence are requiring more personal meetings with the design groups to insure that a higher percentage of the teams meet the above criteria. These faculty also are very conscious of the diversity of the projects and insuring that those projects that are approved for the student teams include a wide variety of engineering topics in their design and construction throughout the two semesters.

Outcome 2. Students will design mechanical components and systems to meet desired specifications using appropriate engineering techniques, skills, and tools, including computer-based tools, and will identify, formulate and solve mechanical engineering problems.

Assessment Method. Senior design project group report and presentation. Criteria for success will be the evaluation of the senior design projects by a team of three faculty responsible for the courses to determine if the appropriate level of engineering analysis and design has been achieved (Appendix A – Form 5). An evaluation instrument has been developed for this purpose and is in use. Also the use of the continuous improvement assessment plan which evaluates performance based on several courses within the curriculum where design is emphasized. This evaluation is performed based on both student surveys and analysis of overall student performance in the appropriate courses.

Criterion for success. This criterion is 70% of student teams will achieve at least a 7.5 on a scale of 10 for the design project based on the evaluations by the faculty on design methodology. Additionally this outcome rating by the student surveys and the performance in courses will exceed 70%.

Results. Fall 2016: In EML 4521 Engineering Design 90% of the student teams scored above a 7.5 on a 10-point scale and 80% scored higher than 8.0 in technical content of their design project as rated by the faculty.

In EML 4551 Design Project 100% of the student teams scored above 8.5 on a 10-point scale in technical content of their design project as rated by the faculty. This is well above the criterion for success and although the results vary from semester to semester, this shows that the emphasis on technical content of the design projects is showing results. Program outcomes associated with technical content are assessed by student surveys, faculty course comments and student outcome performance. For Student surveys all outcomes rated higher than 4.03 on a 5-point scale, faculty comments on student outcome performance rated higher than 3.8 on a 5-point scale, and student outcome performance on all outcomes rated higher than 3.83 on a 5-point scale. These all meet the criterion established for the program.

Spring 2017: In EML 4521 Engineering Design 83% of the student teams scored above a 7.5 on a 10-point scale in technical content of their design project as rated by the faculty. For Student surveys of outcome performance all outcomes rated higher than 4.23 on a 5-point scale, faculty comments on student outcome performance rated higher than 3.79 on a 5-point scale, and for student outcome performance all outcomes rated higher than 3.74 on a 5-point scale. These all meet the criterion established for the program.

Program Improvement. The criteria for success were met in all cases. The three faculty responsible for the senior design sequence are requiring more personal meetings with the design groups to insure that a higher percentage of the teams meet the above criteria. These faculty also are very conscious of the diversity of the projects and insuring that those projects that are approved for the student teams include a wide variety of engineering topics in their design and construction throughout the two semesters.

Outcome 3. Students will communicate effectively in writing, convey technical information through oral presentations and function effectively in multidisciplinary teams.

Assessment Method. Communication is assessed through faculty evaluations of oral presentations and written reports. Teaming skills are assessed through faculty evaluations of team performance along with the results of peer evaluation reports from the students. Each team member will evaluate the contribution of the other team members to the project using an evaluation instrument developed for this purpose.

Criterion for success. This criterion is 80% of the design groups will show a uniform distribution of workload within an average deviation of no more than 10% between team members. Additionally, 80% of the design groups will score at least a 7.5 on a scale of 10 in team participation as rated by the faculty evaluation. Also, 80% of the teams will score at least and 8.0 on a scale of 10 in communication performance.

Results. Fall 2016: In EML 4521 Engineering Design team dynamics were very good. 100% of design teams scored above an 8.5 rating on a 10 point scale in teaming skills. 80% of the teams scored above a 7.5 in writing performance and 90% of the teams scored above 8.5 in oral communication. In EML 4551 Design Project 100% of the design teams scored above 8.5 in oral communication. These results meet the criterion for success.

Spring 2017: In EML 4521 Engineering Design, team dynamics were very good and all design teams showed uniform distribution of workload with 100% of design teams scoring above 8.5 on a 10 point scale in teaming skills. 100% of the teams scored above 8.0 in writing performance and 83% of the teams scored above 8.0 in oral communication.

In both semesters the students performed well in the outcome assessment for communication skills and teaming skills. Ratings were always above 4.0 on a 5 point scale in both semesters based on student surveys, faculty course comments and student outcome performance in these areas.

Program Improvement. Team dynamics were very good. Communication skills improve as students progress through the two course sequence as shown above. These courses have a main focus on communication and teamwork skills and continued emphasis is placed in both of these areas. The team learning event (Ropes course) continues to be used to develop appropriate teaming skills among students and emphasize the need to rely on others and communicate effectively in the successful completion of their team projects.

Overall Program Improvements. Based on the assessment of IEA and ABET outcomes and input from constituents and the program Advisory Board, changes are regularly implemented for improvement in the BSME program. Five faculty review committees have been established to monitor the performance of students. Each committee is responsible for a specific group of courses in the curriculum. Every fall each committee will review all assessment data for their courses from the prior academic year and make appropriate recommendations for change and action to improve performance if deemed necessary. The latest example of the report and the recommendations from 2015-2016 are presented below:

Course Review Committees
Results – Fall 2015 thru Spring 2016

The Department Review Committees met and considered the input from the Student Surveys, the Faculty Course Comment Forms, and the Performance on Outcomes results for the students for each course. The following are the committee recommendations:

<u>Thermal/Fluids Committee</u>:
1. EGN 3343 Engineering Thermodynamics: The committee felt that performance was good in all three categories (student surveys, faculty comments and outcome performance). No additional changes are recommended at this time.
2. EML 3701 Fluid Mechanics: The committee felt that performance was good in all three categories (student surveys, faculty comments and outcome performance). No additional changes are recommended at this time.
3. EML 4142 Heat Transfer: The committee felt that performance was good in all three categories (student surveys, faculty comments and outcome performance). No additional changes are recommended at this time.
4. EML 4127 Applied Thermal/Fluid Engineering: Overall performance was good in all three categories, however student performance on two outcomes was low. No changes are recommended at this time.

<u>Structures Committee</u>:
1. EGN 3311 Statics: In Fall 15 the student survey of course outcomes was good for all outcomes. The student performance on outcomes was good for all outcomes as was the Faculty Course Comments for outcomes 2, 3, and 4. Outcomes 1 and 5 were rated low by the faculty. In Spring 16 student survey results were good for outcomes 1 and 2 but low for outcomes 3 and 4 (outcome 5 had no data). Student performance on course outcomes was just above acceptable for outcomes 1 and 2 but was slightly below for outcomes 3 and 4. Faculty course comments rated performance as acceptable for outcome 4 but low for outcomes 1, 2 and 3. The committee felt that problems were indicated with outcome 3 (internal forces and bending moments) and outcome 4 (centroid and moment of inertia). Math preparation was brought up as a persistent

issue with our students, which influences student performance. **The recommendation was made that faculty need to emphasize these low areas more from semester to semester to have more uniform results.**

2. EGN 3331 Strength of Materials: In Fall 15 student survey data were above 4.0 for all outcomes and faculty course comment data all were above 3.5 for all outcomes. For outcome performance based on grades only one outcome (O4) related to statically indeterminate structures was low. In Spring 16 again O4 showed low results in both student surveys and faculty course comments. Outcome three (O3) on principal stresses was also noted by faculty comments as low. **The recommendation was made that instructors must place more emphasis on these outcomes in future courses.**

3. EML 4500 Machine Design 1: The committee felt that performance was good in all three categories (student surveys, faculty comments and outcome performance) in both semesters. No additional changes are recommended at this time.

<u>Dynamics/Electrical Committee</u>:

1. EGN 3321 Dynamics: In fall15 student survey data was rated high for outcomes 1 and 2 but lower (still above acceptance criteria) for outcomes 3-5. Faculty comments rated students high for outcomes 1 and 5 but low for outcomes 2-4. Student outcome performance was low for outcomes 1-4 and high for outcome 5. In spring16 student survey data were high for all outcomes but again faculty comments rated performance as low for outcomes 2-4. Student outcome performance was again low for outcomes 1-4. **It was recommended to remove the topic of impulse and momentum in plane motion of a rigid body (Topic 10) in the syllabus to focus on other more fundamental topics to help improve performance. They also suggested the Topic 10 in the Common Course Syllabus be changed from "energy and momentum" to "work and energy".**

2. EGM 4045 Electro-Mechanical Devices: Outcome performance was mixed on student performance in course outcomes in fall 15 but was very low in spring 16. Student surveys in fall 15 were very low but were good in one section and low in another section in spring 16. Faculty comments were low in fall 15 but good in spring 16. **It is suggested that more coordination occur between faculty teaching the course. The committee recommended that outcome 5 (Students will be able to incorporate microprocessors to process a task) be deleted as it usually is not covered.**

3. EML 4262 Machine Design 2: Performance in all three categories (student surveys, faculty comments and outcome performance averages) was good in both semesters and met the criteria. This course is planned to be combined with EML 4500 Machine Design.

4. EGN 4432 Dynamic Systems: Student survey ratings and student performance on outcomes were good in fall 15 but student performance on outcomes was low in spring 16. Faculty comments for both semesters showed low scores for student performance. **It was recommended to review mathematics topics such as matrices and ordinary differential equations.**

5. EML 4220 Vibration Synthesis and Analysis: Performance in all three categories was good and met the criteria in fall 15. **The committee recommended that ordinary differential equations be reviewed to help student performance.**

<u>Computation Committee</u>:

1. EGS 1111C Engineering Graphics: Performance was good in all three areas (student surveys, faculty course comments, and student outcome performance) in both semesters. There were no recommendations made for changes in the topics or course outcomes.

2. EML 2538 Computer Applications 1: In fall 15 and spring 16 the performance on all outcomes from each of the three assessment areas was very good. **It was recommended that the common course syllabus be modified in item 6 to remove unnecessary statements and improve clarity.**
3. EML 4534 Computer Applications 2: Performance was good in all three assessment areas for all outcomes in both fall 15 and spring 16. There were no recommendations made for changes in the topics or course outcomes.

Laboratory Committee:
1. EML 3523 Experimental Methodology: Performance was good as assessed by the student surveys and the faculty comments. Student performance on outcomes met the criteria. Student technical reporting results were very good in both semesters. No recommendations for change were made at this time.
2. EML 4730 Mechanical Engineering Laboratory: The results in all three assessment categories for both semesters were excellent. No recommendations were made at this time.
The committee recommended that two 15 hour teaching assistants be assigned to each laboratory class to maintain an experienced TA pool for these courses and improve student performance.

Senior Design Sequence (EML 4521 and EML 4551):
1. Student rating of their performance in all five outcome areas is high for both courses. Faculty ratings of performance for all outcomes in both courses were high. Student performance on outcomes is also good for all outcomes in both courses and meets the criteria.
2. Emphasis continues to be placed on ethics and life-long learning which has resulted in very good student performance in both these areas and very good ratings in all three assessment categories.
3. Teamwork still shows strong performance and the use of the Ropes Course experience is providing very good results. Students see this as a very positive experience as evidenced by their review essay.
4. The resulting emphasis in both courses on the incorporation of sensing and control into the senior design projects is showing very good results in all categories. The knowledge of these areas is being exhibited very well by the students in their project designs and in their presentations.
No changes are recommended for these courses.

Fundamentals of Engineering (EGN 1002):
1. The course continues to be taught in larger sections (96 students) by faculty from various departments. The results of the assessment show very good performance in all areas based on the student surveys, faculty comment forms, and the performance on course outcomes.

Engineering Materials 1 (EGN 3365):
1. Student survey and faculty course comment ratings were high for all outcomes in both sections of the course. Student performance on course outcomes in one section had some low performance based on the results of student quizzes on selected topics throughout the semester. Students need to continually be advised that they must work the assigned homework problems in order to be ready for quizzes throughout the semester. The second section had high performance ratings for the student performance on course outcomes. Faculty comments were high for both sections in all outcomes.

These recommendations and modifications were approved by the faculty on 1 / 23 /17 .

The Mechanical Engineering Continuous Improvement Plan allows the program to assess program and student performance and make appropriate changes that are necessary for continuous improvement.

C.1.9.2 Undergraduate Ocean Engineering Program Goals for Student Learning.

The SLOA provides detailed statements on the achievement of declarative knowledge and skills related to analysis, communication, teamwork and creativity and how the outcomes will be assessed.

The 4 year curriculum for the OE program (including three summer terms) is presented in Figure 9 with a total of 136 credits. The pre-requisites have been reviewed and the program is in compliance with state approved prerequisites. For full time and well-prepared students, the program can be completed in 4 years if pursued aggressively. However, the program can comfortably be completed in 5 years.

The OE curriculum for selected OE programs are provided below for comparison purposes:
Virginia Tech: https://www.aoe.vt.edu/programs/undergrad/aerospace/aeroocean.html
Texas A&M: https://engineering.tamu.edu/media/3639212/catalog-138-flowchart-model-read-only-.pdf
Stevens Institute of Technology: https://www.stevens.edu/sites/stevens_edu/files/files/Stevens_2017-2018_Academic-Catalog.pdf#page=172

Ocean Engineering 4 year Plan

Year 1	**Fall**	**CR**	Year 1	**Spring**	**CR**	Year 1	**Summer**	**CR**
CHM 2045	General Chemistry 1	3	ENC1102	College Writing 2	3	COP 2220	Intro to Programming in C	3
CHM2045L	General Chemistry 1 Lab	1	MAC2312	Calculus with Analytic Geo 2	4	MAC 2313	Calculus with Analy Geo 3	4
ENC1101	College Writing 1	3	OCE 3008	Oceanography	3		Foundations of Humanities	3
EGN1002	Fundamentals of Eng.	3	PHY2048	Gen. Physics for Eng. 1	3			
MAC2311	Calculus with Analytic Geo 1	4	PHY2048L	Gen. Physics Lab 1	1			
	Total:	**14**		**Total:**	**14**		**Total:**	**10**
Year 2	**Fall**	**CR**	**Year 2**	**Spring**	**CR**	**Year 2**	**Summer**	**CR**
MAP 3305	Engineering Math 1	3	EGN 3321	Dynamics	3	EEL 3111	Circuits 1	3
PHY 2044	Physics for Engineers 2	3	EGN 2213	Computer Apps in Eng. 1	3	EGN 3331	Strength of Materials	3
PHY 2049L	General Physics 2 Lab	1	EGN 3343	Eng. Thermodynamics	3		Foundations of Humanities 3	3
EGN 3311	Statics	3	EOC 3130L	Ocean Engineering Lab	3			
EGN 1111C	Engineering Graphics	3						
	Total:	**13**		**Total:**	**12**		**Total:**	**9**
Year 3	**Fall**	**CR**	**Year 3**	**Spring**		**Year 3**	**Summer**	**CR**
EOC 4612C	Intro Electronics & Prog.	3	EOC 3306	Acoustics for Ocean Engineers	3	EGN 4323	Vibrations	3
EML 4534	Computer Appls in ME 2	3	EOC 3123	Ocean Engineering Fluid Mech	4	EGM 4350	Finite Ele Analy for Eng Des (or)	3
EGN 3365	Engineering Materials 1	3	EOC 4193	Ocean Thermal Systems	3	EGN 4377C	Innov Sensing & Act Tech	3
EGN 4432	Dynamic Systems	3	EOC 3410C	Structural Analysis	3		Found Soc & Human Beh	3
	Foundations of Global WAC	3	EOC 2801	Fabrications of OE	1			
	Total:	**15**		**Total:**	**14**		**Total:**	**9**
Year 4	**Fall**	**CR**	**Year 4**	**Spring at SeaTech**	**CR**	**Year 4**	**Summer**	
EOC 3213	Materials 1-Marine Topics	1	EOC 4804L	OE Systems Control & Des Pro	3			
EOC 4422	Ocean Wave Mechanics	3	EOC 4124	Ship Hydrodynamics*	3			
EOC 4631C	Ocean & Env. Data Analysis	3	EOC 4201C	Marine Materials& Corrosion*	3			
EOC 4804	Ocean Sys Control & Design	3	EOC 4307C	Underwater Acoustics*	3			
	Foundation of Global	3	EOC 4412	Ocean Structures*	3			
				Foundation of Soc & Hum Beh	3			
	Total:	**13**		**Total:**	**13**	**TOTAL OE**	**136**	
	* choose two out of four technical electives							

	Writing Exposure
	Writing Skill Building
	Writing Intensive
	Programming Intensive
	Programming Skill Building
	Project-Based

Figure 9. The OE curriculum presented in 8 academic semesters and 3 summer terms.

This curriculum is consistent with other Ocean Engineering programs in peer institutions in terms of subject matter. However, as far as the number of credits and duration of the program, the OE program at FAU requires more credits (136 credits) and, realistically, takes slightly longer than four years to graduate. As a point of comparison, we provide the OE curriculum for the University Rhode Island Ocean Engineering (class of 2017) program below.

I. Student Learning Outcome Assessment (SLOA). The SLOA provides detailed statements on the achievement of declarative knowledge and skills related to analysis, communication, teamwork and creativity and how the outcomes will be assessed.

Content Knowledge (Declarative Knowledge). Students will demonstrate a broad knowledge of fundamental and applied engineering subjects: fluid and solid mechanics, dynamics, hydrostatics and buoyancy, thermodynamics, heat transfer, engineering materials, strength of materials, statistical methods, data analysis, oceanography, ocean wave mechanics, underwater acoustics, dynamic systems and control theory, networks and electronics, electrical machines, and computer programming.

Content Knowledge, Communication Skills, and Critical Thinking Skills. Students will demonstrate the ability to identify, formulate, and solve engineering problems by applying knowledge of mathematics, science and engineering. Students will demonstrate the ability to design an engineering system or component to meet desired needs and requirements using appropriate engineering tools and techniques.

In EOC 4804 (Ocean Engineering System Design), students are required to have sound multi-disciplinary knowledge of engineering and science subjects through the completion of prerequisite courses in mathematics, science, and the ocean engineering core. Every semester faculty and industry members are invited to attend and evaluate the two-semester senior-design course (EOC 4804/EOC 4804L Ocean Engineering System Design) in terms of students' knowledge of engineering and science subjects based on their project performance and final group presentation. The following ABET a-k student outcomes are used as criteria for the evaluation.

- ability to apply knowledge of mathematics, science and engineering
- ability to design and conduct experiments, as well as to analyze and interpret data
- ability to design a system, component, or process to meet desired needs
- ability to function on multi-disciplinary teams
- ability to identify, formulate, and solve engineering problems
- understanding of professional and ethical responsibility
- ability to communicate effectively
- broad education necessary to understand the impact of engineering solutions in a global and societal context
- recognition of the need for, and an ability to engage in life-long learning
- knowledge of contemporary issues
- ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Freshman Year *Fall* Semester

Course Code	Description	Cr	
CHM 101	General Chemistry I Lec **[GE-N]**	3	
CHM 102	General Chem I Lab	1	
EGR 105	Foundations of Engineering I	1	
MTH 141	Intro Calculus w/Analytic Geom **[GE-MQ]**	4	
PHY 203	Elementary Physics I Lect **[GE-N]**	3	
PHY 273	Elementary Physics I Lab **[GE-N]**	1	
	General Education Elective*	3	
		16	

Freshman Year *Spring* Semester

Course Code	Description	Cr	
ECN 201	Principles of Microeconomics **[GE-S]**	3	
EGR 106	Foundations of Engineering II	2	
MTH 142	Intermed Calc with Analytic Geom **[GE-MQ]**	4	
OCE 101	Intro to Ocean Engineering	1	
PHY 204	Elementary Physics II Lec **[GE-N]**	3	
PHY 274	Elementary Physics II Lab **[GE-N]**	1	
	General Education Elective*	3	
		17	

Sophomore Year *Fall* Semester

Course Code	Description	Cr	
MCE 262	Statics	3	
MTH 243	Calculus for Functions of Several Vars	3	
OCE 205	Ocean Engineering Design Tools	4	
PHY 205	Elementary Physics III Lec **[GE-N]**	3	
PHY 275	Elementary Physics III Lab **[GE-N]**	1	
		14	

Sophomore Year *Spring* Semester

Course Code	Description	Cr	
CVE 220	Mechanics of Materials	3	
MCE 263	Dynamics	3	
MTH 244	Differential Equations	3	
OCE 206	Ocean Instrumentation	4	
	Free Elective	3	
		16	

Junior Year *Fall* Semester

Course Code	Description	Cr	
MCE 354	Fluid Mechanics	3	
OCE 301	Fundamentals of Ocean Mechanics	4	
OCE 310	Basic Ocean Measurement	3	
	Professional Elective**	3	
	General Education Elective*	3	
		16	

Junior Year *Spring* Semester

Course Code	Description	Cr	
OCE 408	Intro to Engineering Wave Mechanics and Littoral Processes	4	
OCE 311	Coastal Measurements and Applications	4	
OCE 471	Underwater Acoustics	4	
	General Education Elective*	3	
	Professional Elective**	3	
		18	

Senior Year *Fall* Semester

Course Code	Description	Cr	
CHE 333	Engineering Materials	3	
OCE 416	OCE Professional Practice	2	
OCE 421	Marine Structure Design	3	
OCE 495	Ocean Systems Design Project I	3	
	Professional Elective**	3	
		14	

Senior Year *Spring* Semester

Course Code	Description	Cr	
OCE 496	Ocean Systems Design Project II	3	
OCG 451	Oceanographic Science	3	
	Professional Elective**	3	
	Professional Elective**	3	
	General Education Elective*	3	
		15	

Figure 10. Four Year OE program at University of Rhode Island.

II. Outcomes, Assessment, Criteria for Performance, and Continuous Improvement.

The program has identified 5 outcomes related to the compact. The outcomes, the assessment methods and year-wise results are published on the University's Institutional Effectiveness and Analysis webpage. The continuous improvement plan for the Ocean Engineering Program is described in Appendix B-1.

Outcome 1. (A broad knowledge of fundamental and applied engineering subjects: fluid and solid mechanics, dynamics, hydrostatics and buoyancy, thermodynamics, heat transfer, engineering materials, strength of materials, statistical methods, data analysis, oceanography, ocean wave mechanics, underwater acoustics, dynamic systems and control theory, networks and electronics, electrical machines, and computer programming. This outcome corresponds to ABET Outcome A)

Implementing Strategy. The curriculum is periodically assessed and revised to address all the subjects and topics required in ocean engineering effectively. For graduation, a minimum grade of C is required in all mathematics, physics and chemistry courses and in the ocean engineering courses.

Assessment Method. An assessment method is based on the averaged student performance in a selected set of ocean engineering courses related to this outcome. Instructors use student performance in tests, homework, term projects, presentations and score each student in assessing the degree to which this outcome is achieved (on a scale of 1 to 10, with 10 meaning excellent and 1 meaning poor achievement of the outcome). This direct course assessment method was developed as part of ABET accreditation requirements and is related to ABET Outcome-A which is related to knowledge of mathematics, science and engineering subjects. This assessment is carried out every year. A sample direct course assessment form for EGN 4432 Dynamic Systems is shown in Appendix B-2.

Criterion for success. An average score of 7/10 or above in the assessment based on coursework is the criterion for satisfactory performance.

Outcome 2. **(**An ability to identify, formulate, and solve engineering problems by applying knowledge of mathematics, science and engineering. This outcome corresponds to ABET Outcome E)

Implementing Strategy. The curriculum is designed to include basic engineering subjects in the first two years and ocean-engineering applied subjects in the senior year. The senior capstone design projects are multi-disciplinary in nature and require a sound knowledge of engineering skills and team effort for the successful completion of the project.

Assessment Method. The assessment method is based on the averaged students' performance in a selected set of courses (homework assignments, tests, laboratory and project reports related to this outcome). Instructors assign a score between 1 and 10 (with 1 meaning poor and 10 meaning excellent achievement of the outcome) for each student. The assessment is carried out yearly.

Criterion for success. Class average should be 7/10 or above.

Outcome 3. **(**An ability to design an engineering system or component to meet desired needs and requirements using appropriate engineering tools and techniques. This outcome corresponds to ABET Outcome C)

Implementing Strategy. The senior year two-semester sequence capstone design project course offers students an opportunity to design and build an ocean engineering system or component that meet all the required specifications. In addition, a selected set of OE courses provide "mini" design project experiences.

Assessment Method. The assessment method is based on 1) the averaged students' performance in a selected set of courses (homework assignments, tests, laboratory and project reports related to this outcome) and 2) the senior design evaluation. In terms of coursework assessment, instructors assign a score between 1 and 10 (with 1 meaning poor and 10 meaning excellent achievement of the outcome) for each student. The assessment is carried out yearly. In terms of senior design evaluation, the evaluators (faculty and industry representatives) rank the student group's ability to design engineering systems and components at three different competency levels: unsatisfactory, satisfactory, and excellent. This evaluation is carried out yearly. A sample form for the senior design presentation evaluation is shown in Appendix B-3.

Criteria for success. For acceptable performance, at least 70% of the class's achievement of the outcome is rated satisfactory or excellent in the senior design evaluation, and at least 70% for the average score in the coursework assessment

Outcome 4. **(**An ability to function effectively in teams. This outcome corresponds to ABET Outcome D)

Implementing Strategy. The two-semester sequence capstone senior design project course offers the students an opportunity to work as teams to design and build an ocean engineering system or component that meet all the required specifications. Student's ability to function effectively as a team are crucial for successful project completion,. In addition, a selected set of OE courses provide "mini" teamwork experiences.

Assessment Method. The assessment method is based on 1) the averaged students' performance in a selected set of courses (homework assignments, tests, laboratory and project reports related to this outcome) and 2) the senior design evaluation. In terms of coursework assessment, instructors assign a score between 1 and 10 (with 1 meaning poor and 10 meaning excellent achievement of the outcome) for each student. The assessment is carried out yearly. In terms of senior design evaluation, the evaluators (faculty and industry representatives) rank the student group's ability to function effectively as a team at three different competency levels: unsatisfactory, satisfactory, and excellent. This evaluation is carried out yearly.

Criterion for success. For acceptable performance, at least 70% of the class's achievement of the outcome is rated satisfactory or excellent in the senior design evaluation, and at least 70% for the average score in the coursework assessment

Outcome 5. **(A**n ability to communicate effectively topics in engineering and science. This outcome corresponds to ABET Outcome G)

Implementing Strategy. Many OE courses have term projects requiring written reports and oral presentation, and the course grade depends on the students' communication skills. The capstone-senior design project involves a substantial amount of writing: the write-up of project proposal, interim progress report, and final design report and oral presentation of the project. The course grade depends on the students communication skills. It should be noted that the senior design presentation is open to the public, which traditionally has attracted students (graduate and undergraduate), staff and faculty members and industry/Navy representatives to attend, and the senior design students presenting their design often have to handle challenging questions, ranging from technical merits to practical utility, from the audience. The senior design course ensures that all students are fully prepared and trained for the engineering world.

Assessment Method. The assessment method is based on 1) the averaged students' performance in a selected set of courses (laboratory and project reports related to this outcome) and 2) the senior design evaluation. In terms of coursework assessment, instructors assign a score between 1 and 10 (with 1 meaning poor and 10 meaning excellent achievement of the outcome) for each student. The assessment is carried out yearly. In terms of senior design evaluation, the evaluators (faculty and industry representatives) rank the student group's ability to communicate effectively at three different competency levels: unsatisfactory, satisfactory, and excellent. This evaluation is carried out yearly.

Criterion for success. For acceptable performance, at least 70% of the class's achievement of the outcome is rated satisfactory or excellent in the senior design evaluation, and at least 70% for the average score in the coursework assessment

Assessment of how well students are achieving expected learning outcomes (refer to the program's latest report in the FAU Assessment Database). The five outcomes were assessed recently during FY2016-2017. The criteria for all five outcomes were met (refer to the IEA Assessment Database for the results and evaluation). The mapping of the OE courses to the student learning outcomes is summarized in Appenxix B-4.

III. Continuous Improvement Achievement

A number of program improvements have been made to the BSOE Program. They are:

- The OE curriculum map has been revised (shown in Table 1). In the revised map, each of the outcomes is assessed and evaluated using at least three courses (in general, more than three courses address each specific outcome). This will reduce the statistical fluctuation when evaluating the data.

- Two university student clubs have been created recently. They are: Human powered submarine club and marine robotics club. These clubs have been assigned office / lab spaces and are supported by the department. These clubs are actively recruiting members at the freshmen and sophomore levels. Over the past few years the level of club activities has increased significantly, and the students made significant achievements in the Human Powered Submarine International Competition during the summer of 2017.

- Five fundamental courses including Statics, Dynamics, Strength of Materials, and Thermodynamics were modified to include an additional non-credit recitation hour. This improvement has been very popular with our students as they receive more problem-solving practice in these fundamental courses and improve their math and engineering skills (ABET Outcomes A and E).

- A new course sequencing for EOC4620 (Dynamic Systems), EOC 3114 (Vibrations) and EOC3306 (Acoustics I) was implemented in Fall 2013. The reason behind this implementation is that students can learn and apply as they progress instead of learning all the math theories before they have an opportunity to apply them. In this sequence, students are to take Dynamic Systems between Engineering Math I and Math II courses (both are taught by the Mathematics Department). With this arrangement, students have the opportunity to understand how differential equations can be applied to analyze simple engineering systems before learning partial differential equations that are needed for Acoustics I and Vibration course materials.

- A new course called Introduction to Electronics and Programming was created in 2017. This course exposes students to hands-on basic electronics and programming skills that are needed for the senior design course.

- A new junior elective course called Innovative Sensing and Actuation Technologies was created in 2017. This course was re-designed with the support of an FAU Curriculum Grant Program, to integrate research and inquiry ideas and activities into course assignments, and engage students in the process of discovery as part of FAU's Quality Enhancement Plan (QEP) program: Distinction through Discovery.

- The university has implemented an Undergraduate Research Grant Program that enables undergraduate students to participate in research projects mentored by faculty. Students not only will receive $600 funding support for their projects but also they have the opportunity to present their project findings at the Undergraduate Research Symposium every semester. The OE program faculty actively encourages students to participate in research projects outside the classroom. One of our faculty members, Dr. Joe Su, has been assigned the task of Director of Undergraduate Research to promote UG research activities.

- Significantly more TAs are being supported by the department to assist with the instructional process. The TAs are required to have 6 office hours per week for student help.

- Every semester (for the past two years), student forums (organized by the student societies) are being held in which the students can share their concerns and suggestions for improvement with the department chair.

- There has been a significant improvement in the machine shop and lab facilities. Recently the Department has purchased a new water jet cutter, a 3D printer, and a CNC mill). This equipment has been used heavily by students working on design and club projects.

- Study spaces have been upgraded and improved (Bldg. 36, rooms 170, 162, 156, 164). The students use these spaces for team work and individual activities. These spaces are used throughout the week.

- The department has purchased new laboratory experiments related to controls, electromechanical devices, and motors to be used in various classes as hand-on activity supplements. For instance a number of these experiments have been integrated in our Dynamic Systems course.

C.1.10. Admission Criteria. The Department of Ocean & Mechanical Engineering at Florida Atlantic University accepts students for the Bachelor of Science program in Ocean Engineering (BSOE) and in Mechanical Engineering (BSME) in two general groupings: (1) those with fewer than 60 college credits (referred to as 'freshmen' students) and those with 60 or more college credits (referred to as 'transfer' students). Both freshmen and transfer students must satisfy the University admission requirements. All students must meet the minimum admission requirements of the University. All students must meet the pre-professional requirements in order to be accepted into the Ocean Engineering program.

Freshman Admissions. Admission to the freshman class is competitive and the University encourages all students to apply early. Meeting minimum eligibility requirements does not guarantee admission as each applicant's academic profile will be weighed against the applicant pool in its entirety. This includes high school GPA, rigor of curriculum and test score. Freshman applicants should be aware that additional requirements are necessary for some colleges and majors. The minimum University requirements are as listed below:

Required High School Units. Additional weight is given to all courses clearly marked Honors, Advanced, Gifted, Advanced Placement, Advanced International Certificate of Education or International Baccalaureate. The following units of study in high school are required:

English (3 with substantial composition)	4 units
Mathematics (Algebra 1 level and above)	4 units
Natural Science (2 with lab)	3 units
Social Science	3 units
Foreign Language (of the same language)	2 units
Academic Electives	2 units
Total	18 units

FAU General Admission Requirements: Fall 2018

GPA 3.9-4.0 ACT-21-36, SATR-1060-1600, SAT-1450-2400

GPA 3.6-3.89 ACT- 22-36, SATR-1100-1600, SAT-1510-2400

GPA 3.2-3.59 ACT-33-36, SATR-1490-1600, SAT-2140-2400

College of Engineering and Computer Science Differential Admission

Fall 2018: Applicants must have overall HS GPA of 3.6 and higher AND High School Math Weighted GPA more than or equal to 3.25 OR ACT Math Subsection score more than or equal to 24. High School Math course completed of Pre-Calculus or higher.

General Equivalency Diploma. Persons with a General Equivalency Diploma (GED) from any state must achieve a minimum total score of 3000, with no sub score lower than 550. An SAT score of 1450 or an ACT score of 21 is also required of applicants with a GED. Applicants with a GED should also submit high school transcripts from any school attended.

Non-traditional/Homeschooled students applying for admission who are participating in a non-traditional high school program must present credentials equivalent to those listed above. If the program is not measured in Carnegie Units, a minimum test score of 1450 is required on the SAT (all three sections) or a 21 composite score on the ACT.

Credential Evaluation Services. Applicants who completed their high school and/or part or all of their postsecondary (college or university) work at an institution not in the U.S. are required to have their foreign credentials evaluated by an accredited independent evaluation service.

TOEFL. Official TOEFL results are required of all applicants whose native language is not English. A minimum TOEFL score of 550 on the paper-based test (TOEFL PBT), or 80 on the internet-based version (TOEFL IBT) is required for admission. FAU also accepts **IELTS** test results with a minimum score of 6.5.

Additional Admission Requirements of the College of Engineering and Computer Science. All entering freshmen interested in engineering and computer science degrees will be directly admitted to the FAU College of Engineering and Computer Science Pre-Professional Engineering Program. To be admitted to one of the engineering or computer science degree programs students must satisfy the following requirements first:

- Students must meet University admission requirements.
- Students must obtain a minimum grade of “C” and have a GPA in the core courses (Cal I and Physics I) of 2.5 or greater for OME programs.
- Calculation of the core GPA will be based on the highest grade received in each of the core courses.
- Advanced placement credit scores 4 or above will be given credit for the appropriate course(s). A score of 5 is equivalent to an "A" and a score of 4 is equivalent to a "B".

Students may repeat a core course only once. Failure to receive a passing grade in the second attempt is grounds for denial of admission to an engineering or computer science degree program. The entry-level math requirement for engineering and computer science degree programs is Calculus 1. Students who are placed in lower-level math courses based on their ALEKS test scores may delay their entry into a particular engineering or computer science program.

After successfully completing the core courses, students may apply to a particular engineering or computer science program. Admission will be based on the student's performance in the pre-professional core courses.

Transfer Admissions. The following presents the university requirements for transfer students:

Lower-Division Transfers – Applicants with Fewer than 60 Transferable Credits: Transfer applicants with fewer than 60 transferable credits from a regionally accredited institution should meet the same admission criteria as freshmen, including high school grade point average and SAT or ACT scores. In addition, applicants must have a minimum 2.5 cumulative grade point average in their college or university coursework and be in good academic standing at the last institution attended (2.0 GPA or above).

Upper-Division Transfers – Applicants with 60 or more Transferable Credits: Students who have completed at least 60 transferable credits from a regionally accredited institution but have not received the Associate in Arts degree from a Florida public community or state college may be admitted as upper-division transfers. Applicants must have achieved a minimum 2.5 cumulative grade point average in all prior college or university courses and be in good academic standing at the last institution attended (2.0 GPA or above).

Upper-Division Transfers – Applicants Holding the Associate in Arts Degree from a Florida Public Community or State College: Students who have received the Associate in Arts degree from a Florida public community or state college will be admitted as transfers with priority over applicants who are not Florida residents. They are considered to have completed all general education requirements, and their entering grade point average will be the grade point average for all transferable courses as shown on their final transcript from the community or state college. Students with a Florida community or state college Associate in Arts degree will be admitted to Florida Atlantic University but are not guaranteed admission to a limited access program. Additionally, some programs have higher admission requirements than the general university requirements. Refer to specific program information in this catalog.

Second Baccalaureate – Applicants Holding a Baccalaureate Degree: Students applying for a second baccalaureate degree must have received their first bachelor's degree from a regionally accredited institution and achieved a cumulative grade point average of 2.5 or higher and be in good academic standing at the last institution attended (2.0 GPA or above).

International students are admitted to the program, provided they submit their international credentials, translated into English and evaluated by an independent, professional evaluation service. International students must also demonstrate proficiency in English. A minimum TOEFL score of 550 on the paper-based test (TOEFL PBT), or 80 on the internet-based version (TOEFL IBT) is required for admission. FAU also accepts **IELTS** test results with a minimum score of 6.5.

Transfer Credit: In accordance with normal Florida public university procedures, all transferred postsecondary credits will be entered on the FAU record. In certain cases, however, some credits may not be acceptable toward graduation, depending on the student's major. College-level courses in academic subjects are normally accepted, but courses such as those for vocational training may be acceptable only in a related major. Remedial courses are not accepted for credit toward a degree.

The Office of Undergraduate Admissions conducts an initial evaluation of transferable credits from regionally accredited institutions. The final decision on the acceptability of transferred courses to satisfy the university requirements or those of specific degree programs is made by the college in which the student enrolls. Transfer students must meet with an academic advisor soon after their arrival at FAU to ascertain the acceptability of their transferred courses. The achievement of ABET outcomes (A-K) is evaluated using only the upper level OE courses, and thus the transferred courses will not be part of the ABET program outcome assessment.

C.1.11 Description of internships, practicum, study abroad, field experiences. The ME program does not have an organized internship, practicum, study abroad or field experience program. Even though it is not a requirement for the degree, students are encouraged to take up internship training during the summer before their senior year. However, we are working towards establishing an organized internship program and a study abroad experience for this program. In the Mechanical Engineering Program, the internship training is not used to satisfy any curricular requirement.

Many students in the OE program do take part in industry and government internship programs and gain practical training prior to their senior year. Even though it is not a requirement for the degree, students are encouraged to take up internship training during the summer before their senior year at maritime industries and Navy laboratories. Department plays a very active role in finding and placing students on internship trainings. Each year, about five to ten students take up such internship trainings. In 2013, five students received the NREIP internships, working in Navy labs including NSWC-CD in Bethesda, Maryland. In the Ocean Engineering Program, the internship training is not used to satisfy any curricular requirement.

C.1.12 Pedagogical innovations. For both programs, we have a strong focus on hands-on experiences. The hands on experience approach is exercised through laboratories, design projects, class projects, and extracurricular activities. We have developed new courses that are based on introduction of sensors and actuators for both programs. We require that electronics and controls be integrated in all or most of our design projects. Although these activities may not be called pedagogical innovations, we believe that these activities strengthen our program in producing high quality engineers.

Furthermore, we dedicate a great deal of resources, space, and guidance to our extracurricular club activities. Currently, we have extensive activities in the Marine Robotics Club (MRC), Society of Automotive (SAE) Engineering, Formula Race Car club, Human Powered Submarine (HPS) Club, and Technology & Aerospace Club (TAC). The students participating in these club activities build engineering systems and compete with national and international universities. These activities promote and develop team building skills, multidisciplinary engineering, ethical considerations in engineering tasks, life-long learning, and leadership skills, in addition to strengthening engineering skills. These activities are not for credit and students participate purely based on interest.

Finally, our department is very active in undergraduate research. Many of our faculty members engage in university funded research with undergraduate students. The Office of Undergraduate Research and Inquiry (OURI), funds many small scale research projects for teams of student and faculty researchers. Some of these research activities may be for credit in the form of a Directed Independent Study (DIS) course. The following is a list of undergraduate research projects supported by our faculty.

Kevin Kang

	Name	Email	Research Title	**Products**
	Aya Gare	agare@my.fau.edu	3D printed hydrogel	SURF award
	Kathryn Moschouris	kmoschou@fau.edu	Cell sheet engineering	OURI award

UG Res. Students/Others	Daniel Barba-Allison	dbarbaalliso2013@my.fau.edu	3D printed scaffolds	SURF award
	Chance Mata	cmata2015@fau.edu	3D printed scaffolds	

Oscar Curet

	Name	Email	Research Title	Products
UG Res. Students/Others	Tyler Fisher	tfischer2013@fau.edu	Effect of morphology in bio-propulsion	Robotic system
	Amani Shokry	ashokry1@my.fau.edu	Effect of morphology in bio-propulsion	Robotic system
	Evan Latshaw	evan.latshaw@gmail.com	Understanding the effect of morphology in a bio-inspired propulsion system	SURF 2015
	Andres Hernandez	andreshernan2013@fau.edu	Energy Harvesting from a Flapping Hydrofoil	SURF 2016 & OURI Grant
	Jose Betancourt	jbetancourt2015@fau.edu	Energy Harvesting from a Flapping Hydrofoil	OURI Grant

Erik Engeberg

	Ray Calnen	Fall, '15
UG Res. Students/Others Visiting Researcher Supervision	Engineering Design Team	Spring, '16

Sarah Du

	Name	Email	Research Title	Products
UG Res. Students/Others	Michael Mian	mmian@fau.edu	Endothelialized microfluidics	Co-author of two conference papers; Awardee of a FAU undergraduate research grant
	Sarah Zima	szima@fau.edu	Neuron sensing	Co-awardee of a FAU undergraduate research grant

Mike Kim

	Name	Email	Research Title	Products
UG Res. Students/Others	Danielle Stepien	dstepie1@fau.edu	Interfacial reaction dynamics at microscale during CO_2 sequestration	2016 SURF Award Recipient
	Rochd Amine	arochd2014@fau.edu	Improvement of solar energy conversion efficiency by solar tracking	2016 OURI Undergraduate Research Grants Recipients
	Joshua Griffin	griffinj2012@fau.edu		
	Guillermo Rangel	grangel2014@fau.edu		
	Dawit Dereje	ddereje2012@fau.edu		
	Stephan Hoo-Fatt	shoofatt@fau.edu	Improvement of cooling efficiency for data centers using heat pipes	2016 OURI Undergraduate Research Grants Recipients

Karl Von Ellenrieder

	Name	Email	Research Title	Products
UG Res. Students/Others	Travis Moscicki	tmoscicki2013@fau.edu	USV Control	High-level USV control code

Francisco Presuel-Moreno

	Name	Email	Research Title	Products
UG Res. Students/Others	Dietrich Vogel	dvogel9@fau.edu	Chloride Threshold of Steel Fiber Concrete Composites (spring/15)	Poster UGR Broward/16
	R. Richardson	rricha56@fau.edu	Propagation of Corrosion in Reinforced Mortar Samples by Anodic Current Application (fall/14)	Poster at NACE and Broward UGR 2015

C.1.13 Scope of institutional contributions. The university requires 36 credits of Intellectual Foundations programs for all students. While the classes may not necessarily relate to one's major, they are important as they provide a foundation of knowledge leading to education of well-rounded students. At FAU the IFP is composed of the following:

6 hours of Foundations of Written Communication

6 hours of Foundations of Society & Human Behavior

6 hours of Foundations of Science & the Natural World

6 hours of Foundations of Mathematics & Quantitative Reasoning

6 hours of Foundations of Global Citizenship

6 hours of Foundations of Creative Expression

C.1.14 Advising procedures. All new, first baccalaureate degree-seeking students are required to attend an FAU orientation session. However, incoming transfer students who have earned 60 or more credits have the option of doing "Virtual Orientation" on-line. The University realizes that academic advising is an integral part of the higher education experience. Its primary purpose is to assist students in the development of meaningful educational plans that are compatible with their life goals.

The Department of Ocean and Mechanical Engineering's Advisors handle the department transfer orientation and advises all Ocean Engineering transfer students from orientation through graduation, ensuring that all required courses are taken in the prescribed sequence and that all university and departmental graduation requirements have been met.

Placement in the appropriate math course is of primary importance at this time and is dependent upon the student's competency in mathematics. A student cannot be registered for Calculus I unless he/she performs satisfactorily on a Math Placement Test given by the Mathematics Department. All freshmen, regardless of AP, IB, dual enrollment, and CLEP credits must take the placement test known as ALEKS. ALEKS is a powerful artificial-intelligence based online assessment mechanism that places students in the correct class. Students receive their scores immediately upon completion of the test, and they can take the test as many times as they wish. The following table lists the minimum scores on the ALEKS placement test required for entry into mathematics courses.

Course	ALEKS Score	Course	ALEKS Score
MAT 1033: Intermediate Algebra	15	MAC 2233: Methods of Calculus	40
MGF 1106: Math for Liberal Arts I	30	MAC 2281: Calculus for Engineers I	65
MGF 1107: Math for Liberal Arts II	25	MAC 2311: Calculus w/Analytical Geometry I	65
MAC 1105: College Algebra	30	MAD 2104: Discrete Mathematics	45
MAC 1114: Trigonometry	45	MAS 2103: Matrix Theory	65
MAC 1140: Precalculus Algebra	45	MAT 1932: Topics in Mathematics	30
MAC 1147: Precalculus Algebra and Trig.	50	STA 2023: Introductory Statistics	30

Every student is required to seek academic advisement every semester. The program advisor maintains for each of the students a folder (with appropriate advising sheets and student's starting date) that tracks the student's progress and individual course grades (sample advising sheets are provided in Attachment 1.1-1.6). During an advising session with a student, the advisor ensures that the student is not registered in a course without the required pre-requisite course(s) or grade(s). Once all the courses have been verified, the advisor removes the course registration ‘hold’. The advisor also keeps an unofficial online transcript and updates the OE degree audits for each of the students periodically.

On matters requiring expert knowledge of a particular engineering subject, such as determining the equivalency of the technical contents in a course taken at another ABET-accredited University, the advisor seeks the input of a faculty member having the appropriate background knowledge in the subject.

The program advisor assists the students in many other areas as well, providing information on tutoring, petitions, scholarships and loans, internships and employment opportunities and writing letters of recommendation. Students are counseled on various options available in their particular situations. After the student has completed Calculus I successfully, a plan of study is developed which includes every class required for graduation and the semester it should be taken.

C.1.15 Retention rates.

The enrollment data for the First Time In College (FTIC) cohorts for Fall 2011, 2012, and 2013 are presented in Table 3. The second year retention rates for both programs is generally strong for both ME and OE programs. However, one of the main challenges in maintaining high retention rates is student performance in the Calculus series (especially Calculus I) and Physics series. Our university, as with most US universities, has a high DFW rate in these classes which often results in low retention rates. At FAU, plans have already been implemented to improve student performance in these courses. Furthermore, the college is applying differential admission criteria for engineering which imposes more stringent mathematic knowledge requirements for incoming students.

The department has a limited role in improving freshman retention rates as we are not involved in the delivery of mathematics and physics courses. However, for second year retention purposes, we try to make sophomore level engineering courses more exciting and more engineering oriented by assigning, to the extent possible, our most effective professors to fundamental courses (such as Statics and Thermodynamics) and by using 3-D printing projects in our Engineering Graphics courses. We believe that these efforts help us improve our retention rates.

Table 3. First Time In College (FTIC) Retention Rates, 2011-2013. Source: CECS, Dr. Ali Zilouchian.

'all Cohort	Last Program/Concentration	Count	:nrolled After 1	nrolled After 2	nrolled After 3	nrolled After 4	nrolled After 5	:nrolled After 6 \
2011	/IE Mechanical Engineer	31	93.6%	87.1%	87.1%	61.3%	45.2%	12.9%
2011	3SOE Ocean Engineering	21	100.0%	95.2%	85.7%	76.2%	38.1%	0.0%
2012	/IE Mechanical Engineer	35	97.1%	94.3%	88.6%	74.3%	48.6%	
2012	3SOE Ocean Engineering	17	100.0%	100.0%	100.0%	88.2%	23.5%	
2012	NONE Pre-Engineering/Mechanical Engineering	5	100.0%	100.0%	60.0%	20.0%	0.0%	
2012	NE Pre-Engineering/Oce Engineering	1	100.0%	100.0%	100.0%	100.0%	100.0%	
2013	/IE Mechanical Engineer	39	100.0%	89.7%	82.1%	71.8%		
2013	3SOE Ocean Engineering	14	100.0%	100.0%	92.9%	85.7%		

2013	NONE Pre-Engineering/Mechanical Engineering	15	66.7%	40.0%	26.7%	20.0%		
2013	NE Pre-Engineering/Oce Engineering	9	88.9%	44.4%	11.1%	0.0%		

The historical first and second year enrollment data, prior to 2011, for the OE program is presented in Table 4. Comparing the data below to those for 2011-2013 above shows improvements in this area.

Table 4. Retention Rates for 2007 through 2010 Cohorts in the OE program. Source: CECS, Dr. Ali Zilouchian.

Cohort ▲	n	% Enrolled After 1 Yr	% Graduated Within 1 Yr	% Enrolled After 2 Yrs
2007	34	79.41%	0.0%	61.8%
2008	24	66.67%	0.0%	50.0%
2009	39	76.92%	0.0%	64.1%
2010	40	75.00%	0.0%	52.5%

The historical first and second year enrollment data, prior to 2011, for the ME program is presented in Table 5. Comparing the data below to those for 2011-2013 above shows improvements in this area.

Table 5. Retention Rates for 2007 through 2010 Cohorts in the ME program. Source: CECS, Dr. Ali Zilouchian.

Cohort ▲	n	% Enrolled After 1 Yr	% Graduated Within 1 Yr	% Enrolled After 2 Yrs
2007	85	71.76%	0.0%	47.1%
2008	82	74.39%	0.0%	52.4%
2009	77	76.62%	0.0%	63.6%
2010	81	70.37%	0.0%	55.6%

C.1.16 Graduation rates. The graduation data for the First Time In College (FTIC) cohorts for Fall 2011, 2012, and 2013 are presented in Table 6. The six year graduation rates for the OE program for the 2011 cohort is excellent at 81% while that of ME is good at 58.1%. One of our main strategies in improving 6-yr graduation rates has been the design and offering of a comprehensive and student-centered summer program. In the summer, we offer a variety courses based on students' need to graduate. This strategy has given the students an option to "catch up" in case they have received a poor grade in a course or have not taken the taken required courses due to time constraints.

Table 6. First Time In College (FTIC) 6-yr Graduation Rates, 2011-2013 for both programs. Source: CECS, Dr. Ali Zilouchian.

Fall Cohort	Last Program Concentration	Count	% Graduated 3 Yr	% Graduated 4 Yr	% Graduated 5 Yr	% Graduated 6 Yr
2011	SME Mechanical Engineerin	31	0.00%	16.1%	29.0%	58.1%
2011	BSOE Ocean Engineering	21	0.00%	4.8%	42.9%	81.0%

2012	SME Mechanical Engineerin	35	2.9%	14.3%	40.0%	
2012	BSOE Ocean Engineering	17	0.0%	11.8%	76.5%	
2012	NE Pre-Engineering/Mechan Engineering	5	0.0%	0.0%	0.0%	
2012	ONE Pre-Engineering/Ocea Engineering	1	0.0%	0.0%	0.0%	
2013	SME Mechanical Engineerin	39	2.6%	12.8%		
2013	BSOE Ocean Engineering	14	0.0%	14.3%		
2013	NE Pre-Engineering/Mechan Engineering	15	0.0%	0.0%		
2013	ONE Pre-Engineering/Ocea Engineering	9	0.0%	0.0%		

The graduation rates for ME program cohorts previous to 2012 is presented in Table 7. Compared to the six year graduation rate for the 2011 cohort (58%) it appears that the ME program is making progress in terms of improving graduation rates.

Table 7. Six-yr Graduation Rates for 2007 through 2010 Cohorts in the ME program. Source: CECS, Dr. Ali Zilouchian.

Cohort ▲	n	% Graduated Within 3 Yrs	% Graduated Within 4 Yrs	% Graduated Within 5 Yrs	% Graduated Within 6 Yrs
2007	85	0.0%	1.2%	21.2%	32.9%
2008	82	0.0%	1.2%	14.6%	29.3%
2009	77	0.0%	3.9%	24.7%	35.1%
2010	81	0.0%	4.9%	21.0%	37.0%

The graduation rates for OE program cohorts previous to 2012 is presented in Table 8. . Compared to the six year graduation rate for the 2011 cohort (81%), it appears that the OE program is making significant progress in terms of improving graduation rates.

Table 8. Six-yr Graduation Rates for 2007 through 2010 Cohorts in the OE program. Source: CECS, Dr. Ali Zilouchian.

Cohort ▲	n	% Graduated Within 3 Yrs	% Graduated Within 4 Yrs	% Graduated Within 5 Yrs	% Graduated Within 6 Yrs
2007	34	0.0%	2.9%	35.3%	47.1%
2008	24	0.0%	4.2%	20.8%	33.3%
2009	39	0.0%	7.7%	33.3%	43.6%
2010	40	0.0%	2.5%	17.5%	37.5%

C.1.17. Licensure rates.

Data not collected.

C.1.18. Placement rates.

Data not collected.

C.1.19. Student recruitment. Recruitment activities are pursued by the university through Graduate College and the College of Engineering. The Graduate College provides us with annual Presidential and Provost Scholarships to be used for recruitment of high quality graduate students. The Graduate College also provides funding for recruitment related activities. The departments are very active in support of this goal through meeting with parents and students and reaching out to those interested in engineering. The OE program, due to its specialty and it small size requires focused recruitment. We are currently developing plans to increase the enrollment in this program.

We are also active in recruiting graduate students. This is done through promoting research to support RAs and using departmental resources to support TAs. The number of graduate students being supported by the Department for Fall 2017 is presented in Table 9.

Table 9. Graduate Student Support for Fall 2017. Source: OME, Ms. Ana Calnick.

	Research Assistants	Departmental /Dean's TAs
Ocean Engineering	22	5
Mechanical Engineering	12	11
Total	**34**	**16**

C.2 Graduate Programs:

Departmental educational goals. Over the past six years, the department (faculty, staff, and students) has embarked on achieving the following goals:

- Goal 1. Improve the overall quality of graduate education, the number of students, and student satisfaction in graduate education.

Enablers: Invest in recruiting high quality students from US and international institutions. Promote the importance of quality education among faculty. Update the curriculum to reflect current and future needs. Create a reliable course offering schedule. Offer competitive stipends.

- Goal 2. Increase scholarly activities among graduate students.

Enabler: Encourage submission of a technical paper to a journal or making presentations at a conference prior to graduation; soft requirement for graduation.

- Goal 3: Improve and update research facilities in new emerging areas so students can perform state of the art research with state of the art equipment.

Enabler: Hire new faculty with competitive start-ups to establish new lines of research and new laboratories. Upgrade and upkeep the existing research labs.

- Goal 4: Increase the graduate program reputation nationally and internally.

Enabler: Do a better job advertising our achievements through updated websites and sending out news releases and announcements. Encourage publications with graduate students in the highest quality journals.

C.2.1 Admissions Criteria (MS). Specific admission requirements for Masters of Ocean and Mechanical Engineering are more stringent than the general FAU graduate admissions requirements. A candidate for the master's degree program in mechanical engineering must satisfy the following entry requirements:

1. A baccalaureate degree in engineering, science or mathematics.
2. A 3.0 (on a 4.0 scale) GPA or better in the last 60 credits of undergraduate work.
3. Scores of at least 145 (verbal) and 150 (quantitative) on the Graduate Record Examination (GRE). GRE scores more than five years old will not be accepted.
4. Must demonstrate proficiency in both written and spoken English. Students from non English-speaking countries are required to take the Test of English as a Foreign Language (TOEFL) and achieve a score of at least 550 (paper-based) or 213 (computer-based) or 79(IBT), or take the International English Language Testing System (IELTS) and achieve a score of at least 6.0.
5. All students will have a thesis or advisory committee during their studies. For thesis students their advisor is the chair of the advisory committee. A thesis or advisory committee must be formed before the plan of study can be filed. Students who enter the program without an assistantship will be assigned a mentor by the chair of the graduate committee. Students without an advisor are required to visit at least three faculty members during their first semester requesting to form an advisory committee. A report on the outcome of the faculty visits must be filed with the campus graduate coordinator.
6. Adherence to the policies and regulations and the graduate admission requirements of the University as outlined in the University catalog.
7. Conditional admission may be permitted if the above requirements are not met.

A student is eligible to apply for candidacy when:

1. The student has completed a minimum of 9 credits as a graduate student.
2. The student has maintained a minimum GPA of 3.0 in all courses attempted as a graduate student.
3. The student has filed an approved Plan of Study for the degree program.

Students should file for candidacy as soon as they are eligible. Usually, no more than 20 credits of completed coursework before admission to candidacy will be accepted toward a degree program. A student should be admitted to candidacy prior to beginning work on their thesis.

C.2.2 Admissions Criteria (PhD). Minimum requirements for admission to doctoral studies in both Ocean and Mechanical engineering are as follows:

1. A baccalaureate in engineering or a related field from a recognized institution;
2. An average of "B" or better in the last 60 credits of work attempted;
3. A score of 145 or higher on the verbal and 150 or higher on the quantitative portions of the Graduate Record Examination (GRE). GRE scores more than five years old will not be accepted;

4. Demonstrated proficiency in both written and spoken English. A student from a non-English-speaking country is required to take the test of English as a Foreign Language (TOEFL) and achieve a score of at least 550 (CBT-213, iBT-79), or take the International English Language Testing System (IELTS) and achieve a score of at least 6.0.
5. Three letters of reference attesting to the student's potential for graduate studies in mechanical engineering;
6. Approval for admission by the Department of Ocean and Mechanical Engineering. Usually, an applicant admitted will have a strong record of achievement that exceeds the minimum requirements. It is anticipated almost every applicant will already have a master's degree, but it is not an absolute requirement. Approval for admission by the department will be based on an evaluation of the student's record in terms of likelihood of success in the PhD program.

C.2.3 Graduate student enrollment. The recent history of graduate enrollment data for the ME program is presented in Figure 11. The ME program has historically been focused on undergraduate education. It is obvious that ME graduate program was very weak and significantly below the national average in the early 2011-12 but the graduate enrollment numbers have grown significantly over the past 5 years. Masters degree enrollment has increased from 18 in the Fall of 2012 to 32 in the Spring of 2017 (max of 39 in the Fall 2016); PhD degree enrollment has increased from 8 in Fall 2012 to a maximum of 26 in Spring of 2017. The major reasons for this growth have been hiring of new faculty in the ME discipline and departmental investment in support of PhD students.

The recent history of graduate enrollment data for the OE program is presented in Figure 12. The OE program has historically been strong in graduate education and research. The bulk of this strength came in the number of Masters students and majority of these students were funded by research. However, over the past years, we have made a concerted effort to increase the number of PhD Students in the program. As a result, Masters degree enrollment has reduced from 31 in Fall of 2012 to 19 in Spring of 2017. However, during the same period, the PhD degree enrollment has increased from 11 in Fall of 2012 to 23 in Spring of 2017.

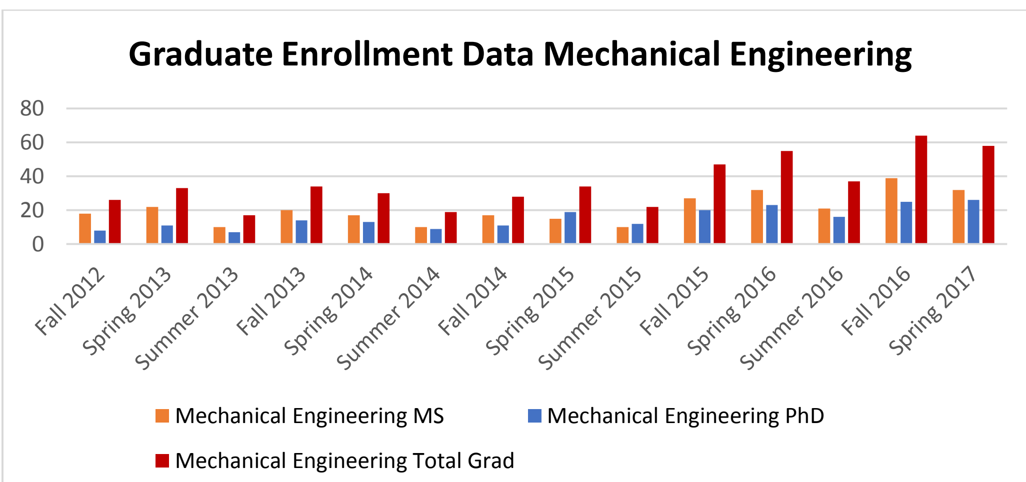


Figure 11. Five year history of graduate student enrollment in the ME program. (Source: Nicholas P. Kelly http://www.fau.edu/iea/data/deptreview.php)

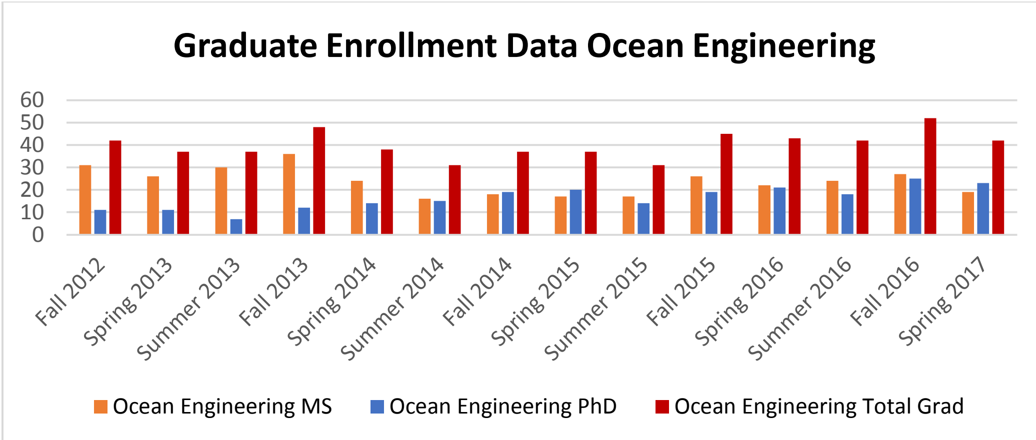


Figure 12. Five year history of graduate student enrollment in the OE program. (Source: Nicholas P. Kelly http://www.fau.edu/iea/data/deptreview.php)

C.2.4 Graduate degrees awarded. The recent history of graduate degrees awarded is presented in Figure 13. In 2011 and 2012, both OE and ME programs were struggling to maintain the SUS requirement of producing 2 PhD degrees per year. Figures 11, 12, 13, and 14 together show the departmental strategy to invest more in PhD enrollment and degree productivity while maintaining an appropriate number of enrollment and degree productivity at the Masters level. This strategy has worked as currently, all of our 5-yr performance measures in terms of MS (20 over a period of 5 years) and PhD degree productivity (10 over a period of 5 years) in both ME and OE programs meet the SUS requirements. The program specific data for MS degree productivity is shown in Figure 14a and for PhD degree productivity in Figure 14b.

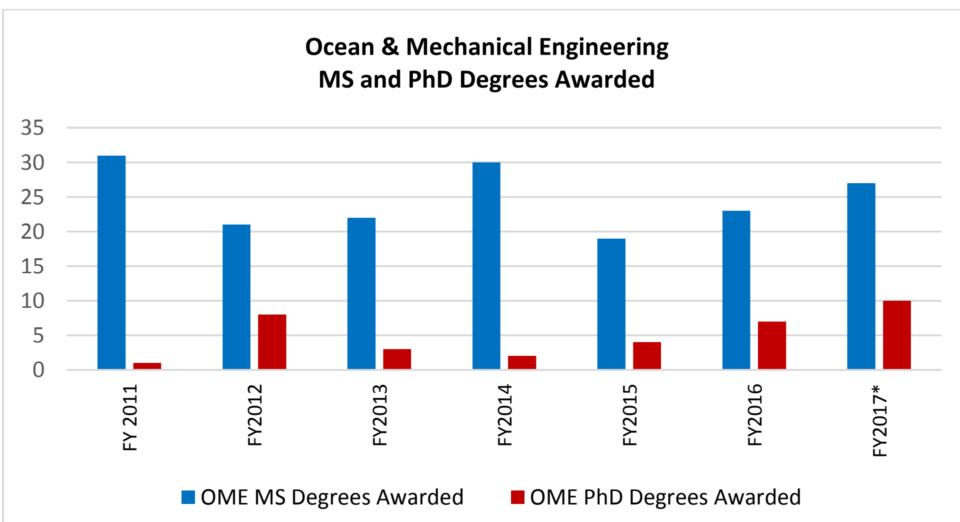


Figure 13. Departmental Masters and PhD degree Productivity History. (Source: Nicholas P. Kelly http://www.fau.edu/iea/data/deptreview.php and Ana Calnick)
***2017 includes Summer 2017 graduation data**

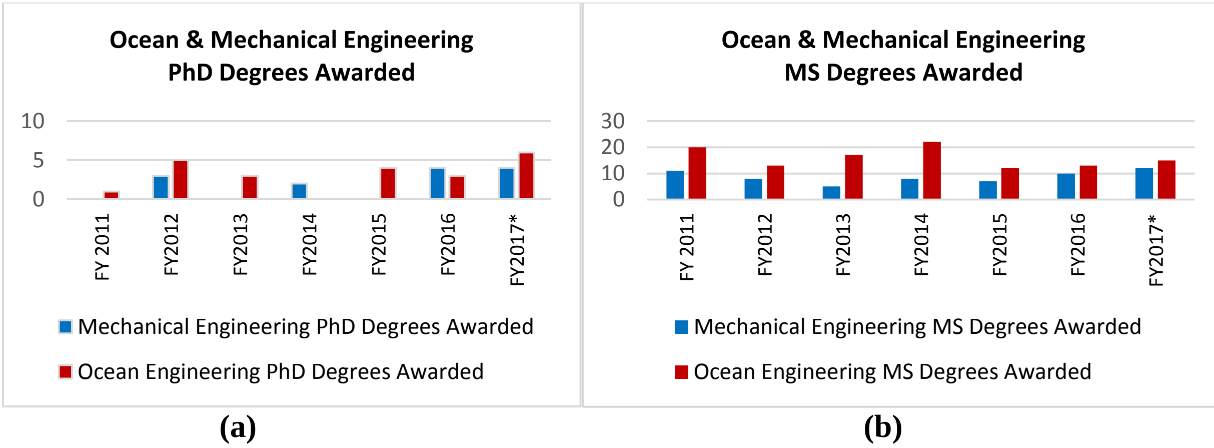


Figure 14. Program specific Masters and PhD degree Productivity History. (Source: Nicholas P. Kelly http://www.fau.edu/iea/data/deptreview.php and Ana Calnick)
***2017 includes Summer 2017 graduation data**

Sustainability of the PhD Degree productivity in both ME and OE programs: Although both ME and OE programs are currently meeting the state requirement by producing over two PhD graduates per year, we have taken extra measures to assure ourselves that the programs will never again be defficient in meeting the state's threshold. We have taken the following steps to assure sustainability in terms of both quantity and quality of the programs (quality and assessment are addressed in section C2):

1- Invested the departmental resources heavily in support of PhD students as Teaching Assistants in both ME and OE programs.

2- The duration of support for departmentally supported PhD students has been set at three years (with one grace semester). This encourages the students to make continuous progress towards graduation.

3- The progress of all PhD students is monitored through annual progress presentations to the supervisory committee. These progress presentations are open to other graduate students and the public. These progress presentation help students make continuous advances towards their degree and also is an important quality control apparatus.

4- As PhD candidates graduate (specifically TAs), we invest in new PhD students. The financial support of Graduate School in providing Provost and Presidential Scholarships as well as providing recruiting funds is a significant help in our recruitment.

5- More PhD students are being supported by funded research. As our research grows, the number of PhD students will also grow. We hope to achieve a 60% RA – 40% TA support among our PhD students.

The above strategies assure us of a continuous productivity and sustainability of our programs. The table below, table 10, shows the number of PhD students expected to graduate in 2018, 2019, and 2020.

Table 10. Expected graduation dates of current PhD students in the OME program.
(Source: OME, Ana Calnick)

	Expected Graduation Date		
Program	**2018**	**2019**	**2020**
PhD ME	10	8	4
PhD OE	13	6	5
Total	**23**	**14**	**9**

According to the above data, there are 10 PhD students in the ME program and 13 in the OE program that are "expected" to graduate in 2018 (Fall, Spring, and Summer); 8 PhD students in ME and 6 PhD students in OE are expected to graduate in 2019; 4 PhD students in ME and 5 PhD students in OE are expected to graduate in 2020. Clearly not all students expected to graduate in 2018 will complete all of their requirement and some will graduate with delays. However, the current numbers are very healthy and almost guarantee the sustainability of the PhD productivity in both programs.

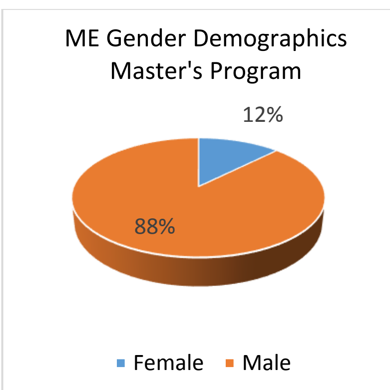
Table 11 lists the PhD students expected to graduate in 2018 in both programs. It is important to note that all of our PhD students (TAs, RAs, and self-supported) are listed below. Many of the PhD students are projected on track to graduate in 2018 (7 in the ME program and 5 in the OE program). Other students are also making progress but, conservatively, they are projected as possible graduates of 2018. Even if the "possible" graduates do not graduate in 2018, their graduation in 2019 is highly likely. Based on our PhD degree productivity in the past five years, our strategies for sustainability, and the presented current data, we have no doubts that not only we will meet the state requirements but we will substantially exceed the required threshold.

Table 11. PhD students in the OME program, and their "projected" progress levels for graduation in 2018. (Source; OME, Ana Calnick)

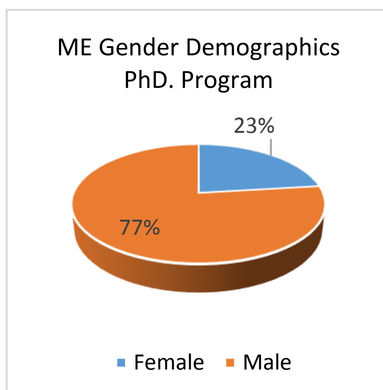
Name	Z Number	Admitted	Advisor	Funding Source	Expected Graduation	Progress
MECHANICAL ENGINEERING						
Abd, Moaed	Z23326939	201601	Engeberg	GRA	Fall 2018	On track
Abdelmola, Fatmaelzahraa	Z23328918	201501	Carlsson	Dept TA	Summer 2018	On track
Ades, Craig J.	Z23171630	201601	Engeberg	Dept TA	Spring 2018	Possible
Firoozi, Negar	Z23366160	201601	Kang	GRA	Fall 2018	On track
Ghahghaei Nazamabadi, Shirin	Z23363543	201508	Abtahi	Dept TA	Fall 2018	Slow Progress
Hache, Florian	Z23327240	201501	Elishakoff	Dept TA	Spring 2018	On track

Krishnan, Vaishakh	Z23396674	201608	Gaonkar	Dept TA	Fall 2018	Possible
Lin, Maohua	Z23308397	201501	Tsai/Kang	Dept TA	Fall 2018	On track
Liu, Jia	Z23338553	201508	Du	GRA	Spring 2018	On track
Wang, Xuesong	Z23363470	201508	Kang	GRA	Summer 2018	On track
OCEAN ENGINEERING						
Balasubramanian, Hariharan	Z23157368	201308	Presuel-Moreno	GRA	Spring 2018	Possible
Biswas, Debojit	Z23337094	201508	Su (Civil)	GRA (Civil)	Fall 2018	Possible
Chen, Hao	Z23309557	201508	Teegavarapu/ Tsai	TA (Civil)	Fall 2018	Possible
Franke, Kristina	Z15355313	201605	Dhanak	RA	Summer 2018	Possible
Gapstur, Christopher	Z15313171	201301	Mahfuz	Self-Supporting	Spring 2018	On track
Gazagnaire, Julia	Z00006886	201608	Beaujean	The Navy	Summer 2018	On track
Kindel, Michael W.	Z23071471	201208	Dhanak	Self-Supporting	Spring 2018	Possible
Miglietta, Victoria	Z23216982	201308	Dhanak	Self-Supporting	Summer 2018	Slow progress
Munoz, Guillermo	Z15130074	201608	Reddy	Self-Supporting	Spring 2018	Possible
Ni, Zao	Z23134167	201601	Dhanak	Dept TA	Fall 2018	On track
Raof, Farhad Fakheri	Z23353562	201605	Kaiser (Civil)	GRA (Civil)	Fall 2018	Possible
Spragg, Donald O.	Z23165992	201608	An	Dept TA	Fall 2018	On track
Vidal, Raul	Z23080975	201408	Carlsson	Dept TA	Fall 2018	On track

C.2.5. Graduate program diversity. Below, we present the current diversity of the students in each graduate program based on gender followed by race. The Mechanical Engineering program currently maintains 12% in its Masters and 23% in its PhD program, Figure 15a and 15b respectively.



(A)



(B)

Figure 15. Current Mechanical Engineering Enrollment Based on Gender at Various Levels. (Source: Nicholas P. Kelly http://www.fau.edu/iea/data/deptreview.php)

The racial diversity of ME's graduate program is presented in Figure 16.

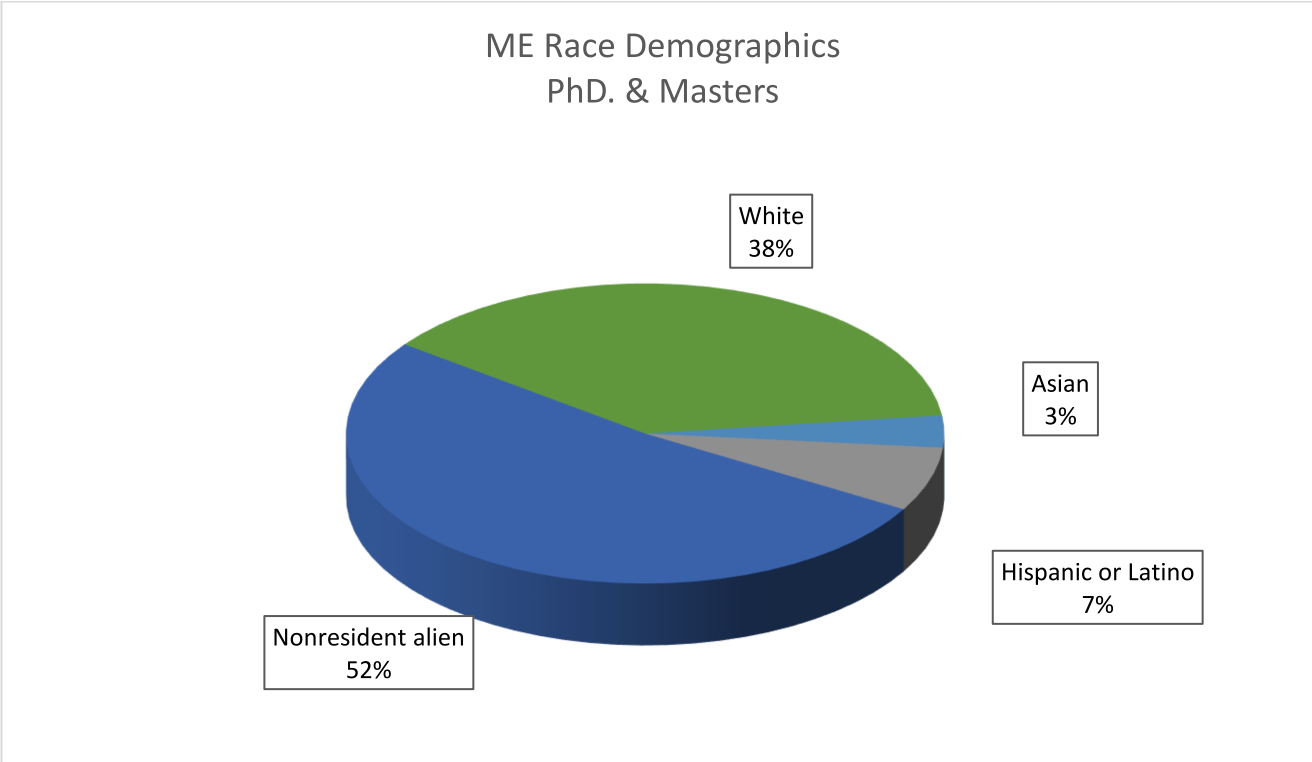


Figure 16. Current Mechanical Engineering Enrollment Based on Race and Ethnicity. (Source: Nicholas P. Kelly http://www.fau.edu/iea/data/deptreview.php)

In the Ocean Engineering program, the percentage of females in the Masters program is 5% and 17% in the PhD program, Figure 17a and 17b, and we plan to aggressively recruit in this area.

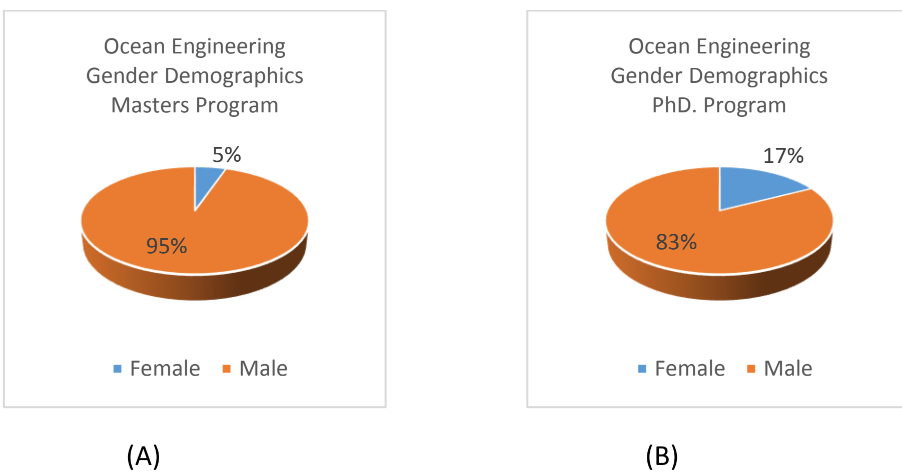


Figure 17. Current Mechanical Engineering Enrollment Based on Gender at Various Levels. (Source: Nicholas P. Kelly http://www.fau.edu/iea/data/deptreview.php)

The racial diversity of OE's graduate program is presented in Figure 18.

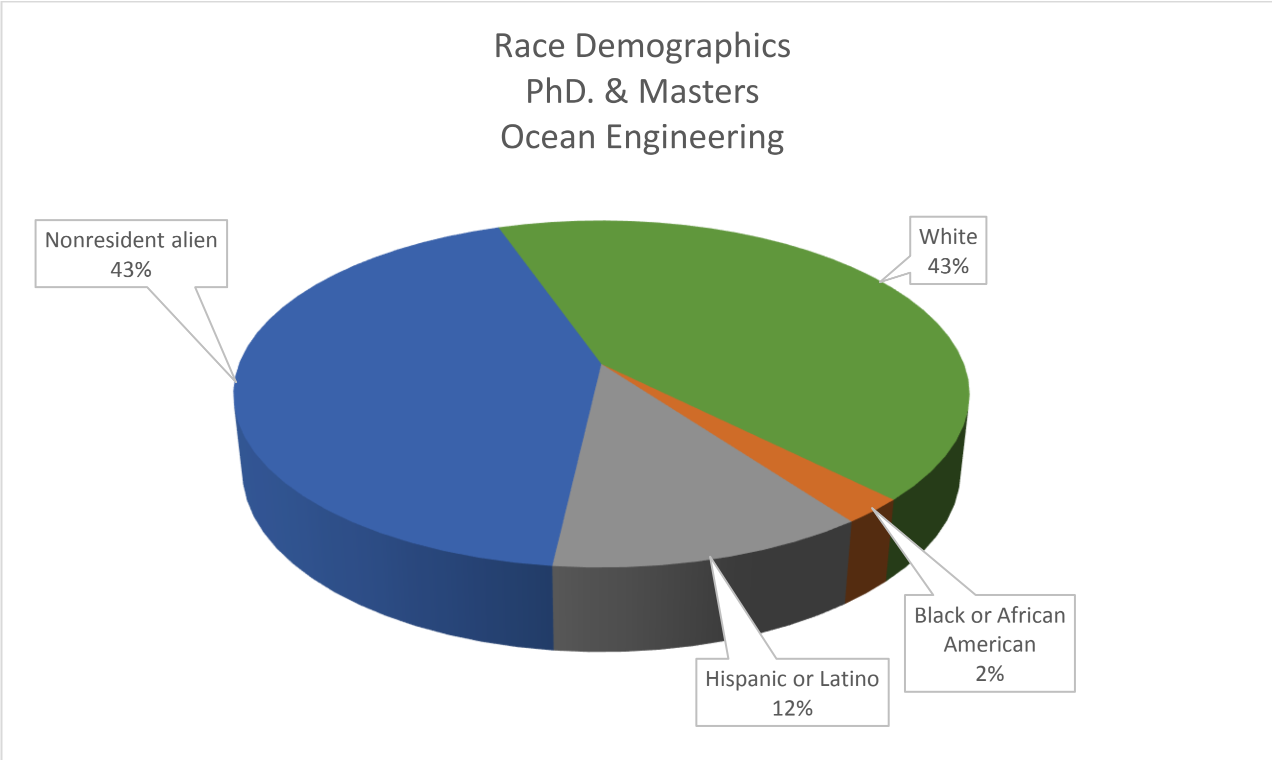


Figure 18. Current Mechanical Engineering Enrollment Based on Race and Ethnicity at Various Levels. (Source: Nicholas P. Kelly http://www.fau.edu/iea/data/deptreview.php)

C.2.6. BS/MS Program. Table 12 shows the number of students admitted to our BS/MS program and Table 13 shows the number graduated. BS/MS program is used attract talented undergraduate students to our graduate program. This program has been a successful recruitment tool over the past 6 years. During the 2011-2017 period, a total of 71 students were admitted to the Ocean and Mechanical Engineering programs and during the same period 42 have graduated. We plan to continue with program and recruit our own talented students to our graduate programs.

Table 12. Recently History of BS/MS Enrollment

BS/MS Admitted

	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017
OE	6	9	3	6	8	6
ME	6	6	5	2	7	7
Annual Total	12	15	8	8	15	13

Table 13. Recently History of BS/MS Graduation

BS/MS Graduated

	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017
OE	1	5	9	3	5	1
ME	0	3	4	3	4	4
Annual Total	**1**	**8**	**13**	**6**	**9**	**5**

C.2.7Outcomes and Assessment of MSME Program. The program has identified the following three outcomes for the MSME program. The assessment method, the criterion for success, the results for fall 2016-spring 2017, and the program improvement are presented for each. The results from the assessment of the faculty evaluations of student performance are analyzed each semester and changes are made as necessary to insure continuous improvement in the program.

Outcome 1. Demonstrate an ability to perform research, and/or perform advanced engineering analysis in their area of specialty.

Assessment Method. Master's thesis or a portfolio of course projects. The faculty advisory committee will evaluate the thesis or portfolio of projects. An evaluation instrument is in use for this purpose (Appendix A – Form 6 and 7).

Criterion for success. 80% of student evaluations will achieve a level of 4 on a scale of 5.

Results. One student completed a Master's degree with thesis and three students completed a non-thesis Master's program in fall 2016. When rated on their ability to perform research and/or engineering analysis the thesis student was rated as 5.0 on a 5-point scale, while the non-thesis students were rated 4.50, 5.0 and 5.0. Four students completed their non-thesis Master's degree in spring 2017 with ratings of 4.50, 4.17, 4.50 and 4.50 on a 5-point scale in ability to perform research and/or engineering analysis. Students are meeting the criterion for success in this area.

Program Improvement. Students are performing well in use of advanced engineering analysis and the program will continue to emphasize its use in the projects associated with the graduate courses.

Outcome 2. Based on fundamental and advanced principles, students will have ability to formulate and analyze engineering problems, and synthesize and develop appropriate solutions.

Assessment Method. Master's Thesis or student project portfolio. The advisory committee for the student will evaluate the thesis or student project portfolio. An evaluation instrument is in use for this purpose.

Criterion for success. 80% of student portfolios will achieve a level of 4 on a 5-point scale.

Results. One student completed a Master's degree with thesis and three students completed a non-thesis Master's program in fall 2016. When rated on their ability to perform research and/or engineering analysis the thesis student was rated as 5.0 on a 5-point scale, while the non-thesis students were rated 4.38, 4.75 and

5.0. Four students completed their non-thesis Master's degree in spring 2017 with ratings of 4.50, 4.17, 4.0 and 4.50 on a 5-point scale in ability to perform research and/or engineering analysis. Students are meeting the criterion for success in this area.

Program Improvement. Students are performing well in problem formulation and solution development, and the program will continue to emphasize its use in the projects associated with the graduate courses.

Outcome 3. Effectively communicate advanced technical concepts to their peers.

Assessment Method. Master's thesis or a portfolio of projects from the graduate classes. The faculty advisory committee will evaluate the thesis or student project portfolio according to the evaluation sheet designed for this purpose.

Criterion for success. 80% of student evaluations will achieve a level of 4 on a 5-point scale.

Results. One student completed a Master's Degree with a thesis and three students completed a non-thesis program in fall 2016. When rated on ability to communicate the thesis student was rate 5.0 on a 5-point scale while the non-thesis students were rated 4.75, 5.0 and 5.0. In spring 2017 four students completed their non-thesis Master's Degree. Their ratings on both written and oral communication were 5.0, 5.0, 4.17 and 4.0 on a 5-point scale showing excellent performance in these areas.

Program Improvement. Students are performing well and meeting the criterion for success. Communication will continue to be emphasized in the student programs.

C.2.8Outcomes and Assessment of PhD-ME Program. The program has identified the following three outcomes for the PhD-ME program. The assessment method, the criterion for success, the results for fall 2016-spring 2017, and the program improvement are presented for each. The results from the assessment of the faculty evaluations of student performance are analyzed each semester and changes are made as necessary to insure continuous improvement in the program.

Outcome 1. Perform original research in their area of specialty.

Assessment Method. Ph.D. dissertation: An evaluation sheet for the dissertation has been developed to be used by the faculty advisory committee (Appendix A – Form 8). On the evaluation sheet is a check-off for submission of a technical journal article to a peer reviewed publication.

Criterion for success. 80% of students will obtain a 4.0 on a 5.0 scale in rating by the faculty on their research performance and 80% of the students will submit a publication based on their research with their advisors approval to a peer reviewed publication.

Results. One student completed their PhD studies in fall 2016 and was rated as 4.67 on the 5.0 scale in research performance. The student submitted a paper to a journal based on the research. No students completed a PhD program in spring 2017.

Program Improvement. Continued emphasis on the importance of the quality of research and the publication of the research results.

Outcome 2. Students will demonstrate an advanced level of knowledge in mathematics and engineering fundamentals relevant to their discipline.

Assessment Method. Department qualifying examination. The performance on the qualifying examination will be evaluated by the faculty advisory committee according to the evaluation sheet (Appendix A – Form 13). Evaluation will also be performed on the PhD dissertation by the advisory committee on the demonstration of an advanced level of knowledge in mathematics and engineering fundamentals (Appendix A – Form 8).

Criterion for success. 80% of students will obtain at least a 4 on a 5-point scale.

Results. One student completed the PhD program in fall 2016. The overall rating of his performance by the faculty on the graduate committee was 4.67 on a 5-point scale. The assessment rating of the student on his performance in mathematics and engineering fundamentals was 4.83. Three students completed the qualifying examination with ratings of 4.0, 5.0 and 5.0 on their performance in mathematics and engineering fundamentals. In spring 2017 no students completed their PhD program. Four students completed their qualifying examination with ratings of 4.25, 5.0, 4.50 and 5.0 on a 5-point scale in mathematics and engineering fundamentals as rated by the faculty.

Program Improvement. Continued emphasis on the importance of preparation for the qualifying examination in mathematics and engineering fundamentals along with an evaluation of these areas in the dissertation.

Outcome 3. Effectively communicate an advanced technical concept to their peers.

Assessment Method. Evaluation of the presentation at the defense of the dissertation by the faculty advisory committee.

Criterion for success. 80% of students will obtain a 4 out of 5 rating on the performance of the dissertation presentation.

Results. One student completed the PhD program in fall 2016 and was rated as 4.46 on a 5-point scale in ability to communicate effectively in both written and oral form based on the evaluation of the faculty committee. No students completed the PhD program in spring 2017.

Program Improvement. Continued emphasis on the importance of presentation skills throughout the technical review presentations required each semester of the students.

C2.9. Outcomes and Assessment of MSOE Program. The MSOE program has identified three outcomes to achieve its goal. The outcomes, assessment methods, criteria for performance and sample results are given below:

Outcome 1. An ability to independently carry out a major design project or research in engineering or applied science.

Implementing Strategy. The outcome will be achieved through thesis and research projects in the coursework.

Assessment Method. For students in the program who are supported and pursue thesis for the degree, successful completion of a thesis to the approval of all three committee members is a means to assess student's ability to independently carry out a major design project or research in an engineering or applied-science field (Appendix A – Form 9). For those seeking non-thesis degrees, the assessment will be based on their portfolio of design and experiment projects and reports made in various courses (Appendix A – Form 10).

Criterion for success. For Masters students with a thesis option, a review is carried out by the student's advisory committee. And each outcome is evaluated from 0 to 10 (0=poor, 5=satisfactory, 10=Excellent). For the non-thesis student, it is required that the students submit a portfolio of all projects, reports, and term papers prepared in various courses. The chair of the student's committee will evaluate the portfolio, at least, one month prior to graduation. A minimum ranking of 7 is required in all categories. In addition, for satisfactory performance,

[1] At least 75% of MS (thesis) students must successfully defend their thesis and graduate in 2 years.
[2] In the assessment of the outcome by the thesis committee, at the least 75% of the students must obtain a ranking of satisfactory or above.
[3] In the assessment of the outcome for non-thesis students, at the least 75% of the students must obtain a ranking of satisfactory or above.

Data Summary (2016-17). In the Fall 2016, 6 students graduated with average outcome score of 8.48. Score of 7 or below occurred only for one student. In the Spring 2017, 3 students graduated with average outcome score of 8.3.

Program Improvement. We will continue to recruit high quality students through offering assistantship/fellowship and encourage students' publication. Our incoming student quality has improved.

Outcome 2. An intermediate level knowledge in mathematics, science, and engineering subjects.

Implementing Strategy. The outcome will be achieved through coursework requirements.

Assessment Method. GPA is a good indicator of this outcome. In the case of non-thesis students, the evaluation of the outcome will be also done based on their course portfolio of project and experiment reports and term papers.

Outcome 3. An ability to effectively communicate topics in engineering and science.

Implementing Strategy.

- Encourage students to attend conferences and publish papers to enhance FAU's reputation.
- Use the thesis results as the base to support current funded research as well as to attract future funding.
- Achieve successful completion of the thesis and other project reports.

Assessment Method. [1] Based on successful completion of the thesis and thesis defense, as more than 75% of the students in the program are under thesis option for the degree.

[2] Using the assessment tool (see in the supporting documents of outcome 1) the thesis committee will also evaluate the achievement of this outcome. For non-thesis students, the evaluation will be based on their portfolio of term papers and project reports in their graduate courses. For the thesis students, a semester review is carry out by the student's advisory committee. And each outcome is evaluated from 0 to 10 (0=poor, 5=satisfactory, 10=Excellent). For the non-thesis student during MS's program shall submit portfolio of all projects, reports, and term papers prepared in various courses in the curriculum for the degree and submit to the chair of the student's committee at least one month prior to graduation for similar outcome revaluation.
Minimum of 7 is required in all categories.

Criterion for success. [1] More 75% of the students passing the thesis defense in the first attempt is a criterion for satisfactory performance. [2] In the assessment of the outcome by the committee, at the least 75% of the students must obtain a ranking of satisfactory or above. [3] In the assessment of the outcome for non-thesis students, at the least 75% of the students must
obtain a ranking of satisfactory or above.

Data Summary (2016-17). In the Fall 2016, 6 students graduated with average outcome 3 (an ability to effectively communicate topics in engineering and science) score of 8.67. In the Spring 2017, 3 students graduated with average outcome score of 9.33.

Program Improvements. We will continue to recruit better students and encourage students' publication. Overall, the MSOE program has met the criteria for satisfactory performance in achieving the outcomes over the years. The program is the major contributor to the teaching and research activity of the program. We are working on making the process better. The assessment and improvement process requires a review in conjunction with the feedback given by the College review committee.

C.2.10 Outcomes and Assessment of PhD-OE Program. The PhD-OE program has identified three outcomes to achieve its goal (Appendix A – Form 11). The outcomes, assessment methods, criteria for performance and sample results are given below:

Outcome 1. An ability to independently carry out original and independent research in an engineering or applied science field.

Implementation Strategy. To achieve this outcome, the program

[1] ensures that students get the necessary background by means of coursework requirements for the degree.

[2] requires students pass both written and oral qualifier examination in core as well as elective subjects prior to advancement to candidacy.

[3] requires students to successfully defend the dissertation proposal

[4] the dissertation committee periodically meets to review progress and to insure that the dissertation research is original, and

[5] requires publication in peer-reviewed conference proceedings and journals.

Assessment Method. Prior to graduation, Ph.D. candidates are expected to have at least one paper published in refereed technical conference proceedings, or one paper published or accepted for publication in a refereed journal. Using an assessment tool the dissertation committee and the Dean's representative will also evaluate the achievement of this outcome (Appendix A – Form 11 and Form 12).

Criterion for success. The criterion is that at least 80% of the Ph.D. graduates publishing at least in one refereed technical conference proceedings, or having one paper published or accepted for publication in a refereed journal. In the assessment of the outcome by the committee, at least 75% of the graduates must obtain a ranking of satisfactory or above.

Data Summary (2016-17). [1] All Ph.D. graduates publishing at least in one refereed technical conference proceedings, or having one paper published or accepted for publication in a refereed journal. Five Ph.D. graduates together, at the time of dissertation defense, has 6 refereed journal papers published, 8 refereed journal papers under review, and 8 papers published refereed technical conference proceedings. [2] In the assessment of the outcome by the committee, all the graduates obtain a ranking of satisfactory or above.

Program Improvement. Recruit best students with fellowships and assistantships , publish papers in top tier journals. Recruit and fill-up faculty position as quickly and appropriately as possible. Enhance interaction with FAU Pillars.

Outcome 2. Advanced level knowledge in mathematics, science, and engineering subjects.

Implementation Strategy. The outcome is achieved through coursework and qualifier-examination requirements. PhD degree requirements include completion of 45 credits of coursework (beyond the Bachelor's degree) which include core courses in mathematics, oceanography and in student's field of specialization. The qualifier examination tests students' knowledge in both core and electives courses and the outcome is assessed based on students' performance in the qualifier examination.

Assessment Method. [1] To advance to candidacy, a Ph.D. student must pass written qualifier examinations, which test at an advanced level the student's knowledge in mathematics, science, and engineering subjects. The written examination is conducted in three core subjects (Physical Oceanography, Advanced Engineering Analysis, and first advanced-level subject in the field of specialization such as Adv. Hydrodynamics I, Corrosion I, Acoustics I, etc.) and in three elective subjects (in the field of specialization such as Hydrodynamics, Structures, Materials, Acoustics, Underwater Vehicles, etc.) [2]Using the assessment tool (Appendix A - Form 11) the dissertation committee will also evaluate the achievement of this outcome.

Criterion for success. [1] A student must score above 70% in all the subjects in the written examination. A student who scores below 70% but above 50% may retake the entire examination for the second and final time.
Two-thirds of the Ph.D. students passing the qualifier examination in the first attempt is considered as a measure of satisfactory performance. [2]In the assessment of the outcome by the dissertation committee, at the least 75% of the graduates must obtain a ranking of satisfactory or above.

Data Summary (2016-17). [1] All students score above 70% in all the subjects in the written examination. [2] In the assessment of the outcome by the dissertation committee, all of the graduates obtain a ranking of satisfactory or above.

Program Improvement. We are looking into the improvement of qualifying exam to strengthen our Ph.D. program.

Outcome 3. An ability to effectively communicate topics in engineering and science.

Implementing Strategy
The outcome is achieved through requirements on writing and defending of dissertation and publication in refereed conferences and journals.

Assessment Method
[1] Prior to graduation, Ph.D. candidates are expected to have at least one paper published in a refereed technical conference proceedings, or one paper published or accepted for publication in a refereed journal as the principal author. [2] In addition the quality of the research and dissertation will be assessed by the dissertation committee (Appendix A –Form 11) and the Dean of Engineering (Appendix A – Form 12) using an evaluation instrument.

Criterion for success
[1] Above 90% of PhD graduates, must have at least one refereed publication prior to graduation. [2] In the assessment of the outcome by the committee, at the least 75% of the graduates must obtain a ranking of satisfactory or above.

Data Summary (2016-17)
[1] All Ph.D. graduates publishing at least in one refereed technical conference proceedings, or having one paper published or accepted for publication in a refereed journal. Five Ph.D. graduates together, at the time of dissertation defense, has 6 refereed journal papers published, 8 refereed journal papers under review, and 8 papers published refereed technical conference proceedings.
[2] In the assessment of the outcome by the committee, all the graduates obtain a ranking of satisfactory or above.

IMPROVEMENTS/CHANGES:

Recruit best students with fellowships and assistantships, filled up faculty vacancy quickly and hire the best in the field. Overall, year after year, the PhD program has satisfactorily achieved the outcomes and its goals. The graduation number is increasing. Considerable efforts have been made through fellowship and scholarship programs to increase the PhD enrollment. The focus of the graduate program effort is to not only increase enrollment but also ensuring that the candidates complete the requirements for the degree in a normative time of not more than three years after MS.

C.2.11. Curriculum. The program options and curriculum for the Ocean and Mechanical Engineering programs is described below.

MSME Program Options

MS Thesis Option. Candidates for the Master of Science degree with the thesis option must complete an approved program of at least 30 credits including:

1. Three core courses (9 credits): EGM 6533, Advanced Strength of Materials; EML 6223, Mechanical Vibrations or EML 6317 Advanced Control Systems; and EML 6716 Advanced Fluid Dynamics;
2. A math course (3 credits): either PHZ 5115 Mathematical Physics, or EOC 5172, Mathematical Methods in Ocean Engineering 1;
3. Four technical electives (12 credits);
4. Before the end of the student's third semester of full-time enrollment, a written thesis proposal must be submitted to the supervisory committee and defended in an oral examination;
5. A Master's thesis (6 credits), which must be defended at an oral examination;
6. At least one-half of the credits must be at the 6000 level or above;
7. At least one-half of the credits must be from the list of Mechanical Engineering courses shown in the Engineering and Computer Science Course Descriptions section.

<u>MS Non Thesis Option.</u> Candidates for the Master of Science degree with the non-thesis option must complete an approved program of at least 33 credits including:

1. Three core courses (9 credits): EGM 6533, Advanced Strength of Materials; EML 6223, Mechanical Vibrations or EML 6317 Advanced Control Systems; and EML 6716 Advanced Fluid Dynamics;
2. A math course (3 credits): either PHZ 5115 Mathematical Physics, or EOC 5172, Mathematical Methods in Ocean Engineering 1;
3. Seven technical electives (21 credits); at the 5000- or 6000-levels; one course may be at the 4000 level;
4. At the time of application for degree, students must submit a portfolio to their advisor consisting of four graduate projects from 11 courses in their program of study. The portfolio will be reviewed by the student's supervisory committee;
5. At least one-half of the credits must be at the 6000 level or above;
6. At least one-half of the credits must be from the list of Mechanical Engineering courses shown in the Engineering and Computer Science Course Descriptions section.

<u>MSME Core Course Requirements.</u> All MS graduate students, regardless of option or specialty, must complete the following core courses or must offer a satisfactory substitute course of similar content from another university or an appropriate substitute consistent with the student's specialty for approval by the supervisory committee via a departmental petition:

- EGM 6533 Advanced Strength of Materials
- EML 6715 Fluid Dynamics 1
- EML 6223 Mechanical Vibration or EML 6930 Control

MSOE Program Options

<u>MS Thesis Option.</u> The MS thesis option requires a minimum of 30 credits, including a minimum of 6 thesis credits. At least 15 of the credits must be taken from the ocean engineering core course list. In addition, 9 credits will be selected in consultation with the student's advisor. At least 15 of the 30 credits must be at or above the 6000 level. No 4000 level courses are allowed. Students electing the thesis option

will be required to complete the thesis program, which includes successful defense and completion of the thesis.

MS Non-Thesis Option. This option requires a minimum of 33 credits. At least 15 of the credits must be taken from the ocean engineering core course list. In addition, 18 credits will be selected in consultation with the student's advisor. No thesis credits may be counted toward this degree. Additionally, 24 of the 33 credits must be at or above the 5000 level.

MSOE. Core Course Requirements. All MS graduate students, regardless of option or specialty, must complete the following core courses or must offer a satisfactory substitute course of similar content from another university or an appropriate substitute consistent with the student's specialty for approval by the supervisory committee via a departmental petition:

- Mathematical Methods in Ocean Engineering I* (EOC 5172)
- Engineering Data Analysis (EOC 6635)
- Physical Aspects of Oceanography (OCP 6050)

In addition, two of the following five courses must be taken:

- Advanced Mechanics of Materials** (EOC 6533)
- Mathematical Methods in Ocean Engineering II* (EOC 6174)
- Advanced Hydrodynamics I (EOC 6185)
- Corrosion I (EOC 6216C)
- Engineering Principles of Acoustics (EOC 6317C)
- Special Topics (EOC 6934)

* Students with an advanced mathematics competency may obtain exemption upon entrance to the program for Mathematical Methods in Ocean Engineering I (EOC 5172) and/or Mathematical Methods in Ocean Engineering II (EOC 6174). These students must demonstrate to their advisor, using course descriptions, that the equivalent of five to six courses beyond calculus, including areas such as differential equations, advanced calculus, matrix theory, complex analysis, and probability and statistics have been taken. Approval by the graduate programs committee is also required.

** May be substituted with Theory of Elasticity (EOC 6934).

C.2.12. Advising Procedure. Advising for the graduate programs is administered by the Director of Graduate Programs and the Associate Chair, Dr. Tsung Su. Dr. Su together with the graduate committee will evaluate applications, recommend support, advise students on what courses to take for both programs, and oversees student progress.

C.3 Faculty

C.3.1 Administrative Structure.

The departmental leadership consists of the Chair (reports to the Dean), Director of Undergraduate Program (reports to the Chair), Director of Graduate Program (reports to the Chair), Undergraduate Affairs Committee (reports to the faculty and Chair), Graduate Affairs Committee (reports to the faculty and

Chair), Personnel Committee (reports to the Chair), and Departmental Resources Committee (reports to the Chair). Ad-Hoc committees are assigned as needed for faculty hiring, laboratory needs, etc.

The above structure is adequate to ensure the quality of the program and is based on shared governance and shared leadership concept. The faculty is involved in all decisions that affect the program. All undergraduate and graduate instructional educational issues are tackled by the respective committees. The recommendations of the committees are then discussed with other faculty and the Chair in a departmental meeting and a final decision is made. Over the past few years, the majority of the decisions have been made based on consensus.

The department Chair meets with Dean on a regular basis and discusses various issues facing the department. The Dean is made aware of all challenges, successes and pitfalls facing the department. The Dean and the Chair work together to address the needs of the department. The administrative structure of the program is presented in Figure 19.

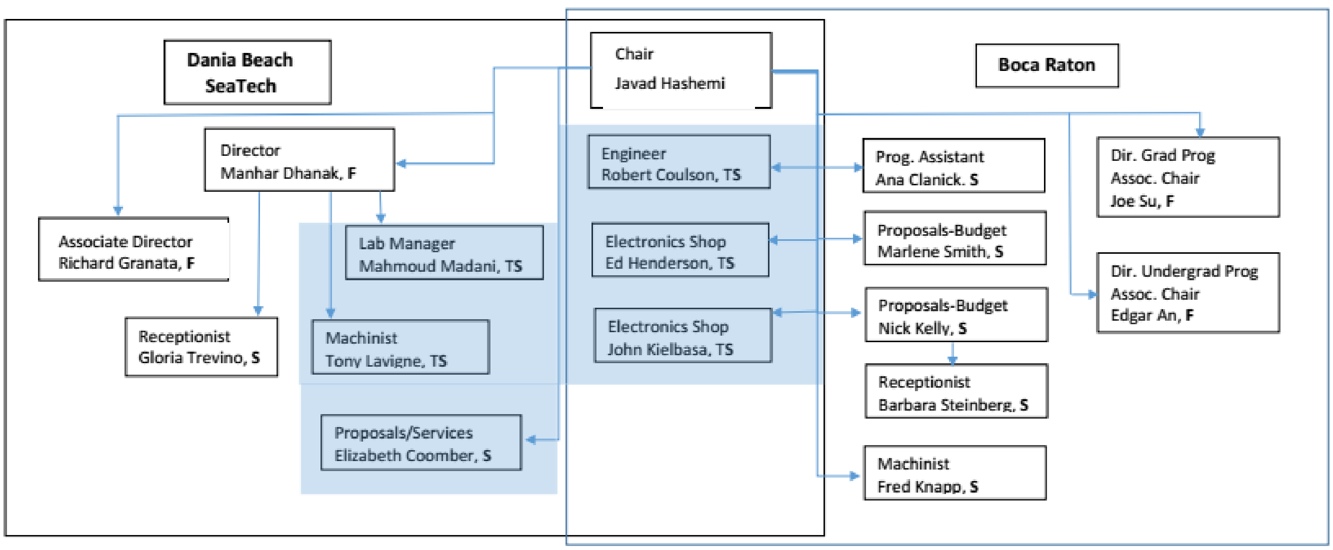


Figure 19. The Ocean And Mechanical Engineering Organizational Chart.

C.3.2Faculty profile. As discussed previously, the total current headcount for the faculty in the Ocean and Mechanical Engineering Department is 25. In terms of gender and ethnicity, the faculty of the department is diverse consisting of Asian (10), Hispanic (2) and various White ethnicities (13). During our recent hiring efforts, we were able to recruit two outstanding female professors. We hope to grow the diversity in the department further during our next round of hiring. The list of all active faculty and brief information regarding background is presented in Table 12. The breakdown according to rank of the faculty is given in the Table 13.

Table 12. Faculty Profiles.

Name	Rank	Type of Academic Appointment TT, T, NTT	FT or PT	Terminal Degree				Professional Registration/ Certification	Level of Activity (high, med, low, none) in:		
					Govt./Industry Practice	Teaching	This Institution		Professional Organizations	Professional Development	Consulting /Summer Work in Industry
AN	Prof. OE	T	F	PhD	0	23	23	N	M(ASEE)	H	N
Abtahi	Assoc. Prof. ME	T	F	PhD	0	34	34	FL	H	M	Y
BEAUJEAN	Prof. OE	T	F	PhD	7	14	14	N	M (ASA, IEEE, MTS)	H	M
Cai	Prof. ME	T	F	PhD	0	29	23	N	H	M	L
Carlsson	Prof. ME	T	F	PhD	3	29	29	FL	M	L	H
Curet	Asst. Prof. OE	TT	F	PhD	0	4	4	N	M(ASME)	H	N
DHANAK	Prof. OE	T	F	PhD	7	27	27	N	H (SNAME, APS, ASEE, ASME, ASNE, AIAA)	H	N
Du	Asst. Prof. ME	TT	FT	PhD	0	3	3	N	ASME	N/A	N/A
Engeberg	Assoc. Prof. ME/OE	T	FT	PhD	0	9	3	N	ASME	N/A	N/A
Gaonkar	Prof. ME	T	FT	PhD	1	50	33	FL	M	H	L
Glegg	Prof. OE	T	F	PhD	8	38	32	FL	H (ASA, AIAA, SNAME, AMS)	H	N
Granata	Prof. OE	T	F	PhD	1	40	18	N	L (ACS, ECS, NACE, ASTM)	H	L

Elishakoff	Prof. ME	T	F	PhD	0	46	27	N	H	H	L
Hashemi	Prof. ME	T	F	PhD	1	29	6	N	M	M	L
Kang*	Asst. Prof. ME	TT	F	PhD	0	3	3	N	N/A	N/A	N/A
Kim	Asst. Prof. ME	TT	F	PhD	0	2	2	N	N/A	N/A	N/A
Mahfuz	Prof. OE	T	F	PhD	10	27	9	N	ASME, Fellow	H	L
Masory	Prof. ME	T	F	PhD	3	34	29	N	M	M	H
Moslemian	Assoc. Prof ME	T	F	PhD	0	30	30	FL	M	H	H
Presuel-Moreno	Assoc. Prof. OE	T	F	PhD	8	11	11	N	M (NACE, Electrochem Soc, ACI, TRB)	M	N
Salivar	Prof. ME	T	F	PhD	5	35	35	FL	M	M	L
Schock	Prof. OE	T	F	PhD	6	22	22	RI	M (SEG, IEEE, ASA)	H	H
Seiffert*	Asst. Prof. OE	TT	F	PhD	4	1	1	N	L SNAME	N/A	M
Su	Prof. ME	T	F	PhD	0	41	35	N	H	H	L
Tsai	Prof. ME	T	F	PhD	3	27	27	N	M	M	L

Table 13. Number of Faculty at Different Ranks.

Faculty	FTE
Full Professors	16
Associate Professors	4
Assistant Professors	5
Emeritus Professors	0

C.3.3 Faculty workload. The requirements for faculty workload in the State of Florida University System are the equivalent of 12 hours for full time faculty for 100% time. An assigned undergraduate course is normally 3 hours or 25% time. Additional percentage may be awarded for a large section of the course or for development of a new course (this generally may range from 5%-8%). A graduate course is normally 25% but may be awarded additional percentage for distance learning sections. Other instructional percentage is awarded for graduate student supervision or participation on graduate committees. Faculty involved in sponsored research may buyout for up to two courses (50% time). Faculty involvement in departmental research which includes publication, presentation at conferences, and proposal preparation and submission is available up to 25% time. Each faculty member must be assigned a minimum of 5% time for service on department, college or university committees. Service assignment may also include laboratory responsibilities, program coordination, ABET responsibilities, and professional society activities. Departmental service assignments may not exceed 20% time. In consultation with the faculty member, the Chair will develop the assignment for each faculty member from these different categories to total 100% time.

D. Research

D.1 funding. The research activities in the department of Ocean and Mechanical Engineering are substantive. The Ocean Engineering program has an impressive record of research in the area of naval architecture, surface and underwater vehicles, marine materials, acoustic communication and imaging, and hydrodynamics. The faculty of Ocean Engineering receive funding from Office of Naval Research (ONR) and other Navy related sources. The department of Mechanical Engineering is also research active in the area of Materials Science with funding from ONR as well.

Over the past 6 years, we focused on maintaining our research strength in the Ocean Engineering but at the same time expand our funding base beyond ONR to other agencies such as National Science Foundation (NSF), National Institute of Health (NIH), Department of Energy, and other agencies. In FY 12, our goal was to reach $4M dollars of new funding in six years and we achieved that in FY 16. FY 17 was less successful but our efforts in FY 18 have resulted in significant new funding and we hope to reach $3M in new funding in FY 18. To achieve this goal we hired six new faculty members with expertise that could help us expand our funding base. The faculty are mentored at the university level through the Office of Vice President of Research (OVPR) and at the departmental levels through interaction with department Chair and assignment of faculty mentors. Specifically, OVPR offers workshops for proposal writing, mentorship awards, and overall assistance in proposal development and submission. This strategy has paid off and we have been able to receive substantial funding from NSF, NIH, DOE, and FAA. Table 14 presents the number of proposals funded and the total new awards for the past 6 years; for FY 2018 we have commitments for $2.6M from various agencies and to this point approximately $900K is dedicated to FY2018.

Table 14. Recent History of Awards Received. (Source: OME, Nicholas P. Kelly)

Awards Received for Ocean & Mechanical Engineering Per Fiscal Year (in millions)											
Fiscal Year 2012 (7/1/11-06/30/12)		Fiscal Year 2013 (7/1/12-06/30/13)		Fiscal Year 2014 (7/1/13-06/30/14)		Fiscal Year 2015 (7/1/14-06/30/15)		Fiscal Year 2016 (7/1/15-06/30/16)		Fiscal Year 2017 (7/1/16-06/30/17)	
#	$	#	$	#	$	#	$	#	$	#	$
26	$ 2.3	18	$ 0.9	22	$ 1.3	19	$ 1.6	27	$ 4.2	15	$ 1.6

The research expenditure history is presented in Figure 15. It is safe to suggest that the average research expenditure for the department is close to $2M/yr. This is a competitive research expenditure average for a department of similar size to ours.

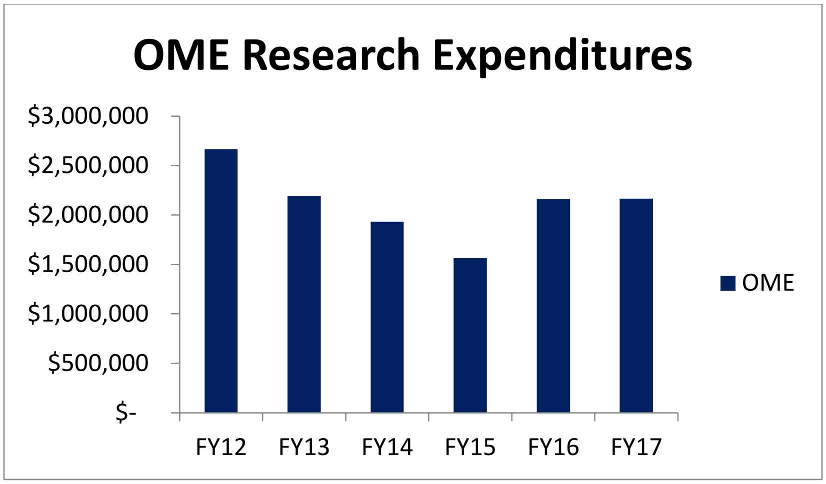


Figure 15. Research Expenditure History for the Ocean and Mechanical Engineering Department. (Source: CECS, Lynn Asseff)

A list of current active awards including the source of funding is presented in the table 16.

Table 16. Current Active Awards and the respective PIs. (Source: OME. Nicholas P. Kelly)

AWD-000214: ONR-Advancing Analytical and LES-Based Predictions 04/01/2014 (version 2)	ONR-Advancing Analytical and LES-Based Predictions of Turbulence Ingestion Noise in Complex Environments	Dr. Stewart A Glegg (Z00008493)
AWD-000215: EdgeTech-Testing and Evaluation of CHIRP SAS Techn 05/01/2014 (version 2)	EdgeTech-Testing and Evaluation of CHIRP SAS Technology	Dr. Steven G Schock (Z00009552)
AWD-000219: Stevens Inst Tech-Atlantic Ctr for Innovative Desi 04/01/2010 (version 1)	Stevens Inst Tech-Atlantic Ctr for Innovative Design and Control of Small Ships Studies on SWACH Trimaran and Unmanned Surface Vessel	Dr. Manhar R Dhanak (Z00011981)
AWD-000224: Clarkson Aerospace Corp-AFRL Collaboration Program 09/03/2013 (version 4)	Clarkson Aerospace Corp-AFRL Collaboration Program - Materials and Research	Dr. Hassan Mahfuz (Z00017275)

AWD-000226: FLDOT-Concrete Pipe - Electrochemical Cell, Phase 03/18/2014 (version 3)	FLDOT-Concrete Pipe - Electrochemical Cell, Phase II	Dr. Francisco Presuel-Moreno (Z00019557)
AWD-000229: FLDOT-Environmental Suitability of Weathering Stee 05/29/2014 (version 2)	FLDOT-Environmental Suitability of Weathering Steel Structures in Florida - Material Selection, Phase 2	Dr. Richard D Granata (Z00006803)
AWD-000232: FLDOT-Durability of fiber reinforced concrete pip 11/15/2014 (version 0)	FLDOT- Durability of fiber reinforced concrete pipe exposed to Florida aggressive environments	Dr. Francisco Presuel-Moreno (Z00019557)
AWD-000726: ONR - USV Platforms for Multi-UXV operations in Su 05/20/2015 (version 4)	ONR - USV Platforms for Multi-UXV operations in Support of Surface Autonomy	Dr. Manhar R Dhanak (Z00011981)
AWD-000762: SIT - Maritime Security Center (MSC) 06/01/2015 (version 2)	SIT - Maritime Security Center (MSC)	Dr. Manhar R Dhanak (Z00011981)
AWD-000763: NSU - Electromagentic Observatory in the Straits o 05/18/2015 (version 1)	NSU - Electromagentic Observatory in the Straits of Florida: Oceanographic Perspective	Dr. Manhar R Dhanak (Z00011981)
AWD-000766: NSF - NRI: Small EEG and EMG Human Model-Based Ada 05/27/2015 (version 1)	NSF - NRI: Small EEG and EMG Human Model-Based Adaptive Control of a Dexterous Aftifical Hand	Dr. Erik D Engeberg (Z23317180)
AWD-000799: NSF - CRII:SCH: A smart biosensor for monitoring c 07/10/2015 (version 1)	NSF - CRII:SCH: A smart biosensor for monitoring cell sickling in patients with sickle cell disease	Dr. Sarah Du (Z23317026)
AWD-000868: NSF - NRI: Collaborative Research: Enabling Risk-A 10/05/2015 (version 0)	NSF - NRI: Collaborative Research: Enabling Risk-Aware Decisions Making in Human-Guided Unmanned Surface Vehicle Teams	Dr. Karl D Von Ellenrieder (Z00008180)
AWD-000916: FLDOT - Chloride diffusivity and resistivity of cu 12/21/2015 (version 0)	FLDOT - Chloride diffusivity and resistivity of cured and mature binary/ternary concrete	Dr. Francisco Presuel-Moreno (Z00019557)

AWD-000917: FLDOT - Corrosion propagation of carbon steel reba 12/21/2015 (version 0)	FLDOT - Corrosion propagation of carbon steel rebars in high performance concrete	Dr. Francisco Presuel-Moreno (Z00019557)
AWD-000918: NIH - Development of multifunctional biodegradable 01/13/2016 (version 2)	NIH - Development of multifunctional biodegradable drug-loaded polymer stents for inoperable esophageal malignancies	Dr. Yunqing Kang (Z23317108)
AWD-000920: FLDOT - Corrosion prevention of bridge tendons usi 01/15/2016 (version 1)	FLDOT - Corrosion prevention of bridge tendons using flexible filler materials	Dr. Francisco Presuel-Moreno (Z00019557)
AWD-000942: NSWC - Adaptive Sensing in Challenging Underwater 02/18/2016 (version 4)	NSWC - Adaptive Sensing in Challenging Underwater Environments Using Multiple Autonomous Vehicles	Dr. Manhar R Dhanak (Z00011981)
AWD-000949: FLDOT - Durability of Fiber Reinforced Concrete Pi 03/15/2016 (version 0)	FLDOT - Durability of Fiber Reinforced Concrete Pipe Exposed to Florida Aggressive Environments	Dr. Francisco Presuel-Moreno (Z00019557)
AWD-000972: ONR - The Influence of Transverse Shear Loading on 04/09/2016 (version 1)	ONR - The Influence of Transverse Shear Loading on Face/Core Debonding and Crack Kinking in Foam Core Sandwich Structure	Dr. Leif A Carlsson (Z00010298)
AWD-000973: NSF - Multiscale modeling of water absorption and 06/01/2016 (version 0)	NSF - Multiscale modeling of water absorption and mechanical strength of polymer matrix composite materials containing voids	Dr. Sarah Du (Z23317026)
AWD-001017: ONR - 11th International Conference on Sandwich St 06/01/2016 (version 0)	ONR - 11th International Conference on Sandwich Structures (ICSS 11)	Dr. Leif A Carlsson (Z00010298)
AWD-001019: ONR - Volumetric PIV system for research on flexib 07/15/2016 (version 1)	ONR - Volumetric PIV system for research on flexible propulsors	Dr. Oscar Curet (Z23234163)

AWD-001038: NSF - Dynamic and Fatigue Analysis of Healthy and 09/01/2016 (version 0)	NSF - Dynamic and Fatigue Analysis of Healthy and Diseased Red Blood Cells	Dr. Sarah Du (Z23317026)
AWD-001042: IHI - Fatigue Life Prediction of Composite Structu 07/19/2016 (version 1)	IHI - Fatigue Life Prediction of Composite Structures Under Ocean Current Loan Spectra	Dr. Hassan Mahfuz (Z00017275)
AWD-001071: NIAA - Study Damage Modes in Lightweight Sandwich 07/13/2016 (version 0)	NIAA - Study Damage Modes in Lightweight Sandwich Structures Using Analysis and Testing	Dr. Leif A Carlsson (Z00010298)
AWD-001098: OSF - Multiple channels in bioceramic scaffolds pr 08/01/2016 (version 0)	OSF - Multiple channels in bioceramic scaffolds promote rapid vascularization and robust bone formation	Dr. Yunqing Kang (Z23317108)
AWD-001100: Contech - Galvanic Coupling of Aluminum Pipe and G 09/30/2016 (version 1)	Contech - Galvanic Coupling of Aluminum Pipe and Galvanized Hardware in Soils	Dr. Francisco Presuel-Moreno (Z00019557)
AWD-001132: UCF - Hybrid Rocket Competition 2016-2017 10/01/2016 (version 0)	UCF - Hybrid Rocket Competition 2016-2017	Dr. Javad Hashemi (Z23133951)
AWD-001258 IHI - Fatigue Modeling of Composite Structures and Flow Characterization of Ocean Current Turbine	IHI - Fatigue Modeling of Composite Structures and Flow Characterization of Ocean Current Turbine	Dr. Hassan Mahfuz (Z00017275)
AWD-001273 ONR - The Response of a Rotor to Transient Inflows: Analytical Study	ONR - The Response of a Rotor to Transient Inflows: Analytical Study	Dr. Stewart A Glegg (Z00008493)
AWD-001291 Sandia - Metal-Carbon Fiber Composite Interconnects in Seawater	Sandia - Metal- Carbon Fiber Composite Interconnects in Seawater	Dr. Francisco Presuel-Moreno (Z00019557)
AWD-001316 NIH - Placenta-on-a-Chip Sensing Platform to Study Placental Malaria	NIH - Placenta-on-a-Chip Sensing Platform to Study Placental Malaria	Dr. Sarah Du (Z23317026)
AWD-001331 SFSCA - Development of an Artificial Hand Exhibit	SFSCA - Development of an Artificial Hand Exhibit	Dr. Erik D Engeberg (Z23317180)

AWD-001333 NIH - Virtual Neuroprosthesis: Restoring Autonomy to People Suffering from Neurotrama	NIH - Virtual Neuroprosthesis: Restoring Autonomy to People Suffering from Neurotrama	Dr. Erik D Engeberg (Z23317180)

Figure 19 shows the distribution of funding based on funding source among active research accounts. This distribution is reasonably balanced and ideal for a research intensive department.

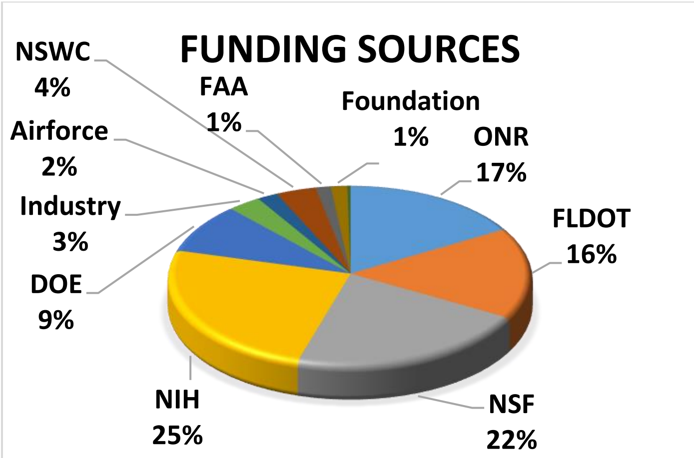


Figure 19. Distribution of active funding based on funding agency. (Source: OME, Nicholas P. Kelly and J. Hashemi)

Research trajectory and sustainability of funded research productivity in the OME department: Although both ME and OE programs are currently very active in the area of funded and unfunded research, the sustainability of research funding is a problem that faces all universities. It is a well-known fact that the growth in federally funded R&D is slow and also the state and federal earmarks that used to be readily available are no longer as accessible. We have taken the following steps to assure sustainability:

1- Hired 6 new faculty in areas of research important to the state of Florida and nation as a whole including expertise in robotics, sensors, bioinspired engineering, and biomedical fields.

2- We plan to hire three additional professors in the coming year in areas that complement our existing Ocean Engineering research.

3- The new faculty recruits are selected such that not only can they initiate their own lines of research but also can collaborate with colleagues from other disciplines. This strategy promotes synergy which is crucial for us to maintain our research productivity in the future.

4- Sustainability of funding partly depends on the number of proposals submitted. The OME departmental is very aggressive in writing and submitting high quality proposals. Over the past six years our proposal submission rates to competitive funding agencies has been at 43 proposals per year which translates to 1.7 proposals per faculty per year. We have started to reward effort in securing and success in funded research. As a result, we hope to increase the number of proposals submitted to 3 proposals per faculty per year.

5- We have a strong focus on competitive and stable funding sources. Also we have expanded our funding base to multiple funding agencies including ONR, FDOT, NSF, DOE, and NIH.

Finally, the average rate of new funding received over the past 6 years has been approximately $2M/yr while the average research expenditure over the same period has been $2.1M/yr. In terms of research trajectory, although we are still in a state of flux, we believe that we can increase our newly funded annual research dollars to $2.6M- $4.2M range based on the number of faculty in our department. However this will be a challenging task and requires taking full advantage of all of our strengths. Overall, the historical research data, our strategies for maintaining competitiveness, quality of our new recruits, and our funding and expenditure rates portend a stable and sustainable research enterprise for the department for the coming decade.

D.2 Publications. The number of publications and other scholarly activities in the department over the past 6 years are presented in Table 16. Based on the FY 16 data, the number of publications in the department is 62 which results in an annual publication productivity of 2.5 per faculty. Our goal is to reach three publications per faculty per year.

In addition to the journal publications, our faculty have been involved in publishing books in their disciplinary areas. A selection of the noteworthy books published recently is presented below:

- M. Dhanak and N. I. Xiros (Eds.), ***Springer Handbook of Ocean Engineering***, 2016.
- Elishakoff, D. Pentaras, and C. Gentilini, ***Mechanics of Functionally Graded Material Structures***, World Scientific, 2017.
- R. Messenger and A. Abtahi, ***Photovoltaic Systems Engineering***, CRC Press, 2017.
- G. cai and W.Q. Zhu, ***Elements of Stochastic Dynamics***, World Scientific, 2017.
- S. Glegg and W Davenport, Aeroacoustics of Low Mach Number Flows, ***Fundamentals Analysis, and Measurement***, Academic Press, 2017.
- Isaac Elishakoff, ***Probabilistic Methods in the Theory of Structures, Strength of Materials, Random Vibrations***, and Random Buckling, World Scientific, 2016.

D.3 Interdisciplinary efforts. We have strategically hired new faculty in areas that could establish interdisciplinary research efforts with other departments in the college and with other colleges as well as increasing our collaborations with newly formed multidisciplinary Pillars of research at FAU (including ISENSE and HBOI Harbor Branch). Our most successful interdisciplinary collaborations have been with the College of Medicine. We have recently received two major NIH grants in collaboration with School of Medicine and Biomedical Sciences.

D.4 Establishment of goals for research. Our research and scholarly goals over the next six years are as follows:

- Maintain an average new funding record of $2.6M to $4.2M annually (~100k to 150K per faculty per year)

- Engage in both basic and applied research
- Engage in state of the art research
- Reach a publication record of 3 articles per faculty per year
- Publish in high impact journals in the field
- Continue participation in large multidisciplinary research efforts
- Continue publishing textbooks and research monographs in the field of faculty expertise
- Engage the community in our research activities

Table 16. Recent History of Publication Productivity. (Source: http://www.fau.edu/iea/data/deptreview.php)

	Ocean and Mechanical Engineering			College Total	University Total
	2013-2014	2014-2015	2015-2016	2015-2016	2015-2016
1. Books (including monographs & compositions)	4	7	6	23	105
2. Other peer-reviewed publications	65	64	62	337	1,124
3. All other publications	19	14	19	83	582
4. Presentations at professional meetings or conferences	35	61	51	224	1,377
5. Productions/Performances/Exhibitions	0	4	2	10	233

E. Service and Community Engagement

Our department is heavily engaged in national and international as well as community service. The service in the form serving as reviewers and editors for journals, participating in national and international conferences as Chairs and Co-Chairs, and participating in national disciplinary societies. Furthermore, we have been involved with teacher training workshops, k-12 summer workshop activities, and other community outreach activities.

F. Other Program Goals

Our program goals are to:

- Increase enrollment of high quality undergraduate students through better recruitment
- Increase enrollment of high quality MS and PhD students through more active recruitment
- Increase degree productivity at all levels (BS through PhD) through in-time advising
- Engage in continuous improvement of our programs at all levels through updated curricula
- Become ranked in existing ranking systems

G. Strengths and Opportunities

The strengths of our programs are as follows:

- Strong research growth in new emerging areas
- Opportunity to work with our growing Pillars at FAU
- Outstanding faculty and great staff support
- Good research facilities
- Improving graduate program quality and productivity
- Improving undergraduate program quality and productivity
- Strong undergraduate club and society activities

H. Weakness and Threats

The following weakness and threats have been identified for our programs:

- Faculty salaries are low
- Slow process of replacing faculty leaving due to retirement or other reasons
- Faculty and technical staff retention strategies need be developed
- Investment in infrastructure repair and upkeep specifically the poor state of bldg. 36
- We need more faculty at the assistant professor level
- We need more lab space and improved support facility
- Lack of funds for research equipment maintenance
- The OE program is a specialty program and needs continuous recruitment
- Program ranking
- Students' Math performance

We invite the reviewers to comment on our weaknesses and threats and also if possible make comments/suggestions on the following specific questions:

What are some of the strategies that you have used in your institution to improve college and departmental raking and visibility?

What are some of the strategies that you have used in your institution to improve student performance in mathematics?

What are some of the strategies that you have used in your institution to improve research equipment maintenance?

What are some of the strategies that you have used in your institution to generate revenue for your units?

I. Resource Analysis

The program budget is determined by the Dean's Office according to the overall goals of the College. The Dean's Office provides annual funding for purchasing instructional, machine shop, and electronic shop equipment. The Chairs and the Dean constantly discuss ways of providing the resources needed to maintain the quality of the educational programs.

Sources of Financial Support

The sources of financial support include the following:

1. The annual budget supplied by the Dean's Office
2. The instructional equipment support provided by the Dean's Office
3. A portion of the overhead charged on research grants that is returned to the department
4. Funds received from laboratory fees for various courses in the curriculum
5. Undergraduate research funds are available through office of Quality Enhancement Program

We need more resources for graduate student (TA) support and for departmental operations.

J. Future Directions

In terms of Research, future directions will be based on synergy developed in the department, college and across the university and it will depend on the successful hiring efforts in the OE program. But we foresee the following directions for the whole department in terms of research, education, and service activities:

- Increase funding in large scale multidisciplinary areas (ocean science and biomedical)
- Improve educational quality and become the best engineering program in the state in terms of producing effective engineers
- Become more active in service at the national and international levels – specifically journal editorships

K. Student Feedback

The following is a synopsis of student feedback in the ME and OE programs. In general the student's feedback indicates that majority of students have had a good to excellent experience at FAU. The data also indicates that OE graduates have a higher excellent rating than ME graduates. This could be due to the difference in size of the two programs; the ME program is significantly larger and therefore larger senior classes. Furthermore, the data indicates that a good portion of students have an offer from industry prior to graduation. The data also shows that a good percentage of the students in both programs consider pursuing a graduate degree.

OE Program Educational Experience Data (Source: CECS, Teresa Perez and Stephanie Waldorf)

Spring 2015 21 students

1. My overall educational experience at FAU was:

	Excellent	Good	Average	Below Average	Poor
Total:	**7**	**13**	**1**		

2. My educational experience in OE was

	Excellent	Good	Average	Below Average	Poor
Total:	9	9	3		

- 85% of the graduates rate the program as good or excellent.

3. Do you plan on pursuing a Masters Degree?

	Yes	No	Unsure
Total:	10	5	6

- 47% of graduates plan to pursue a Masters degree

4. Do you have a full-time engineering position (or an offer)

	Yes	No	Negotiating
Total:	6	12	3

- 42% of students have a job offer or are negotiating prior to graduation.

Spring 2016 35 Students

1. My overall educational experience at FAU was:

	Excellent	Good	Average	Below Average	Poor
Total:	7	24	3		1

2. My educational experience in OE was

	Excellent	Good	Average	Below Average	Poor
Total:	11	20	3	1	

- 88% of the graduates rate the program as good or excellent.

3. Do you plan on pursuing a Masters Degree?

	Yes	No	Unsure
Total:	**13**	**8**	**14**

- **37% of graduates plan to pursue a Masters degree**

4. Do you have a full-time engineering position (or an offer)

	Yes	No	Negotiating
Total:	**10**	**23**	**2**

- **34% of graduates have received an offer or are negotiating prior to graduation**

ME Program Educational Experience Data

Spring & Summer
2013

1. My overall educational experience at FAU was:

	Excellent	Good	Average	Below Average	Poor
Total:	2	9	8	1	

2. My educational experience in ME was

	Excellent	Good	Average	Below Average	Poor
Total:	3	10	6	1	

- **65% of the graduates rate the program as good or excellent.**

3. Do you plan on pursuing a Masters Degree?

	Yes	No	Unsure
Total:	8	5	7

- **40% of the graduates plan to pursue a Masters degree.**

4. Do you have a full-time engineering position (or an offer)

	Yes	No	Negotiating
Total:	6	11	3

- **45% of graduates have a job offer or are negotiating prior to graduation.**

Fall 2013

1. **My overall educational experience at FAU was:**

	Excellent	Good	Average	Below Average	Poor
Total:	1	21	6	2	1

2. My educational experience in ME was

	Excellent	Good	Average	Below Average	Poor
Total:	2	21	7	1	

- **74% of the graduates rate the program as good or excellent.**

3. Do you plan on pursuing a Masters Degree?

	Yes	No	Unsure
Total:	9	6	16

- **29% of the graduates plan to pursue a Masters degree**

4. **Do you have a full-time engineering position (or an offer)**

	Yes	No	Negotiating
Total:	8	17	6

- **45% of graduates have a job offer or are negotiating prior to graduation.**

Spring & Summer 2014

1. My overall educational experience at FAU was:

	Excellent	Good	Average	Below Average	Poor
Total:	2	19	5	1	

2. My educational experience in ME was

	Excellent	Good	Average	Below Average	Poor
Total:	2	20	5		

- **81% of the graduates rate the program as good or excellent.**

3. Do you plan on pursuing a Masters Degree?

	Yes	No	Unsure
Total:	9	5	13

- **33% of the graduates plan to pursue a Masters degree**

4. Do you have a full-time engineering position (or an offer)

	Yes	No	Negotiating
Total:	8	18	1

- **33% of graduates have a job offer or are negotiating prior to graduation.**

Appendix A

Mechanical Engineering Student Assessment Forms

Undergraduate Assessment:

The following forms are examples associated with assessing student performance based on the ABET accreditation outcomes a-k as shown below.

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

Each of the following three forms are used for each required course in the curriculum. Form three on Student Performance on Course Outcomes shows the relationship of the particular course outcomes to the ABET outcomes a-k.

Form 1: **Student Survey of Course Outcomes**:

Department of Mechanical Engineering
Student Survey of Course Outcomes

Course Number and Title: EML 4521 Engineering Design
Semester Taught: Fall 2017
Instructor: ____________________

Please use this form to rate your personal feelings of achievement of the published outcomes for the course as listed below. The following 0 to 5 rating scale should be used in assessing your achievement of the outcomes. This information will be presented for review to the Department ABET/SACS committee at the end of each semester. The committee will evaluate performance of the specified outcomes by the students and make recommendations for changes as appropriate.

5 - Complete understanding of the technical content of the outcome or the specified skills and a confidence in applying the techniques to engineering problems.

4 - Good understanding of the technical content of the outcome or the specified skills and an ability to apply the techniques to engineering problems.

3 - Adequate understanding of the technical content of the outcome or the specified skills and some ability to apply the techniques to engineering problems.

2 - Marginal understanding of the technical content of the outcome or the specified skills and some difficulty in applying the techniques to engineering problems.

1 - No understanding of the technical content of the outcome or the specified skills.

0 - Did not cover the information specified in the outcome in the class.

Outcome 1: The students will be able to formulate and analyze problems, and synthesize and develop solutions based on fundamental principles. ________

Outcome 2: The students will design basic mechanical components or processes to meet desired specifications using appropriate engineering tools and techniques.

____

Outcome 3: The students will demonstrate an understanding of professional, societal and ethical responsibility.

____

Outcome 4: The students will function effectively in teams and communicate their ideas to their peers.

____

Outcome 5: The students will recognize the need to engage in life-long professional development and learning.

Form 2: **Faculty Course Comments Form**:

Department of Mechanical Engineering
Faculty Course Comments Form

Course Number and Title: EML 4521C Engineering Design
Semester Taught: Fall 2017
Instructor:____

This form is to be used at the end of the semester to make comments about your experiences with the students in your class. Please make any comments that you feel are appropriate about positive or negative observations.

- Do you feel that the students had the necessary background from the prerequisite courses that they needed? Was remedial work necessary?

- Do you feel that they progressed throughout the semester as you planned?

- Please use the following 0 to 3 scale to rate your coverage of topics/skills of each outcome.

3 – Ample time to cover the topic/technical content of the outcome or the specified skills.

2 – Adequate time to cover the topic/technical content of the outcome or the specified skills.

1 – Limited time to cover the topic/technical content of the outcome or the specified skills.

0 – Did not cover the topic/technical content of the outcome or the specified skills.

Outcome 1: The students will be able to formulate and analyze problems, and synthesize and develop solutions based on fundamental principles.____

Outcome 2: The students will design basic mechanical components or processes to meet desired specifications using appropriate engineering tools and techniques.____

Outcome 3: The students will demonstrate an understanding of professional, societal and ethical responsibility. ____

Outcome 4: The students will function effectively in teams and communicate their ideas to their peers. ____

Outcome 5: The students will recognize the need to engage in life-long professional development and learning. ____

Please rate the overall class achievement of the course outcomes for your course using the following 0 to 5 scale.

5 – Students exhibited complete understanding of the technical content of the outcome or the specified skills and showed confidence in applying the techniques or skills.

4 – Students exhibited considerable understanding of the technical content of the outcome or the specified skills and showed an ability to apply the techniques or skills with few mistakes.

3 – Students exhibited a partial understanding of the technical content of the outcome or the specified skills but showed limited ability to apply the techniques or skills, often committing minor mistakes.

2 – Students exhibited little understanding of the technical content of the outcome or the specified skills and had difficulty in applying the techniques or skills to engineering problems.

1 – Students exhibited no understanding of the technical content of the outcome or the specified skills and were unable to apply them to engineering problems.

0 - Did not cover the information specified in the outcome in the class.

Outcome 1: The students will be able to formulate and analyze problems, and synthesize and develop solutions based on fundamental principles. ____

Outcome 2: The students will design basic mechanical components or processes to meet desired specifications using appropriate engineering tools and techniques. ____

Outcome 3: The students will demonstrate an understanding of professional, societal and ethical responsibility. ____

Outcome 4: The students will function effectively in teams and communicate their ideas to their peers. ____

Outcome 5: The students will recognize the need to engage in life-long professional development and learning.____

This information will be presented for review to the Department ABET committee at the end of each semester.

Form 3: Student Performance on Course Outcomes:

EML 4521 Engineering Design
Fall 2017
Student Performance on Course Outcomes

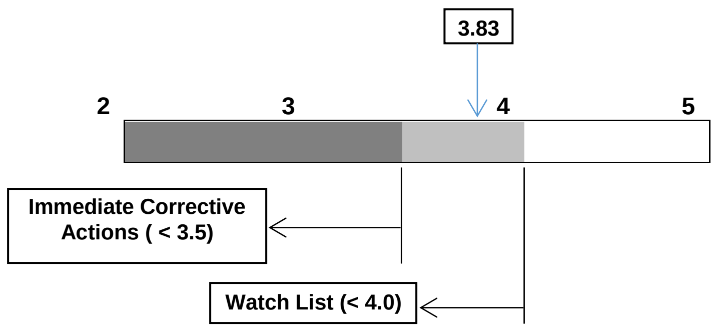
Outcome	Assignment	Course Assignment Assessment Ave (5pt max)	Student Survey Assessment Ave (5pt max)	Faculty Assessment Ave (5pt max)
1	Project proposal, HW assignments/exam			
2	Project proposal, HW assignments/exam			
3	HW assignments			
4	Project proposal, Presentations			
5	HW assignments			

Course Outcomes: (letters in parentheses indicate correlation of the outcome with the appropriate ABET program outcomes a-k)

1. The students will be able to formulate and analyze problems, and synthesize and develop solutions based on fundamental principles. (a,c,e,k)
2. The students will design basic mechanical components or processes to meet desired specifications using appropriate engineering tools and techniques. (a,c,e,k)
3. The students will demonstrate an understanding of professional, societal and ethical responsibility. (f,h,j)
4. The students will function effectively in teams and communicate their ideas to their peers. (d,g,j)
5. The students will recognize the need to engage in life-long professional development and learning. (i,j)

Form 4: Outcome Assessment Tool - The data from all of the required courses in the ME curriculum are used to provide an overall assessment of the student survey results, the faculty comment results and the student performance on outcomes results in relation to the ABET outcomes a-k. An example of one outcome (outcome a) for Student Performance on Course Outcomes is presented below:

Fall 2017 - Outcome Performance



Program Outcome (a)

An ability to apply knowledge of mathematics, science, and engineering

Based on scale of 1-5

Summary of Student Performance Data								Average = 3.91
Contributing Courses	**Course Outcomes**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
EGN 1002 Fundamentals of Engineering								
EGN 1111C Engineering Graphics	4.25	4.30	4.20	4.15				
EGN 2213 Computer Applications in ME I	4.10							
EGN 3311 Statics	3.57	3.32	3.60	4.49				
EGN 3343 Thermodynamics I	3.41	2.92	3.68					
EGM 4045 Electro-Mechanical Devices	3.50	3.50	2.50	2.50				
EML 3701 Fluid Mechanics	4.10	4.60	4.50					
EGN 3321 Dynamics	3.91	3.91	4.08	4.05				
EGN 3331 Strength of Materials	4.00	3.60	3.80	3.80				
EML 4534 Computer Applications in ME II	4.50	4.20	4.30	4.30				
EML 4142 Heat Transfer	4.64	4.49	4.38	4.37				
EGN 4432 Dynamic Systems	3.70	3.70	4.00	3.40	4.20			
EGN 3365 Engineering Materials I	3.74	3.72	3.6					
EML 3523C Experimental Methodology	4.20	4.00	3.90					
EML 4127 Applied Thermal/Fluid Engr	3.70	3.70	3.40	4.60				
EML 4500 Machine Design I	3.75	3.75	3.75	3.75				
EML 4262 Machine Design II	3.75	3.88	3.94	3.35	3.35			
EML 43730L ME Laboratory								

EML 4521 Engineering Design	3.85	3.85						
EML 4551 Design Project	4.50	4.60						
EGM 4350 FEM in Engineering Design	4.20	4.20	4.20	4.20				
EGN 4323 Vibration Synthesis & Anal								

The resulting outcome rating of 3.91 meets the criterion for performance of greater than 3.50 on a 5.0 scale. This assessment is done for each of the a-k outcomes. In the above chart any course outcome in black exceeds the criterion as it is above 4.0. Any outcome in blue meets the criterion by exceeding 3.50 but is noted for improvement. Any outcome in red needs to be addressed as it is below the criterion. The data are reviewed by the Faculty Review Committees which are responsible for certain courses and provide their recommendations for improvement as shown in the text on pages 19-22.

Form 5: Senior Design Assessment. The following form is used for assessing student performance for the Student Learning Outcomes Assessment (SLOA). The form below is a reduced example of a faculty assessment sheet of performance for one of the senior design courses which rates individual student performance on Technical Content of their design project, Writing Skills of the project, Oral Skills of the presentations, and Teaming Skills in relation to their project team. This form also provides an overall rating of team performance in these areas. The example provided has been reduced to show the results from three teams of the eleven teams that were rated in the course that semester. The overall ratings are the results for the eleven teams.

The overall averages and the percentage of groups exceeding a certain level are used to assess performance on the SLOA's of Content Knowledge, Communication and Critical Thinking as discussed on pages 15-19.

Engineering Design - Fall 2017 Faculty Assessment Chart

		Technical Content					Writing Skills				
		Fac 1	Fac 2	Fac 3	Ave		Fac 1	Fac 2	Fac 3	Ave	
1	1	9	8	10	9.00		8.5	7.5	9	8.33	
	2	9	8	10	9.00		8.5	7.5	9	8.33	
	3	9	8	10	9.00		8.5	7.5	9	8.33	
						Group Ave					Group Ave
						9.00					8.33
		Fac 1	Fac 2	Fac 3	Ave		Fac 1	Fac 2	Fac 3	Ave	
2	1	10	8	10	9.33		9	8	9	8.67	
	2	10	8	10	9.33		9	8	9	8.67	
	3	10	8	10	9.33		9	8	9	8.67	
	4	10	8	10	9.33	Group Ave	9	8	9	8.67	Group Ave
						9.33					8.67
		Fac 1	Fac 2	Fac 3	Ave		Fac 1	Fac 2	Fac 3	Ave	
3	1	9.5	8	10	9.17		9.2	8	9.5	8.90	
	2	9.5	8	10	9.17		9.2	8	9.5	8.90	
	3	9.5	8	10	9.17		9.2	8	9.5	8.90	
						Group Ave					Group Ave
						9.17					8.90
				Overall Average		8.48			Overall Average		7.99
				Std Deviation		0.717			Std Deviation		0.743
				t		2.228			t		2.228
				Std Error		0.532			Std Error		0.552
				95% CI Upper Bound		9.02			95% CI Upper Bound		8.54
				95% CI Lower Bound		7.95			95% CI Lower Bound		7.44

Technical Content:

100% of groups > than 7.0
82% of groups > than 7.5
82% of groups > than 8.0

Writing Skills:

82% of groups > than 7.0
73% of groups > than 7.5
64% of groups > than 8.0

Engineering Design - Fall 2017 Faculty Assessment Chart

		Oral Skills					Teaming Skills				
		Fac 1	Fac 2	Fac 3	Ave		Fac 1	Fac 2	Fac 3	Ave	
1	1	9	9.3	8	8.77		9.5			9.50	
	2	9	9.3	8	8.77		9.5			9.50	
	3	9	9.3	8	8.77		9.5			9.50	
						Group Ave					Group Ave
						8.77					9.50
		Fac 1	Fac 2	Fac 3	Ave		Fac 1	Fac 2	Fac 3	Ave	
2	1	9	6.7	8	7.90		8.8			8.80	
	2	10	6.7	8	8.23		9			9.00	
	3	10	6.7	10	8.90		9.8			9.80	
	4	19	6.7	10	8.57	Group Ave	9.8			9.80	Group Ave
						8.40					9.35
		Fac 1	Fac 2	Fac 3	Ave		Fac 1	Fac 2	Fac 3	Ave	
3	1	10	8	8	8.67		9.3			9.30	
	2	10	8	10	9.33		10			10.00	
	3	9.5	8	10	9.17		10			10.00	
						Group Ave					Group Ave
						9.06					9.77
				Overall Average		8.48			Overall Average		7.99
				Std Deviation		0.717			Std Deviation		0.743
				t		2.228			t		2.228
				Std Error		0.532			Std Error		0.552
				95% CI Upper Bound		9.02			95% CI Upper Bound		8.54
				95% CI Lower Bound		7.95			95% CI Lower Bound		7.44

Oral Skills:

100% of groups > than 7.0
82% of groups > than 7.5
82% of groups > than 8.0

Teaming Skills:

82% of groups > than 7.0
73% of groups > than 7.5
64% of groups > than 8.0

Form 6: ME Graduate Assessment - Master's Degree with thesis: The following form is used by the faculty graduate advisory committee to rate the student's performance on the written thesis and the formal oral presentation of the results. The data for fall 2016 and spring 2017 are presented on pages 49-50.

EVALUATION OF MASTER'S THESIS & PRESENTATION

Expected student outcomes for the Mechanical Engineering Master's Thesis

1. Demonstrate an ability to perform research and/or perform advanced engineering analysis in their area of specialty.

2. Based on fundamental and advanced principles, students will be able to formulate and analyze engineering problems, and synthesize and develop appropriate solutions.

3. Using advanced engineering tools and techniques, students will be able to design mechanical/manufacturing systems to meet desired specifications.

Student's Name: __________________________ Expected date of graduation: ___________________

Project portfolio courses: ____

Advisory committee: ____

Please use the following scale of evaluation:

Unsatisfactory **Satisfactory** **Excellent**

1--------------------2--------------------3--------------------4--------------------5

---

1. Has the student demonstrated an ability to perform research?

Evaluation: _________

2. Did the student use advanced engineering analysis (Master's level work) in his/her thesis?

Evaluation: _________

3. Did the student develop an appropriate solution for his/her thesis based on fundamentals and advanced topics?

Evaluation: __________

4. Did the student produce a satisfactory written thesis?

Evaluation: __________

5. Did the student present his/her thesis orally in a satisfactory manner?

Evaluation: __________

Overall Evaluation: ___________ Signature: _________________ Date:________________

Form 7: ME Graduate Assessment - Master's Degree without thesis: Students are required to prepare a portfolio of graduate projects from their courses which is evaluated by the faculty on the student's graduate committee to show that the expected student outcomes are met. The data for fall 2016 and spring 2017 are presented on pages 49-50.

EVALUATION OF PROJECT PORTFOLIO

Expected Student Outcomes for the Mechanical Engineering Master's Degree

1. Demonstrate an ability to perform research and/or perform advanced engineering analysis in their area of specialty.

2. Based on fundamental and advanced principles, students will be able to formulate and analyze engineering problems, and synthesize and develop appropriate solutions.

3. Using advanced engineering tools and techniques, students will be able to design mechanical/manufacturing systems to meet desired specifications.

Student's Name: ___________________________ Expected date of graduation: ____________________

Project portfolio courses: ____

____

Advisory committee: ____

Please use the following scale of evaluation:

Unsatisfactory **Satisfactory** **Excellent**

1--------------------2--------------------3--------------------4--------------------5

---

1. Did the student use advanced engineering analysis (Master's level work) in his/her projects?

Evaluation: _________

2. Did the student develop an appropriate solution for his/her projects based on fundamentals and advanced topics?

Evaluation: __________

3. Did the student produce satisfactory written reports?

Evaluation: __________

4. Did the student use advanced engineering tools or software to design a mechanical/manufacturing system?

Evaluation: __________

Overall Evaluation: ___________ Signature: ____________________

Date: ________________________

Form 8: ME Doctor of Philosophy Assessment. The following form is used by the faculty graduate advisory committee to rate the student's performance on the dissertation and the formal oral presentation of the results. The data for fall 2016 and spring 2017 are presented on pages 50-52.

EVALUATION OF PH.D DISSERTATION & PRESENTATION

Expected student outcomes for the Mechanical Engineering PH.D Degree

1. Demonstrate an ability to perform research in their area of specialty.

2. Demonstrate an advanced level of knowledge in mathematics and engineering fundamentals.

3. Effectively communicate an advanced technical concept to their peers.

Student's Name: ___________________________ Expected date of graduation: ____________________

Student's Advisory Committee: ____

____

Please use the following scale of evaluation:

Unsatisfactory **Satisfactory** **Excellent**

1--------------------2--------------------3--------------------4--------------------5

---

1. Has the student demonstrated an ability to perform research?

Has student submitted his/her research for publication: Yes ______ No _________

Evaluation: __________

2. Has the student demonstrated an advanced level of knowledge in mathematics and engineering fundamentals?

Evaluation: _________

3. Did the student produce a satisfactory written dissertation?

Evaluation: __________

4. Did the student present his/her dissertation orally in a satisfactory manner?

Evaluation: __________

Overall Evaluation: ___________ Signature: ___________________________

Date: ______________________________

Form 9: OE Graduate Assessment - Master's Degree with thesis:

Department of Ocean and Mechanical Engineering **Florida Atlantic University**

OUTCOMES ASSESSMENT OF MSOE (THESIS) GRADUATE STUDENT

To be completed by all members of the student's thesis committee after the defense. The adviser shall collect the completed forms and return to the graduate program coordinator, Anastasia Calnick (acalnick@fau.edu).

SEMESTER OF THESIS DEFENSE:

Name of the Student: ....

Thesis Advisor (Chair of Thesis Committee): ....

Other thesis Committee Members: **(1) ....**
(2) ....
(3) ....

Title of the Thesis: ....

Evaluator Name: ....

Evaluator: Based on the student's thesis research, presentation and defense, please evaluate the outcomes, listed in the table below, on a scale of 0 to 10 with 0 meaning poor, 5 satisfactory and 10 excellent.

Scale: 0..................... 5...........................10
Poor Satisfactory Excellent

	Outcome	**Score (on above scale of 0 to 10)**
1	Student's knowledge of engineering and science subjects at graduate (MS) level.	
2	Student's ability to independently carry out a major design project or research in an engineering or applied science field.	
3	Student's ability to effectively communicate topics and research in engineering and science	

Use this space to provide other **general (not on thesis specifics)** comments and suggestions for any improvement of above and related outcomes:

Form 10: OE Graduate Assessment - Master's Degree without thesis:

MS (non-thesis) Ocean Engineering

OUTCOMES ASSESSMENT OF MSOE (non-thesis) GRADUATE STUDENT

This form will be completed by the committee assigned to each non-thesis student during the final semester of the student's MS program. The student shall submit a portfolio of all projects, reports and term papers prepared in various courses in the curriculum for the degree and submit to the chair of the student's committee at least one month prior to graduation. The following evaluation form will be completed by each of the committee members. The Chair of the committee shall collect all the completed forms and return to Anastasia Calnick of the Department of Ocean and Mechanical Engineering.

SEMESTER OF GRADUATION:

Name of the Student:

Advisor (Committee Chair)

Other Committee Members: **(1)**
(2)
(3)

Area of Student's specialization within Ocean Engineering:

Evaluator's (Committee Member) Name:

Evaluator: Based on the projects, reports and term papers done by the student in the coursework, which are compiled in the enclosed portfolio, evaluate the outcomes, listed in the table below, on a scale of 0 to 10 with 0 meaning poor, 5 satisfactory and 10 excellent.

Scale: 0 ....5 10
Poor Satisfactory Excellent

	Outcome	Score (on above scale of 0 to 10)
1	Student's knowledge of engineering and science subjects at graduate (MS) level.	
2	Student's ability to independently carry out a major design project or research in an engineering or applied science field.	
3	Student's ability to effectively communicate topics and research in engineering and science	
<u>Use this space to provide any other comments and suggestions for any improvement of above and related outcomes:</u>		

Form 11: OE MS and PhD Thesis Advisor Report.

FLORIDA ATLANTIC UNIVERSITY

College of Engineering & Computer Science

MS Thesis / PhD Dissertation Advisor Report

Today's Date: ______________________________

Student's Name: ______________________________

Thesis / Dissertation: MS Thesis ☐ PhD Dissertation ☐

Student's Department: ______________________________

Advisor's Name: ______________________________

Committee Members: ______________________________

____

____

Proposal Defense Date(s): ______________________________

Progress Report Meeting Date(s): ______________________________

Research Supported by: Research Grant ☐ Departmental Funds ☐ Other ☐

List all research publications from this research (published and/or submitted): ______________

____

____

____

____

____

____

____

Advisor Signature ______________________________

Department Chair Signature ______________________________

Form 12: OE MS and PhD Dean's Office Report.

FLORIDA ATLANTIC UNIVERSITY
College of Engineering & Computer Science

MS / PhD Dean's Office Defense Report

Today's Date: ____________________

Student's Name: ____________________

Thesis / Dissertation: MS Thesis ☐ PhD Dissertation ☐

Student's Department: ____________________

Advisor's Name: ____________________

Committee Members: ____________________

____

____

Associate Dean or Designee: ____________________

Defense Start Time: ____________________

Defense End Time: ____________________

Comments from the Associate Dean or Designee:

____

____

____

____

____

____

____

____

Signature **Date**

Form 13: ME and OE Student Outcome Assessment for a Doctoral Degree Qualifying Exam.

EVALUATION OF QUALIFYING EXAM

Expected Student Outcome for Doctoral Degree

1. Students will demonstrate an advanced level of knowledge in mathematics and engineering fundamentals relevant to their discipline.

Student's Name: ______________________ Expected date of graduation: ________________

Major field of study: ____

Minor field of study: ____

Academic Affairs committee: ____

____

Please use the following scale of evaluation:

Unsatisfactory **Satisfactory** **Excellent**
1------------------2-------------------3------------------4-------------------5

---

1. Did the student demonstrate an advanced level of knowledge in mathematics on his/her qualifying exam?

   Evaluation: ________

2. Did the student demonstrate an advanced level of knowledge in his/her major field of study?

   Evaluation: ________

3. Did the student demonstrate an advanced level of knowledge in his/her minor field of study?

   Evaluation: ________

4. Did the student present his/her written solutions in a professional manner?

   Evaluation: ________

Overall Evaluation: _________ Signature: ___________________________

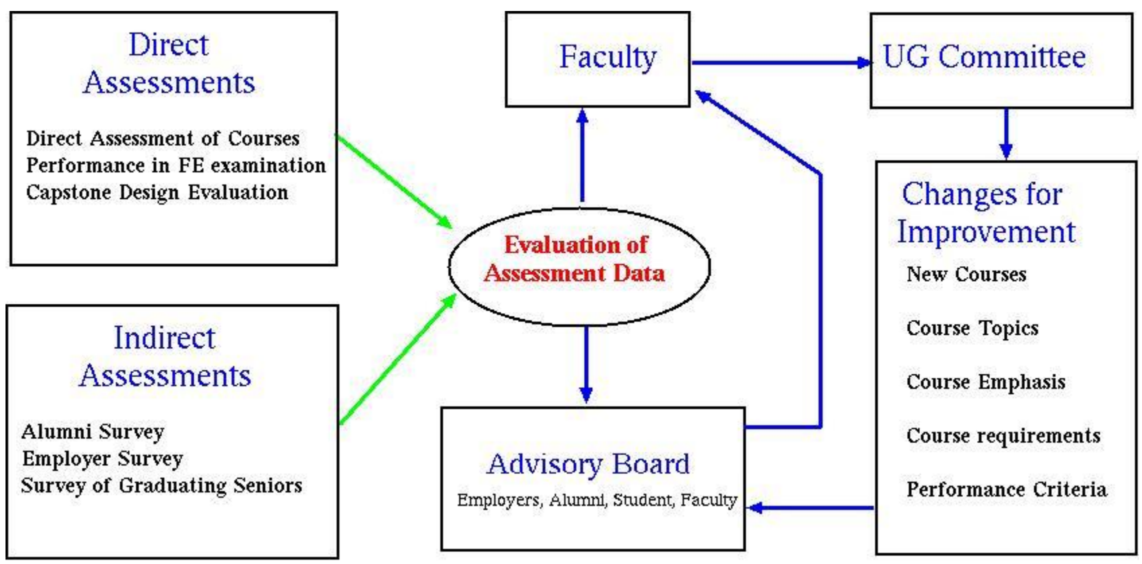
Date: ___________________________

Please return this form to Anastasia Calnick

Appendix B

Form – 1: Assessment and Continuous Improvement Plan

The continuous process of assessment, evaluation, and improvement related to attaining outcomes is illustrated in the following flowchart. Direct assessment of outcomes includes appraisal of performance in capstone senior design projects and assessment of students' performance in courses. Indirect assessment includes alumni and employer surveys, survey of graduating seniors, and students' self-assessment on course outcomes. Assessment data were used to determine how well the desired program outcomes were being achieved. Based on the evaluation of the assessment data (gathered from a variety of sources), the program faculty, with the recommendation of the undergraduate committee, approves implementation of changes for improvement. The changes could include introduction of new courses, new facilities and instructional equipment or space, change or emphasis of topics, course requirements etc. The BSOE constituency including the students, alumni, and the Industrial Advisory Board may also offer feedback through the assessment process for improvement.



Form 2 - Direct Course Assessment Form

EGN 4432 Dynamic Systems

Semester / Year: ______________________

Direct Course Assessment on Course Outcomes

Outcome	Assignment	Course Assignment Assessment Ave (10pt max)
1		
2		
3		
4		
5		

NOTE: Please do not include students' grades who withdrew your class.

Course Outcomes: (letters in parentheses indicate correlation of the outcome with the appropriate program outcomes a-k)

Outcome 1: A basic knowledge of the fundamental principles governing the dynamics of simple mechanical, thermal, fluid and electrical systems. (a)

Outcome 2: An ability to apply the knowledge of mathematics and engineering to model simple dynamic systems. (a)

Outcome 3: An ability to simulate dynamic systems using computer simulation tools. (k)

Outcome 4: An ability to characterize the stability properties of a dynamic system. (e)

Outcome 5: An ability to design a simple feedback control system that meets desired system output specifications. (c)

NOTE: If any of the outcomes above is less than 7 out of 10, please provide comments as to how improvements can be made and implemented in the future

Form 3 - EVALUATION OF EOC 4804 OCEAN ENGINEERING SYSTEMS CONTROL & DESIGN

Instructor: ________________________

Year:___________________

Project Title:

____

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Evaluator's Name and Affiliation (Please Print): ____

Dear Evaluator: Based on the design accomplishments, team effort and project presentation, please rate the team's overall attainment of the following outcomes. **If any of the outcome(s) cannot be evaluated based on the available information, you may leave those unevaluated**. Any additional comments are welcomed. Please return the completed forms to Dr. An. Thanks!

Item	Evaluation		
	Poor	**Satisfactory**	**Excellent**
a. An ability to apply knowledge of mathematics, science, and engineering			
b. An ability to design and construct experiments, as well as to analyze and interpret data			
c. An ability to design a system, component, or process to meet desired needs			
d. An ability to function on multi-disciplinary teams			
e. An ability to identify, formulate, and solve engineering problems			
g. An ability to communicate effectively			
h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context			
i. A recognition of the need for, and an ability to engage in life-long learning			
j. A knowledge of contemporary issues			

k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice			

Additional Comments: (Continue on the other side, if more space is needed.)

Form 4- Mapping of OE Courses to Student Learning Outcomes

	Student Learning Outcomes (1: Lowest, 10: Highest)				
Courses	**1**	**2**	**3**	**4**	**5**
EOC 4612C Into to Electronics & Programming	**x**	**x**	**x**		**x**
EOC 3130L OE Lab				**x**	**x**
EOC 4631C OE Data Analysis	**x**	**x**			
EOC 3213 Marine Topics	**x**	**x**	**x**		
EOC 3306 Acoustics for Ocean Engineers	**x**	**x**			
EOC 4620 Dynamic Systems	**x**	**x**	**x**		
EOC 4422 Ocean Wave Mechanics	**x**	**x**		**x**	
EOC 4804 OE Systems Control & Design			**x**	**x**	**x**
EOC 3410 Structures I	**x**	**x**			**x**
EOC 4412 Ocean Structures	**x**	**x**			**x**
EOC 3114 Vibrations	**x**	**x**			**x**
EOC 4193 Ocean Thermal Systems	**x**	**x**	**x**		
EOC 3123 OE Fluid Mechanics	**x**	**x**			
EOC 4124 Ship Hydrodynamics	**x**	**x**	**x**		
EOG 4201C Marine Materials and Corrosion	**x**	**x**			
EOC 4307 Underwater Acoustics	**x**	**x**			
EOC 4804L OE Systems Control & Design			**x**	**x**	**x**