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CATALOG _____

Graduate Programs—PROGRAM CHANGE REQUEST

DEPARTMENT: OCEAN AND MECHANICAL ENGINEERING

COLLEGE: ENGINEERING AND COMPUTER SCIENCE

PROGRAM NAME:
PHD IN OCEAN ENGINEERING

EFFECTIVE DATE
(PROVIDE TERM/YEAR)

MARCH 2016

PLEASE EXPLAIN THE REQUESTED CHANGE(S) AND OFFER RATIONALE BELOW AND/OR ATTACHED:

THIS PROPOSAL IS FOR CHANGES TO THE PROGRAM REQUIREMENTS FOR THE DOCTOR OF PHILOSOPHY IN OCEAN ENGINEERING TO INCLUDE A SUSTAINABLE INFRASTRUCTURE ENGINEERING OPTION. THIS NEW OPTION WILL ACCOMMODATE INCREASED SOCIETAL INTEREST IN SUSTAINABLE DEVELOPMENT AND CALLS FOR A SUSTAINABLE INFRASTRUCTURE TRACK TO BE OFFERED IN THE PHD ENGINEERING PROGRAM.

THE NEW PROGRAM IS EXPECTED TO INCREASE GRADUATE STUDENT ENROLLMENT FROM STUDENTS WITH MASTER'S DEGREES IN MECHANICAL, CIVIL, AND GEOMATICS ENGINEERING.

THE PROPOSALS HAVE BEEN APPROVED BY THE DEPARTMENT GRADUATE COMMITTEE.

Faculty contact, email and complete phone number:
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561-297-3896

Consult and list departments that might be affected by the change and attach comments.
The Department of Civil, Environmental & Geomatics Engineering (CEGE) have been consulted and have contributed to this Proposal

Approved by:

Department Chair: Janad Alker

College Curriculum Chair: _____

College Dean: [Signature]

UGPC Chair: Wm J McDaniel

Graduate College Dean: [Signature]

UFS President: _____

Provost: _____

Date:

9/4/15

9/8/15

9/9/15

10-7-2015

Email this form and syllabus to UGPC@fau.edu one week before the University Graduate Programs Committee meeting so that materials may be viewed on the UGPC website prior to the meeting.

Doctor of Philosophy with Major in Ocean Engineering

The degree of Doctor of Philosophy with major in Ocean Engineering is conferred on a candidate by the University upon completion of comprehensive training and in recognition of the candidate's ability to independently and efficiently pursue research in ocean engineering.

The requirements for the degree include performing original research, preparing a dissertation describing this research and systematic advanced studies in engineering and the underlying sciences. This section discusses the details of the degree regulations.

Admission Requirements

Applicants must have a master's degree in Engineering, Science or Mathematics from an accredited college or university. A student with outstanding scholastic achievement who holds only a baccalaureate degree may be admitted directly to the Ph.D. program. See later section for requirements.

1. Applicants must have a 3.0 GPA (on a 4.0 scale) or better in the last 60 credits of work attempted and must have an official transcript forwarded directly to the FAU Graduate College from each college-level institution attended;
2. Applicants must have scores of at least 145 (verbal) and 150 (quantitative) on the Graduate Record Examination (GRE);
3. Applicants must demonstrate 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 (paper-based) or 213 (computer-based) or 79 (iBT);
4. Applicants must submit to the Graduate College at least two letters of recommendation attesting to the student's ability to pursue with distinction a curriculum of advanced study and research in a chosen area;
5. Applicants should abide by the policies and regulations and the graduate admission requirements of the University as outlined in this University Catalog;
6. Conditional admission may be permitted if the above conditions are not met.

Degree Requirements

The degree of Doctor of Philosophy in Ocean Engineering will be conferred on candidates who have fulfilled the following requirements:

1. Completed 54 credits of course and dissertation work after the M.S. degree (84 credits for those admitted to the Ph.D. directly after the B.S. degree). Of the 54 credits, 21 credits must be coursework;
2. Of the 21-credit minimum of coursework, at least 12 credits must be from the Ocean, Mechanical*, Civil* or Geomatics* Engineering programs. No more than 3 credits of directed independent study may be used to satisfy the 21-credit minimum;
3. A minimum of 33 dissertation credits. No more than 39 dissertation credits may be counted toward the total credit requirement for the Ph.D. degree;
4. A major program of research and advanced studies in ocean engineering;
5. Unless otherwise stated, a minimum of 9 credits in advanced mathematics or equivalent beyond the B.S. degree;
6. Successful completion of General Examination 1, a written comprehensive examination of coursework;
7. Successful completion of General Examination 2, a dissertation proposal defense;
8. Submitted and defended a dissertation based on original research in the student's area of specialization. The supervisory committee, the Department chair and the Graduate College must have approved the dissertation;
9. Complied with the University's Graduate Policies and Regulations and satisfied the University's Graduate Degree

Requirements.

* Only available for the Sustainable Infrastructure Engineering option

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Core Course Requirements

All 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 preference for approval by the supervisory committee.

| Common Core Course, Choose three: | |
|---|-------------------|
| Mathematical Methods in Ocean Engineering 1 | EOC 5172 |
| Engineering Data Analysis | EOC 6635 |
| Physical Aspects of Oceanography | OCP 6050 |
| Offshore Structures* | EOC 6431 |
| In addition, two of the following courses must be taken: | |
| Advanced Hydrodynamics 1 | EOC 6185 |
| Corrosion 1 | EOC 6216C |
| Engineering Principles of Acoustics | EOC 6317C |
| Special Topics | EOC 6934 |
| Advanced Mechanics of Materials* | EGM 6533 /CES6107 |
| Finite Element Methods* | EGM5351/CES 6119 |
| Infrastructure System Management* | CGN 6506 |
| Operations Research for Engineering* | ESI 6306 |
| Special Topics* | CGN6930 |

* Only available for the Sustainable Infrastructure Engineering option

Transfer Credits

The doctoral program may accept for transfer 6 credits beyond the baccalaureate degree from other institutions to the student's degree program upon approval by the Department and subject to the following restrictions:

1. The student must present a transcript identifying the course in which the student has earned a grade of "B" or better, along with a catalog/course description;
2. The course must not have been counted toward any other graduate or undergraduate degree awarded or to be awarded to the student;
3. The student's advisor and the Ocean Engineering graduate program committee, who may seek the advice of other faculty if needed, will decide whether to accept or reject the course credit;
4. Obtaining credit for a non-FAU course does not alter the total number of credits required for graduation;

Additional credits consistent with University policy may be considered for transfer subject to the restrictions above, if approved by the student's advisor.

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Recency of Credits

No credit earned ten or more years before the degree is awarded may be counted toward a graduate degree.

Course Load

Full-time graduate students are those who register for 9 or more credits during the fall and spring semesters and 6 credits during the summer. Students who wish to register for more than 15 credits for any semester must obtain approval in advance from the Graduate College. All students receiving financial assistance must satisfy these requirements, and all international students must be full-time students. In the graduating semester, the student may be allowed to take 1 credit.

Residency Requirements

Candidates must satisfy the minimum residency requirement for the Ph.D. by completing beyond the master's degree either (1) 18 credits in one calendar year, or (2) 24 credits in no more than two calendar years on the SeaTech or Boca Raton campus of FAU. To satisfy University requirements, two semesters must be full-time, consisting of 9 credits in the spring or fall term and 6 credits in the summer term.

Candidates may be permitted to conduct all or part of their research in the field, in government or industrial laboratories or elsewhere off campus only if adequate staff, dissertation research supervision and facilities, as determined by the Department, are available.

Program Options

Students who wish to specialize in specific Ocean Engineering programs may pursue in-depth studies in the areas of marine materials, offshore structures and corrosion; hydrodynamics and physical oceanography; marine vehicles; acoustics and vibrations; and Sustainable Infrastructure Engineering. Unless otherwise stated, the Ocean Engineering Department graduate courses are 3 credits each, and all programs require a minimum of 9 credits in graduate level mathematics or equivalent.

When suggested elective courses as listed in the following sections are not offered, equivalent courses as determined by the student's supervisory committee may be taken.

Marine Materials, Offshore Structures and Corrosion Option

It is suggested that students in the Marine Materials and Corrosion Option take the following courses in addition to the core courses required for all Ocean Engineering Ph.D. students.

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| Advanced Fracture and Failure Processes 1 | EOC 6157 |
| Corrosion 1 | EOC 6216C |
| Corrosion 2 | EOC 6218C |
| Physical Metallurgy | EOC 6230 |
| Special Topics (Theory of Elasticity) | EOC 6934 |
| <i>Depending on a student's area of thesis research, elective courses may be chosen from, but are not necessarily limited to, the following:</i> | |
| Physical Chemistry 1 | CHM 3410 |
| Advanced Topics in Physical and Theoretical Chemistry | CHM 6581 |
| Introduction to Finite Element Methods | EGM 5351 |
| Advanced Strength of Materials | EGM 6533 |
| Mechanics of Composite Materials | EGM 6562 |
| Mechanical Properties of Polymers | EML 6235 |
| Fracture Mechanics | EML 6239 |
| Signal Processing | EOC 6630 |
| Special Topics (Nanostructured Materials) | EOC 6934 |

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Hydrodynamics and Physical Oceanography Option

It is suggested that students in the Hydrodynamics and Physical Oceanography Option take the following courses in addition to the core courses required for all Ocean Engineering Ph.D. students.

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| Advanced Computational Fluid Dynamics | EML 6726 |
| Advanced Hydrodynamics 1 | EOC 6185 |
| Turbulent Flow | EOC 6190 |
| <i>Depending on a student's area of focus, the elective courses may be chosen from the following list together with other courses offered by the Ocean Engineering Department:</i> | |
| Mathematical Methods in Ocean Engineering 2 | EOC 6174 |
| Advanced Ocean Wave Mechanics | EOC 6320 |
| Experimental Marine Hydrodynamics | EOC 6506C |
| Hydrodynamic Aspects of Ship Design | EOC 6515 |
| Special Topics (Ship Structural Design; Flow Control) | EOC 6934 |

Marine Vehicles Option

In addition to the core requirements, recommended courses include those below.

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| Intelligent Underwater Vehicles 1 | EOC 6663 |
| Marine Power Plant Design and Optimization | EOC 6808 |
| Special Topics (Elements of High Speed Marine Vehicles) | EOC 6934 |
| Other courses that may be taken will be determined by the student's area of study. | |

Acoustics and Vibrations Option

It is recommended that students in the Acoustics and Vibrations Option take the following courses in addition to the core courses required for all Ocean Engineering Ph.D. students.

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| Mechanical Vibrations | EML 6223 |
| Advanced Hydrodynamics 1 | EOC 6185 |
| Ocean and Seabed Acoustics | EOC 6312 |
| Signal Processing | EOC 6630 |
| Special Topics | EOC 6934 |

Sustainable Infrastructure Engineering Option

The Faculty in all affected departments recommend that students in the Sustainable Infrastructure Engineering option take two more elective courses as approved by the dissertation adviser in addition to the core courses required for all Ocean Engineering Ph.D. students. This program requires a minimum of 3 credits in graduate level mathematics or equivalent.

Depending on the student's area of focus, elective courses may be chosen from the courses offered by the Department as well as from supporting departments such as Civil Engineering, Computer Engineering, Electrical Engineering, Mathematics, Mechanical Engineering and Physics.

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Supervisory Committee

In consultation with the student and the advisor, a supervisory committee will be nominated by the Department chair, approved by the dean of the College of Engineering and Computer Science and appointed by the Graduate College.

The supervisory committee shall consist of no fewer than four members selected from the Ocean and Mechanical Engineering faculty. Additional members can be from the Ocean and Mechanical Engineering Department, other departments, other universities or from industry.

The committee will include at least one person selected from the faculty from outside the discipline of the student's major. If the student elects or is required to select a minor, this member of the supervisory committee shall represent the discipline selected as the minor.

The supervisory committee should be appointed as soon as possible after the student has passed General Examination 1 and, in general, no later than the end of the second year of equivalent full-time study. Duties of the supervisory committee include:

1. To ensure that the student is aware of all regulations governing the degree. It should be noted, however, that this does not absolve the student of the responsibility of making inquiries regarding the regulations and procedures;
2. To discuss and approve the proposed course of study, dissertation research project and the student's plans for its execution;
3. To conduct and take part in the General Examination 2. No fewer than four faculty members shall be present for the General Examination 2, which must be given on campus;
4. To meet following General Examination 2 to review the research progress, the expected results and make suggestions for completion of the program;
5. To meet on campus when the dissertation is completed and conduct the final oral examination to assure that the dissertation is original research and a contribution to knowledge. No fewer than four faculty members shall be present with the candidate for this examination, but only members of the official supervisory committee are required to sign the dissertation. The supervisory committee must approve the dissertation;
6. To review the student's dissertation carefully. Before signing, each committee member must be sure that it is free of grammatical, editorial or technical errors.

Plan of Study and Admission to Candidacy

Admission to the doctoral program at FAU does not automatically constitute admission to candidacy for the degree. A Plan of Study for the Ph.D. degree (Form 5) must be submitted to the Graduate College before the end of the second semester of enrollment. The Graduate College will admit a student to candidacy for the Doctor of Philosophy degree after the following conditions have been met:

1. Admission to graduate school to work toward the doctoral degree;
2. Successful completion of the General Examination 1 (Ph.D. Qualifying Exam);
3. Selection of a dissertation faculty advisor and the formation of a supervisory committee;
4. Formulation and submission of a program of study that is approved by the Department;
5. Recommendation of the supervisory committee and Department chair.

Note: Students may not enroll for Ph.D. dissertation credits (EOC 7980) until they have been admitted to candidacy.

Following the successful completion of General Examination 1, the student must complete and submit the form "Admission to Candidacy for the Doctoral Degree (Form 8)." General Examination 1 and submission of admission to candidacy form should be completed at least two semesters before the beginning of the semester in which the degree is to be conferred. A student not admitted to candidacy before the beginning of the fourth academic year of graduate work at the University must petition through the College to the Graduate College for permission to register for additional work.

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Coursework and Research

The work for the Ph.D. degree must consist of research and advanced studies in ocean engineering. The student who previously obtained a master's degree will be required to complete a total of 54 credits of course and dissertation work for the Ph.D. At least 18 of the credits must be taken from the Ocean Engineering list of courses and all core course requirements must be satisfied. A minimum of 33 credits of doctoral dissertation research will be required. No more than 39 dissertation credits may be counted toward the 54-credit requirement. The remaining credits may be selected from the listing of OE courses, advanced mathematics courses, elective courses, directed independent study (DIS) or dissertation. A minimum of 9 credits of graduate-level mathematics must be satisfied. Also, the supervisory committee may approve up to 6 credits at the 4000 level.

B.S. to Ph.D. Program

A student with outstanding scholastic achievement who holds only a baccalaureate degree (B.S.) may be admitted directly to the Ph.D. program in Ocean Engineering. The student with a B.S. will be required to complete a total of 84 credits of course and dissertation work for the Ph.D. At least 18 of the credits must be taken from the Ocean Engineering list of courses, and all core course requirements must be satisfied. A minimum of 33 credits of doctoral dissertation research will be required. No more than 39 dissertation credits may be counted toward the 84-credit requirement. The remaining credits may be selected from the listing of OE courses, advanced mathematics courses, elective courses, directed independent study (DIS) or dissertation. A minimum of 9 credits of graduate level mathematics must be satisfied. Also, the supervisory committee may approve up to 9 credits at the 4000 level.

General Examination 1

After the completion of three Ocean Engineering core courses and three elective courses, the student will be required to take a General Examination 1, or Ph.D. Qualifying Exam. The primary purpose of General Examination 1 is to evaluate the student's ability, not only to demonstrate a thorough knowledge of Ocean Engineering course material, but to evaluate original thinking. The written examination will be in three parts: One covering the core courses, one covering elective subjects and one is a review and analysis of a research paper. The exam on the three core courses will be four hours in duration and will require four problems to be answered. The electives exam will be a three-hour exam and will require one problem from each elective to be answered. The research paper exam will be a two-day take home exam requiring the student to answer questions on a specific research paper. A new set of examinations will be prepared and questions and problems from previous examinations are not available to students. It is expected that the examination on the elective courses will focus on the student's area of specialization.

An overall grade of 70 percent on the written examination is passing. Students who score below 70 percent are given the option of re-taking exams on topic areas in which they scored less than 70 percent before the beginning of the next semester. The student must score 70 percent in each subject that is retaken. Alternatively the student may retake the entire exam when it is next offered. There would only be one opportunity to retake all or part of the exam. General Examination 1 is scheduled early in the fall semester and early in the spring semester each year.

For students who have obtained the M.S. in Ocean Engineering at FAU, General Examination 1 must be taken no later than the beginning of the third semester of Ph.D. study or at the first opportunity it is offered thereafter. Those admitted to the Ph.D. program directly after the B.S. degree in Ocean Engineering at FAU may take the examination after completing 24 credits of graduate coursework. For students not so previously enrolled, the exam must be taken by the beginning of the fourth semester or as soon as it is offered thereafter.

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General Examination 2

At an appropriate point in the student's graduate studies, normally within 12 months of passing General Examination 1, the student must complete General Examination 2. This is the dissertation proposal defense, in which students defend the choice of a dissertation topic and answer questions on fundamental issues related to their research. The student must have passed General Examination 1, selected the dissertation topic, formed a supervisory committee and completed a literature survey prior to the dissertation proposal defense.

In General Examination 2, the student should be prepared to demonstrate the ability to perform research on a topic approved by the supervisory committee by presenting a comprehensive literature survey combined with a critical analysis of the state of the art in the particular field. While this examination will be centered around the particular

research area, it will not necessarily be limited to that subject. If unsuccessful in the examination, the student may, at the discretion of the Department, either remain in the doctoral program and retake the examination at a later date or withdraw from the program. No more than two attempts will be permitted.

Dissertation and Progress Reviews

Following successful completion of the dissertation proposal defense (General Examination 2), the student is expected to engage in an intensive program of coursework and doctoral dissertation based on a major, original research project. During each subsequent semester, the student's supervisory committee will review the progress. If at any time the student's progress in the research is found to be unsatisfactory, the supervisory committee will report to the Department chair, inform the student in writing as to the nature of the difficulties and record the committee's opinion in the student's file. The student will then be given ample opportunity to improve performance and defend the student's position at a further review meeting held at the end of the semester. If no improvement has been demonstrated, the student's future program, including the continuation of stipend and tuition waiver, may be reconsidered.

By the beginning of the semester in which the degree is to be conferred, a candidate for the Doctor of Philosophy degree must deliver a draft of the dissertation to the supervisory committee. Not less than two weeks after the submission of the first draft of the dissertation, the candidate is expected to give a seminar covering the results of the research; this seminar will be followed by a dissertation examination by the supervisory committee. The seminar should be given as early as possible, but not later than two months before the degree is to be conferred.

The Ph.D. dissertation final version must be approved by the supervisory committee and Department chair and submitted to the dean of the College of Engineering and Computer Science at least one week prior to the due date for submission to the Graduate College. The candidate is responsible for allowing sufficient time for members of the supervisory committee to examine the dissertation. The dissertation must be delivered to the Department in the format described in the [Graduate Thesis and Dissertation Guidelines](#). The guidelines may also be obtained at the Graduate College or from the Ocean Engineering program.

Upon receiving approval of the Graduate College and following completion of all other University requirements, the degree will be recommended. Application for the degree must be made one semester before the semester of graduation.

Unsatisfactory Performance

A graduate student whose performance is deemed unsatisfactory will be denied further registration in the Department programs.

Unsatisfactory performance is defined as failure to maintain a minimum 3.0 GPA in all FAU graduate program courses at the end of the second semester in the program (this should normally constitute 15 to 18 credits) or after any subsequent semester.

Please note that this is more strict than the University requirement. A student who exhibits unsatisfactory scholarship in the Ocean Engineering graduate program is not precluded from applying to another program in the University. No graduate credit may be earned for courses completed with a "C-" or lower even if grades in other courses bring the average to a satisfactory level. A student who withdraws from a course after the Drop/Add period may be required to repay any tuition benefits received.

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| <p>Approved by:</p> <p>Department Chair: _____</p> <p>College Curriculum Chair: _____</p> <p>College Dean: _____</p> <p>UUPC Chair: _____</p> <p>Undergraduate Studies Dean: _____</p> <p>UFS President: _____</p> <p>Provost: _____</p> | <p>Date:</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> | <p>1. Syllabus must be attached; syllabus checklist recommended; see guidelines and checklist: www.fau.edu/academic/registrar/UUPCinfo</p> <p>2. Review Provost Memorandum: Definition of a Credit Hour www.fau.edu/provost/files/Definition_Credit_Hour_Memo_2012.pdf</p> <p>3. WAC approval (attach if necessary)</p> <p>4. Gen. Ed. approval (attach if necessary)</p> <p>5. Consent from affected departments (attach if necessary)</p> |
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