Guide to Graduate Studies and Research in Ocean and Resources Engineering at University of Hawaii at Manoa

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TABLE OF CONTENTS

BACKGROUND

Hawaii's unique location, climate and marine-oriented activities make the University of Hawaii at Manoa (UH) an ideal place for education and research in ocean and resources engineering. The graduate program in ocean engineering at UH was initiated in 1966 and is one of the first in the United States. Ocean Engineering became an academic department in the College of Engineering in July 1968. In July 1977, the department was accredited for its Master of Science program by the Engineer's Council for Professional Development (ECPD), now known as the Accreditation Board for Engineering and Technology (ABET). In October 1988, UH officially integrated all marine-oriented programs into the School of Ocean and Earth Science and Technology (SOEST). The Department of Ocean Engineering and the Hawaii Natural Energy Institute of the College of Engineering became part of SOEST to form the technology component of this school. In July 1999, the department changed its name to Ocean and Resources Engineering (ORE) to better reflect the research thrust of the faculty.

Educational and research emphasis in ORE is placed on coastal, offshore, ocean resources, and oceanographic engineering. Coastal engineering deals with coastal and harbor problems, sediment transport, nearshore environmental engineering, and coastal flood hazards. Offshore engineering is concerned with structures and systems used in the deeper parts of the ocean and includes hydrodynamics of fluid-body interaction, seakeeping and dynamic responses of ships and platforms, and hydroelasticity of floating structures. Ocean resources engineering considers the engineering systems needed to develop the ocean's energy, mineral, and living resources, the potential use of the ocean for waste disposal, and the environmental and economic aspects of such activities. Oceanographic engineering involves the design, operation, and maintenance of the mechanical, electrical, and computing technology and instrumentation that supports oceanographic and marine operations.

ACADEMIC PROGRAM

Program Objectives

ORE offers a graduate program leading to the Master of Science (MS) and Doctor of Philosophy (PhD) degrees. The goal of the program is to prepare students for the engineering profession and to conduct research in support of education. These objectives, along with the curriculum described below, were developed in collaboration with ORE's advisory panel.

The objective of the program at the MS level is to produce graduates who:

1. Are able to handle multidisciplinary problems by assimilating relevant information and applying mathematics, science, and engineering principles;

2. Are proficient engineers translating client's requirements and technical needs into solvable tasks and synthesizing solutions into actionable recommendations or engineering designs;
3. Have broad understanding of the ocean and resources engineering disciplines as well as the changing needs and technologies in the industry;
4. Are highly proficient and ready to assume responsibility on tasks related to one or more of the ocean and resources engineering disciplines;
5. Are able to make proper judgment related to professional, ethical, managerial, economic, and other non-technical issues commonly encountered in engineering practice; and
6. Can communicate in written and verbal form and work effectively with peers, clients, and the public in conveying new ideas, products, or designs.

The program at the PhD level shares the objective of the MS program, with the added emphasis on producing graduates who:

7. Can conduct original research and develop new technologies in ocean and resources engineering; and
8. Have the experience to publish in refereed journals.

This additional emphasis prepares our doctoral graduates to pursue research careers in industry and academia.

Student Outcomes

1. Working knowledge of fundamental mathematics, science, and engineering principles that include statics, dynamics, fluid mechanics, solid mechanics, and probability and statistics
2. Proficiency in the core program of Ocean and Resources Engineering that comprises hydrostatics, oceanography, water waves, underwater acoustics, ocean instrumentation, and laboratory and field experience
3. Mastery of at least one of the four Ocean and Resources Engineering disciplines that include coastal, offshore, ocean resources, and oceanographic engineering
4. An ability to identify, formulate, and solve complex ocean and resources engineering problems by applying principles of engineering, science, and mathematics
5. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
6. An ability to communicate rationale, methodologies, and recommendations of projects effectively in written and verbal form with a range of audiences
7. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

8. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
9. An ability to develop and conduct research through appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions, and
10. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.
11. Meeting of educational goals through a customized program of study, training, and research.

MS Degree

The ORE program at the MS level has the following requirements:

- Pre-program,
- MS General Exam,
- Core, option-area, and elective courses, and
- MS thesis (Plan A) or independent project (Plan B).

The pre-program (which includes a general education component, one year of college-level mathematics and science, and one and one-half years of engineering topics) provides students with a broad educational background that covers the technical and non-technical issues commonly encountered by engineers in professional practice. Students with an undergraduate engineering degree from an ABET accredited program satisfy the pre-program requirements a priori. Not all students in the program have an undergraduate degree in engineering. The department requires these students to make up any deficiencies by completing the required pre-program courses listed in Appendix B.

The MS degree can be earned under either the Plan A (thesis) or Plan B (independent project) option. This requires a minimum of 30 academic credits, at least 24 of which must be earned in advanced courses numbered 600 or above. Up to two credits of directed reading and six transferred credits can be counted toward the MS requirements. Students who satisfy the pre-program requirements must take the general examination during the first semester of their full-time enrollment. This test is used to gauge incoming students' knowledge of mathematics, science, and basic engineering principles, as well as their preparation for graduate-level coursework. Students requiring pre-program work must take the general examination in the semester following the completion of their pre-program, and prior to their semester of graduation. The general examination may be repeated once. Passing this exam advances the student to master's candidacy. Students who have passed the Fundamentals of Engineering (FE) examination within the three years prior to their admission to ORE are exempted from taking the general examination.

The core, option-area, and elective courses offered by ORE are listed in Appendix B. The core courses provide students with a broad understanding of the topics of interest to ocean and resources engineering. This includes hydrostatics, oceanography, water wave mechanics, and underwater acoustics. The laboratory course connects material covered in the classroom with observations made and data collected in the ocean. The option-area courses prepare students for specialization in coastal, offshore, ocean resources, and oceanographic engineering. The capstone design project is typically team-taught by faculty members and practicing professional engineers. Its objective is to familiarize students with the planning and design of an engineering project in a consulting firm setting. All MS students are required to participate in a public speaking workshop organized by the department, take an on-line research ethics training class, and attend 15 seminars which cover the latest in developments and research – as well as contemporary issues – related to ocean and resources engineering. The core, option-area, and seminar requirements amount to 25 academic credits; the remaining credits are to be chosen to form a coherent plan of study.

Students complete their study with a thesis (Plan A) or independent project (Plan B). The thesis is research oriented and carries six academic credits. The independent project focuses on engineering application and design and carries three academic credits. Both require a proposal outlining the subject area, objectives, proposed methodology, sources of data, and anticipated results, and must be approved by a committee of at least three graduate faculty members. The majority of this committee should be comprised of ORE departmental, cooperating, and affiliate graduate faculty members and the committee should include at least one ORE departmental faculty member. The committee must be approved by the ORE Graduate Chair who, in consultation with the Committee Chair, may appoint additional member(s) to the committee. The thesis/project provides students with an opportunity to explore and contribute to the development of the latest technology in an ocean and resources engineering discipline. This work results in a thesis (Plan A) or a report (Plan B) that should demonstrate both mastery of the subject matter and an aptitude for clear and effective communication. The student must present and defend their work at a final examination, which provides the committee with an opportunity to assess the student's understanding and ability to integrate his or her work at the MS level. The MS final examination may be repeated once.

PhD Degree

Students pursuing a PhD are required to achieve a broad understanding of the principal areas of ocean and resources engineering, as well as a thorough understanding of their research area. Students are expected to have knowledge related to fundamental engineering courses (see Appendix B for the MS basic engineering pre-program requirements) as well as the core courses of the ORE MS degree. Doctoral students are also encouraged to take courses relevant to their research interests.

The ORE program at the PhD level has the following requirements:

- PhD qualifying exam,
- An advanced mathematics course at the graduate level and ORE 792 Seminar
- PhD comprehensive exam, and
- PhD dissertation and defense.

All intended PhD candidates are expected to take a qualifying examination, preferably before or during the third semester of full-time enrollment. In addition to covering basic undergraduate mathematics and engineering fundamentals, the examination tests the students' understanding of the core courses of the ORE MS degree. The examination is conducted by ORE's PhD qualifying exam committee and the outcome is determined by a vote of the departmental faculty. The qualifying examination may be repeated only once.

After passing the qualifying examination and advancing to candidacy, the student forms a dissertation committee and begins preparing his/her dissertation proposal. The dissertation committee should consist of a minimum of five graduate faculty members with at least one ORE departmental faculty member and at least one faculty member from outside ORE. The majority of this committee should be comprised of ORE departmental, cooperating, and affiliate graduate faculty members. The committee must be approved by the ORE Graduate Chair who, in consultation with the Committee Chair, may appoint additional member(s) to the committee. Upon completion of their dissertation proposal, the student must take a comprehensive examination which is conducted by the dissertation committee. This is meant to measure the student's preparation and ability to conduct original research in the area of the proposed dissertation topic. The examination consists of a presentation of the student's proposed research followed by an oral component in which the student must defend the novelty of the proposed research, address any issues raised by the committee, and demonstrate his/her ability to successfully conduct the proposed research. The comprehensive examination may be repeated only once.

PhD students are expected to publish their research in refereed journals. This provides feedback from the research community while developing a publication track record prior to graduation. The student must present and defend the dissertation at a final examination, which is conducted by the dissertation committee. This examination may not be repeated except with approval from the graduate program and the Graduate Division, which has additional rules pertaining to the defense.
http://manoa.hawaii.edu/graduate/content/final-defense

Responsible Conduct of Research Training

The University of Hawaiʻi values research integrity. To help ensure compliance with UH policies, all ORE students are required to complete the online portion of the Responsible Conduct of Research (RCR) training before submitting a research proposal. Details are available on the UH RCR website in the Collaborative Institutional Training Initiative Certification (CITI) section.
https://www.hawaii.edu/researchcompliance/responsible-conduct-research

Admissions

Students are admitted for graduate studies based on their scholastic records. Candidates for the MS program typically have a bachelor's degree in an engineering discipline, which provides an adequate background in mathematics, science, and mechanics. Students with undergraduate degrees other than engineering will be required to make up deficiencies in basic engineering courses. Students seeking admission to the PhD program should have an MS in engineering, or equivalent qualifications. Exceptionally qualified students with a BS in engineering who do not hold an MS degree may petition for direct admission to the PhD program. Admission letters include a preliminary list of deficiencies, if any, determined by the ORE Graduate Chair.

Deadlines to submit applications for admission to the ORE graduate program are January 15 for fall semester admission and August 15 for spring semester admission. The ORE application checklist (available on the ORE admissions webpage) includes all the forms and supporting documents that need to be submitted; application materials should be submitted to the UH Graduate Division, with supplemental materials submitted via the Graduate Application Supplemental Documents Upload Website.

Detailed admission requirements and forms are available at the University of Hawaiʻi Graduate Division web page. Official scores for the GRE General Test are required from all applicants. Official English Proficiency Exam scores are required from non-native English speaking students. TOEFL - Test of English as a Foreign Language - minimum scores are 600/100 (paper/Internet), with subtest scores of 25 for listening and 25 for speaking. IELTS - International English Language Testing System - minimum score is 7.00.
http://manoa.hawaii.edu/graduate/content/prospective-students

Forms required by ORE can be downloaded from the ORE admissions web page.
http://www.soest.hawaii.edu/ore/program/admission/.

- Supplemental information form
- Statement of objectives
- Letter of recommendation form
- Graduate assistantship application

After the required documents are received, Graduate Division screens the application to ensure that university admission requirements are satisfied. The ORE Admissions Committee and ORE Graduate Chair then evaluate the application and determine the applicant's admissibility to the ORE program.

Advising and Progress

Upon admission, the ORE Department Chair meets with each incoming student at a preliminary conference to discuss the program requirements and establish the educational goals. The ORE Graduate Chair will reconfirm any pre-program deficiencies for students from non-ABET accredited undergraduate programs through evaluation of transcripts and course descriptions. The UH Graduate Division requires that all transfer credits must be approved during the first semester of enrollment, and must not have been used in obtaining a prior degree. The ORE program allows up to six transfer credits from courses taken elsewhere. These courses must be equivalent to the core and option-area courses of the program and approved by the course instructors upon evaluation of the course notes, assignments, and exam questions. If these requirements are met, the ORE Graduate Chair then recommends to the Associate Dean of Graduate Division to approve the transfer credits.

The ORE Graduate Chair serves as the advisor to students who do not meet the pre-program requirements. Once pre-program requirements are met, the ORE Department Chair appoints an academic advisor from the pool of ORE departmental faculty. The academic advisor helps students develop a program of study meeting their specific educational goals, navigate the program requirements, and ensures that all university and department guidelines are met. At the onset of their research, students must select a research advisor to guide their research and serve as their Committee Chair.

Graduate Division requires that several forms are submitted by the student during their program to track progress. These forms can be found on the Graduate Division website.
http://manoa.hawaii.edu/graduate/content/forms
In addition to the Graduate Division forms, PhD students are required to submit internal Form I-A (Dissertation Committee and Proposal, available in the ORE office) prior to scheduling their comprehensive examinations. Their research proposal must be attached to the form and submitted to the Graduate Chair for approval. ORE further monitors progress of students through an internal student progress form which is updated each semester and upon graduation. The purpose of this progress form is to help keep students on track and to provide data for subsequent assessments of the ORE program.

Policies regarding conduct and harassment are available on the SOEST website.
https://www.soest.hawaii.edu/soestwp/sexual-harassment-and-bullying/

Timeline

The minimum residency requirement for an MS degree at UH is two semesters full-time. The following chart outlines the typical timeline to satisfy the requirements in the MS program. Since the core and option-area courses are offered with the fall-spring sequence in mind, most students begin their enrollment in the fall semester. Students who do not require pre-program coursework proceed directly to the program coursework and take the general examination during their first semester. Most complete the degree requirements between 16 months and two years. Students with pre-program deficiencies typically spend three years full-time to complete the program.

Table 1. ORE MS Timeline

MS Requirements	Semester			Semester			Semester		
	Fall	Sp	Sum	Fall	Sp	Sum	Fall	Sp	Sum
Pre-program									
General Examination									
Coursework									
Approval of research									
Research									
Final Examination									

The minimum residency requirement for a PhD degree is three semesters full-time. Based on Graduate Division statistics, the average time to complete a PhD degree in ORE is 5.5 years. The following chart shows the typical timeline to satisfy the PhD program requirements. Most students admitted into the PhD program satisfy the pre-program requirements and proceed directly to the program coursework. PhD students typically take the qualifying examination after a full year of coursework. The comprehensive examination must be taken within three years of enrollment.

Table 2. ORE PhD Timeline

PhD Requirements	Semester			Semester			Semester			Semester			
	Fall	Sp	Sum	Fall	Sp	Sum	Fall	Sp	Sum	Fall	Sp	Sum	Fall
Pre-program													
Program Coursework													
Qualifying Exam													
Approval of research													
Research													
Comprehensive Exam													
Dissertation Defense													

Students failing any one of the general, qualifying, comprehensive, or final* examinations twice will be dropped from the program (*if a re-take is granted in the case of a PhD exam). Students, who do not complete all requirements within seven years after admission will be automatically dropped from the program. Reinstatement for a limited period of time is possible only upon submission of a petition to Graduate Division via the ORE Graduate Chair providing a detailed degree plan and new limited timeline for completion of all degree requirements.

FACULTY

Departmental Faculty

ORE has 8 departmental faculty members. All faculty members are graduate faculty with the UH Graduate Division and are responsible for instruction, research, and administration within the department. To administer the department, faculty serve rotational terms as ORE Department Chair and Graduate Chair.

- E.M. Briggs, PhD, Assistant Professor – Autonomous sensors and instrumentation, chemical sensors, coral reef metabolism, biogeochemical dynamics
- K.F. Cheung, PhD, PE, Professor – Coastal and offshore engineering, marine hydrodynamics, computational methods, water wave mechanics, coastal flood hazards

- D. Gedikli, PhD, Assistant Professor – Offshore marine structures, experimental hydrodynamics and fluid-structure interactions, structural dynamics, dynamical systems
- B.M. Howe, PhD, Research Professor – Ocean acoustics including tomography and ambient sound, ocean observing sensor webs including fixed (e.g., cabled) and mobile platforms (e.g., gliders and profilers), navigation, and communications
- Z. Huang, PhD, Associate Professor – Marine energy, hydrodynamics of ocean waves, coastal and ocean engineering, coastal sediment transport, coral reef hydrodynamics, tsunami hazard mitigation
- M. Krieg, PhD, Assistant Professor - Marine Robots, biomimicry analysis, unconventional propulsion, hydrodynamic modeling, autonomous systems and control, distributed fluid sensing, coupled autonomous systems
- E.M. Nosal, PhD, Associate Professor – Passive acoustic monitoring methods, ocean ambient noise, sediment acoustics, bioacoustics, signal processing, inverse methods
- J.E. Stopa, PhD, Assistant Professor – Marine forecasting / hindcasting, data analysis applications in geophysical datasets, oceanic remote sensing, spectral wave models, wind and wave climate

Cooperating Graduate Faculty

ORE has a number of cooperating faculty members from other research or academic units at UH. Cooperating faculty members give seminars on their research, serve on student research committees, and advise students on their theses or independent research projects.

- M. Chyba, PhD, Professor of Mathematics – Robotic control theory and systems
- P. Cross, PhD, Specialist at Hawaii Natural Energy Institute – Meteorology, oceanography, wave energy, renewable energy generation
- O. Francis, PhD, PE, Associate Professor of Civil Engineering – Coastal infrastructure, sustainable water and wastewater systems, ocean waves
- R. Ghorbani, PhD, Associate Professor of Mechanical Engineering – Renewable energy
- B.T. Glazer, PhD, Associate Professor of Oceanography – Instrumentation
- S.M. Masutani, PhD, PE, Researcher, Hawaii Natural Energy Institute – Thermodynamics, energy systems
- J.R. Smith, PhD, Specialist (Marine Geophysical) and Science Program Director, Hawaii Undersea Research Laboratory – Marine mapping technology and instrumentation
- Z. Song, PhD, Assistant Professor of Mechanical Engineering – Autonomous Navigation, Multi-agent systems
- J. Yu, PhD, Researcher, Hawaii Natural Energy Institute – Marine bioproducts

Affiliate Graduate Faculty

ORE has several affiliate faculty members from the engineering and scientific communities. Affiliate faculty members volunteer their time and bring individual expertise, external perspectives and real-world engineering experience to the academic program. Some of them serve on student research committees and team-teach the capstone design project with the ORE faculty.

- C. Ertekin, PhD, Professor (retired), Ocean and Resources Engineering
- D. Greeson, PhD, US Navy Captain (ret), Nuclear Engineer, Pearl Harbor Naval Shipyard
- E. G. Pawlak, PhD, Professor of Mechanical and Aerospace Engineering, University of California San Diego
- D. Rezachek, PhD, PE, Alternate Energy Specialist (retired), Energy, Resources, and Technology Division, Department of Business, Economic Development and Tourism, State of Hawaii, Honolulu, Hawaii
- D. Smith, PhD, PE, Senior Coastal Engineer, Sea Engineering
- L. VanUffelen, PhD, Assistant Professor, Department of Ocean Engineering, University of Rhode Island
- D. Vithanage, PhD, PE, Technical Director and Vice President, Oceanit Laboratories, Inc., Honolulu, Hawaii

Adjunct Faculty

- B. Jones, PhD, Director of Data and Modeling and Associate Director, Applied Research Laboratory, University of Hawaiʻi
- S.W. Yoon, PhD, Adjunct Professor of Ocean & Resources Engineering

RESEARCH FACILITIES

Kilo Nalu Observatory

The Kilo Nalu Observatory (KNO) is located on the south shore of Oahu, east of downtown Honolulu and west of Waikiki and Ala Moana, just off Point Panic and Kakaako Park. KNO provides a window into the physical, biological and chemical environment of nearshore coral reefs, as well as data and power connections to a suite of observational instruments that resolve waves, tides, currents and nearshore water quality. The observatory is managed and maintained by ORE. It supports both ORE teaching (e. g., infrastructure and instrument development and data analysis) and for research projects (e. g., developing autonomous underwater vehicle (AUV) docking, navigation and command and control; small scale wave energy converter prototype

testing; and new sensor testing). KNO is a testbed for the deep water ALOHA Cabled Observatory (ACO, below).

ALOHA Cabled Observatory

The ALOHA Cabled Observatory (ACO) provides another avenue for ocean observations and ocean technology development. Since June 2011, the ACO has provided power, network communications and timing to instruments at a seafloor node 4728 m below the water surface, 100 km north of Oahu; it is the deepest power and Internet node on the planet. ACO is a prototypical example of a deep observatory system that uses a retired first-generation fiber-optic telecommunications cable. The cabled observatory system provides infrastructure for continuous, interactive ocean sampling enabling new measurements and new modes of ocean observing which integrate ship and cabled observations. Present sensors measure currents, pressure, temperature, and salinity, along with video and acoustics. Students are able to analyze data from the ACO for projects, design and fabricate new sensors for the system, and participate on service cruises with a state-of-the-art ROV. ACO uses KNO as a testbed.

Other Opportunities for Laboratory, Field Work and In-Ocean Experimentation

ORE maintains research facilities at the UH Marine Center (at Pier 35 in Honolulu Harbor) for field work and in-ocean experiments. These facilities include a test tank, field research equipment and instrumentation (with machine shop support), as well as access to various ocean vessels. In addition to the larger ship, *Kilo Moana*, there is a 19-foot "Safe-boat" as well as local boats that can be hired as necessary. Field equipment includes SCUBA diving gear, acoustic current profilers, current meters, pressure sensors, wave gauges, anemometers, hydrophones, buoys, and mooring equipment. The UHMC also operates the remotely operated vehicle ROV Lu'ukai, rated for 6,000 m. It is used to service the ACO, as well as for other research such as deep sea biology surveys for deep sea mining studies.

FINANCIAL SUPPORT AND TRAINING OPPORTUNITIES

Financial support is available through graduate assistantships (research and teaching) and internships. Assistantships and internships include tuition waivers and subsidized fringe benefits. Research projects provide financial support to graduate assistants while providing them with the opportunity to participate in engineering studies and familiarize themselves with theoretical, numerical, and experimental methods. A number of local engineering firms sponsor ORE internships and provide practical training at their sites. Further details (and the assistantship application) are available on the ORE admissions page. http://www.soest.hawaii.edu/ore/program/financial-support/

PLACEMENT DATA

Statistics from the 2007-2019 graduates provide a clear picture of where ORE students are coming from and where they are heading after graduation. Approximately 30% of our students have Hawaiʻi ties (those who studied or worked in Hawaii prior to enrollment), 45% were recruited from other parts of the U.S. and 25% from foreign countries. After graduation, 45% found work in Hawaii, 45% found work outside of Hawaii, 5% continued studies in Hawaii, and 5% continued studies outside of Hawaii. Nearly all graduates obtained employment or continued their studies in ocean and resources engineering (or related fields).

Career opportunities for graduates in ocean and resources engineering exist in several areas. Approximately 55% of the 2007-2019 graduates found work in private industry including consulting, environmental service, and construction firms in the U.S. About 15% of them joined, or continued their employment with, federal agencies such as the Army Corps of Engineers and the Navy; 5% found work with U.S. community colleges and universities. Another 10% entered Ph.D. programs or received post-doctoral positions at U.S. universities. The 15% of graduates who went abroad continue to study, or work for government agencies and in academia.

FURTHER INFORMATION

FOR FURTHER INFORMATION, WRITE:
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E-MAIL: adminore@hawaii.edu
URL: www.soest.hawaii.edu/ore

APPENDIX A. ADVISORY PANELS

The ORE faculty regularly assess and updates the educational objectives, program outcomes, assessment processes, and academic program in general with input from alumni and their employers, as well as local and international panels of professionals representing the ocean and resources engineering communities.

APPENDIX B. MS COURSEWORK REQUIREMENTS

Pre-program requirements

ORE offers a graduate program and typically relies on the students' undergraduate education to fulfill the pre-program requirements which include:

1. A general education component including economics, management, and humanities;
2. One year (30 credits) of college level mathematics and basic science; and
3. One and one-half years (45 credits) of basic engineering science and design.

These requirements cannot be satisfied with graduate-level courses. Students with undergraduate engineering degrees normally satisfy these requirements and can directly proceed to the graduate-level ORE program. Students with undergraduate degrees other than engineering will be required to make up deficiencies in basic engineering courses, including

- Computer aided design (CAD),
- Statics (CEE 270),
- Dynamics (CEE 271 or ME 271),
- Fluid mechanics (CEE 320 or ME 322),
- Mechanics of materials (CEE 370 or ME 371), and
- Probability and statistics (CEE 305),

and elective courses in the following subjects depending on the student's intended option area in the department:

- Surveying,
- Hydraulics,
- Civil engineering materials,
- Structural mechanics,
- Geotechnical engineering,
- Environmental engineering,
- Corrosion engineering,
- Thermodynamics,
- Heat transfer, and
- Material science and engineering.

Course requirements

The ORE MS graduate program includes a 12-credit core that covers:

- ORE 411 Buoyancy and Stability (3 credits)
- ORE 601 Ocean Engineering Laboratory (3)
- ORE 603 Oceanography for Ocean Engineers (3)
- ORE 607 Water Wave Mechanics (3)

The minimum required grade for the 4 core courses and their prerequisites is B-.

Students must take the 1-credit ORE 792 Seminar course, which requires attending at least 15 seminars related to ocean and resources engineering, completing Responsible Conduct of Research training, and completing a science communication workshop.

The MS program also requires a set of option-area courses to be completed. In consultation with their academic advisor, students select a 12-credit course of study in coastal, offshore, ocean resources, or oceanographic engineering. The course requirements for these option areas are listed below. Enrollment of ORE students in classes in departments other than ORE depends on the availability of the class and is subject to the approval of the Chair of the relevant department if a major override is needed.

Coastal engineering (12 credits)

ORE 783B Capstone Design Project – Coastal (3); and

Three of the following:

- ORE 609 Hydrodynamics of Fluid-Body Interaction (3)
- ORE 661 Coastal and Harbor Engineering (3)
- ORE 664 Near-shore Processes and Sediment Transport (3)
- CEE 656 Marine Geotechnics (3)
- GG 420 Beaches, Reefs, and Climate Change (3)

Offshore engineering (12 credits)

ORE 783C Capstone Design Project – Offshore (3); and

Three of the following:

- ORE 609 Hydrodynamics of Fluid-Body Interaction (3)
- ORE 612 Dynamics of Ocean Structures (3) or CEE 675 Structural Dynamics I (3)
- ORE 630 Structural Analysis in Ocean Engineering (3) or CEE 686 Finite Elements in Structures (3)
- CEE 656 Marine Geotechnics (3)
- ME 404 Computational Fluid Dynamics (3) or ME 626 Viscous Flows (3)

Ocean resources engineering (12 credits)

ORE 783D Capstone Design Project – Ocean Resources (3); and

Three of the following:

- ORE 609 Hydrodynamics of Fluid-Body Interaction (3)
- ORE 677 Marine Renewable Energy (3)
- ORE 678 Marine Mineral Resources Engineering (3)
- ME 453 Energy Conversion Systems (3)
- ME 610 Renewable Energy Engineering and Sustainability (3)

Oceanographic engineering (12 credits)

ORE 783C or 783D Capstone Design Project (3); and

Three of the following:

- ORE 608 Probability and Statistics for Ocean Engineers (3)
- ORE 654 Applications of Ocean Acoustics (3)
- OCN 620 Physical Oceanography (3)
- OCN 640 Observational Physical Oceanography (3)
- ME 451 Feedback-Control Systems (3) or ME 452 Robotics (3)

MS students round-out their studies with 6 credits following one of the following plans:

- Plan A: ORE 700 Thesis Research (6)
- Plan B: ORE 695 Master's Project (3) and a free elective course (3)

Other course requirements/options

Although the UH Graduate Division requires a minimum of 30 credits for graduation, most students take more than the required minimum (averaging around 33 credits).

Students are encouraged to take courses in the other option areas as electives. In addition, ORE offers the following electives:

- ORE 330 Mineral & Energy Resources of the Sea (3)
- ORE 654 Applications of Ocean Acoustics (3)
- CEE/ORE 621 Coastal Flood Mitigation (3)
- CEE/ORE 624 Coastal Modeling (3)
- ORE 641 Environmental Fluid Dynamics (3)
- ORE 680 Ocean Engineering and Resilience in a Changing Climate (3)
- ORE 699 Directed Reading or Research
- ORE 707 Nonlinear Water Wave Theories (3)
- ORE 766 Numerical Methods in Ocean Engineering (3)
- ORE 791 Special Topics

Other departments offer courses relevant to ORE. These courses are approved on an individual basis as electives by the academic advisor.