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College of Sciences

www.sci.odu.edu/
143 Oceanography & Physics Building
Norfolk, VA 23529
757-683-3274

Chris Platsoucas, Dean
Christopher Osgood, Associate Dean
Terri M. Mathews, Associate Dean

Ph.D.
• Applied Experimental Psychology
• Biomedical Sciences
• Chemistry
• Computational and Applied Mathematics
• Computer Science
• Ecological Sciences
• Human Factors Psychology
• Industrial/Organizational Psychology
• Oceanography
• Physics

Psy.D.
• Clinical Psychology

Master’s
• Biology
• Chemistry
• Computational and Applied Mathematics
• Computer Science
• Ocean and Earth Science
• Physics
• Psychology

Overview
The College of Sciences’ degree programs are designed to prepare students for careers in the sciences and to lay broad foundations for specialized training in these fields of knowledge.

The college is comprised of the Departments of Biological Sciences, Chemistry and Biochemistry, Computer Science, Mathematics and Statistics, Ocean, Earth and Atmospheric Sciences, Physics, and Psychology. The Departments of Biological Sciences, Chemistry and Biochemistry, Mathematics and Statistics, Ocean, Earth and Atmospheric Sciences, and Physics cooperate with the Darden College of Education to provide the necessary courses for a Masters of Science in Education in the respective field.

Programs
The College of Sciences has developed graduate programs in the basic and applied sciences that meet the needs of the Eastern Virginia region, the state, the nation and the world. These programs address a variety of challenges, ranging from basic research to the quest for solutions to contemporary problems in science. The importance of these challenges is reflected by the more than $17 million in funded grants and contracts for educational and research endeavors currently generated by the college. The college provides the nation with much-needed graduate programs in broad fields of concentration leading to both master’s and doctoral degrees. Related program emphases within the major areas of study are designed to meet the professional needs of the students and communities served.

The college’s faculty of 160 highly skilled professional educators is devoted to guiding students toward an assimilation of the most current scientific theories, research, and practices.

College Financial Aid
The College of Sciences has established teaching and research assistantship stipends that range from $5,250 to $20,500. The responsibility for distributing these assistantship stipends lies in each department. In addition, each department has fellowship and tuition exemption funds available for competitive distribution.

Dominion Graduate Scholars
Programs in the College of Sciences offer a number of very competitive awards for graduate students newly admitted into Ph.D. programs. Some of these are Dominion Graduate Scholar appointments that carry a stipend of $18,000 for a 12-month period and full tuition exemptions. These Scholars must be enrolled in at least nine hours of graduate courses each semester, and three graduate credits during the summer to meet institutional eligibility requirements. These students are expected to be scholars in residence and spend full time in pursuit of their studies. Since the teaching or research experience will be more limited than for other awards, the Scholars will have sufficient time to devote to their academic studies.

All admission materials are considered as a part of the evaluation process. Students apply to specific graduate programs and may inquire about the Dominion Graduate Scholarship. After a student has been appointed to a Dominion Scholarship, the Graduate program director will submit a copy of their letter-of-offer, letter-of-acceptance and the awardee’s credential summary.

Minimum criteria for eligibility are as follows:
1. GRE scores of either:
   2. 1200 combined verbal and quantitative, or
   3. 1300 in any two of verbal, quantitative, or analytical.
2. Undergraduate GPA of 3.20 overall and 3.50 in the major, out of 4.00 maximum.
3. Evidence of research aptitude by undergraduate thesis/research, publications, M.S. thesis and/or letters of reference.
4. Information concerning the Dominion Graduate Scholar Program may be obtained from the graduate program director for the program of interest.
5. Written acknowledgment from a faculty member agreeing to serve as the student’s major advisor, if the student is accepted.

Doctor of Philosophy - Biomedical Sciences
Robert E. Ratzlaff, Graduate Program Director

In this interdisciplinary program all students are required to master a broad knowledge of the basic biomedical sciences. Integration of the basic courses is reinforced by a rotation of laboratory experiences and by special seminars that highlight disciplinary interrelationships and approaches to biomedical research. The student progresses from a core of basic courses to in-depth study of specific biomedical problems. This includes advanced doctoral courses and the doctoral research project. Under the guidance of the graduate faculty, the student will integrate knowledge from the broad spectrum of biomedical disciplines into his or her focus on an area of specialization.

The program graduate will be a scientist with a broad biomedical education and a demonstrated ability to carry out original and creative research, cognizant of the disciplinary interfaces and implications and capable of pursuing and/or recommending continuing lines of study. He/she will be prepared to bridge the gap between practice and discovery in the art of medicine and the practice of science. The graduate is capable of serving in an industrial, governmental, or academic teaching or research setting, either independently or as a member of a team.
Admission
The requirements for admission to the biomedical sciences Ph.D. program are as follows:
1. A bachelor’s degree from an accredited college or university with a B (3.00) average. Students with advanced degrees are encouraged to apply.
2. Completion of the Graduate Record Examination (GRE); verbal + quantitative > 1,000 or 300 on the new GRE.
3. Prior training in biology (two years), calculus and/or statistics, and organic chemistry (one year). Additional courses in biology, chemistry, and physics are recommended.

Curriculum and Requirements
To accomplish the objectives of the program, the student:
1. Enrolls in the basic biomedical sciences courses to develop a broad foundation for more advanced course work and dissertation research;
2. Selects appropriate advanced course work approved by the guidance committee;
3. Completes at least 79 credit hours beyond the bachelor’s degree or 48 credit hours beyond the master’s degree;
4. Presents two seminars;
5. Passes either
   A. written and oral qualifying examinations on course work or
   B. an NIH-style grant proposal written on a research question in an area not specific to the planned research in the mentor’s laboratory and an oral exam on the grant proposal and on coursework;
6. Develops an interdisciplinary research proposal in NSF or NIH format that is accepted by the guidance committee;
7. Performs publishable research to demonstrate the ability to complete original and creative research projects; and
8. Prepares and successfully defends a dissertation.

Application Procedures
The completed application for the biomedical sciences Ph.D. program will include the following items:
Transcripts of all college course work. Transcripts will be official transcripts sent by the registrars of the colleges attended.
1. Graduate Record Examination (GRE) test scores, sent directly from the Educational Testing Service to the Old Dominion University Graduate Admissions Office. The Medical College Admissions Test (MCAT) can substitute for the GRE (minimum score 26).
2. A statement of personal goals and academic objectives.
3. Three letters of recommendation, preferably from faculty members at colleges attended who are familiar with the applicant’s academic and research capabilities.
4. A completed application form.
5. Receipt of the application fee. Checks should be made payable to Old Dominion University.
6. Test of English as a Foreign Language (TOEFL) test scores, sent directly from the ETS to ODU International Graduate Admission Office must accompany international applications for applicants with a degree issued outside of the United States.

Applications to Old Dominion University can be completed on-line http://admissions.odu.edu/home.php.
The applicant is responsible to ensure that all application materials are received and the application is complete in all respects.

Financial Aid
Sources of financial aid available to biomedical sciences Ph.D. students include
1. waivers of tuition,
2. research and teaching assistantships and
3. loans.

Department of Biological Sciences
110 Mills Godwin Building
Norfolk, Virginia 23529-0266
(757) 683-3595
http://sci.odu.edu/biology/
Wayne L. Hynes, Chair
Deborah A. Waller, Assistant Chair
Ian K. Bartol, Ecological Sciences Ph.D. Graduate Program Director
Robert E. Ratzlaff, Biology Master’s Graduate Program Director
Robert E. Ratzlaff, Biological Sciences Ph.D. Graduate Program Director

The Department of Biological Sciences provides a broad selection of course offerings. The degree program in biology allows for the selection of elective subjects most suited to the individual’s vocational interests.

Master of Science—Biology
Robert E. Ratzlaff, Graduate Program Director

The Department of Biological Sciences provides a broad selection of course offerings. The degree program in biology allows for the selection of elective subjects most suited to the individual’s vocational interests.

The curriculum for the Master of Science program is developed around one’s interests such as:
• botany,
• ecology,
• immunology,
• infectious diseases,
• marine biology,
• microbiology,
• physiology,
• reproductive biology,
• systematic biology, and
• zoology.

In addition, there are two specially designed concentration areas in:
• biotechnology and
• wetland ecology.

Facilities in the Department of Biological Sciences include:
• electron microscopy,
• terrestrial and aquatic animal care facilities,
• biomechanics,
• environmental pollution,
• marine benthic ecology,
• biotechnology,
• spectroscopy,
• cell culture,
• protein separation,
• DNA sequencing,
• GIS (Geographic Information System),
• digital imaging,
• a greenhouse,
• herbarium,
• zoological museum,
• animal facilities, and
• field science wet laboratories.

In addition, excellent opportunities exist for research and instruction off-campus at field research sites including:
• Blackwater Ecological Preserve,
• Virginia Coast Reserve-Long Term Ecological Research Site,
• Virginia Institute of Marine Sciences Eastern Shore Marine Laboratory, and
• other regional agencies and facilities.

Admission Information
Students who wish to enter this program should apply to the Master of Science in biology program and indicate their proposed field of study in the Statement of Interest, a required component of the application. Applications for admission can be obtained via the Internet at http://admissions.odu.edu/home.php or from:

Office of Graduate Admissions
Old Dominion University
Norfolk, VA 23529-0050
(757) 683-3685

Requirements for regular admission to the master’s program in biology are:
1. a bachelor’s degree in biology or a related field from an accredited college or university;
2. a grade point average of at least 3.00 on a 4.00 scale;
3. Satisfactory scores on the General portion of the Graduate Record Examination (Verbal+Quantitative 1000 or 300 on the new GRE) or at least a 24 on the Medical College Admission Test
4. two letters of recommendation;
5. an essay describing the area of biology of interest for graduate study, professional goals and motivation for graduate study in biology; and
6. written acknowledgment from a Department of Biological Sciences faculty member agreeing to serve as the student’s major advisor, if the student is accepted.

The Test of English as a Foreign Language (TOEFL) is required of all applicants whose native language is not English: minimum scores are 550 for the paper-based test, 213 for the computer-based or 79 on internet-based test.

Deadlines for application to the program are:
• February 1 for summer admission, early fall admission and consideration for a graduate teaching assistantship;
• June 1 for fall semester admission; and
• October 1 for spring semester admission.

Degree Requirements
Two degree options are available — thesis and non-thesis. A minimum of 31 semester hours of graduate credit is required of thesis students and 37 of non-thesis students; three-fifths of these credits must be at the 600-level or above. Research (BIOL 698) is required of all students. All students must deliver a scientific presentation in an appropriate public forum. For thesis students, the presentation should be at a scientific meeting. Course work, including any required courses, is selected according to the interest of the student, with the guidance and approval of the student’s faculty advisory committee. All students will complete a comprehensive exam (written or oral) that covers the student’s program of study. A substantial research project and a defense of the written thesis (BIOL 699) are required of students selecting the thesis option.

Master of Science - Biology

Many pertinent graduate courses are offered for the Master of Science in Biology programs that can be applied toward the degree requirements. A program of study is developed by the student with approval of advisory committee and the Graduate Program Director.

Master of Science - Wetland Biology Concentration

The wetland biology concentration has been structured to contain essential clusters in the following disciplines: plant identification, wetland and aquatic ecology, soils and hydrology, regulation, technical application, topical seminars, internships, and research and/or thesis. Recommended course are:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 519</td>
<td>Wetland Plants</td>
<td>5</td>
</tr>
<tr>
<td>BIOL 550</td>
<td>Principles of Plant Ecology</td>
<td>4</td>
</tr>
<tr>
<td>OEAS 508</td>
<td>Introductory Soils</td>
<td>4</td>
</tr>
<tr>
<td>OEAS 622</td>
<td>Wetland Hydrology</td>
<td>3</td>
</tr>
</tbody>
</table>

Master of Science - Biotechnology Concentration

The biotechnology program is designed to enable the student to learn basic skills in cell and molecular biology, with the flexibility to develop a curriculum in the areas of infectious diseases, immunology, physiology, or environmental molecular biology.

Biotechnology students are required to take five core courses (below) in addition to the research and presentation requirements.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 523</td>
<td>Cellular and Molecular Biology</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 541</td>
<td>Biochemistry Lecture</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 543</td>
<td>Intermediate Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 671</td>
<td>Molecular and Immunological Techniques</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 755</td>
<td>Molecular Genetics</td>
<td>3</td>
</tr>
</tbody>
</table>

The remaining coursework is selected according to the interest of the student, with the guidance and approval of the student’s faculty advisory committee.

Master of Science in Education - Biology

Refer to the Darden College of Education section of this catalog (http://catalog.odu.edu/graduate/dardencollegeofeducation/).

Doctor of Philosophy - Ecological Sciences

Dr. Ian K. Bartol, Graduate Program Director

Program Description

The primary goal of the doctoral program in ecological sciences is to provide advanced training in ecological, evolutionary and integrative biology.

The program has notable strengths in a broad range of biological subdisciplines, including:

• ecosystem studies,
• experimental ecology,
• community ecology,
• behavioral ecology,
• marine biology,
• molecular genetics,
• conservation biology,
• systematics,
modeling,
evolutionary biology,
biomechanics,
parasitology, and
functional morphology.

Program faculty conduct studies in a variety of terrestrial, freshwater, and marine environments on several continents, and their research focuses on a broad spectrum of taxa, including, but not limited to:

- vascular plants,
- polychaetes,
- mollusks,
- crustaceans,
- insects,
- arachnids,
- birds,
- fishes,
- and amphibians.

Many faculty combine active field research with parallel laboratory studies. Quantitative approaches are encouraged and the opportunity exists to obtain a master’s degree in statistics while pursuing a doctorate in ecological sciences. The program is enhanced by excellent on-campus resources that include a scanning electron microscopy lab, genetic sequencing facilities, herbarium, aquatics laboratory, water tunnel and flow quantification facility, GIS facilities, greenhouse, and digital imaging facilities. Field research sites have been established in:

- the Virginia Coastal Reserve,
- Blackwater Ecologic Preserve,
- Great Dismal Swamp,
- Atlantic Ocean,
- Chesapeake Bay,
- and other areas.

Admission

Application forms for admission to the Ph.D. program in ecological sciences are available from the Office of Admissions and online (http://web.odu.edu/odushima/admissions.shtml). The following should be sent to the Admissions Office:

1. the completed application form;
2. official transcripts from all universities attended;
3. Graduate Record Examination (GRE) scores;
4. test of English as a Foreign Language (TOEFL) score (from students whose native language is not English);
5. three letters of recommendation, including one from the applicant’s major advisor; and,
6. a statement of professional goals that includes specific research interests.

If an applicant is interested in requesting financial aid, an application for institutional graduate financial assistance should be completed during the application process (see Office of Admissions web page for form). The deadline for application to the program is February 1 for the subsequent fall semester. Students may be admitted during the spring and summer semesters as well, provided they obtain permission from the Graduate Program Director.

To qualify for admission, a student needs:

1. a satisfactory academic average (overall GPA score of at least 3.0 on a 4.0 scale, and overall GPA in the sciences of at least 3.0);
2. GRE scores near the 70th percentile on each of the examination sections (verbal, quantitative, and analytical) with a combined total of at least 1,000 to 1,200 preferred on the verbal and quantitative sections;
3. a TOEFL score of at least 550 (paper-based test), 213 (computer-based test), or 79 (internet-based test) for applicants whose native language is not English;
4. satisfactory letters of recommendation; and
5. a statement of professional goals as stated above.

A master’s degree is desirable but not required. The applicant is expected to have a background in the sciences, with an appropriate undergraduate degree and substantial course work in biology, chemistry or geology. Applicants are strongly advised to contact the ODU faculty member closest to their area of interest prior to submitting an application to determine whether that faculty member is accepting new graduate students. No student, regardless of qualifications, is admitted to the Ecological Sciences Program without the approval of a specific faculty advisor. Potential applicants therefore should initiate a dialogue, preferably by email, with an appropriate member of the program faculty. Applicants should consult the list of faculty in the Department of Biological Sciences, which includes a brief description of their research interests. Applicants may also find it desirable to visit the campus for an interview with a potential advisor and the Graduate Program Director.

It is important for potential applicants to realize that many considerations enter into the decision to accept a student into the program. In addition to the strength of an applicant’s credentials (GRE scores, transcripts, and letters of recommendation), the availability of space in the appropriate faculty advisor’s lab and availability of adequate financial aid may influence the decision. Of these, space in an appropriate advisor’s lab is the most important consideration after an applicant’s academic qualifications. For this reason, applicants are strongly encouraged to contact a potential advisor directly.

Program Requirements

Program requirements are designed to provide a firm foundation in conceptual elements of ecological, evolutionary, and integrative biology, while moving students expeditiously toward their own research. In general, students must complete:

- 48 hours beyond the master’s degree or,
- in the absence of a master’s, 70 hours beyond the bachelor’s degree.

The student’s program of study should be broad and balanced. Course work varies with each student, depending on background and goals. Enrollment in a weekly ecology seminar is required, on average, one semester each year. Professional experience (environmental management or teaching) is encouraged. A five-member advisory committee of faculty is selected to guide the student through his or her course of study and to provide initial approval of the dissertation research. This committee also administers the comprehensive written and oral candidacy examinations, which are taken after all required course work is completed and the research skill requirement (proficiency on one foreign language or computer programming) is satisfied. The written exam must be passed before the oral exam may be taken. Once the candidacy exams are completed and a dissertation committee approves a written dissertation prospectus, the student advances to candidacy. At least three of the members of the original advisory committee, including the committee chair (student’s major advisor), will compose the dissertation committee. This committee approves a written dissertation prospectus and will supervise the research. At this time, the student’s attention turns almost exclusively to his or her own research. However, students continue to participate in seminar courses on a variety of topics, and an average of one seminar course per year of residency on campus is required. At the conclusion of their research, the student
submits a dissertation to the committee and presents a public defense of this work.

Department of Chemistry and Biochemistry
110 Alfriend Chemistry Building
Norfolk, VA 23529-0126
(757) 683-4078
http://sci.odu.edu/Chemistry/
Peter F. Bernath, Chair
Craig A. Bayse, Graduate Program Director

Master of Science – Chemistry
The Department of Chemistry and Biochemistry offers a program of study leading to the degree of Master of Science in Chemistry. This program offers a sound academic background of coursework and research to prepare the student for further graduate study or employment in fields requiring an advanced degree. Areas of specialization within the program include: analytical chemistry, biochemistry, environmental chemistry, marine chemistry, materials chemistry, organic chemistry and physical chemistry.

Admission
An application (www.admissions.odu.edu), transcripts, two letters of recommendation from former college instructors, a resume, a writing sample, an essay about career goals and Graduate Record Examination (GRE) scores (general only) are required for consideration of admission to the program. Admission to regular status requires a grade point average of 3.00 in the major and 2.80 overall (on a 4.00 scale). General university admission requirements also apply. In addition, a Bachelor of Science degree (or equivalent) with a major in chemistry (or another science) is required, although applications from majors in all science disciplines are encouraged. Undergraduate courses in organic chemistry, inorganic chemistry, analytical chemistry, inorganic chemistry, analytical chemistry (quantitative and instrumental analysis), physical chemistry and calculus are required for regular admission. Deficiencies in any of these areas will be identified and must be rectified by taking undergraduate coursework.

Program Requirements
Writing Proficiency Policy
The departmental graduate committee will request a writing sample from each new student. The graduate committee will refer students in need of remedial assistance to the Writing Center.

Options
Candidates for the master’s degree have two options in their program: the Research/Thesis option and the Non-Thesis option.

Courses
Thesis option, 30 hours minimum, including: 24
Research and Thesis 6
Total Hours 30
Non-thesis option, 33 hours minimum, including: 30
Independent study 3
Total Hours 33

Up to 15 hours may be taken in related courses given by other departments pending approval from the Graduate Studies Committee of the Department of Chemistry and Biochemistry. At least 60 percent of the credit hours must be from 600-level courses or higher.

Students who earn grades of C+ or lower in any two graduate courses will not be allowed to continue in the M.S. program.

Core Courses
There are five core areas. These are:
- analytical chemistry,
- biochemistry,
- inorganic chemistry,
- organic chemistry and
- physical chemistry.

Students enrolled in the research/thesis option must take one course from three different core areas; non-thesis option students must take one course from each of the core areas.

Seminar
All students are required to register for seminar CHEM 690 (one credit, pass/fail) and attend departmental seminars for one semester. During the last semester of study, students are required to register for CHEM 691 (two credits, graded) and present a seminar on their research or independent study.

Research and Thesis
During their first semester (and not later than the end of their first academic year), students electing the Research/Thesis Option are required to interview the chemistry graduate faculty, choose a graduate faculty research advisor, and select a research committee in consultation with their advisor and the Graduate Program Director. Upon completion of their research, students must write a formal thesis describing their research and defend it to their research committee.

Non-Thesis Option
Not later than the end of their first academic year, students electing the Non-Thesis Option are required to interview the chemistry graduate faculty and choose an independent study advisor. Non-thesis students and their independent study advisor will then agree upon an independent study project. Upon completion of their independent study project, non-thesis students must write a formal Independent Study Report acceptable to their independent study advisor and the Graduate Studies Committee and pass an oral exam on their project.

Master of Science in Education - Chemistry Major
Refer to the Darden College of Education section of this catalog (http://catalog.odu.edu/graduate/dardencollegeofeducation/).

Doctor of Philosophy – Chemistry
The Ph.D. program in Chemistry prepares students in the application of chemical principles to address many of society’s technical, environmental, and biomedical problems. Students will be able to provide leadership in industrial, governmental, and educational institutions in directing research and/or development to solve these problems. The Ph.D. degree in Chemistry is granted to students who have:

1. mastered advanced knowledge of definite sub-fields of chemistry
2. become familiar with research in these specific fields and developed perceptions of opportunities for further scientific advances
3. demonstrated the capacity to perform original, independent, and scholarly scientific investigation in their specific field and interpret their results.

All students admitted to the program must read and understand the regulations and policies described here and elsewhere throughout this catalog relevant to Old Dominion University’s requirements for Ph.D. degrees. The essential credit requirements for the Chemistry Ph.D. are:
A minimum of 78 credit hours beyond the Bachelor’s degree
48 credit hours beyond the Master’s degree

Admission
An application (www.admissions.odu.edu), transcripts, three letters of
recommendation from former college instructors, an essay about career
goals and Graduate Record Examination (GRE) scores (aptitude section) are
required for consideration of admission to the program. Admission to regular
status requires a grade point average of 3.00 in the major and 3.00 overall
(based on a 4.00 scale). General university admission requirements apply. In
addition, a bachelor’s degree (or equivalent) with a major in chemistry (or
another science) is required, although applications from majors in all science
disciplines are encouraged. Undergraduate courses in inorganic chemistry,
organic chemistry, analytical chemistry (quantitative and instrumental
analysis), physical chemistry and calculus are required for regular admission.
Deficiencies in any of these areas will be identified and must be rectified by
taking undergraduate coursework in these areas.

Program Requirements
Writing Proficiency Policy
The departmental graduate committee will request a writing sample from
each new student. If the graduate committee feels that remedial assistance in
writing is needed, the student will be referred to the Writing Center.

Courses
A minimum of 78 semester hours beyond the undergraduate degree or
48 hours past the master’s degree is required by this program. The broad
requirements for granting the Ph.D. are as follows:
• satisfactory performance in core and elective courses,
• successful completion of both written and oral portions of the Candidacy
  Examination,
• completion of the dissertation prospectus,
• and completion of a satisfactory dissertation and defense of the
dissertation.

Students who earn grades of C+ or lower in any two graduate courses will
not be allowed to continue in the Ph.D. program.

Core Courses
Students must choose one course from three different core areas. The core
areas are:
• analytical chemistry,
• biochemistry,
• environmental chemistry,
• inorganic chemistry,
• organic chemistry, and
• physical chemistry.

Classes from each area are listed on the following pages.

Elective Courses
Students are required to take nine credit hours of elective courses. The
courses are to be chosen upon consultation with their advisor and/or their
guidance committee.

Teaching
Students are required to spend at least one semester as a teaching assistant.

Seminar
All students are required to register for seminar CHEM 890 (one credit,
graded pass/fail) and attend departmental seminars throughout their graduate
career. Twice during their career, students will register for (two credits)
and present a seminar, which will receive a letter grade. In the second
year, students will give a background literature talk on their research. The
second semester of CHEM 891 may not be taken in the same semester as
graduation.

Advisor Selection
During their first semester (and not later than the end of their first semester),
students are required to interview the chemistry graduate faculty (a signed
sheet of at least three faculty members is required), choose a graduate faculty
research advisor, and select a guidance committee in consultation with their
advisor and the Graduate Program Director.

Candidacy Examination
A student admitted to the Ph.D. program in chemistry becomes a candidate
for the Ph.D. degree by passing the Ph.D. Candidacy Examination. This
examination consists of a written portion and oral portion. The student is
required to submit a written description of a novel research idea in the
form of a grant proposal, and then present and defend the idea to his or her
guidance committee.

Dissertation
The dissertation is the final and most important part of the work required
for the Doctor of Philosophy degree in chemistry. The dissertation must be
based on original research and make a contribution to existing knowledge of
sufficient interest to warrant publication in a refereed journal. The candidate
normally works closely with the research advisor, who is chair of the
dissertation committee.

Dissertation Defense
The final examination of the candidate consists of the oral defense of the
dissertation. This public examination is conducted by the dissertation
committee with the research advisor serving as chair.

Department of Computer Science
Engineering & Computational Sciences Bldg.
4700 Elkhorn Ave, Suite 3300
Norfolk, VA 23529-0162
http://www.cs.odu.edu/
Desh Ranjan, Chair
Ravi Mukkamala, Graduate Program Director (MS Program)
Mohammad Zubair, Graduate Program Director (Ph.D. Program)

Programs
The Department of Computer Science offers programs leading to the
Master of Science with a major in computer science, an accelerated five
year combined B.S.C.S. and M.S. with a major in computer science
and the Doctor of Philosophy in computer science. The Department of
Computer Science also offers a Master of Science and Master of Engineering
in computer engineering (jointly with the Department of Electrical
and Computer Engineering in the Batten College of Engineering and
Technology) and a Master of Science in computer science with a computer
information sciences emphasis (jointly with the Information Technology
Department in the College of Business and Public Administration).

Computer science traces its foundation to mathematics, logic and
engineering. Studies in computer science encompass theory, experimental
techniques, and engineering methodology. The computer science curriculum
exposes students to aspects of each of these disciplines and fosters an
appreciation and understanding of them. Students are exposed to the
broad theoretical basis of computer science through lecture and laboratory
experience. The Computer Science Department has a unique curricular
model that applies computer science education to the real world. In addition,
the Computer Science Department offers a set of courses to professionals
who need supplementary experience. A graduate of the computer science
program will have a broad fundamental knowledge of the field and in-
depth knowledge in a particular subject area. To acquire breadth, graduate
students in the department are required to take core courses which together
with the undergraduate core courses cover major aspects of computers and
computation. At the master’s level, the department supports in-depth study in the following areas:

- bioinformatics,
- data mining,
- digital libraries,
- high performance computing,
- networking,
- security,
- software engineering, and
- computational foundations.

At the Ph.D. level, areas of specialization are limited only by the interests of the available faculty. The department has an excellent state of the art computing facility. Please visit the department’s home page for details: http://www.cs.odu.edu.

Master of Science - Computer Science

Entrance Requirements

Students entering the Master of Science program in computer science should meet the minimum university graduate admission requirements (http://admissions.odu.edu/graduate.php?page=requirements). In addition, an applicant must have a strong background in computer science. Students who do not have a sufficient background in computer science may enter the graduate program as provisional students and make up for their deficiencies by taking appropriate courses. Applicants are required to take the GRE aptitude test; for the computer information sciences emphasis area (described below), the GMAT aptitude test may be used. Two letters of recommendation from faculty members of academic institutions are required in addition to all transcripts at the postsecondary level. For students whose native language is not English, either a TOEFL score of 550 (paper-based) and 79 (internet-based) or IELTS score of 6.5 is also required.

Requirements

The departmental requirements for the master’s degree are described below. All these requirements must be satisfied in addition to the University requirements outlined under the Academic Information section of this Catalog.

Core courses

As approved by the GPD from a list of courses such as:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 550</td>
<td>Database Concepts</td>
<td>3</td>
</tr>
<tr>
<td>CS 555</td>
<td>Introduction to Networks and Communications</td>
<td>3</td>
</tr>
<tr>
<td>CS 517</td>
<td>Computational Methods and Software</td>
<td>3</td>
</tr>
<tr>
<td>CS 600</td>
<td>Algorithms and Data Structures</td>
<td>3</td>
</tr>
<tr>
<td>CS 665</td>
<td>Computer Architecture</td>
<td>3</td>
</tr>
</tbody>
</table>

Colloquium

Attend at least 10 colloquia as detailed below.

Course options

Three options are available for candidates for master’s degrees:

- thesis option,
- project option,
- and course-only option.

Thesis Option

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course work</td>
<td>24</td>
</tr>
<tr>
<td>Thesis research</td>
<td>6</td>
</tr>
<tr>
<td>Colloquium</td>
<td>1</td>
</tr>
<tr>
<td>Total Hours</td>
<td>31</td>
</tr>
</tbody>
</table>

A minimum of 31 credit hours is required. The candidate is required to write a thesis and make an oral presentation of the results.

Project Option

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course work</td>
<td>30</td>
</tr>
<tr>
<td>Project work</td>
<td>3</td>
</tr>
<tr>
<td>Colloquium</td>
<td>1</td>
</tr>
<tr>
<td>Total Hours</td>
<td>34</td>
</tr>
</tbody>
</table>

A minimum of 34 credit hours is required. The candidate is required to prepare a written report on the project and to present it orally.

Course-only Option

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course work</td>
<td>33</td>
</tr>
<tr>
<td>Colloquium</td>
<td>1</td>
</tr>
<tr>
<td>Total Hours</td>
<td>34</td>
</tr>
</tbody>
</table>

A minimum of 34 credit hours is required. In addition, the candidate is required to appear for an exit examination that requires a comprehensive written report and an oral examination.

Course restrictions

No more than six credits of the following courses may be counted towards the degree:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 697</td>
<td>Independent Study in Computer Science</td>
</tr>
<tr>
<td>CS 791</td>
<td>Graduate Seminar</td>
</tr>
<tr>
<td>CS 796</td>
<td>Topics in Computer Science</td>
</tr>
</tbody>
</table>

At least three credits counted toward the computer science degree must be taken at the 700-level from courses other than CS 791 and CS 796.

Time Limit

All requirements for the master’s degree must be completed within six years.

Master of Science - Computer Information Systems Emphasis

Requirements

This area, offered jointly with the Information Systems and Technology Department of the College of Business and Public Administration, is appropriate for students with either a bachelor’s degree in business administration with a major in information systems and a computer science minor or with a bachelor’s degree in computer science with a business administration minor.

Core courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 551</td>
<td>Software Engineering Survey</td>
</tr>
<tr>
<td>or IT 620</td>
<td>Systems Analysis and Design</td>
</tr>
<tr>
<td>CS 550</td>
<td>Database Concepts</td>
</tr>
<tr>
<td>or IT 650</td>
<td>Database Management Systems</td>
</tr>
<tr>
<td>CS 556</td>
<td>Database Administration I</td>
</tr>
<tr>
<td>or IT 660</td>
<td>Enterprise Information Systems</td>
</tr>
<tr>
<td>CS 557</td>
<td>Database Administration II</td>
</tr>
<tr>
<td>or IT 672</td>
<td>Information Architectures</td>
</tr>
</tbody>
</table>

Two must be taken from each department.

Colloquium

Attend at least 10 colloquia as detailed below.

Course options

Same as described above in the M.S. in computer science. For the course-only option, the 11th course must be a CS 600/700-level course.
Course restrictions
Same as described above in the M.S. in computer science.

Time Limit
All requirements for the master’s degree must be completed within six years.

Accelerated B.S. and M.S. in Computer Science
This program allows for exceptionally successful students to earn both a B.S. and M.S. in Computer Science within five years by allowing them to count up to 12 credits of graduate coursework toward both their bachelor’s and master’s degree in Computer Science. All options available under the MS program are available under this program.

Master’s Degree - Computer Engineering

Major

Entrance Requirements
An undergraduate degree in an Accrediting Board for Engineering and Technology (ABET)-accredited computer engineering program is an ideal preparation for the program, though students with degrees in either computer science or electrical engineering should be able to enter the program with very few deficiencies (typically no more than three courses) and are encouraged to apply.

Requirements
All students are required to take four core courses: CS 555, CS 665, ECE 544, and ECE 642. Students must also take four electives from an approved list of computer science, electrical and computer engineering, and mathematics courses with at least one selection from computer science and one selection from electrical and computer engineering. Each student must pass a written examination and/or oral comprehensive examination and a writing proficiency examination.

Master of Science
A minimum of 31 credits is required, including 24 credits of approved course work, six credits of research, and one credit of colloquium. The candidate is required to prepare a thesis.

Master of Engineering
A minimum of 31 credits is required, including 30 credits of approved course work and one credit of colloquium.

Doctor of Philosophy - Computer Science

Admission
Students entering the Ph.D. program in the Computer Science Department should meet the minimum university graduate admission requirements (http://admissions.odu.edu/graduate.php?page=requirements). Students may be admitted directly to the Ph.D. program with either a bachelor’s or a master’s degree. Prior to applying for admission, students are encouraged to visit the department’s website and ensure that their research interests match with that of a faculty member. Students are expected to show proficiency in Problem Solving & Programming, Introduction to Computer Architecture, Advanced Data Structures and Algorithms, Introduction to Theoretical Computer Science and Operating Systems at an undergraduate level.

Advisor
Upon admission to the Ph.D. program, a faculty advisor will be assigned to the student for general guidance. The student, however, is expected to find a dissertation advisor by the time he or she completes the qualifying process.

Course Requirements
Students with a master’s degree in computer science must complete coursework as specified below:
1. A minimum of 24 hours of post-master’s coursework at 800-level.
2. Complete the dissertation work of 24 credit hours or more.
3. A minimum of six hours may be transferred into the Ph.D. program from post-master’s coursework done elsewhere.

Students with an undergraduate degree in computer science must complete coursework as specified below:
1. 12 credit hours of core coursework approved by the GPD from a list of courses such as: CS 550, CS 555, CS 517, CS 600, and CS 665.
2. A minimum of 36 hours of coursework at 600-level or above, of which at least 24 credit hours must be at 800-level.
3. Complete the dissertation work of 24 credit hours or more.

Students with an undergraduate or master’s degree in a discipline outside computer science must complete the 72 credit hours of coursework as specified above. Additionally, these students need to demonstrate proficiency in Problem Solving & Programming, Introduction to Computer Architecture, Advanced Data Structures and Algorithms, Introduction to Theoretical Computer Science and Operating Systems at an undergraduate level.

Research Guidance Committee
A Research Guidance Committee will be formed after the student has passed the breadth oral examination of the PhD qualifying process. The duties of a Research Guidance Committee are:
1. To advise the student on the course preparation, in particular to help prepare a plan of study
2. To help define the research area of the student.
3. To prepare and administer the candidacy exam.

A Research Guidance Committee is formed according to the following procedure:
1. The student finds a regular faculty advisor. Note that a regular faculty advisor can be different from the temporary faculty advisor assigned to the student upon admission to the Ph.D. program.
2. The advisor selects the members of the Research Guidance Committee in cooperation with the student and the Graduate Studies Committee.
3. The Research Guidance Committee consists of the advisor, at least three full-time computer science faculty members and at least one full-time faculty member outside of the Computer Science Department. All members should hold the rank of assistant professor or higher. All the committee members must be approved graduate faculty as defined in
A Dissertation Committee is formed according to the following procedure:

1. The faculty advisor selects the members of the Dissertation Committee in cooperation with the student and the Graduate Studies Committee.
2. The Dissertation Committee consists of the advisor, at least three full-time computer science faculty members and at least one full-time faculty member outside of the Computer Science department. All these members should hold the rank of assistant professor or higher. All the committee members must be approved graduate faculty as defined in the university faculty handbook. The current research interests of the computer science members of the committee should be related to the research goals of the student.
3. Additional members may be appointed to the committee.
4. Additional members may be appointed to the committee.
5. The committee must complete a Ph.D. Guidance Committee Form. This form is submitted to the Graduate Program Director by the Graduate Studies Committee and to the Dean of the College of Sciences for approval.

The Associate Vice President for Graduate Studies is an ex-officio member of all Dissertation Committees.

Dissertation

A minimum of 24 credit hours of dissertation work is required. The work must represent an achievement in research and must be a significant contribution in the field. Students are required to publish (or have in the revision process) at least one paper in a refereed journal or refereed conference proceedings based on their dissertation work.

Dissertation Defense

The examination will be oral and the examination committee must have the completed dissertation at least two weeks before the examination date. In addition to the examination, students are required to give a public oral presentation on their dissertation results.

Time Requirement

Ph.D. students should normally be full-time. A full-time student can be expected to satisfy all the Ph.D. requirements in three to four years when entering with an M.S. degree or four to five years with a bachelor’s degree. No student (full-time or part-time) will be allowed to study for the Ph.D. degree beyond eight years from the date of admission into the program.

Colloquium

Students are expected to actively participate in the colloquium activities of their research area for at least four semesters.

Ph.D. Qualifying Process

Students who have been admitted to study toward the doctoral degree in computer science must complete the qualifying process which may take up to 18 months after a student has been admitted in the Ph.D. program. The Ph.D. qualifying process consists of three components.

1. Breadth Oral Examination
2. Research Ability Oral Examination
3. Advanced Course Requirement

Breadth Oral Examination

The examination should be passed no later than 12 months after admission into the Ph.D. program (preferably during the first 6 months after admission into the program). In case a student fails the examination, it is still expected that the student will pass the examination within 12 months of admission. The examination may be repeated at most once. The scheduling of this examination will be on-demand. A student wanting to take the breadth examination will contact the GPD at least six weeks before the suggested date of the examination. Once a student has requested an examination, a committee of four faculty members will be formed that will be responsible for evaluating the student.

The examination will last for two hours. On the day of the examination, the student will be given an initial list of questions two hours before the oral examination. Note that this list will not contain follow-on questions which the committee is free to ask. Students will be evaluated on their familiarity with core computer science topics. We have organized these topics under the undergraduate computer science course categories. The list of courses is given below. For the most recent syllabi for these courses, please visit: http://www.cs.odu.edu.

• Problem Solving & Programming (CS 250)
• Introduction to Computer Architecture (CS 270)
• Advanced Data Structures and Algorithms (CS 361)
• Instruciton to Theoretical Computer Science (CS 390)
• Operating Systems (CS 471)

Research Ability Oral Examination
The examination should be passed no later than 18 months after admission into the Ph.D. program (preferably during the first 12 months after admission into the program). In case a student fails the examination, it is still expected that the student will pass the examination within 18 months of admission. The examination may be repeated at most once.

The scheduling of this examination will be on-demand. A student wanting to take the research ability examination will select one of the department approved areas and contact the GPD at least six weeks before the desired date of the examination. Once a student has requested an examination, the selected area committee members will be responsible for evaluating the student.

A student who has completed a master’s thesis and/or has publications accepted in referenced conferences/journals can apply to the GPD for exemption from the research ability examination. The exemption also requires an endorsement form an ODU CS faculty member who is willing to be the student’s Ph.D. advisor. Please contact the GPD for details.

The examination will last two hours. On the day of the examination, the student will be given an initial list of questions two hours before the oral examination. Not that this list will not contain follow-on questions, which the committee is free to ask. Students will be evaluated on their understanding of the reading list (list of papers, book chapters, etc.) maintained by each area committee.

Advanced-level Course Requirement
Ph. D. students are expected to take at least four 800-level regular courses. These four courses should be taught by at least three different faculty members. Ph.D. students are expected to maintain a minimum grade of B in each of these courses. If you have any doubt whether a course is a regular 800-level course and will be counted toward this requirement, please check with your GPD. This requirement should be completed no later than 18 months after admission into the program. Note that these courses will be counted toward the minimum 800-level credit hour requirement for Ph.D. students.

Department of Mathematics and Statistics
2300 Engineering and Computational Sciences Building
Norfolk, VA 23529
757-683-3882
http://sci.odu.edu/math/
J. Mark Dorrepaal, Chair
Richard D. Noren, Graduate Program Director
N. Rao Chaganty, Statistics Program Director

Graduate Study in Computational and Applied Mathematics
The master’s and doctoral programs in computational and applied mathematics offered by the Department of Mathematics and Statistics are designed to produce applied mathematicians and statisticians who can meet the growing demand for analytical and computational skills in traditional scientific and multi-disciplinary fields. Students in the program can choose to pursue an option in either applied mathematics, statistics or biostatistics.

Applied mathematics is the application of mathematics to the solution of non-mathematical problems. Such problems may originate in math-oriented fields (physics, chemistry, and engineering) as well as in such areas such as geology, oceanography, meteorology, biology, ecology, environmental health, economics, actuarial science, business (operations and market research), banking, and medicine. Students will learn to use methods of applied mathematics, probability, statistics, biostatistics, numerical analysis, and scientific computing in seeking solutions to such problems. For work in computational and applied mathematics, training in an additional field of application is a necessity.

The desire and ability to use mathematics to bring together various disciplines is the unique characteristic of an applied mathematician. Not only has mathematical modeling and solving of societal and scientific problems increased the demand for applied mathematicians, but the flexibility and breadth of knowledge inherent in this discipline make it attractive for those who do not want to become irreversibly specialized.

Old Dominion University is one of the few American institutions offering a program expressly in applied mathematics. There are approximately 22 graduate program faculty members in the Department of Mathematics and Statistics, and current enrollment in the program is about 50 students. Areas of faculty research include analytical and numerical modeling in oceanography and meteorology, computational fluid dynamics and stability theory, elasticity and fracture mechanics, combustion theory, magnetohydrodynamics, mathematical biology, numerical analysis and approximation, optimization, applied probability, statistical inference, reliability, multivariate statistics, generalized linear models, estimating equations, biostatistics, nonparametric statistics, bioinformatics, and high performance computing.

Facilities within the metropolitan area include the NASA/Langley Research Center, the Virginia Modeling, Analysis and Simulation Center (VMASC), and the Eastern Virginia Medical School.

Program Financial Aid. Graduate assistantships in the Department of Mathematics and Statistics offer stipends ranging from $15,000 to $18,000. The level of award is determined on the basis of previous experience and performance as a graduate assistant and on the student’s academic achievement and potential in applied mathematics or statistics. In addition, a number of teaching and research positions are available for financial support of graduate assistants during the summer months (June and July).

Writing Proficiency. All students in the graduate program are expected to demonstrate an acceptable level of writing ability. Students needing help to remedy their writing deficiencies will be referred to the Writing Center for diagnosis and assistance. All M.S. candidates will enroll in MATH 632 or in STAT 632 for a master’s project.

Master of Science - Computational and Applied Mathematics

Admission
An applicant to the master’s program in computational and applied mathematics should have a bachelor’s degree in mathematics, statistics, computer science, or an application area with a strong mathematics component (e.g., physics or engineering). Undergraduate mathematics preparation should include course work in linear algebra, advanced calculus, differential equations, probability, and numerical methods. Undergraduate averages of 2.80 overall (4.00 scale) and 3.00 in the major and related mathematics courses are required.

A student who does not fully meet all requirements for admission as a regular graduate student may be allowed, with permission of the program director, to enroll as a provisional graduate student. Students lacking adequate preparation will be required to make up their deficiencies by taking appropriate undergraduate courses in addition to those specified for the master’s program.

A formal application form, official transcripts and two letters of recommendation should be forwarded to the Office of Admissions. It is recommended that applicants supply Graduate Record Examination aptitude scores.

The following material should be mailed directly to the director of the graduate program in computational and applied mathematics, Department of Mathematics and Statistics: a list of all mathematics courses taken and other courses closely allied to the applicant’s primary interests in applied math or statistics along with the texts used (titles and authors), chapters studied or
topics covered, and grades. This information should be enclosed with the financial aid application (if the applicant is submitting one).

Students may enroll in the program on either a full-time or part-time basis. Courses are offered on a regular basis during the late afternoon and early evening hours which allows part-time students to obtain master’s degrees or post-master’s graduate credit.

**Requirements**

The M.S. candidate must complete a minimum of 31 normal credit hours of course work designed to fulfill an option in either applied mathematics, statistics or biostatistics. With approval of the graduate program director, up to six of these credits may be chosen from a field of application (e.g., geology, oceanography, ecosystem analysis, computer science, economics, health sciences, operations research, physics and engineering mechanics) in which the student applies analytical and numerical techniques to another discipline. All programs of study must be approved by the graduate program director, and substitutions may be made only with his or her approval.

**Master’s Project Requirement**

The M.S. candidate will be assigned to a faculty advisor for a master’s project. Each student will enroll in MATH 632 or STAT 632 to complete his/her project. The master’s project is designed not only to broaden students’ analytical competency but also to enhance students’ writing and reporting skills on a technical subject.

**Colloquium Requirement**

In order to develop an appreciation for the breadth of contemporary research in applied mathematics and statistics, all M.S. candidates will attend and succinctly summarize and evaluate in writing at least eight professional seminars given by research faculty or external seminar visitors. The Richard F. Barry Colloquium Series is run by the department throughout the academic year. The department also conducts seminars jointly with other departments.

**Prerequisites**

Prerequisite courses for the applied mathematics option are:

At most, three from the following can be applied towards the 31-credit degree requirement:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 501</td>
<td>Partial Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>MATH 508</td>
<td>Applied Numerical Methods I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 509</td>
<td>Applied Numerical Methods II</td>
<td>3</td>
</tr>
<tr>
<td>MATH 517</td>
<td>Intermediate Real Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 518</td>
<td>Intermediate Real Analysis II</td>
<td>3</td>
</tr>
<tr>
<td>MATH 522</td>
<td>Applied Complex Variables</td>
<td>3</td>
</tr>
</tbody>
</table>

Prerequisite courses for the Statistics and Biostatistics options are:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 316</td>
<td>Introductory Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>STAT 331</td>
<td>Theory of Probability</td>
<td>3</td>
</tr>
<tr>
<td>STAT 431/531</td>
<td>Theory of Statistics</td>
<td>3</td>
</tr>
<tr>
<td>STAT 532</td>
<td>Sampling Theory *</td>
<td>3</td>
</tr>
<tr>
<td>STAT 535</td>
<td>Design and Analysis of Experiments *</td>
<td>3</td>
</tr>
<tr>
<td>STAT 537</td>
<td>Applied Regression Analysis *</td>
<td>3</td>
</tr>
</tbody>
</table>

* Only these courses can be applied towards the 31-credit degree requirement.

**Applied Mathematics Option**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 617</td>
<td>Measure and Integration</td>
<td>3</td>
</tr>
<tr>
<td>MATH 618</td>
<td>Applied Functional Analysis</td>
<td>3</td>
</tr>
<tr>
<td>MATH 632</td>
<td>Master’s Project</td>
<td>3</td>
</tr>
<tr>
<td>MATH 637</td>
<td>Tensor Calculus and Differential Geometry</td>
<td>3</td>
</tr>
<tr>
<td>MATH 693</td>
<td>Engineering Analysis III</td>
<td>3</td>
</tr>
<tr>
<td>MATH 622</td>
<td>Numerical Solutions to Differential Equations</td>
<td>3</td>
</tr>
</tbody>
</table>

or MATH 721 Advanced Applied Numerical Methods I

And at least 15 additional credit hours of approved graduate course work

<table>
<thead>
<tr>
<th>Total Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
</tr>
</tbody>
</table>

**Statistics Option**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 505</td>
<td>Introduction to Data Handling</td>
<td>3</td>
</tr>
<tr>
<td>STAT 535</td>
<td>Design and Analysis of Experiments</td>
<td>3</td>
</tr>
<tr>
<td>STAT 537</td>
<td>Applied Regression Analysis</td>
<td>3</td>
</tr>
<tr>
<td>STAT 540</td>
<td>Clinical Trials</td>
<td>3</td>
</tr>
<tr>
<td>STAT 550</td>
<td>Categorical Data Analysis</td>
<td>3</td>
</tr>
<tr>
<td>STAT 625</td>
<td>Mathematical Statistics I</td>
<td>3</td>
</tr>
<tr>
<td>STAT 626</td>
<td>Mathematical Statistics II</td>
<td>3</td>
</tr>
<tr>
<td>STAT 627</td>
<td>Linear Statistical Models</td>
<td>3</td>
</tr>
<tr>
<td>or STAT 628</td>
<td>Applied Multivariate Analysis</td>
<td>3</td>
</tr>
<tr>
<td>STAT 632</td>
<td>Master’s Project</td>
<td>3</td>
</tr>
<tr>
<td>STAT 640</td>
<td>Survival Analysis</td>
<td>3</td>
</tr>
</tbody>
</table>

At least 6 additional credits of approved graduate course work

<table>
<thead>
<tr>
<th>Total Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
</tr>
</tbody>
</table>

**Biostatistics Option**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 505</td>
<td>Introduction to Data Handling</td>
<td>3</td>
</tr>
<tr>
<td>STAT 535</td>
<td>Design and Analysis of Experiments</td>
<td>3</td>
</tr>
<tr>
<td>STAT 537</td>
<td>Applied Regression Analysis</td>
<td>3</td>
</tr>
<tr>
<td>STAT 540</td>
<td>Clinical Trials</td>
<td>3</td>
</tr>
<tr>
<td>STAT 550</td>
<td>Categorical Data Analysis</td>
<td>3</td>
</tr>
<tr>
<td>STAT 625</td>
<td>Mathematical Statistics I</td>
<td>3</td>
</tr>
<tr>
<td>STAT 626</td>
<td>Mathematical Statistics II</td>
<td>3</td>
</tr>
<tr>
<td>STAT 627</td>
<td>Linear Statistical Models</td>
<td>3</td>
</tr>
<tr>
<td>or STAT 628</td>
<td>Applied Multivariate Analysis</td>
<td>3</td>
</tr>
<tr>
<td>STAT 640</td>
<td>Survival Analysis</td>
<td>3</td>
</tr>
</tbody>
</table>

And two 600-level courses from either the College of Health Sciences or the Eastern Virginia Medical School offerings in epidemiology, community health, or history of diseases. Also required is the master’s project, STAT 632, involving the use of statistical techniques in medical or health related real-life settings.

**Certificate in Modeling and Simulation**

The Department of Mathematics and Statistics at Old Dominion University plays an integral part in the University’s campus-wide initiative to promote its research in Modeling and Simulation. The Department of Mathematics and Statistics offers a certificate in Modeling and Simulation. In order to obtain a certificate in Modeling and Simulation, a student must complete four graduate courses that include MSIM 601 (Introduction to Modeling and Simulation). MSIM 601 is offered by the Department of Engineering Management and System Engineering. Students may select three other simulation courses from the following Modeling and Simulation courses.

**Modeling and Simulation courses in Computational Mathematics**

Select three from the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 508</td>
<td>Applied Numerical Methods I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 509</td>
<td>Applied Numerical Methods II</td>
<td>3</td>
</tr>
<tr>
<td>MATH 622</td>
<td>Numerical Solutions to Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>MATH 632</td>
<td>Master’s Project</td>
<td>3</td>
</tr>
<tr>
<td>MATH 721/821</td>
<td>Advanced Applied Numerical Methods I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 722/822</td>
<td>Advanced Applied Numerical Methods II</td>
<td>3</td>
</tr>
</tbody>
</table>

**Modeling and Simulation courses in Statistics**

Select three from the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 535</td>
<td>Design and Analysis of Experiments</td>
<td>3</td>
</tr>
<tr>
<td>STAT 537</td>
<td>Applied Regression Analysis</td>
<td>3</td>
</tr>
</tbody>
</table>
complete one of the following options: preparation prior to entering, each participant will ordinarily be required to While the individual program will depend on the nature of the student's student's guidance committee. field of application whenever such courses contribute appropriately to his or encouraged to select courses in more than one of these option areas and in a course work designed to meet the student's objectives and to fulfill an option guidance committee, and together they will plan a complete program of doctoral dissertation work is required. Each student will be assigned a degree (24 credit hours beyond the master's degree) and exclusive of A minimum of 55 normal credit hours of course work beyond the bachelor's aptitude scores, if the student will not have completed a master's degree by the intended date of admission.

Master of Science in Education - Mathematics
Refer to the Darden College of Education section of this Catalog (http://catalog.odu.edu/graduate/dardencollegeofeducation/).

Doctor of Philosophy - Computational and Applied Mathematics
Admission
Applicants who appear to be qualified for study at an advanced graduate level may be admitted to the doctoral program in computational and applied mathematics. These will be students with very strong backgrounds in mathematics, statistics, computer science, or application areas with a mathematics component (e.g. physics or engineering).

Students may be admitted directly to the Ph.D. program with either a bachelor’s or a master’s degree. A grade point average of 3.00 (4.00 scale) in the major and related mathematics courses is required.

Students are required to submit three letters of recommendation and GRE aptitude scores, if the student will not have completed a master’s degree by the intended date of admission.

Requirements
Course Requirements
A minimum of 55 normal credit hours of course work beyond the bachelor’s degree (24 credit hours beyond the master’s degree) and exclusive of doctoral dissertation work is required. Each student will be assigned a guidance committee, and together they will plan a complete program of course work designed to meet the student’s objectives and to fulfill an option in applied mathematics, statistics or biostatistics. The student is strongly encouraged to select courses in more than one of these option areas and in a field of application whenever such courses contribute appropriately to his or her program. Each program, however, must be directed and approved by the student’s guidance committee.

While the individual program will depend on the nature of the student’s preparation prior to entering, each participant will ordinarily be required to complete one of the following options:

Applied Mathematics Option

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 605</td>
<td>Complex Variables I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 617</td>
<td>Measure and Integration</td>
<td>3</td>
</tr>
<tr>
<td>MATH 618</td>
<td>Applied Functional Analysis</td>
<td>3</td>
</tr>
<tr>
<td>MATH 622</td>
<td>Numerical Solutions to Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>MATH 637</td>
<td>Tensor Calculus and Differential Geometry</td>
<td>3</td>
</tr>
<tr>
<td>MATH 638</td>
<td>Mathematical Theories of Continua</td>
<td>3</td>
</tr>
<tr>
<td>MATH 693</td>
<td>Engineering Analysis III</td>
<td>3</td>
</tr>
<tr>
<td>MATH 801</td>
<td>Asymptotic and Perturbation Methods</td>
<td>6</td>
</tr>
<tr>
<td>MATH 802</td>
<td>and Integral Equations</td>
<td>6</td>
</tr>
<tr>
<td>MATH 821</td>
<td>Advanced Applied Numerical Methods I</td>
<td>6</td>
</tr>
<tr>
<td>MATH 822</td>
<td>and Advanced Applied Numerical Methods II</td>
<td>6</td>
</tr>
<tr>
<td>MATH 803</td>
<td>Advanced Applied Mathematics I</td>
<td>3</td>
</tr>
<tr>
<td>or MATH 825</td>
<td>Computational Fluid Dynamics and Solid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>Total Hours</td>
<td></td>
<td>36</td>
</tr>
</tbody>
</table>

Statistics or Biostatistics Option

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 517</td>
<td>Intermediate Real Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>STAT 547</td>
<td>Analysis of Longitudinal Data</td>
<td>3</td>
</tr>
<tr>
<td>STAT 550</td>
<td>Categorical Data Analysis</td>
<td>3</td>
</tr>
<tr>
<td>STAT 625</td>
<td>Mathematical Statistics I</td>
<td>3</td>
</tr>
<tr>
<td>STAT 626</td>
<td>Mathematical Statistics II</td>
<td>3</td>
</tr>
<tr>
<td>STAT 627</td>
<td>Linear Statistical Models</td>
<td>3</td>
</tr>
<tr>
<td>STAT 628</td>
<td>Applied Multivariate Analysis</td>
<td>3</td>
</tr>
<tr>
<td>STAT 630</td>
<td>Time Series Models</td>
<td>3</td>
</tr>
<tr>
<td>STAT 640</td>
<td>Survival Analysis</td>
<td>3</td>
</tr>
<tr>
<td>STAT 827</td>
<td>Statistical Inference I</td>
<td>3</td>
</tr>
<tr>
<td>STAT 828</td>
<td>Statistical Inference II</td>
<td>3</td>
</tr>
<tr>
<td>Total Hours</td>
<td></td>
<td>33</td>
</tr>
</tbody>
</table>

Students who wish to concentrate in Biostatistics must take STAT 540 and at least six credits at the 700-level from either the College of Health Sciences or the Eastern Virginia Medical School offerings in epidemiology, community health, or history of diseases.

Colloquium Requirement
In order to develop an appreciation for the breadth of contemporary research in applied mathematics and statistics, all Ph.D. candidates will attend and succinctly summarize and evaluate in writing at least 16 professional seminars given by research faculty or external seminar visitors. The Richard F. Barry Colloquium Series is run by the department throughout the academic year. The department also conducts seminars jointly with other departments.

Foreign Language
A foreign language is not required.

Residency Requirement
An essential feature of doctoral study is the provision of total concentration on the field of study for significant periods of time. Students who wish to pursue a part of their doctoral study on a part-time basis may do so, but all doctoral students shall spend at least two academic years engaged in full-time graduate study.

Admission to Candidacy Examination
At the end of the core mathematics or statistics course work and prior to selecting a dissertation advisor, the student must pass an Admission to Candidacy Examination designed to test scholarly competence and knowledge and to give the examiners a basis for constructive recommendations on subsequent study. The written portion of this examination will be based upon an examination syllabus that will be provided to each student. The outcome of this examination will be reported to the vice provost for graduate studies and research as passed, failed, additional work to be completed, or to be re-examined. In the event of a re-examination, the outcome must be reported as passed or failed. This decision is final. The examination must be passed at least eight months prior to the granting of the degree.

Dissertation
A doctoral dissertation representing an achievement in research and a significant contribution to the field is required. Students must register for Research 898 or 899 each semester in which they are doing substantial work on their dissertations. A minimum of 24 hours of such research credit is required.

Defense of Dissertation
This examination will be oral and must be completed at least four weeks before the date on which the degree is to be conferred. The dissertation committee members must have the completed dissertation at least two weeks before the date of the oral examination. Under normal circumstances, it
is expected that the student will have had a research paper accepted for publication prior to the dissertation defense.

Department of Ocean, Earth and Atmospheric Sciences
406 Oceanography and Physics Building
Norfolk, VA 23529
757.683.4285
http://www.odu.edu/sci/oceanography/
H. Rodger Harvey, Chair
Peter N. Sedwick, Graduate Program Director

Mission
The Department of Ocean, Earth and Atmospheric Sciences acquires and disseminates knowledge of the earth system, including the relationships among the biological, chemical, geological, and physical components of our planet. It is critical that we understand both natural and human-induced processes that change this system so we are prepared to meet present and future challenges. With curiosity, creativity, scholarship, and respect as cornerstones of our philosophy, we strive to increase scientific knowledge and literacy through excellence in research, education, and service to the Commonwealth of Virginia and society in general.

General Description of Graduate Degrees
Two graduate programs are offered:

• Master of Science in ocean and earth sciences
• Doctor of Philosophy in oceanography.

The Master of Science degree has both thesis and non-thesis options. Areas of emphasis are biological, chemical, and physical oceanography and geological sciences. Interdisciplinary studies are encouraged. The curriculum is designed to prepare graduates for professional practice in their area of interest. Official transcripts, letters of recommendation, TOEFL scores (international students), and a statement of goals and interest for graduate study should all be submitted to the Office of Admissions by February 1 for full consideration. Scores on the GRE verbal, analytical, and quantitative sections are required

The department receives considerable support from the Commonwealth and local philanthropic sources, as well as from private industry and area citizens. Establishment of the Virginia Graduate Marine Science consortium by the General Assembly in 1979 demonstrated the Commonwealth’s determination to achieve excellence in marine science. The purpose of the consortium is to advance marine science instruction, research, training, and advisory services and to enhance Virginia’s position in seeking funding to carry out these activities. Charter members of the consortium are Old Dominion University, the University of Virginia, Virginia Polytechnic Institute and State University, and the College of William and Mary. The Samuel L. and Fay M. Slover endowment to Old Dominion University in 1986 significantly accelerated the program of marine studies. In 1991, a Center for Coastal Physical Oceanography (CCPO) was established at Old Dominion University by the Commonwealth of Virginia. The center is a Designated Center for Excellence.

The Department of Ocean, Earth and Atmospheric Sciences is housed in three buildings. The Oceanography/Physical Sciences Building contains state-of-the-art teaching laboratories, computer facilities, and research laboratories for geological sciences and biological, chemical and geological oceanography. The Center for Coastal Physical Oceanography is located in ODU’s Innovative Research Park and houses all of the department’s physical oceanography laboratories. The Center for Quantitative Fisheries Ecology is housed close to campus. The department maintains a 55-foot research vessel, the R/V Fay Slover, primarily for estuarine and coastal studies. In addition to the Slover, the department has a number of small boats, suitable for near shore investigations.

Graduate Certificate in Spatial Analysis of Coastal Environments
The certificate in spatial analysis of coastal environments provides an interdisciplinary program for students wishing to pursue careers in coastal management or research, remote sensing, or geographic information systems (GIS) applications. Rendered upon completion of the requirements, the certificate is an academic affidavit comprised of courses in geography and ocean, earth, and atmospheric sciences and is administered by the two departments. Students must take courses in the areas listed below and complete them with a cumulative GPA of 3.00 or higher and no grade below a C (2.00). The certificate is available to postgraduate professionals who meet the requirements. Students with comparable professional experience may be able to show competence in selected courses through examination.

Students seeking graduate certification are required to complete the 500-level courses.

I. Core Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOG 504</td>
<td>Digital Techniques for Remote Sensing</td>
</tr>
<tr>
<td>BIOL 519</td>
<td>Wetland Plants</td>
</tr>
<tr>
<td>BIOL 550</td>
<td>Principles of Plant Ecology</td>
</tr>
<tr>
<td>BIOL 555</td>
<td>Molecular Systematics</td>
</tr>
<tr>
<td>OEAS 511</td>
<td>Structural Geology</td>
</tr>
<tr>
<td>OEAS 526</td>
<td>Concepts in Oceanography for Teachers</td>
</tr>
</tbody>
</table>

II. Interpretive Analysis Courses (Select two from the following)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOG 502</td>
<td>Geographic Information Systems</td>
</tr>
<tr>
<td>GEOG 522</td>
<td>Coastal Geography</td>
</tr>
<tr>
<td>GEOG 590</td>
<td>Applied Cartography/GIS</td>
</tr>
<tr>
<td>OEAS 595</td>
<td>Special Topics</td>
</tr>
<tr>
<td>GEOG 595</td>
<td>Topics in Geography</td>
</tr>
</tbody>
</table>

III. Capstone Seminar

Select one of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOG 519</td>
<td>Spatial Analysis of Coastal Environments</td>
</tr>
<tr>
<td>OEAS 519</td>
<td>Spatial Analysis of Coastal Environments</td>
</tr>
</tbody>
</table>

Total Hours: 15

Master of Science - Ocean and Earth Sciences
Peter N. Sedwick, Graduate Program Director

Admission
Applicants who have obtained a bachelor’s degree in a science (e.g., biology, chemistry, geology, physics), mathematics, or engineering, with a minimum 3.00 grade point average in their major and a 2.80 overall grade point average, are eligible for regular admission to the program. At least one semester of calculus is also required. Ocean and earth sciences are interdisciplinary; consequently, it is expected that applicants have science courses outside their major.

For students wishing to study geological sciences, an undergraduate major in geology is required for regular admission. Students wishing to study physical oceanography should have majored in physics, mathematics, engineering, computer science, meteorology or related physical sciences. Such applicants must have completed 36 hours in one of these fields and completed mathematics through partial differential equations.

An applicant who does not meet all requirements for admission as a regular graduate student may be admitted as a provisional graduate student. Students lacking adequate preparation for the program may make up deficiencies by taking appropriate undergraduate courses.

Requirements
The student shall meet all university requirements for graduate degrees outlined in the Requirements for Graduate Degree section in this catalog.
including at least 30 hours of graduate study. A maximum of 12 hours of credit may be transferred into a graduate degree program from non-degree status at Old Dominion University or from another accredited institution, except in the case of an approved interinstitutional program. All students are expected to demonstrate competency in oral communication and proficiency in writing.

Course Distribution
A minimum of 12 hours of basic course work in the four sub-disciplines of oceanography is required of all M.S. students. This core program consists of:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>OEAS 604</td>
<td>Introduction to Physical Oceanography</td>
<td>3</td>
</tr>
<tr>
<td>OEAS 610</td>
<td>Advanced Chemical Oceanography</td>
<td>3</td>
</tr>
<tr>
<td>OEAS 620</td>
<td>Advanced Geological Sciences</td>
<td>3</td>
</tr>
<tr>
<td>OEAS 640</td>
<td>Advanced Biological Oceanography</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Hours</strong></td>
<td></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

A student must achieve a grade of B or better in each of the core courses. The remaining 18 credits are chosen from a list of graduate courses approved by the student’s guidance committee. At least 60 percent of all courses must be at the 600 level or above. For the non-thesis option, up to three hours of research may be used to meet course requirements. For the thesis option, up to six hours of research may be used to meet the course requirements.

Non-Thesis Option
A student in the non-thesis program must pass a written comprehensive examination testing breadth of knowledge in oceanography. The examination is given twice yearly, normally in October and March. The examination grades are fail, pass, or pass with distinction. A student who has failed the examination may retake it only once.

Thesis Option
Before a student embarks on thesis research, a thesis advisory committee must be formed. Further information on university guidelines for forming this committee can be found in the Requirements for Graduate Degrees section of this catalog. The student must also submit a thesis proposal which outlines the research to be undertaken and identifies the resources required for completion of the research. Guidelines for the preparation of the thesis proposal are available from the graduate program director. Any student whose thesis research requires departmental funding must obtain prior approval from the department chair and graduate program director. No funds will be given without this approval. The thesis proposal requires the approval of the graduate program director and the student’s thesis advisory committee.

As part of the thesis requirement, the student is required to present a public defense of the research. The public defense and approval of the thesis by the student’s Thesis Committee satisfy the comprehensive examination requirement. Students in the thesis program should consult the graduate program director regarding the preparation of the M.S. thesis, scheduling a thesis defense, and the final submission of the thesis.

Time Requirement and Field Work
Each student is required to have at least ten days of shipboard experience, fieldwork, or a combination of the two. Scheduled class field trips may not be counted toward this requirement.

Request to Graduate
The student should obtain a copy of the form Application for Graduation from the Registrar’s Office and complete this application. The deadline for submitting this application is listed in the class schedule each semester and usually falls near the end of the semester preceding the one during which graduation is anticipated. It is the student’s responsibility to meet these deadlines and submit the necessary paperwork for graduation.

Removal of Incompletes
At least one month prior to graduation, all incomplete grades should be cleared. An Academic Record Change form is used for this purpose, and the instructor of the course and the department chair need to sign this form.

Doctor of Philosophy - Oceanography
Peter N. Sedwick, Graduate Program Director

Admission
The doctoral degree in oceanography is granted to students who have:

1. mastered definite fields of knowledge, become familiar with research in these specific fields, and developed perceptions of opportunities for further advances;
2. demonstrated the capacity to do original, independent, scholarly investigation or creative work in their specific fields; and
3. shown the ability to integrate the field of specialization with the larger domains of knowledge and understanding.

All students are expected to demonstrate competency in oral communication and proficiency in writing.

All students in the oceanography Ph.D. program are responsible for reading and understanding the regulations and policies set forth here and throughout this catalog regarding requirements for the Ph.D. degree. The essential credit requirements for the Ph.D. are as follows. The student shall complete 48 credit hours beyond the master’s degree or 78 credit hours for students admitted to the program with a bachelor’s degree. Up to 24 credits can be granted for dissertation.

Requirements

Major Advisor and Guidance Committee
A major advisor must be identified to the graduate program director (GPD), at least provisionally, prior to admission to the program. After receiving admission to the program and enrolling, students consult with the GPD and their major advisor about initial course work. Before completion of nine semester hours (i.e. before the end of the student’s first semester), the student will form a guidance committee in consultation with the major advisor. Please see the graduate program director and the Requirements for Graduate Degrees section of this catalog for further information on forming a guidance committee.

Plan of Study—Curriculum Plan
Sometime in the first year of study, the student shall prepare a plan of study with the aid and approval of the guidance committee. Students should see the graduate program director and refer to the Requirements for Graduate Degrees section of this catalog for further information on preparing a plan of study.

Course Work Requirements
Students who do not have an M.S. degree in oceanography normally complete the following within the first year:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>OEAS 604</td>
<td>Introduction to Physical Oceanography</td>
<td>3</td>
</tr>
<tr>
<td>OEAS 610</td>
<td>Advanced Chemical Oceanography</td>
<td>3</td>
</tr>
<tr>
<td>OEAS 620</td>
<td>Advanced Geological Sciences</td>
<td>3</td>
</tr>
<tr>
<td>OEAS 640</td>
<td>Advanced Biological Oceanography</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Hours</strong></td>
<td></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

However, waiving the requirement to take any of these core courses requires the approval of the graduate program director. Students must achieve a grade of B or better in each of the core courses. Any student receiving a C (2.0) or lower in any graduate course will be dropped from the program. In consultation with the advisor and guidance committee, students will plan a complete program of course work designed to meet their objectives (see the
section above). Depending on the entry status of the student, the following credit hours are also required:

- Those entering the Ph.D. program with an M.S. degree in oceanography must complete any needed core courses (see above), and a minimum of 48 credit hours of lecture courses and dissertation research.
- Those entering the Ph.D. program with a B.S. or M.S. degree in a discipline outside of oceanography shall complete 12 credit hours of the core courses listed above, and a minimum of 66 hours of additional lecture courses and dissertation research, for a total of 78 credit hours.

A maximum of 12 graduate credit hours may be transferred into a graduate degree program from non-degree status at Old Dominion University or from another accredited institution, except in the case of an approved interinstitutional program.

Diagnostic Examination
The guidance committee shall administer a written and oral diagnostic examination during the first semester of residence (or before nine credit hours have been completed) for students entering the program with an M.S. degree in oceanography. For students matriculating with a bachelor’s degree or an M.S. degree in another field, the guidance committee shall administer the diagnostic examination no later than the third semester of residence (or before completion of 27 credit hours). The diagnostic examination will be prepared by the student’s guidance committee in consultation with the graduate program director. The results of this examination are used as guidance for the curriculum plan. The guidance committee may also recommend to the graduate program director, based on the student’s performance in the core oceanography courses, that the diagnostic examination be waived. This must be done in writing, in a memo signed by all members of the student’s guidance committee.

Computer Language Skills
To satisfy this requirement the student must either take a course in MATLAB programming (OEAS 595) or solve a substantial problem by writing an original computer program. The student’s advisor in consultation with the guidance committee develops the problem and a reasonable timetable for its completion. The problem must be solved independently with no help from others. The results will be evaluated by the advisor and guidance committee who will determine whether the student has solved the posed problem to their satisfaction. This computer language skills requirement should be completed before taking the candidacy exam.

Ship Time Requirement and Fieldwork
Each student is required to have at least ten days of shipboard experience, fieldwork, or a combination of the two. Scheduled class field trips may not be counted toward this requirement.

Candidacy Exam
Near the completion of course work and before becoming heavily involved in dissertation work, the student shall pass a candidacy examination designed to test scholarly competence and knowledge of oceanography. The exam has written and oral portions prepared by the guidance committee. Additional details on the structure, form and content of the candidacy exam are available from the graduate program director and in the Requirements for Graduate Degrees section in this Catalog.

Formation of a Dissertation Committee
After the candidacy examination has been passed and the dissertation committee formed, the guidance committee’s responsibilities are completed. The dissertation committee is a new committee and is formed to supervise the student’s dissertation research. Students should see the graduate program director or refer to the Requirements for Graduate Degrees section in this Catalog for further information on the formation of a dissertation committee. Changes to the dissertation committee must be made in advance of the oral dissertation defense. Such changes are made only with the approval of the GPD and college dean.

Admission to Candidacy
Admission to candidacy is a formal step that occurs after the student has:
1. passed both parts of the Ph.D. candidacy examination;
2. filed a dissertation prospectus approved by the student’s dissertation committee; and,
3. completed all formal course work.

The student must be admitted to candidacy at least 12 months before the time the degree is expected to be received, but usually not before the completion of one-and-a-half years of graduate work.

Dissertation Preparation
General regulations and procedures governing the submission of a doctoral dissertation are given in the Guide for Preparation of Theses and Dissertations (obtained at http://sci.odu.edu/sci/about/information/thesis/index.shtml). Students should read this guide carefully before beginning to write their dissertation. Writing the dissertation as chapters that can be submitted for publication is encouraged.

Please note that the thesis and dissertation guide in place at the start of the semester will remain in force for the entire semester, and any changes made to the guide over the academic year (and the dates of these changes) will be listed on the cover page of the guide. Changes to the previous guide will also be noted on the cover page of the guide, or in a separate document that can be downloaded from the same site as the complete guide. For more information on dissertation preparation and approval in the College of Sciences, see http://sci.odu.edu/sci/about/information/thesis/index.shtml.

Dissertation Defense
The format of a dissertation defense is determined by the dissertation committee with the approval of the GPD. The defense is chaired by the director of the dissertation committee. The chair will act as moderator, ruling on questions of procedure and protocol that may arise during the defense. Students should see the graduate program director or refer to the Requirements for Graduate Degrees section in this catalog for further information on the format of the dissertation defense.

Satisfactory performance on this examination (oral dissertation defense) and adherence to all regulations outlined above complete the requirements for the Ph.D. degree. All requirements for the doctoral degree must be completed within eight calendar years from the date of initial registration in the program.

Dissertation Acceptance and Submission
Once the dissertation committee has approved the dissertation, the student and major advisor must go over the entire dissertation to ensure that it adheres to the format described in the Guide for Preparation of Theses and Dissertations before submitting the dissertation to the GPD for review. Three days should be allowed for this review. Once the GPD has approved the dissertation, the student submits the dissertation to the associate dean in the College of Sciences for approval. All approvals must be completed by the day before commencement. However, the associate dean generally requires that all dissertations be submitted prior to this deadline. Students should consult with the GPD for further details.

Request to Graduate
The student should obtain a copy of the form Application for Graduation from the Registrar’s Office and complete this application. The deadline for submitting this application is listed on the Registrar’s Office website at www.odu.edu/registrar and usually falls near the end of the semester preceding the one during which graduation is anticipated. It is the student’s responsibility to meet these deadlines and submit the necessary paperwork for graduation.
Removal of Incompletes
At least one month prior to graduation, all incomplete grades should be cleared. An Academic Record Change form is used for this purpose, and the instructor of the course and the department chair need to sign this form.

Department of Physics
306 Oceanography/Physics Bldg.
(757) 683-3468
http://sci.odu.edu/physics/
Charles I. Sukenik, Chair
Leposava Vuskovic, Graduate Program Director
The Department of Physics offers programs of study leading to both the M.S. degree in physics and the Ph.D. degree in physics. Primary focus is placed on the Ph.D. program, and most students enrolled for graduate study are enrolled in that program. Students have the opportunity to perform research in state-of-the-art facilities under faculty direction. Graduates are prepared for research at the highest levels in academia, government laboratories, and corporate laboratories.

Admission
Applicants for admission to graduate study must have an earned bachelor’s degree in physics or a closely related discipline from an accredited institution or an equivalent degree from a foreign institution. The applicant is normally required to have a minimum cumulative grade point average of 3.0 on a 4.0 scale. In addition, the general portion of the Graduate Record Examination (GRE) is required for application to either the master’s or the doctoral program; applicants to the doctoral program are strongly encouraged to take the GRE specialized physics test as well. The Test of English as a Second Language (TOEFL) is required of all nonnative speakers of English who have resided in the U.S. for less than ten years.

It is normally expected that most incoming graduate students will be supported as teaching assistants. Old Dominion University requires that all graduate teaching assistants who do not speak English as a first language pass a test of spoken English.

Admission decisions are based on undergraduate achievement, GRE scores, and personal reference letters. Graduate study may commence at the beginning of any academic term. Decisions regarding financial support for students entering in the fall term are normally made by April 15, so a student’s completed application must be received by January 15.

Anyone who applies after January 15 should communicate directly with the graduate program director concerning the availability of support.

Foreign language requirement
None

Thesis Option
Thirty graduate credits that must include the following courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 556</td>
<td>Intermediate Quantum Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>or PHYS 621</td>
<td>Quantum Mechanics I</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 603</td>
<td>Classical Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 604</td>
<td>Classical Electrodynamics I</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 697</td>
<td>Seminar</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 698</td>
<td>Research</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 699</td>
<td>Research</td>
<td>3</td>
</tr>
</tbody>
</table>

No more than 12 credits numbered at the 500 level may be used to meet this requirement. Up to 12 credits from other university departments may be used to meet this requirement if approved by the graduate program director.

Doctor of Philosophy - Physics
requirements
The broad requirements for the Ph.D. degree are
1. satisfactory performance in a designated core of graduate courses,
2. successful completion of the Ph.D. Candidacy Examination, which has both written and oral parts,
3. successful completion of a teaching requirement, and
4. satisfactory completion of a dissertation.

Each student’s course of study must have the advance approval of the graduate program director.

Course Requirements
Seventy-eight graduate credits beyond the undergraduate degree or 48 graduate credits beyond the master’s degree must be taken and must include the following courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 601</td>
<td>Mathematical Methods in Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 603</td>
<td>Classical Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 604</td>
<td>Classical Electrodynamics I</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 621</td>
<td>Quantum Mechanics I</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 697</td>
<td>Seminar</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 804</td>
<td>Classical Electrodynamics II</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 807</td>
<td>Statistical Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 811</td>
<td>Computational Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 821</td>
<td>Quantum Mechanics II</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 831</td>
<td>Advanced Seminar I</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 832</td>
<td>Advanced Seminar II</td>
<td>1</td>
</tr>
</tbody>
</table>

A minimum of six additional credits for specialized full-semester courses at the 800 level must be taken. A student may waive or substitute for any of these courses with the approval of the graduate program director.

Up to 12 credits from other university departments may be used to meet this requirement if approved by the graduate program director. A student may

Master of Science - Physics
requirements
A student may select either the thesis or non-thesis option. For either option, each student’s course of study must have the advance approval of the graduate program director.

Non-Thesis Option
Thirty graduate credits that must include the following courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 556</td>
<td>Intermediate Quantum Mechanics</td>
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</tr>
<tr>
<td>or PHYS 621</td>
<td>Quantum Mechanics I</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 603</td>
<td>Classical Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 604</td>
<td>Classical Electrodynamics I</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 697</td>
<td>Seminar</td>
<td>1</td>
</tr>
</tbody>
</table>

No more than 12 credits numbered at the 500 level may be used to meet this requirement. Up to 12 credits from other University departments may be used to meet this requirement if approved by the graduate program director.

Written Comprehensive Examination
In addition to these course requirements, the candidate must pass a written comprehensive examination. It is usually taken just before the student’s third semester of study. If a student fails this examination, he or she is allowed a second attempt, which must be at the time when the Written Exam is next given. In all but the most extraordinary circumstances, a student will not be allowed any additional attempts to pass this examination. Normally, this written examination is the same as the written portion of the Ph.D. Candidacy Examination, graded at the master’s level.
waive PHYS 832, with the approval of the graduate program director, if he or she presents a paper at a scientific meeting. Before formation of his or her dissertation committee, a student is formally advised about these courses and other academic matters by graduate faculty advisors. There is no foreign language requirement.

**Ph.D. Candidacy Examination**

A student admitted to the Ph.D. program in physics becomes a bona fide candidate for the Ph.D. degree by passing the Ph.D. Candidacy Examination. The purpose of this comprehensive examination is to determine if a student has the foundation and maturity to begin research in physics. A student who does not pass the Ph.D. Candidacy Examination within the allowed number of attempts explained below will be dismissed from the Ph.D. program. However, that student would still have the opportunity to satisfy the requirements for the M.S. degree in physics.

The Ph.D. Candidacy Examination consists of two parts—the Written Examination and the Oral Examination. Each part must be passed independently in order to pass the Ph.D. Candidacy Examination.

**Written Examination**

The written examination is given two times each year—in late August and early January. A student admitted to the Ph.D. program must take this examination by the beginning of his or her third semester of graduate study. In circumstances such that the student has not had the appropriate courses to meet this deadline, he or she may petition the Graduate Program Committee for an extension. If a student fails this examination, he or she is allowed a second attempt, which must be at the time when the Written Examination is next given. In all but the most extraordinary circumstances, a student is dismissed from the Ph.D. program after failing the written examination twice.

**Oral Examination**

The Oral Examination is a one-hour presentation given by a student to an oral examination committee (normally consisting of his or her dissertation committee, minus the external member), meeting in closed session, normally on a topic relevant to the student’s dissertation research. This presentation must be made within one year and one semester after a student passes the written examination. A request for extension of the deadline must be made in writing to the Graduate Program Committee.

A student’s dissertation advisor, in consultation with the student, may choose from two possible formats for this presentation:

1. a presentation by the student directly on his or her dissertation research or
2. a presentation on a specific topic that the student has been assigned to investigate for several months.

For either option, the student must write a short paper of 10 or fewer pages on his or her presentation topic and give it to all members of the oral examination committee at least two weeks before the scheduled date of the examination. The committee, by majority vote, will determine whether the student passes or fails the oral examination. A student who fails the oral examination will be allowed a second attempt. The student’s dissertation advisor will decide the format and timing of such a second attempt, with the provision that the second attempt must be completed within six months of the first attempt.

**Teaching Requirement**

Each candidate for the Ph.D. degree must earn a minimum of four teaching credits, which are defined in the following way:

- One such credit is awarded for teaching a one-hour recitation for one semester in the Department of Physics, and
- two such credits are awarded for teaching a one-semester laboratory course in the Department of Physics.

The graduate program director may approve the substitution of an equivalent amount of teaching experience in the Department of Physics for this requirement.

**Dissertation**

The dissertation is the final and most important requirement that must be completed by a candidate for the Ph.D. degree in physics. It must be based on original research in physics that makes a contribution to existing knowledge and be of sufficient quality and interest to merit publication in a refereed physics journal. Research that is classified by the U.S. Government (in a way that restricts its distribution) is not a suitable basis for a dissertation, as one essential characteristic of a dissertation is that its contents must be disseminated freely.

The candidate’s dissertation research is supervised generally by his or her dissertation committee. Close supervision is provided by the candidate’s research advisor, who is a member of the dissertation committee and may be a tenured, tenure-track, research, or adjunct member of the graduate-certified faculty of the Department of Physics. If the research advisor is a tenured or tenure-track member of the faculty, he or she is the chair of the candidate’s dissertation committee. If the research advisor is an adjunct or research faculty member, a tenured or tenure-track graduate-certified faculty member must serve as co-advisor and also serve as chair of the dissertation committee. The dissertation committee is composed of five members, a majority of whom must be tenured or tenure-track members of the graduate-certified faculty of the Department of Physics and one of whom must be a tenured or tenure-track faculty member of the graduate-certified faculty in a department of Old Dominion University other than the Department of Physics. It is the responsibility of the research advisor and the candidate to nominate prospective members for the dissertation committee to the graduate program director, who must formally approve the membership of the dissertation committee.

The format of the dissertation is specified by the Guide for Preparation of Theses and Dissertations, and variations allowed within the Department of Physics are specified by the graduate program director.

**Dissertation Defense**

The final examination that a candidate must pass in order to receive the Ph.D. is an oral examination by the dissertation committee based on the candidate’s public presentation of the results contained in his or her dissertation. This defense is conducted in two phases:

1. a public presentation in front of the dissertation committee that is open to any person who may wish to attend and direct relevant questions to the candidate and
2. a closed session between the candidate and the dissertation committee in which the candidate is questioned further by that committee.

The dissertation committee determines by majority vote whether the candidate passes or fails this final oral defense. If the candidate fails, he or she is allowed only one additional attempt to pass at a later time.

**Applied Physics Endorsement**

A student who meets all other requirements for the Ph.D. in physics may receive an applied physics endorsement by completing PHYS 809 and PHYS 812.

**Department of Psychology**

Mills Godwin Bldg
Norfolk, VA 23529
http://sci.odu.edu/psychology/
Barbara Winstead, Chair

**Graduate Study**

The Department of Psychology offers a program of study leading to the degree of Master of Science with a major in psychology and programs
leading to the Doctor of Philosophy with majors in applied experimental psychology, human factors psychology and industrial/organizational psychology.

The department also participates in a program leading to the degree of Doctor of Psychology in clinical psychology. This program, under the direction of the Virginia Consortium Program in Clinical Psychology, is a joint venture of the Departemnts of Psychology at Old Dominion University and Norfolk State University and the Department of Psychiatry and Behavioral Sciences at Eastern Virginia Medical School.

Master of Science - Psychology
Louis H. Janda, Graduate Program Director

The master’s program in psychology offers a course of study leading to the Master of Science with a major in general psychology. The master’s degree program is appropriate for students wishing to enter a doctoral program at Old Dominion or another university or for those seeking the master’s as a terminal degree. The curriculum is designed to provide a strong background in research methods and general psychology so that the student will have a wide range of choices for future professional development.

Graduate students are encouraged to work closely with members of the faculty and to participate in the research and other professional activities that are available within the department. Faculty are involved in research in the general areas of clinical, social, health, developmental, human factors, organizational, personnel, and community psychology. Currently, faculty and students are engaged in research projects on various topics including: personal relationships, coping with discrimination and bias, parenting, work-family conflict, driving behaviors, predictors and interventions for substance abuse and health risk behaviors, hindsight bias, response to alarms, medical modeling and simulation, telework, training of women and minorities in STEM fields, and internet-based training and education.

Admission

To qualify for admission, a candidate must meet the general university admission requirements. In addition, the candidate must present:

1. undergraduate courses in statistics and research methods and nine additional hours in psychology;
2. official scores on the aptitude section of the Graduate Record Examination (GRE) (applicants who do not have a bachelor’s degree in psychology must also take the advanced psychology GRE test); and
3. transcripts of all undergraduate and graduate work.

A brief statement by the student outlining personal goals and academic objectives and three letters of reference (at least two of which are from former college or university teachers) are requested. All credentials in support of applications should be sent to the Office of Admissions.

Requirements

To qualify for the Master of Science in psychology, a student must meet the following requirements:

1. The student must maintain a B average (3.00 on a 4.00 scale) in a minimum of 36 hours of course work.
2. The student is required to successfully complete a core of courses established by the faculty with at least a B (3.00) average in these courses. The core courses consist of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSYC 713</td>
<td>Research Fundamentals</td>
<td>2</td>
</tr>
<tr>
<td>PSYC 727</td>
<td>Analysis of Variance and Experimental Design</td>
<td>8</td>
</tr>
</tbody>
</table>
& PSYC 728 | and Correlational Design |
| PSYC 731 | Human Cognition | 3 |
or PSYC 741 | Sensation and Perception |
| PSYC 651 | Developmental Psychology | 3 |

or PSYC 749 Advanced Social Psychology

Total Hours 16

Completion of the core is a prerequisite for beginning work on the thesis (including registration for PSYC 698 and PSYC 699). Full-time students must complete the core courses in the first year, and part-time students must do so in the first two years.

In addition to completing the core requirements, students must complete a total of 30 hours of course work plus 6 hours of research and thesis. Prior to beginning the thesis research, the student will submit a request to the graduate program director to form a thesis committee. The student will identify two members of the committee and the GPD will appoint the third member. When the student has completed the research, a written thesis must be submitted to the thesis committee. Completion of the thesis depends on acceptance of the thesis by the thesis committee and the graduate program director, as well as passing an oral exam in a public defense of the thesis.

Areas of Concentration

Students receiving a master’s degree in psychology may choose to concentrate their studies in one of four possible areas. The student must complete 12 credit hours in courses relevant to the area and maintain a minimum GPA of 3.00 in those courses. Course credit hours to fulfill the core requirements may not be used toward an area of concentration. The following is a list of the four areas and relevant courses for each area.

Applied Cognitive Psychology

Required

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSYC 661</td>
<td>Psychopathology</td>
<td>3</td>
</tr>
<tr>
<td>PSYC 663</td>
<td>Intellectual Assessment</td>
<td>3</td>
</tr>
<tr>
<td>PSYC 664</td>
<td>Personality Assessment</td>
<td>3</td>
</tr>
</tbody>
</table>

Other relevant courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSYC 651</td>
<td>Developmental Psychology</td>
<td>3</td>
</tr>
<tr>
<td>PSYC 653</td>
<td>Personality Psychology: Theory and Research</td>
<td>3</td>
</tr>
<tr>
<td>PSYC 745</td>
<td>Psychometric Theory</td>
<td>3</td>
</tr>
<tr>
<td>PSYC 792</td>
<td>Advanced Seminar in Physiological Psychology</td>
<td>3</td>
</tr>
</tbody>
</table>

Clinical Psychology

Required

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSYC 661</td>
<td>Psychopathology</td>
<td>3</td>
</tr>
<tr>
<td>PSYC 663</td>
<td>Intellectual Assessment</td>
<td>3</td>
</tr>
<tr>
<td>PSYC 664</td>
<td>Personality Assessment</td>
<td>3</td>
</tr>
</tbody>
</table>

Other relevant courses

<table>
<thead>
<tr>
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<th>Title</th>
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<tbody>
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<td>Psychometric Theory</td>
<td>3</td>
</tr>
<tr>
<td>PSYC 792</td>
<td>Advanced Seminar in Physiological Psychology</td>
<td>3</td>
</tr>
</tbody>
</table>

Industrial/Organizational Psychology

Required

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSYC 745</td>
<td>Psychometric Theory</td>
<td>3</td>
</tr>
<tr>
<td>PSYC 750</td>
<td>Organizational Psychology</td>
<td>3</td>
</tr>
<tr>
<td>PSYC 763</td>
<td>Personnel Psychology</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Hours 6

Other relevant courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSYC 749</td>
<td>Advanced Social Psychology</td>
<td>3</td>
</tr>
<tr>
<td>PSYC 836</td>
<td>Multilevel Models: HLM</td>
<td>3</td>
</tr>
</tbody>
</table>
Dominion University is to provide graduate training consisting of four phases:

1. A core of basic psychology, acquired primarily at the master’s level;
2. In-depth training in statistics, methodology, and grant and manuscript writing;
3. Research experience in a field of AE psychology; and
4. Completion of a dissertation representing a significant contribution to AE psychology. For example, two research fields with which numerous faculty members are involved are health psychology and developmental psychology.

**Requirements**

The Ph.D. degree in AE requires at least 84 semester hours of credit beyond the bachelor’s degree or at least 48 semester hours of post-master’s training. Students entering the program with a bachelor’s degree must complete the first phase of the program by meeting the requirements for the master’s degree in general psychology (i.e., 36 semester hours with appropriate course work). For the student with a bachelor’s degree, completion of the program requires approximately five years of study. For the student who holds the master’s degree upon entering the Ph.D. program, completion requires approximately three years. The student is required to complete a core of master’s-level courses with at least a B average.

The core courses consist of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSYC 813</td>
<td>Research Project I</td>
<td>2</td>
</tr>
<tr>
<td>PSYC 827</td>
<td>Analysis of Variance and Experimental Design</td>
<td>4</td>
</tr>
<tr>
<td>PSYC 828</td>
<td>Regressional and Correlational Design</td>
<td>4</td>
</tr>
<tr>
<td>PSYC 845</td>
<td>Psychometric Theory</td>
<td>3</td>
</tr>
</tbody>
</table>

**Select one of the following:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSYC 651</td>
<td>Developmental Psychology</td>
</tr>
<tr>
<td>PSYC 849</td>
<td>Advanced Social Psychology</td>
</tr>
</tbody>
</table>

**Select one of the following:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSYC 831</td>
<td>Human Cognition</td>
</tr>
<tr>
<td>PSYC 841</td>
<td>Sensation and Perception</td>
</tr>
</tbody>
</table>

Total Hours: 19

Attaining the master’s degree requires two years of study.

Following the master’s degree requirements, the student forms a guidance committee of graduate faculty members who assist in developing a plan of study tailored to the student’s needs and interests. The plan of study outlines the minimum of 48 hours of post-master’s training, including:

1. Completion of the remaining required course (PSYC 833, Grant and Manuscript Writing);
2. Completion of one additional quantitative course (3 credits);
3. Maintenance of a strong focus in research methods and statistics;
4. Completion of supplementary courses to support the chosen specialty (e.g., health-related courses to be taken by health specialists); and
5. Development of a viable research program.

**Candidacy Examination**

Prior to admission to candidacy (i.e., the beginning of formal work on the dissertation), each student is required to pass a written and oral candidacy examination. There are two options for this requirement.

1. **Qualifying Exam:** questions assess
   - Core experimental psychology (statistics, methodology, experimental principles, ethics; four hours) and a specialty area (research program and relevant content knowledge; eight hours).
   - An oral examination follows the written, during which the student defends answers to the written components (two hours).

2. **Major Area Paper**
   - A review paper (quantitative or qualitative) or theoretical analysis of a research area designated by the student as an important area for contemporary applied experimental psychology.
   - The resulting paper should define the student as an expert in that area, and be of publishable quality.
C. The student must defend the work to the guidance committee, and submit the work for publication in a journal relevant to the student’s research specialty, as a book chapter, or as an approved grant proposal before this option is passed.

Research Emphasis
A major objective of the AE psychology program is to provide the student with substantial experience in planning, designing, conducting, and reporting results of independent research. Toward this end, a student is expected to engage in a variety of research activities. This expectation is reflected in the program’s few traditional classroom course requirements beyond the master’s degree. The time should be spent on mostly research-related activities (e.g., reading, individual study [research], and dissertation). The student is expected to acquire research experiences that go well beyond formal course requirements. These research experiences may take a variety of forms and occur in a variety of settings. For example, the student is encouraged to engage in both laboratory and field research related to the AE specialty, to serve as a member of a larger research team when appropriate or available (perhaps serving as a graduate research assistant on an externally sponsored grant), and to engage in independent non-sponsored research. The student is also encouraged to seek out opportunities to conduct research projects (including grants and contracts funded through the Old Dominion University Research Foundation) on his or her own and in collaboration with faculty members. The accumulation of these research experiences should result in presentation of papers at professional meetings, the publication of manuscripts in refereed journals, the publication of technical reports, and the submission of grant/contract proposals.

Graduate Student Teaching
Teaching a course is an experience that is worthwhile regardless of the eventual career role(s) that a student envisions, and the experience should be taken seriously for its professional value. Benefits associated with teaching a course include expanding and solidifying knowledge about general and AE psychology, polishing communication skills, and establishing professional identification. Although there are other ways to acquire these benefits (e.g., presentations at conferences, consulting experiences, organizing and conducting workshops), teaching a course systematically builds these experiences into a student’s Plan of Study. Moreover, any student who plans an academic career should teach one or more courses in preparation for that career. The student should also recognize that during the course of graduate training, financial support is often provided by the Psychology Department from graduate teaching assistant or adjunct teaching funds. This type of financial support almost always requires that the student be partially or fully responsible for teaching a course. The student should be prepared for an eventual obligation to teach a psychology course by enrolling in Teaching of Psychology (PSYC 815).

Dissertation
The doctoral dissertation must represent an achievement in research and a significant contribution to knowledge in the major area of study. It is equivalent to more than 24 semester hours of course work.

Dissertation Defense
An oral examination in defense of the dissertation is required. The aim of the defense is to explore with the candidate the methodological and substantive contributions of the completed dissertation.

Research Opportunities
AE faculty conduct numerous research projects on health and public health, quantitative, cognitive, developmental, social, and ethics topics. Students have access to laboratory facilities as well as field settings in which faculty work. Research is supported by a variety of funding agencies from federal (including the National Institutes of Health) to state agencies. Students are encouraged to become engaged in one of these research programs early in the process of their education.

Doctor of Philosophy - Human Factors Psychology

Bryan Porter, Graduate Program Director

Admission
The graduate program in human factors (HF) psychology, accredited by the Human Factors and Ergonomics Society, admits students with bachelor’s or master’s degrees from psychology or related fields. Each applicant must submit:

1. Official scores from General Test of the Graduate Record Examination (GRE). Applicants with degrees from fields outside psychology must also submit GRE scores for the Subject Test in psychology.
2. A brief statement by the student outlining the prospective student’s personal goals and academic objectives.
3. Three letters of reference, at least two of which are from former college or university teachers.
4. Transcripts of all prior academic work including grades for experimental methods and statistics courses or equivalent.
5. Applicants are also encouraged to submit a writing sample.

Overview of the Topical Areas
The HF doctoral program follows the scientist-practitioner model with emphasis on psychological theory and behavioral science, statistics and research methodology, practical experience, and fundamental and innovative areas of human factors/engineering psychology. The following is a partial list of these areas:

- Aviation psychology
- Behavioral modeling
- Complex system operation
- Display design
- Driving and navigational performance
- Ergonomics
- Human-computer interaction
- Perception and performance
- Medical systems
- Neuroergonomics
- Simulation
- Team performance
- Training
- Usability testing
- Warnings and alarms
- Virtual environments
- Information processing and workload

Requirements
The program requires at least 84 semester hours of credit beyond the bachelor’s degree or approximately 48 hours of post-master’s education. For the individual entering with a bachelor’s degree, the general plan of graduate education consists of four phases:

1. A core of basic psychology, acquired while working toward the master’s degree;
2. Broad education in the general area of human factors psychology;
3. Research and applied experience in human factors psychology; and
4. Completion of a dissertation representing a significant professional contribution to human factors psychology.

For the individual entering with a master’s degree, a minimum of 48 hours of doctoral-level credits is required, based on the faculty’s and the Ph.D. program director’s review of the student’s educational background. Students who enter with a master’s degree will typically pursue a plan of study identical in spirit to the latter three phases of the plan of study followed by a student entering with a bachelor’s degree (see phases listed above).
For the student with a bachelor’s degree, completion of the program requires approximately five years of study. For the student who holds the master’s degree upon entering the Ph.D. program, completion will require approximately three years. A student entering the program with a bachelor’s degree must complete the first phase of the program by meeting the requirements for the master’s degree in general psychology (i.e., 36 semester hours with appropriate course work). The student is required to complete successfully a core of master’s-level courses, with at least a B average in these courses.

The core courses consist of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSYC 813</td>
<td>Research Project I</td>
<td>2</td>
</tr>
<tr>
<td>PSYC 827</td>
<td>Analysis of Variance and Experimental Design</td>
<td>4</td>
</tr>
<tr>
<td>PSYC 828</td>
<td>Regressional and Correlational Design</td>
<td>4</td>
</tr>
<tr>
<td>PSYC 831</td>
<td>Human Cognition</td>
<td>3</td>
</tr>
<tr>
<td>PSYC 841</td>
<td>Sensation and Perception</td>
<td>3</td>
</tr>
<tr>
<td>Select one of the following:</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>PSYC 651</td>
<td>Developmental Psychology</td>
<td></td>
</tr>
<tr>
<td>PSYC 849</td>
<td>Advanced Social Psychology</td>
<td></td>
</tr>
</tbody>
</table>

Total Hours: 19

Completion of the first phase requires two years of study.

Following the student’s second year, the student forms a guidance committee of graduate faculty members who assist in developing a plan of study tailored to the student’s needs and interests. The plan of study outlines the student’s minimum of 48 hours of post-master’s education.

**Candidacy Examination**

Prior to admission to candidacy (i.e., the beginning of formal work on the dissertation), each student is required to pass a qualifying examination covering the breadth of the general HF discipline as well as the student’s primary area of concentration. The examination consists of a written part (eight hours) and an oral part (two hours).

**Publication and Application**

Prior to graduation, students are required to demonstrate their ability to assume first authorship in a refereed journal, and to create an application of research methodology and/or computing skills. An example of such an application might include a data analysis program, a simulation program or a patentable technology innovation.

**Practical Experience**

The student must obtain professional practice experiences during the course of graduate education. An internship is one excellent option for meeting this requirement. However, the student can also meet the requirement by participating in at least two applied research projects or consulting activities under the direct supervision of a Ph.D. psychologist (or psychologists). The student’s guidance committee establishes the criteria for meeting the professional-practice experience requirement and judges the adequacy of the experiences.

**Dissertation**

The doctoral dissertation must represent an achievement in research and a significant contribution to knowledge in the major area of study. It is equivalent to no more than 24 semester hours of course work.

**Dissertation Defense**

An oral examination in defense of the dissertation is required. The aim of the defense is to explore with the candidate the methodological and substantive contributions of the completed dissertation.

**Research Opportunities**

Lab facilities are available for research in cognition, human perception and performance, modeling and simulation, and psychophysiology. Facilities include personal computers, local area networked testing stations, sound-attenuated testing chambers, driving simulators, flight simulators, and a human-computer interaction laboratory. Access to university computing and multimedia development facilities is also available. To complement the program’s emphasis on modeling and simulation, students also have access to the Virginia Modeling, Analysis and Simulation Center (VMASC). VMASC is an ODU-affiliated research and development center where scientists from a number of disciplines create and test computer models and simulation applications to benefit industrial, academic, and governmental interests.

Research is supported by private sector, local, state or federal governmental organizations (e.g., National Science Foundation, National Institutes of Health, NASA, etc.), or one of the military services. Doctoral students are encouraged to become engaged in one of these research programs early in the process of their education.

**Doctor of Philosophy - Industrial/Organizational Psychology**

Bryan Porter, Graduate Program Director

**Admission**

The Doctor of Philosophy (Ph.D.) program in industrial and organizational (I-O) psychology admits students with bachelor’s or master’s degrees from psychology or related fields. Each applicant must submit:

1. Official scores on the Graduate Record Examination including the verbal, quantitative, analytical writing scores. Applicants with degrees from fields outside psychology must also submit GRE scores for the Subject Test in psychology;
2. A brief statement outlining the prospective student’s personal goals and academic objectives;
3. A sample of recent academic writing (e.g., a paper required in an undergraduate course);
4. Three letters of reference, at least two of which are from former college or university teachers; and
5. Transcripts for all prior academic work.

**Overview of the Topical Areas**

The program covers current theoretical and practical issues and topics within I-O psychology. The following is a partial list of these areas:

- Job analysis
- Psychological testing
- Selection systems
- Personnel training
- E-training
- Human resource development
- Human resource management
- Occupational safety and health
- Work motivation
- Work-family interface
- Job satisfaction
- Organizational commitment
- Leadership
- Group and team processes
- Organization development and change and perceived fairness in the workplace
- New forms of work organization such as telework and virtual teams
- International aspects of I-O psychology.

**Requirements**

The program requires at least 84 semester hours of credit beyond the bachelor’s degree or approximately 48 hours of post-master’s education, which includes up to 24 dissertation research credits. For the individual entering with a bachelor’s degree, the general plan of graduate education consists of four phases:
1. Course work in general psychology, acquired while working toward the master’s degree;
2. Broad education in the general area of I-O psychology;
3. Research and professional-practice experience in I-O psychology; and
4. Completion of a dissertation representing a significant professional contribution to I-O psychology.

For the individual entering with a master’s degree, a minimum of 48 hours of doctoral-level credits is required, based on a review of the student’s educational background by the faculty and the Ph.D. programs director. The entering student holding a master’s degree must pursue a plan of study identical in spirit to the latter three phases of the student with the bachelor’s degree (see phases listed above).

For the student with a bachelor’s degree, completion of the program requires approximately five years of study. For the student who holds the master’s degree upon entering the Ph.D. program, completion requires approximately three years. A student entering the program with a bachelor’s degree must meet the requirements for the master’s degree in general psychology (i.e., 36 semester hours with appropriate course work). The student is required to complete a core of master’s-level courses with at least a B average. The core courses consist of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
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<tr>
<td>PSYC 827</td>
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<td>4</td>
</tr>
<tr>
<td>PSYC 828</td>
<td>Regressional and Correlational Design</td>
<td>4</td>
</tr>
<tr>
<td>PSYC 845</td>
<td>Psychometric Theory</td>
<td>3</td>
</tr>
<tr>
<td><strong>Select two of the following:</strong></td>
<td></td>
<td><strong>6</strong></td>
</tr>
<tr>
<td>PSYC 850</td>
<td>Organizational Psychology</td>
<td></td>
</tr>
<tr>
<td>PSYC 863</td>
<td>Personnel Psychology</td>
<td></td>
</tr>
<tr>
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<td>PSYC 849</td>
<td>Advanced Social Psychology</td>
<td></td>
</tr>
</tbody>
</table>

Total Hours: 19

Attaining the master’s degree requires two years of study.

Following the student’s second year, the student must form a guidance committee of graduate faculty members who assist in developing a plan of study tailored to the student’s needs and interests. The plan of study outlines the student’s minimum of 48 hours of postmaster’s education.

**Candidacy Examination**

Prior to admission to candidacy (i.e., the beginning of formal work on the doctoral dissertation), each student is required to pass a candidacy exam. There are two methods a student might use to pass the candidacy exam:

1. The student publishes three manuscripts, at least one as first author, in peer-reviewed journals; or
2. The student completes a qualifying examination covering the student’s areas of specialization. The candidate is examined broadly in the areas, not merely in a single aspect of concentration. The examination consists of a written part (12 hours) and an oral part (two hours).

**Practical Experience**

The student must obtain professional practice experiences during the course of graduate education. An internship is one excellent option for meeting this requirement. However, the student can also meet the requirement by active involvement in applied research or consulting activities under the direct supervision of one or more Ph.D. psychologists. The student’s guidance committee establishes the criteria for meeting the professional-practice experience requirement and judges the adequacy of the experiences.

**Dissertation**

The doctoral dissertation is a significant and creative research achievement and a significant contribution to knowledge in I-O psychology. An oral examination in defense of the dissertation is required. The aim of the defense is to evaluate the doctoral candidate’s mastery of the methodological and substantive contributions of the completed dissertation.

**Research Opportunities**

Laboratory and field research programs are conducted by the I-O faculty on such diverse topics as selection systems, training systems, development and implementation of performance appraisal systems, team performance and assessment, work-family interface, workplace diversity and inclusion, organizational change, occupational safety and health, innovation management, telework, virtual teams, and international I-O issues. Research is supported by a variety of agencies such as the National Science Foundation; National Institutes of Health; National Institute for Occupational Safety and Health; the NASA/Langley Research Center; the Virginia Modeling, Analysis and Simulation Center; and the military services. Students are encouraged to become engaged in one of these research programs early in the process of their education.

**Doctor of Psychology - Clinical Psychology**

Robin Lewis, Graduate Program Director

The Department of Psychology participates in a program that awards the degree of Doctor of Psychology (Psy.D.) in clinical psychology. This program, offered through the Virginia Consortium Program in Clinical Psychology, is a joint venture of the Departments of Psychology at Old Dominion University and Norfolk State University and the Department of Psychiatry and Behavioral Sciences at Eastern Virginia Medical School. The combined efforts of these institutions give considerable breadth and depth to this unique program. The emphasis of the program is on the training of highly skilled psychologists. The program uses a “practitioner-scientist” model that emphasizes a balanced integration of clinical and scientific training. The program is accredited by the American Psychological Association.

**Admission**

Detailed information about the program and a downloadable application are available at the program’s website: http://www.sci.odu.edu/vcpcp. To be admitted to the Doctor of Psychology program, the student must have a baccalaureate degree and an acceptable background in psychology. In addition, the applicant must present:

1. Official scores on the Graduate Record Examination
2. A brief statement outlining personal goals and academic objectives
4. A personal interview is also required.

**Requirements**

The Doctor of Psychology program provides students with a high level of professional training. The program consists of a minimum of five years of post-baccalaureate training. The curriculum involves a specific sequence of required courses to ensure mastery of the knowledge and skills necessary for professional competence. The first two years (six semesters) provide for an intense program of basic behavioral science and clinical courses and practica. In the third and fourth years, students complete their advanced training practica and course work as well as an empirical doctoral dissertation. The one-year full-time clinical internship is completed during the fifth year. The internship is not provided by the Virginia Consortium.

**Student Evaluation**

Students are regularly evaluated in both course work and practicum activities. A formal evaluation of student’s progress is conducted annually. At the end of the second year, each student is evaluated through a written
and oral comprehensive examination that covers both course and clinical competence.

**Dissertation Award**

The David Leigh Pancoast Award is given to the student in the Virginia Consortium Program in Clinical Psychology with the outstanding doctoral dissertation.
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