

# Doctor of Philosophy Engineering with a Concentration in Engineering Management and Systems Engineering (PhD)

## Degree Description

The Doctor of Philosophy (Ph.D.) focuses on developing the necessary skills to perform and evaluate rigorous research. Graduates are prepared for careers in teaching and research at academic institutions as well as in other public and private organizations characterized by innovation and technological leadership. The program blends highly theoretical with more applied or pragmatic research. The fields of research supported by the program are defined by the diverse specializations of the department faculty. Students in the Ph.D. program work closely with faculty to develop world-class expertise in their chosen fields of research. Advising faculty expect doctoral students to become collaborators, supporting the faculty's research agenda, and contributing towards their research goals. *This program is available on-campus and online.*

## Admission Requirements

Admission to the Ph.D. program is competitive. The admission process is designed to select applicants that have a strong alignment between their own research interests and an area of specialization of one of the faculty. The best qualified applicant or applicants for an area of specialization are then selected. The number of students admitted into any faculty's area of specialization is dependent on the faculty's projected ability to advise additional doctoral students. The selected is based on the applicants' academic history, maturity in the development of research capabilities, and proficiency in specialized skills demanded by the research area.

In addition to general University admission requirements, which include English language proficiency for international students, applicants must have: (1) A master's degree or equivalent with a grade point average of 3.50 in an appropriate field from an accredited institution of higher education. (2) Undergraduate degree from an ABET-accredited program in engineering or engineering technology with a GPA of 3.00 (out of 4.00) or better. Students who hold bachelor's degrees in other disciplines or who do not meet the GPA requirement may be considered for admission based on transcript evidence of applicable physics and calculus courses, a resume indicating relevant work experience in an engineering discipline, and/or satisfactory GRE quantitative scores.

Each applicant is required to submit the following documentation when initially applying: (1) Transcripts from all institutions that the applicant has attended; (2) Graduate Record Examination general aptitude scores; (3) A curriculum vitae that highlights professional and research related activities; and (4) an essay of 500 words or less describing personal and academic goals, professional objectives, preparation for graduate study, and how the chosen program will help the applicant achieve these goals and objectives. The essay should clearly state the specific area in which the applicant intends to specialize.

Applicants whose interests can be supported by a faculty's specialization and demonstrate adequate preparation to meet the demands of doctoral studies will be contacted by the Graduate Program Director. The GPD may request additional information that will assist in the selection process. Additional information may include but is not restricted to: publications, samples of research reports, and documents or materials that support proficiency claims of specialized skills. If warranted, the GPD will organize an interview of the

applicant by faculty that have specializations in areas that may overlap with the applicant's intended area of research.

Admission is contingent on having the support of a faculty that is willing to commit to acting as an advisor should the applicant be admitted.

Students lacking adequate academic preparation may be required to complete coursework in addition to the graduate admission requirements. Students may be admitted to the Ph.D. program deficient in these leveling courses, but as part of their plan of study, the student must take and successfully complete these courses at the earliest possible opportunity. All students must have mathematics coursework through the level of integral calculus; matrix algebra or differential equations; and a course in calculus-based statistics (ENMA 420 (<http://catalog.odu.edu/search/?P=ENMA%20420>) or equivalent). As part of masters-level coursework, all students must have completed the following engineering management leveling courses or their equivalent: ENMA 600 (<http://catalog.odu.edu/search/?P=ENMA%20600>), ENMA 603 (<http://catalog.odu.edu/search/?P=ENMA%20603>), and ENMA 604 (<http://catalog.odu.edu/search/?P=ENMA%20604>).

## Curriculum Requirements

### General Requirements

The Ph.D. program is intended to develop scholarship and research capabilities in the student. Graduates will be experts in their chosen field, highly skilled researchers, critical thinkers, and competent communicators and debaters. Graduates will demonstrate this in a variety of ways that will include, but is not limited to, their performance in: coursework, written and oral examinations, closed and public debates and defenses, and contribution to their field's body of knowledge. The development and assessment of such expertise and scholarship take place under the guidance, advising, and mentorship of a faculty that is an expert in the field, and appropriate guidance, dissertation, and examination committees.

### Curricular Requirements

Curriculum requirements in engineering management are in accordance with the general requirements for Ph.D. degrees as specified in the Requirements for Graduate Degrees section of this catalog. The Ph.D. program is governed by a Plan of Study that is established by the student in conjunction with his/her advisor and guidance committee within the first nine credit hours of coursework and will follow the established course requirements (below) unless a substitution to one or more courses is agreed upon between the advisor and student and approved by the Graduate Program Director. The plan of study is designed to prepare the student to undertake scholarly research in the particular field and specialization of their dissertation. The coursework selected will provide the student with (1) the requisite foundational knowledge of the selected field, and (2) the necessary research skills. A high degree of flexibility is provided to customize the plan of study, taking into account the diversity in the fields of study, the multidisciplinary nature and variety of research that is undertaken, as well as the different levels of preparation that individual students have.

At least three-fifths (3/5) of formal coursework must be at the 800 level for all doctoral programs.

### Subject Area Specialization (Advisor-driven)

Complete the specialization	9
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### Subject Area Electives (Suggested courses)

Select a minimum of two of the following:	6
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ENMA 661	Systems Engineering Design	
ENMA 815	Systems Analysis	
ENMA 824	Risk Analysis	
ENMA 843	Reliability and Maintainability	
ENMA 854	Big Data Fundamentals	
ENMA 863	Robust Engineering Design	

### Research Skills (required)

ENMA 811	Engineering Research Methodology	3
ENMA 820	Multivariate Statistics for Engineering	3

ENMA 821	Foundations of Research	3
<b>Research Skills Electives</b>		
Complete electives		9
<b>Dissertation Research *</b>		
Complete dissertation		24
<b>Total Credit Hours</b>		<b>57</b>

\* Up to 6 dissertation research hours may be replaced by coursework with the approval of the advisor and GPD.

## Additional Requirements

### Requirements for Graduation

In addition to any University and College requirements presented in this catalog, the Ph.D. program in engineering management requires:

1. Satisfactory completion of a minimum of 48 credit hours of postmaster's degree credit or equivalent level of performance coursework. This shall include a minimum of 24 credit hours of coursework that complies with the student's plan of study, and a minimum of 18 credit hours of dissertation research hours.
2. Passing a written and oral candidacy examination at the completion of formal coursework.
3. The completion of research representing independent original research and its formal documentation as a dissertation.
4. The successful defense of a dissertation proposal.
5. The successful final public defense of the dissertation before an audience, which includes an appropriately selected committee of faculty knowledgeable in the field of the research.

### Continuance Requirements

Students may be separated for failure to comply with any policies, procedures or requirements that pertain to this Ph.D. program or student behavior. In addition to the requirements for graduation, separation from the program may be warranted for the following reasons, among others:

Coursework:

1. All students admitted to Engineering Management and Systems Engineering programs must earn a grade of "C" or better in all courses required for the degree and in all Engineering Management prerequisite courses. A student may be separated from the program if he/she receives a grade lower than a "C". Additionally, a student may be separated from the program if he/she receives 2 (two) grades lower than a "B".

Adherence to programmatic expectations:

1. Students are expected to complete their coursework according to an agreed upon plan of study. See plan of study requirements above. Failure to adhere to the plan of study may result in separation from the program.
2. Students are expected to make timely progress on their coursework and research. Persistent failure to meet deadlines and milestones or other indicators that demonstrate progress, as assessed and documented by the guidance or advisory committee may lead to separation from the program.
3. Students are expected to remain within the specialization area of their advisor and committee members. Students that deviate outside of the agreed upon research area will be notified of this deviation. The student may lose the support of their advisor and committee if the deviation persists. A student will be given a limited period of time (generally one semester) to acquire an advisor that is capable of supporting their new research direction. Separation from the program will result if the student cannot obtain a new advisor, whether this is due to the lack of a specialization in the new field, or if a faculty with a suitable specialization cannot take on additional advising responsibilities.
4. Similarly, if a student is left without an advisor for any other reason (e.g. departure of a faculty advisor from the program), it is contingent on the student to obtain a new advisor in a timely manner. This may

require flexibility and willingness by the student to adjust their area of specialization. The department will assist the student and take their particular situation into consideration when the loss of an advisor is due to factors outside of the student's control. Separation from the program will, however, result if no advisor is obtained after a limited period of time (generally one semester).

Quality of Research

1. A student that persistently submits work of low quality whether it be in documented or in oral form, may be required to submit for special reviews by the committee. Records taken by the advisor, and the guidance or advisory committees, which document the quality problems and present remedial actions where appropriate will be used to help ascertain whether the problems can reasonably be expected to be resolved, or if separation from the program is warranted.

Ethical Behavior

1. Any student partaking or demonstrating behaviors that might be considered to go against the policies and conditions expected for responsible conduct in research, Old Dominion University expected codes of conduct, or ethical considerations that might be specific to an area of research, may result in separation from the program.