Systems Engineering, Ph.D.

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Systems Engineering is geared toward the rapid design and development of large and complex systems. Systems Engineering integrates all the specialty and sub-specialty groups of engineering disciplines into a team whose efforts result in a structured development process that proceeds from concept to production to operation. Example systems include coastal ecosystems, water treatment facilities, computer networks, visualization platforms, deep-water drilling operations, highway safety systems, biofuels production facilities, robotic units, refineries, fiber optic networks, aircraft, vehicle control systems, biomass gasification units, management of utilities during disaster events, and power grids.

Each of the five engineering departments at UL Lafayette participates in the offering of the Systems Engineering Ph.D. degree with a discipline concentration within each department. This innovative program builds upon the research-based learning experience associated with most Engineering Ph.D. programs by adding the additional learned skill set of Systems Engineering principals. The graduate of this program is expected to be highly appealing to both industry and academic positions. The applicant is required to select a concentration (specialization) department from within the college - chemical engineering, civil engineering, electrical engineering, mechanical engineering, or petroleum engineering. Hence, the graduate exits the program with a strong specialized knowledge appropriate of a traditional engineering Ph.D. coupled with expertise in the application of systems theory toward solving complex problems within their specialty. The program does accept direct Ph.D. (student has a B.S. in an acknowledged engineering field) and Post-M.S. students (previously obtained a M.S.).

Admission

Admission of applicants into the program is based on a thorough evaluation of student capabilities measured via a variety of metrics inclusive of the GRE Exam (Graduate Record Exam), TOEFL (Test of English as a Foreign Language), written essays, reference documentation, and evaluation of transcripts from previous educational programs.

For Post-B.S. or direct admission (B.S. to Ph.D.) into the program, the students must hold a B.S. from a recognized engineering discipline and have at least a 3.0 Cumulative GPA within the last 70 hours of engineering coursework from their B.S. program. For the GRE General Test taken prior to August 2011, a Success Evaluation Score should be in excess of 1,150. The Success Evaluation Score (SES) is computed as detailed below:

ES = GRE Quantitative Score + (GRE Analytical Score x 100)

Note that the maximum GRE Quantitative score is 800 and the maximum GRE Analytical score (often referred to as the "Written Portion") is 6.0. For the GRE General Test taken August 2011 or after, please refer to the department for the SES minimum. All other criteria for the proposed program must follow the graduate admission policy of the university. Students without an engineering degree will not be allowed to directly enter the Ph.D. program; they will be required to obtain a M.S. (or B.S.) in an engineering field prior to acceptance. The M.S. in Engineering program at UL Lafayette does allow admission of students without an engineering degree provided that the student takes a series of leveling courses.

Post-M.S. students must have at least one of their two degrees being an engineering degree and have a M.S. cumulative GPA of at least 3.0. Note that students with a M.S. in engineering that do not have a B.S. in engineering may be required to take "leveling" courses within their concentration area (civil, chemical, electrical, computer, mechanical, or petroleum). It is the goal of the UL Lafayette College of Engineering that all of its graduates can successfully sit for the Professional Engineering licensure exam; hence, the need for fully discipline-leveled graduates. The extent of leveling courses required will be determined on a case-by-case basis within each department.

General Requirements

A minimum of 72 hours above the bachelor's degree is required. At least 48 of these hours must be in coursework including 24 hours from a General Systems Engineering Program Core and 24 hours from a Specialty Core from their selected concentration (either chemical, civil, electrical, mechanical, or petroleum engineering). The Specialization Core content will be designed by the student and major professor as part of the student's program of study (see more details below on program development).

General Program Core (24 hours)

1. Project Management (3 hours) – Principles of engineering management applicable to project development and implementation. Includes topics such as systems theory and concepts, organizational structure, project planning, scheduling, staffing, budgeting, and control of engineering projects.
2. Engineering Statistics (3 hours) – Basic concepts of random variation in engineering projects, planning experiments and analyzing the resulting data.
3. Six Sigma (3 hours) – A study of the lean six sigma philosophy, six sigma tools, and the six sigma infrastructure within the organization.
4. Linear and Non-Linear Programming (3 hours) – Techniques for optimizing linear and non-linear models of engineering systems. Deterministic and stochastic techniques; continuous and discrete variables and functions; constrained and unconstrained problems.
5. Graduate Mathematics, Statistics, or Science Elective (3 hours) – Selected in consultation with the student's major professor and graduate committee (requires program coordinator's approval as well).
6. Systems Engineering I (3 hours) – General analytical concepts used in the modeling and analysis of engineering systems, including system requirements, cost modeling and life cycle analysis.
7. Systems Engineering II (3 hours) – Design and integration of engineering systems, including structured and object-oriented analysis techniques. Life cycle issues and tools. Team-based preliminary system design project.
8. Non-Emphasis Graduate Engineering Elective (3 hours) – The student must take one course from another engineering department outside of his/her specialization to enhance the multi-disciplined flavor of the student's educational experience.

Specialization Core (at least 24 hours)

At least 24 hours must be taken from a student's concentration department and/or classes offered by the College of Engineering and/or the Ray P. Authement College of Sciences. Departments may specify a set of courses as a required part of the Specialization Core. Outside specified courses, there is no specific sequence of courses required by each department for meeting the Specialization Core. This structure provides significant opportunity for the student to meet the requirements of System Engineering training from the humanistic factors, economics, and project management perspectives, while at the same time allowing an appreciable level of specialization and customization to meet individual learning needs within a specific engineering discipline.

Required Specialization Core Courses for Chemical Engineering:

- CHEE 601 – Transport Phenomena **3 Credit(s)**
- CHEE 610 – Advanced Thermodynamics I **3 Credit(s)**
- CHEE 620 – Advanced Reactor Design **3 Credit(s)**

Program of Study

A program of study for the Specialization Core must be designed upon entry of a student into the program. This program of study to be drafted under the lead of the major professor and program coordinator will detail courses that the student must successfully complete. The program must obtain approval by the student's graduate committee, and hence, will require a majority acceptance by the student's graduate committee. The program of study will also require approval from the program coordinator.

Post M.S. Students

Note that Post-M.S. students may be required to take additional courses beyond the General Program Core requirements. The number and actual courses will be determined based on the content of their M.S. program of study.

Coursework Success

All students must maintain over the entire course of their Ph.D. program at least a 3.0 Cumulative GPA and will be allowed only one "C" as a final graduate course grade within their final transcript.

Student Matriculation into M.S. in Engineering

Students who do not successfully complete the requirements of the Ph.D. program in Systems Engineering will have the opportunity to complete the requirements for a M.S. in Engineering at UL Lafayette. However, the student will be required to successfully meet the full requirements of the M.S. program.

Special Requirements

The UL Lafayette College of Engineering offers an innovative leadership development program entitled "Designing Leaders" that is offered once a year during the spring semester. Leadership is often listed as a key targeted characteristic for Systems Engineers. Therefore, since the graduates of the Systems Engineering Ph.D. degree program must have strong leadership skills, it is required that all students in the Systems Engineering Ph.D. program enroll in and successfully complete Designing Leaders program prior to graduation. Enrollment in Doctoral Engineering Seminar, ENGR 696, is required each semester that a student is registered. Credit does not count towards satisfying doctoral program coursework requirements.

General Comprehensive Examination

A comprehensive examination will be administered after all required courses are completed. This exam focuses on the student's use of the content obtained from the courses taken within the program and how it was used to structure a research proposal, implementation plans, and commercialization concept. The comprehensive exam requires a written component that presents a research proposal on a topic not closely aligned with the student's dissertation topic. This written proposal requires the student to prepare his/her proposal following the current National Science Foundation (NSF) proposal format. A second component of the comprehensive exam is a verbal presentation of the proposal to the graduate committee. The topic of the comprehensive exam must be agreed upon by the student's graduate committee prior to the initiation of the exam. The student will be granted one semester to prepare the exam materials and the defense (both component tests administered the following semester). The student must work independently and not utilize advice from faculty (they can utilize advice from student colleagues). Both components are pass/fail with a majority vote of the graduate committee on the outcomes required. The student will be allowed two attempts at each component.

Dissertation

A comprehensive, written dissertation that summarizes all aspects of the original research performed by the candidate is required. To accomplish this, a minimum of 24 dissertation hours must be completed. To enhance the experience of the candidate and to address the intent of a strong appeal to industry, each committee will include an industry member to provide a strong industrial perspective (this committee member will not serve as a voting member, but as an advisor from an industry perspective throughout the entire process). To further entrench the learning of current state-of-the-art product development methodology, the dissertation research to be performed by the candidates must follow a generalized Six Sigma format. Additionally, each dissertation must have a significant "Commercialization" chapter that details how the discoveries and associated technology developments may be brought into the engineering marketplace.

Dissertation Proposal Defense

Prior to the initiation of the student's dissertation study, a verbal defense (via PowerPoint) of the proposed dissertation topic must be made to the student's graduate committee. This proposal and defense will lay out the research hypotheses, goals, methods, and expected results. An acceptance of the proposal by the major professor and a majority vote of the graduate committee are required.

Final Examination

The final examination will be a dissertation defense administered after the dissertation is completed and reviewed by the student's dissertation committee. With this exam, a thorough review of the dissertation by the graduate committee along with a stand-up defense is required.

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University of Louisiana at Lafayette
104 E. University Circle
Lafayette, LA 70503
(337) 482-1000
webmaster@louisiana.edu

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