



TEXAS TECH UNIVERSITY  
Edward E. Whitacre Jr.  
College of Engineering™

*Industrial Engineering Department*

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# Graduate Handbook

Master of Science in Industrial Engineering (MSIE)  
Master of Science in Systems and Engineering Management (MSSYEM)  
Doctor of Philosophy in Industrial Engineering (PhD-IE)  
Doctor of Philosophy in Systems & Engineering Management (PhD-SYEM)

**A guide for general requirements specific to  
the Department of Industrial Engineering**

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Revised December 3, 2015 Graduate Studies in Industrial Engineering

## **PREFACE**

The Department of Industrial Engineering at Texas Tech University provides outstanding opportunities for students seeking the Master of Science in Industrial Engineering (MSIE), Master of Science in Systems & Engineering Management (MSSYEM), Doctor of Philosophy with an industrial engineering major (PhD-IE), or Doctor of Philosophy with a systems and engineering management major (PhD-SYEM). The industrial engineering department dates back more than 75 years. Graduate studies in industrial engineering at Texas Tech have produced over 1,000 M.S. and over 200 Ph.D. graduates, who hold leadership positions in research, manufacturing, government, and consulting organizations.

The graduate faculty invites you to consider our program: faculty, instruction, research and facilities. The following material explains the general procedures, milestones, responsibilities and expectations regarding the M.S. and Ph.D. degrees.

### **1.0 AREAS OF SPECIALIZATION**

The Department of Industrial Engineering maintains five primary areas of specialization:

- I. Ergonomics and Human Factors Engineering,
- II. Manufacturing Systems,
- III. Operations Research,
- IV. Statistics and Quality Assurance,
- V. Systems and Engineering Management.

### **2.0 GRADUATE FACULTY**

Graduate faculty with accompanying bios and research interests can be found on the IE website.

### **3.0 APPLICATION AND ADMISSION**

Graduate application information and all necessary paperwork can be found from the Graduate School website at: <http://www.depts.ttu.edu/gradschool/>. Completed application forms should be sent directly to Graduate Admissions. Applications should be completed online using the “Texas Common Application” process for both the master’s and doctorate degrees for all students. The web site is located at: <https://www.depts.ttu.edu/gradschool/admissions/index.php>.

Admission is granted in two steps: (1) by receiving the initial approval of Graduate Admissions, pending receipt of all necessary application materials and (2) by receiving the final approval from the Graduate Committee in the Department of Industrial Engineering. Applicants for admission are notified of their admission decision by the Graduate Admissions Office.

Two levels of admission exist: (1) full admission and (2) conditional admission. Full admission is necessary for ultimately becoming a degree candidate. Candidacy forms are held by the Graduate School until all conditions for full admission are met. In addition to the two levels of admission, one level of temporary non-degree student status (GTMP) is provided to allow people to enroll in graduate courses for one semester prior to admission or to enable people to take graduate courses for credit without seeking a graduate degree. Therefore, students seeking a graduate degree must gain acceptance from the graduate degree program before their second semester of enrollment or the completion of 12 semester hours. Any exception to this rule is granted solely at the Graduate Dean's discretion.

In order to earn a graduate degree in industrial engineering or systems and engineering management from Texas Tech you must eventually gain full admission status. All applications for admission are processed by the

Graduate Admissions Office  
P.O. Box 41030  
Texas Tech University  
Lubbock, TX 79409-1030  
Telephone: (806) 742-2787

In general, graduate admission status remains in effect as long as a student is active in consecutive fall and spring semesters, with or without summer enrollment, and maintains academic performance that meets the current minimum requirements specified by the Graduate School and the Industrial Engineering Department. Otherwise, the student must reapply each term he/she intends to be active in the graduate program and readmission is not guaranteed.

### 3.1 Full Admission to a Degree Program:

Persons who meet the admissions requirements of the Graduate School and the Department of Industrial Engineering will receive full (unconditional) admission to the graduate program and are eligible to receive a graduate degree upon successful completion of an appropriate plan of study. Each and every application for graduate studies in the Department of Industrial Engineering is carefully evaluated. Prior performance and potential performance for the degree sought are considered. Although some exceptions occur, full admission status requires that the applicant possess a recognized (accredited) degree in an engineering discipline or have successfully completed a leveling program specified by the Graduate Faculty of the Department of Industrial Engineering. There is no fixed deadline for application specified by the department. However, the Graduate School may specify admission deadlines, so students are encouraged to consult the graduate school website (<http://www.depts.ttu.edu/gradschool>). Students are encouraged to submit their materials early in the semester prior to their desired entry semester. Only those completed applications received by March 1<sup>st</sup> (for fall semester applicants) and October 1<sup>st</sup> (for spring semester applicants) are guaranteed consideration for admission and financial assistance. This will help to ensure that sufficient time will be available for necessary travel and visa arrangements (if necessary), and full consideration for financial aid.

To be considered for full admission status, a student's application must include:

- (1) an application form;
- (2) transcripts of all previous college work;
- (3) scores from the GRE (Graduate Record Exam);
- (4) three reference letters;
- (5) a non-refundable application fee.

The GRE is required for both the MS and PhD programs. Students must submit their GRE scores, but admission into the graduate program is not based on the GRE score criteria alone. As a general guide, the Department of Industrial Engineering expects successful applicants for the M.S. programs to possess at least a B average in their last 60 hours of undergraduate work. For work at the Ph.D. level, a 3.5 grade point average in an M.S. program is expected. Academic performance as a non-degree

student (GTMP) may be one factor considered in the admissions process. In addition, the Ph.D. program applicant's credentials are examined to assess his/her potential for in-depth research work.

International students are subject to additional requirements as determined by the Graduate Admissions Office. In addition to financial and immigration requirements, TOEFL (Test of English as a Foreign Language) scores are required.

### 3.2 Conditional Admission to a Degree Program:

A student may be admitted conditionally to the Industrial Engineering, or Systems and Engineering Management Graduate Program if: (1) his/her undergraduate degree lacks fundamental engineering subject areas and/or (2) the academic record of his/her prior degree(s) does not give clear indication of the potential for successful completion of a graduate program of study in industrial engineering or systems and engineering management. Students must contact their graduate advisors their first semester in the program to see whether conditions are attached to their degree programs. Students, who are admitted conditionally, due to a lack of background in engineering, will be required to undertake additional study and/or testing to bring their background up to full admission standards. Additional work may take the form of "leveling" course requirements. Leveling work is described in Section 4.

Students who are admitted conditionally because of questionable performance at the undergraduate or graduate level will typically be required to demonstrate their ability to perform in a graduate program by attaining acceptable grades in the first semester(s) of graduate work. When the background leveling, testing, and/or grade performance requirements are successfully completed, the student will receive full admission status.

### 3.3 Temporary Non-degree Student:

A student who has earned a bachelor's degree from a recognized U.S. institution and who was in good standing at the school last attended may be admitted as a "Temporary Non-degree Student" (GTMP) in non-degree studies. Students are allowed to take graduate courses for one semester without being admitted to the Graduate Program in Industrial Engineering or Systems and Engineering Management. The Department of Industrial Engineering may accept course work (up to 6 graduate credit hours for part-time students and 9 hours for full time students) taken at Texas Tech under this classification, which is consistent with a legitimate plan of study for either the M.S. or Ph.D., pending acceptance by the Graduate School and department as described in Sections 3.1 and 3.2.

## **4.0 FUNDAMENTAL REQUIREMENTS**

Successful completion of the graduate program in the Department of Industrial Engineering is based on the assumption that the applicant possesses either an accredited B.S.I.E. degree or the functional equivalent. Otherwise, the applicant will be required to follow a plan of study that will serve as a functional equivalent in critical areas. The functional equivalent includes basic knowledge in undergraduate engineering leveling work.

Undergraduate leveling requirements may be specified as a condition for admission to the graduate programs in industrial engineering. The leveling requirements fall in two categories: (1) mathematics and (2) engineering science. Students are expected to complete leveling early in their graduate programs. Leveling requirements should be completed in the first half of a graduate student's plan of

study, in terms of graduate credit hours in industrial engineering. If sufficient progress in satisfying leveling requirements is not made, the graduate faculty may block enrollment in industrial engineering courses until the leveling requirements are completed. In general, a student may substitute a similar graduate course, if available, for the undergraduate leveling course with advance approval from the student's advisor and the course instructor. A grade of 'C' or better in each undergraduate leveling course or 'B' or better in each graduate leveling course, or their equivalents at another university, is expected. All leveling coursework must be taken for a grade and cannot be taken under the pass/fail option. If the course(s) are not taken at TTU, the burden of proof for content and completion rests on the student. The student must provide course outlines and other materials to satisfy the student's advisor of the equivalency of the proposed course(s).

*Mathematics.* Graduate students in the Department of Industrial Engineering are expected to possess a mathematical background up to and including Calculus III or the equivalent. This background includes differential calculus and integral calculus. If an applicant's transcript does not indicate this background, a condition of the missing Calculus courses will be placed on the applicant. This condition will be in effect until the student provides proof (through transcripts and course descriptions) that the condition has been met. In addition to the Calculus requirement, students are expected to possess a basic, college-level knowledge in both probability and statistics. Applicant transcripts that do not reflect a course in probability and statistics at either the undergraduate or graduate level will have the admission condition of a course in probability and statistics.

*Engineering Science.* Every applicant is expected to possess a sound knowledge of fundamental engineering science material. Fundamental knowledge is typically demonstrated by at least 9 hours of traditional engineering science courses, similar to those required of B.S.I.E. graduates, 3 hours of college level chemistry (with lab), and 3 hours of college level physics (with lab). Engineering science courses include Statics (CE 2301), Dynamics (CE 2302), Mechanics of Solids (CE 3303), Mechanics of Fluids (CE 3305), Engineering Material Science (ChE 3330), Fundamentals of Electrical Engineering (EE 2304), Materials (ME 2311), Engineering Thermodynamics (ME 3321), Fluid Mechanics (ME 3370), and other similar courses.

The engineering science course selection is flexible. The student's choice of engineering science courses may be tailored to individual needs, relative to his/her choice of specialty areas in industrial engineering. However, the student's advisor must approve the final selection.

Typically, the condition of up to "9 credit hours of engineering science" will be placed on non-engineering applicants, if less than three engineering science courses can be found on the applicant's transcript. The applicant may get the total reduced, if he/she can show evidence that he/she has completed such courses.

Similarly a requirement of "3 hours of college level chemistry" or "3 hours of college level physics" will be placed on applicants who are missing such courses.

## **5.0 PROGRAM REQUIREMENTS**

The Department of Industrial Engineering maintains five primary areas of specialization, with a number of courses pertaining to each area:

### **I. Ergonomics and Human Factors Engineering**

- IE 5301. Ergonomics and Design
- IE 5302. Bayesian Analysis for Human Decision
- IE 5303. Work Physiology
- IE 5304. Occupational Biomechanics
- IE 5305. Cognitive Engineering
- IE 5306. Safety Engineering
- IE 5307. Loss Assessment and Control
- IE 5308. Risk Assessment of Human Behaviors
- IE 5309. Human Factors in Engineering and Design
- IE 5371. Bioengineering Systems
- IE 6304. Control Theory for Humans

### **II. Manufacturing Systems**

- IE 5351. Advanced Manufacturing Processes
- IE 5352. Advanced Manufacturing Engineering
- IE 5353. Sustainable Manufacturing
- IE 5355. Computer-Aided Manufacturing
- IE 5356. Biomedical Design and Manufacturing
- IE 5357. Manufacturing Facilities Planning and Design
- IE 5358. Nano-manufacturing

### **III. Operations Research**

- IE 5311. Principles of Optimization
- IE 5312. Queueing Theory
- IE 5314. Multistage Decision Processes
- IE 5316. Simulation Models for Operations Analysis
- IE 5317. Statistical Analysis for Digital Simulation
- IE 5318. Operations Research Modeling with Spreadsheets
- IE 5319. Risk Modeling and Assessment

### **IV. Statistics and Quality Assurance**

- IE 5342. Design of Experiments
- IE 5344. Statistical Data Analysis
- IE 5345. Reliability Theory
- IE 5346. Total Quality Systems

### **V. Systems and Engineering Management**

- IE 5320. Systems Theory
- IE 5321. Decision Theory
- IE 5322. Industrial Cost Analysis
- IE 5323. The Engineering Management Environment
- IE 5324. Advanced Economics of Systems

IE 5325. Productivity and Performance Improvement in Organizations  
IE 5328. Activity Scheduling  
IE 5329. Project Management  
IE 6323. Systems Management Global Environment  
IE 6329. Systems Management Seminar

## **VI. Industrial Engineering Courses Independent of Area of Specialization**

IE 5331. Theoretical Studies in Industrial Engineering Topics  
IE 5332. Independent Study in Industrial Engineering Topics\*  
IE 6000. Master's Thesis  
IE 6331. Theoretical Studies in Advanced Industrial Engineering Topics  
IE 6332. Independent Study in Advanced Industrial Engineering Topics \*  
IE 6399. Research Methods in Science and Technology  
IE 7000. Research  
IE 8000. Doctoral Dissertation

Catalog course descriptions are provided on the IE website.

### **5.1 Master of Science in Industrial Engineering:**

Once admission has been gained (Section 3), the Master of Science in industrial engineering can be earned under one of two programs: (1) the 30-hour non-thesis program or (2) the 30-hour thesis program (see Appendix A for MS Milestone Sequence and Milestone Sequence Flow Chart – Note, students that do not follow the milestone sequence provided in this document can possibly delay their graduation at their own risk). In either case, the plan of study and application for candidacy (Program for the Master's Degree and Admission to Candidacy) must be signed by the student's advisor and filed before the submission deadlines published by the Graduate School (typically 6 months prior to graduation). If changes are to be made in the plan of study once it has been approved, the Form for Reporting Changes on Graduate Degree Programs is used and must also be signed by the student's advisor. In addition, an intent to graduate (Statement of Intention to Graduate) must be filed by the student early (usually within the first month) in the term of intended graduation. All necessary forms can be obtained from the Graduate School at: <http://www.depts.ttu.edu/gradschool/>.

Detailed Graduate School deadlines are available from the Graduate School each term. It is the responsibility of each student to comply with the Graduate School deadlines and fees. Students are encouraged to contact the Graduate School early in their final term to verify that they are in compliance with all requirements.

*Non-thesis Program.* The 30-hour program requires a minimum of 30 graduate credit hours, approved by the student's graduate advisor and the Graduate Dean, and successful completion of the M.S. final examination (see Appendix A). Students in the MSIE program must take at least 1 course in at least 4 of the 5 areas (see Appendix C).

The 30-hour program may include up to 6 semester hours of graduate level work transferred from another U.S. university. Transfer courses must be approved by the student's advisor and the Graduate Dean. Considerations include the course content, the strength of the graduate program, and the grade earned (a grade of 'B' or better is required).



Typically, up to 6 credit hours can be taken in approved non-industrial engineering courses and serve as a minor. Up to 9 non-industrial engineering credit hours can be taken if a formal minor is pursued, pending approval of the student's advisor and the Minor Department. The student's advisor is responsible for administering the 30-hour M.S. non-thesis degree option. Note – a maximum of 2 independent study courses of IE5332 will be allowed on a student's M.S. non-thesis plan of study.

As a requirement for graduation, students pursuing this option must successfully pass a final oral examination covering their graduate studies. The examination is intended to demonstrate to the faculty that the student has mastered the important concepts, techniques, and methodologies of industrial engineering and can apply them to real world engineering and management problems. The exact content and questions are determined by the examining faculty committee and may cover all such material that they consider relevant. Efforts are made to include faculty members who have instructed the student in class and/or are familiar with the student's work and area(s) of interest in industrial engineering. The student should request that the exam be scheduled in their last semester. Students must be enrolled during the term in which they take the final examination and complete all other graduation requirements.

If the examination is not passed on the first attempt, it may be repeated once. Under these circumstances, the student will be informed in writing of his/her deficiencies and of recommended steps to correct these deficiencies. It is the Graduate Committee Chair's responsibility to notify the student and the Graduate School of test results.

*Thesis Program.* The 30-hour thesis program requires a minimum of 24 graduate semester credit hours plus 6 hours of thesis research credit (IE 6000) approved by the student's M.S. committee. Students in the MSIE program must take at least 1 course in at least 4 of the 5 areas. The 30-hour M.S. thesis program may include up to 6 semester hours of graduate level work transferred from another U.S. university. Considerations include the course content, the strength of the graduate program, and the grade earned (a grade of 'B' or better is required). The student's plan of study must be approved by his/her committee, his/her graduate advisor, and the Graduate Dean. Note – a maximum of one independent study course of IE5332 will be allowed on a student's M.S. thesis plan of study.

The master's thesis is expected to represent independent work by the student, conducted under the supervision of his/her graduate committee. It must be written clearly and concisely in English. The focus of the thesis may be an original contribution to the body of knowledge of an area relevant to industrial engineering or a significant application of existing knowledge to a real engineering or management problem. Students are encouraged to draw upon their work experience in defining a thesis topic.

As soon as the student's area for the thesis has been determined, the student is responsible for structuring his/her committee. The committee must consist of at least three members of the graduate faculty, at least two members (or a majority of the committee for larger committees) must be from the Department of Industrial Engineering. A formal written plan of study and research proposal must be submitted to the committee, and an oral proposal successfully made, prior to enrollment in IE 6000. All members of the committee must approve the plan of study and proposed topic. The student's graduate advisor must also approve and sign the plan of study and committee. The advisory committee is formally appointed by the Graduate Dean, upon the recommendation of the Department



of Industrial Engineering. Once enrolled in IE 6000, a student must maintain his/her enrollment each term until he/she defends his/her thesis and completes all other graduation requirements.

With the aid of his/her major professor, the student must complete the research work and then schedule and successfully present and defend his/her thesis to the faculty. The final draft of the thesis document must be submitted to the thesis committee 2 weeks prior to the final defense to allow committee members adequate time to prepare for the defense. All theses must conform to the style and format set out by the Graduate School. It is the responsibility of the student to write the document and work with the Graduate School to meet all thesis style and format requirements and to deliver the proper number of copies to the Graduate School. The Graduate School issues a complete list of deadlines each term, relative to graduation requirements. In addition to the Graduate School requirements, the student is expected to furnish each committee member and the department with a bound copy of the thesis. The student's major professor is responsible for the administration of the M.S. thesis program, once a topic and major professor are selected. At the time of the thesis defense, the student must be currently registered in at least 3 hours of IE 6000 under his/her major professor and must have taken at least 6 hours of IE 6000 under his/her major professor up to and including the semester in which the defense is scheduled. After the defense, the major professor will report the defense results to the Graduate School and also assign a letter grade to 6 hours of the IE 6000 credits taken, reflecting the student's grade on the thesis.

5.2 Master of Systems and Engineering Management (MSSYEM). The Department of Industrial Engineering at Texas Tech also offers a master's degree in Systems and Engineering Management. This degree is offered both on-campus and through distance education (video/internet). The degree has more flexibility in the course requirements so that it can be tailored to the student's industrial needs. This degree has 15 hours of core credits:

1. IE 5320. Systems Theory
2. IE 5321. Decision Theory, IE 5322. Industrial Cost Analysis, IE 5324. Advanced Economics of Systems, or IE 5325. Productivity and Performance Improvement in Organizations
3. IE 5323. The Engineering Management Environment or IE 5329. Project Management
4. IE 5311. Principles of Optimization or IE 5318. Operations Research Modeling with Spreadsheets
5. IE 5316. Simulation Models for Operations Analysis, IE 5319. Risk Modeling and Assessment, or IE 5346. Total Quality Systems

In addition to the 15 hours of core credits, the degree requires 15 hours of elective credits. The MSSYEM can be obtained with a thesis or non-thesis option just like the MSIE, and, except for the difference in the core credits, all the other degree requirements are the same (see Appendix A).

5.4 Doctor of Philosophy: Once admission has been gained (Section 3), the Doctor of Philosophy with a major in industrial engineering or systems and engineering management is earned by completing a minimum of 60 graduate level semester credit hours (beyond the B.S. level) – including 3 credit hours of IE 7000 – plus at least 12 credit hours of IE 8000 and the successful completion and defense of a dissertation (see Appendix B for PhD Milestone Sequence and Milestone Sequence Flow Chart – Note, students who do not follow the milestone sequence provided in this document can possibly delay their graduation at their own risk). At least 45 semester credit hours must be completed in industrial engineering or IE-equivalent courses at another university. The 60 credit hours must include at least 30 semester credit hours of course work completed at Texas Tech University, with a maximum of 30 transfer credit hours allowed. Doctoral students with a major in

industrial engineering must take at least 1 course in at least 4 of the 5 areas in the Department of Industrial Engineering (transfer courses may be used with approval of the student's graduate advisor).

A minimum of 15 semester credit hours may be completed to serve as a minor. The minor area(s) should be chosen to support the Ph.D. research work.

A total of up to 30 semester credit hours from a M.S. program may be counted in either the major area or the minor area or a combination to the two areas. Transfer credit hours are evaluated by the student's graduate advisor as to their applicability to his/her plan of study. Courses completed more than 7 years prior to entry in the Ph.D. program must be justified, in writing, by the student as to their relevance towards the Ph.D. plan of study. The acceptance of such course work is at the discretion of the student's advisor and the Graduate Dean.

The Graduate School requires a "residency" period of each Ph.D. student. Residency normally constitutes full-time study, and to have completed 24 hours within a 12 month period, at Texas Tech. Specific details regarding current residency requirements are listed in the Graduate Catalog. In some cases, a Ph.D. student will be asked by his/her committee to satisfy tool requirements in order to complete the Ph.D. program. Tool requirements consist of courses at either the graduate or undergraduate level and are not counted in either the major or minor course hours.

The Ph.D. committee will consist of a minimum of four members with IE faculty always the majority. The dual degree programs will consist of four members with 2 IE faculty and 2 from the other participating university. It is acceptable to have two outside university members as long as the majority of the members are current IE faculty.

Once admission to the Ph.D. program has been obtained, a number of specific requirements must be met (see Appendix B). The listing below provides a sequence of events that must take place in order to earn the Doctor of Philosophy with a major in industrial engineering or systems and engineering management:

1. **Admission to the Ph.D. Program.** This requirement is discussed in Section 3.
2. **Preliminary Examination.** The preliminary examination consists of a 3 credit hour, IE 7000, independent study research course, under the direction of a member of the Industrial Engineering Graduate Faculty who has agreed to serve as the student's major professor (dissertation committee chairperson or co-chairperson and research advisor). The subject matter and exact content of this work is proposed, in writing, by the student and approved, in writing, by the major professor. In general, the content should challenge the student in the areas of problem definition and formulation, literature review, problem solving methodologies, and creative solutions. The preliminary examination allows the faculty to assess the student's abilities and potential to produce meaningful research results in his/her doctoral research program. The preliminary exam should be completed as early as possible in the student's program, preferably by the end of the second or third long semester for full-time, on campus students, and by the end of the fourth or fifth long semester for part time students. IE 7000 can be taken any time up to the semester in which the Qualifying Exam is completed. In addition, more than 3 credit hours of IE 7000 can be taken, if the student does

not complete the preliminary exam requirements during the original semester of registration; however, only 3 credit hours will be graded and counted toward the preliminary exam requirement.

- 3. *Plan of Study and Committee.*** A formal plan of study, detailing the major and minor courses and the Ph.D. committee, must be approved by the graduate advisor and the Graduate Dean. A Ph.D. committee is typically made up of at least 3 industrial engineering graduate faculty members and at least 1 graduate faculty member from outside industrial engineering (for larger committees, a majority of faculty must always be from industrial engineering). One of the industrial engineering faculty members will serve (mandatory) as the committee chairperson or co-chairperson and the research advisor. The composition of the doctoral committee for PhD students (IE or SYEM) in the Joint TTU-ITESM (Instituto Tecnológico de Estudios Superiores de Monterrey) program will consist of a minimum of 4 faculty members – 2 members from TTU and 2 from ITESM with 2 of the four professors (one from each institution) serving as co-chairs for the committee. Formulation of a plan of study is primarily the responsibility of the student and his/her major professor. The Doctoral Proposal and Report of Preliminary Examination form (see Graduate School for appropriate forms) is filed with the Graduate School by the student's major professor. Note – a maximum of 2 independent study courses of IE5332 or IE6332 will be allowed on a student's Ph.D. plan of study.
- 4. *Research Proposal.*** Each Ph.D. student is responsible for developing a research proposal in writing. This development should be done under the direction of the major professor and committee. Proposals may vary in length, but are expected to outline the research objective, relevant research questions, and a review of the literature, a proposed research procedure, and a summary of the contributions expected from the research. Research proposals must ultimately be presented to the student's committee and approved by that committee. A copy of the proposal in its revised form, if revisions are necessary, is to be placed on file in the industrial engineering office for possible examination by students and faculty. The research proposal document must be submitted to the dissertation committee at least 2 weeks prior to the defense of the proposal to allow committee members adequate time to prepare for the defense. Once a student successfully completes his/her Ph.D. preliminary exam (see above), qualifying exam (see below) and the defense of the dissertation proposal is approved (doctoral candidacy status recommendation), the student may register for IE 8000. IE 8000 registration must be maintained until all graduation requirements are completed. A full-time Ph.D. student must take a minimum of 3 credit hours of IE 8000 per semester once he/she achieves doctoral candidacy status until completion of his/her doctoral program. A full-time student is allowed to take only one, 1 credit IE 8000 semester during the last semester in his/her doctoral program, if he/she has successfully defended and only needs to turn in final document. Any exception to this policy must be approved by the department chair and the graduate committee.
- 5. *Qualifying Examination.*** Successful completion of a qualifying examination must be accomplished before a Ph.D. student can be admitted to candidacy. The examination is structured by the student's committee. The format is typically both verbal as well as written. Typically, the verbal defense is scheduled to coincide with the student's proposal defense meeting and written exam questions are submitted 2 weeks after the student submits his/her

final proposal to the committee (this requires a submission of the proposal document to the committee at least 4 weeks before the student's scheduled qualifying exam/proposal defense date). At the time of the qualifying exam, the student must have taken at least 3 hours of IE 7000 under his/her major professor up to and including the semester in which the exam is taken. A report of the outcome is written by the major professor and submitted to the Graduate School using the Qualifying Exam Report Form. The student must also have earned a passing letter grade in his/her preliminary exam (3 hours of the IE 7000 credits taken under his/her major professor) by the end of the semester in which the student takes the Qualifying Exam in order to remain in good standing and be able to begin to register for IE 8000 the next semester.

- 6. *Dissertation and Defense.*** Once the proposed research is completed, it must be formally reported in the form of a Ph.D. dissertation. The dissertation must be defended by the Ph.D. candidate in an open forum. All Ph.D. students must have at least one journal paper submitted prior to the final defense. Before scheduling the Ph.D. defense, the candidate must provide evidence of submission to the committee (e.g., letter from journal editor, or manuscript ID number). The final draft of the dissertation document must be submitted to the committee 2 weeks prior to the final defense to allow committee members adequate time to prepare for the defense. A typical defense will include the student, his/her committee and a representative of the Graduate School as well as any other people wishing to hear or challenge the results. The Ph.D. committee will consist of a minimum of four members with IE faculty always the majority. The dual degree programs will consist of four members with 2 IE faculty and 2 from the other participating university. It is acceptable to have two outside university members as long as the majority of the members are current IE faculty. A positive vote by the committee as to the technical merit of the research constitutes a successful defense. This vote is reported to the Graduate School by both the Graduate School representative as well as the major professor. All dissertations must conform to the style and format set out by the Graduate School. It is the responsibility of the student to write the document in English and work with the Graduate School to meet all dissertation style and format requirements and to deliver the proper number of copies and abstracts to the Graduate School (see Appendix B for details). In addition to the Graduate School requirements for the dissertation, the student is expected to furnish the department and each committee member with a bound copy of the dissertation. At the time of the dissertation defense, the student must be currently registered in at least 3 hours of IE 8000 under his/her major professor and must have taken at least 12 hours of IE 8000 under his/her major professor up to and including the semester in which the defense is scheduled. After the defense, the major professor will also assign a letter grade to 12 hours of the IE 8000 credits taken, reflecting the student's grade on the dissertation.

The student's major professor is responsible for the administration of the Ph.D. program, once a topic and major professor are selected. A summarized sequence of major steps required for the Ph.D. degree is shown in Appendix B. The Graduate School issues a complete list of deadlines each term, relative to graduate requirements.

Dissertation Format – the Department of Industrial Engineering at Texas Tech University allows for several formats to be used in the composition of a student's doctoral dissertation. The formats that are acceptable to the department are the traditional dissertation composed of the following sections:

introduction, literature review, research methodology, results and analysis, and research conclusion (with all appropriate bibliographic references and appendices required). Texas Tech University is a research university and expects all Ph.D. students to provide the chairperson of their dissertation committee with at least one submitted journal paper from their dissertation work prior to their final defense. The IE Department also allows the use of a modified format that includes all the material presented in the traditional format sections, but constructed in a structure that incorporates three refereed journal publications within the text of the dissertation. The three refereed papers must be of scientific quality and must be submitted to approved journals by the time of final defense. The chairperson of the candidate's dissertation committee, in conjunction with the dissertation committee, is the determinate of which journals will constitute acceptable venues for submission for publication. The Ph.D. candidate must have prior approval from the dissertation committee chairperson and the dissertation committee for the format to be used in the dissertation document.

## **6.0 CONTINUATION IN THE GRADUATE PROGRAM**

The Graduate School requires that a student earn at least a 3.0 grade point average (GPA) over the courses listed in his/her plan of study (filed with the Graduate School) to be eligible for graduation. Additionally, the GPA for each semester for all graduate courses taken must be at least 3.0 (regardless of the plan of study) for the student to remain "in good standing." An earned semester GPA of less than 3.0 will cause the student to be placed on academic probation. The condition for removal from probation is usually stated as a GPA of 3.0 or greater in the subsequent semester's work. Failure to merit removal from probation may result in suspension (dismissal) from the Graduate School. In addition to the general requirements of the Graduate School, the Department of Industrial Engineering requires that its graduate students receive no more than two (2) grades of 'C' or less in industrial engineering course work. Students who fail to meet this criterion will be dropped from the Graduate Program in Industrial Engineering. In addition, all doctoral students will be reviewed by the graduate committee on an annual basis to determine whether satisfactory progress in the program is being made. The graduate committee may recommend dismissal for those students not making satisfactory progress. Students who are suspended or dropped may petition the Graduate School and department for re-admission.

## **7.0 ACADEMIC INTEGRITY**

It is the policy of Texas Tech University and the Department of Industrial Engineering to support and expect a high standard of honesty and academic integrity on the part of its students. The attempt of students to present as their own any work which they have not honestly performed is regarded by the faculty and administration as a most serious offense and renders the offenders liable to serious consequences, possibly suspension. This includes, but is not limited to:

1. Cheating or dishonesty on examinations, quizzes, written assignments, term projects, lab work or other activity. This includes obtaining information during an exam or assignment from an unauthorized source or another student, assisting others in cheating, alteration of grades or records, and unauthorized possession of examinations or other materials.
2. Plagiarism, offering the work of another as one's own without acknowledgment. Any quotation or expression of material taken from any source (e.g. books, journals, the internet, magazines, reports or writings of others) must be explicitly credited as such. Reference guides which have details on style and proper referencing procedures for writing assignments



are available at the library. All students are responsible for ensuring that written assignments adhere to these guidelines.

Any breach of academic integrity is subject to immediate disciplinary action, at the discretion of the professor, which may range from a failing grade on the assignment or exam to a failing grade in the course. At the recommendation of the graduate committee, a student guilty of academic dishonesty or plagiarism may be dismissed from the Graduate Program in Industrial Engineering. The University's disciplinary policy and procedure is outlined in the Student Affairs Handbook.

## **8.0 FINANCIAL SUPPORT**

Financial support awarded on a competitive basis is available within the Department of Industrial Engineering. Support consists of three primary forms: (1) scholarships, (2) research assistantships, and (3) teaching assistantships. All scholarships and assistantship appointments require that the recipient be a full-time student and be enrolled in a minimum number of credit hours during their appointment. The number of hours required is determined at the beginning of each term.

Scholarships. A limited number of scholarships are granted each year on a competitive basis. Scholarships applications are available through the Graduate School website at <http://www.depts.ttu.edu/gradschool/financial/aid.php>. The deadline for receiving applications each year is January 15. Scholarships are typically granted for the Fall term, cover a 12-month time period, and allow the recipient to pay tuition and fees at "resident" rates. Scholarship awards may vary depending on the availability of funds. All scholarships are awarded for a maximum of one year. A student must reapply each year for future consideration.

Research Assistantships. Research assistantships are granted by individual faculty members, relative to one of their research projects. Typically, research assistantships are granted on a 0.5 time basis, requiring approximately 20 hours of work per week. Research assistantship appointments are usually made on a term-by-term basis and allow the recipient to pay tuition and fees at "resident" rates for the term appointed, in addition to the assistantship payments. Assistantship payment rates vary and are negotiated between the student and the faculty member making the appointment.

Teaching Assistantships. Teaching assistantships are granted by the chairperson, relative to departmental needs and budgets. Typically, teaching assistantships are granted on a 0.5 time basis, requiring the assistant to develop, deliver and/or grade instructional materials. Approximately 20 hours of work per week are expected. Teaching assistantship appointments are usually made on a term-by-term basis and allow the recipient to pay tuition and fees at "resident" rates for the term appointed, in addition to the assistantship payments. Assistantship payment rates vary and are negotiated between the student and the chairperson.

Other graduate scholarship and assistantship opportunities may exist outside the Industrial Engineering department (e.g., at a College level or within another department on campus) but the student should contact the potential offering entities directly as the Industrial Engineering department neither administers these awards nor maintains a list of such opportunities.

## **9.0 MINORS IN INDUSTRIAL ENGINEERING**

Students who are not majoring in industrial engineering or systems and engineering management are allowed a minor in industrial engineering at both the M.S. and Ph.D. levels.

9.1 Master of Science Minor: In order to earn an industrial engineering minor at the M.S. level, a thesis program student must successfully complete a minimum of 6 semester credit hours in approved industrial engineering courses. In addition, a member of the graduate faculty from the Department of Industrial Engineering must be appointed to the student's committee. Students in a non-thesis, 30-hour program, are required to complete 9 semester credit hours in approved industrial engineering courses for a minor.

9.2 Doctor of Philosophy Minor: In order to earn an industrial engineering minor at the Ph.D. level, a student must successfully complete a minimum of 15 semester credit hours in approved industrial engineering courses. In addition, a member of the graduate faculty from the Department of Industrial Engineering must be appointed to the student's committee.

### **10.0 FULL TIME STATUS IN THE GRADUATE PROGRAM**

Enrollment in 9 or more hours in a long semester and 3 hours in a summer session is considered a “full time” load. A student may be considered “full time” when taking fewer hours, to complete degree requirements in their last semester. A student is allowed only one “last semester” with full time status for less than “full time” enrollment.

### **11.0 CURRICULAR PRACTICAL TRAINING**

A student on an F-1 visa who wishes to complete an internship in industrial engineering while completing his/her graduate program is eligible to do so through Curricular Practical Training (CPT) if he/she meets certain requirements.

1. The student must have completed at least 15 hours of credit at TTU as part of his/her current graduate degree program and must meet any other residency requirements determined by the Office of International Affairs.
2. The internship must be related to Industrial Engineering as determined through examination of the job description in the position offer letter and additional contact by the department chair with the offering company, if needed.
3. The maximum duration of the CPT will be 7 months, regardless of whether the CPT work is completed full time or part time. No extensions to CPT will be permitted.
4. The student will present the position offer letter to the department chair for approval at least two weeks before a response to the company is due. In order to determine whether the position relates to Industrial Engineering, the department chair may ask for additional information about the position from the student and/or the company. If CPT is approved, the student will be issued a CPT approval letter indicating the description of the work (e.g., position name), employer name and address, beginning date, ending date, and semester of registration in IE 5335. Specific goals and deliverables of the CPT will be specified as part of the IE 5335 course. The project report completed as part of IE 5335 must discuss the academic theories and models related to the student's internship experience, with appropriate citations, in addition to describing the applied outputs completed during the internship. In order to be eligible to take IE 5335, a student cannot



- be a permanent employee of the company in which the internship is conducted during the semester of registration.
5. **Course Registration** – Students must be registered for credit in IE 5335 Internship for the first semester in which CPT is taken. A student may only count 3 hours of IE 5335 on his/her plan of study. Students enrolled in CPT full time may not take other courses during their CPT semester(s). Students enrolled in CPT part time must take at least 6 hours of other course credit during their CPT semester(s)

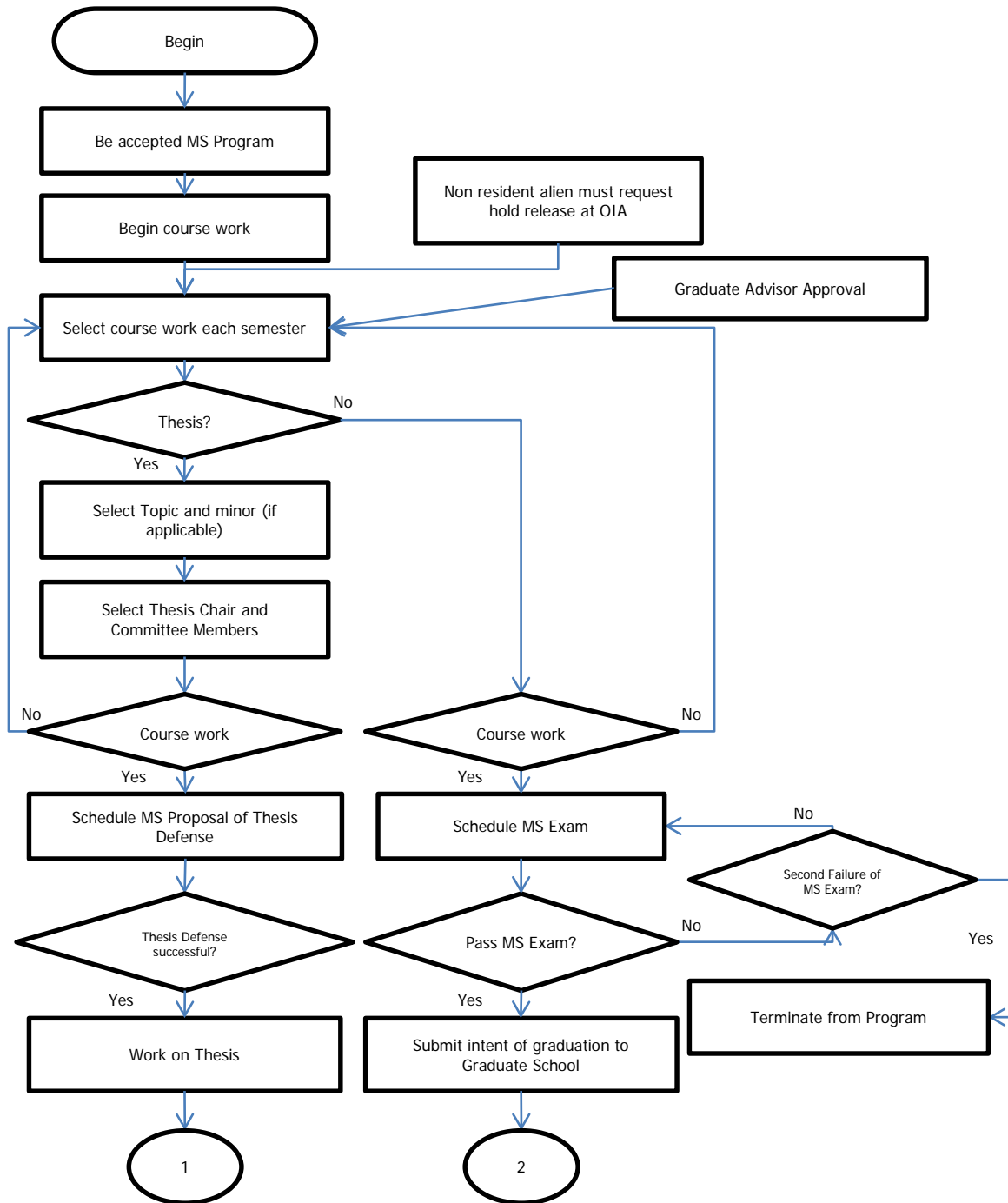
## APPENDIX A

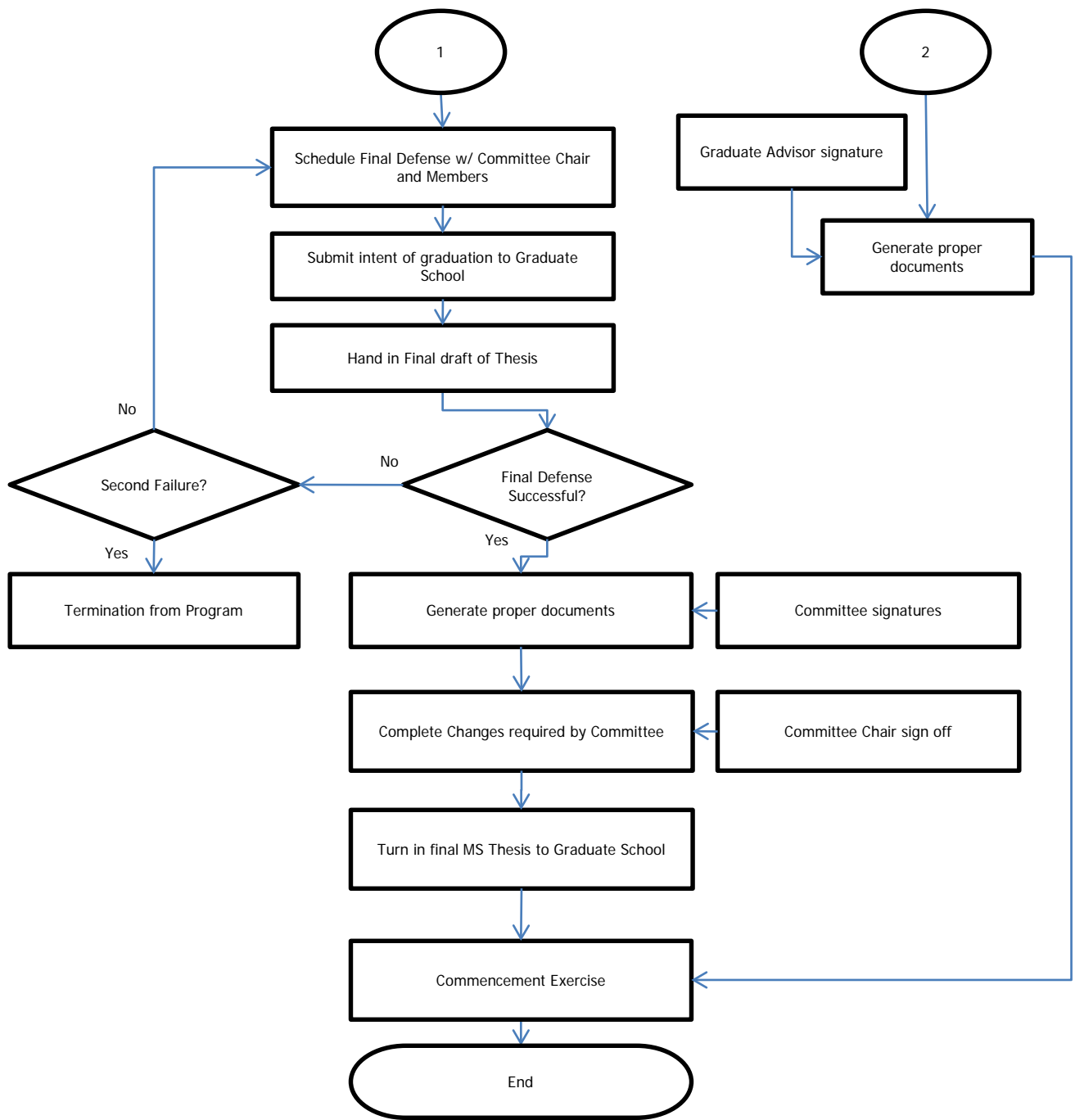
### MS Milestone Sequence

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#### Sequential Process:

- Be accepted into MS Program (IE or SYEM)
- Begin graduate course work (non resident alien must go to the Office of International Affairs before the term begins to get important information about registration, University ID account, etc.)
- Select Thesis Topic and minor area (if applicable) for thesis major; non thesis major do not need to complete this task.
- Select Thesis Chair (Major Professor)
- Select course work for each semester (this must be approved by the Graduate Advisor)
- If non resident alien, must request the release of hold from Office of International Affairs
- Submit preliminary plan of study to Graduate School (must have the graduate advisor signature + minor area advisor signature, if a formal minor is declared)
- Select Committee Members and get sign off by selected Committee Members on plan of study (Thesis option only)
- Complete core course requirements
- Schedule MS Exam (start and end dates) with the Graduate Advisor (Non Thesis option only)
- Successfully defend
  - o MS Exam (Non thesis option)
  - o Proposal defense (Thesis option)
- Work on Thesis (Thesis option)
- Schedule Final Defense of MS thesis with Committee Chair and Members
- Submit intent to graduate to Graduate School in the final semester (term)
- Hand in final draft of Thesis to Committee Members 2 weeks prior to Final Defense
- Successfully defend Final MS Thesis
  - o Get Committee members signatures
  - o Generate proper documents for Graduate School
- Complete changes required by Committee to get the final document for MS Thesis
- Obtain Committee Chair sign off on final corrections to Thesis (Thesis option only)
- Turn in final MS Thesis document to Graduate School
- Commencement Exercise (graduation)





## APPENDIX B

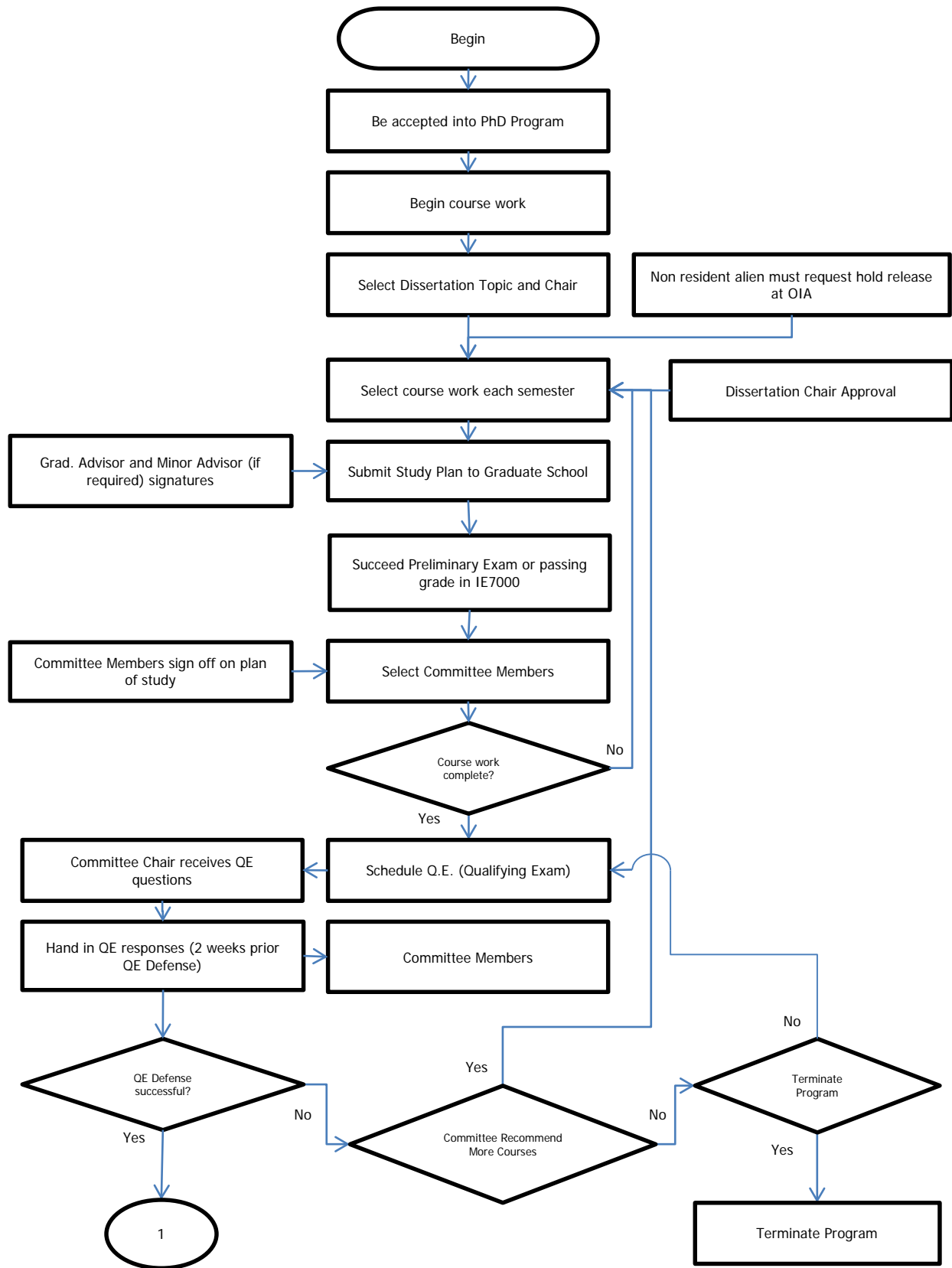
### PhD Milestone Sequence

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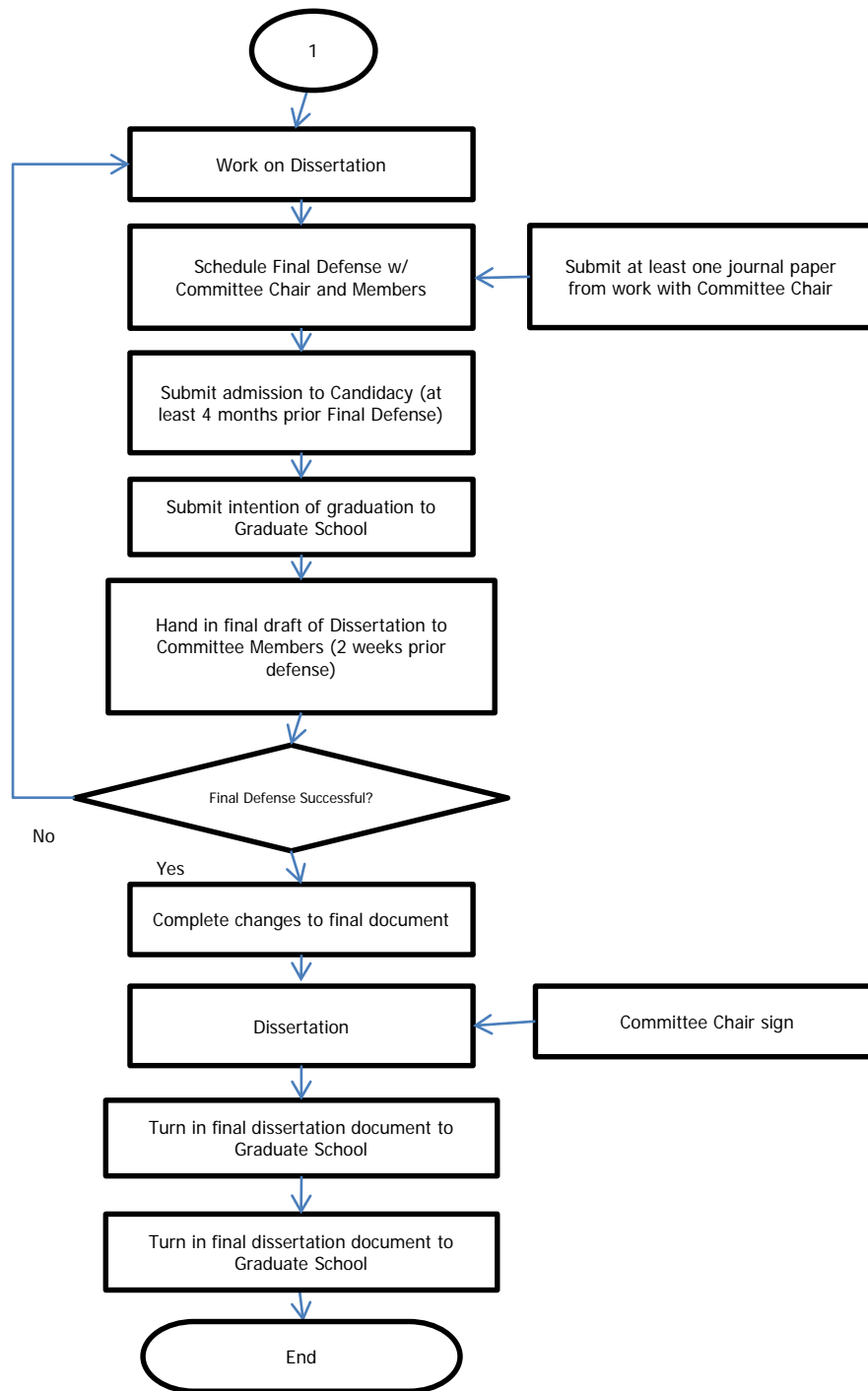
#### Sequential Process:

- Be accepted into PhD Program (IE or SYEM)
- Begin graduate course work (non resident alien must go to the Office of International Affairs before the term begins to get important information about registration, University ID account, etc.)
- Select Dissertation Topic and minor area (if applicable)
- Select Dissertation Chair (Major Professor)
- Select course work for each semester (this must be approved by the Dissertation Chair and the Graduate Advisor)
- If non resident alien, must request the release of hold from Office of International Affairs
- Submit preliminary plan of study to Graduate School (must have the graduate advisor signature + minor area advisor signature, if a formal minor is declared)
- Select Committee Members and get sign off by selected Committee Members on plan of study
- Succeed at the preliminary exam and obtain a passing grade in IE 7000
- Complete core course requirements
- Schedule Qualifying Exam (start and end dates) with the Committee Chair and Committee Members and Submit Proposal to Committee Members
- Committee Chair receives Qualifying Exam questions from Committee Members and submits to student
- Hand in written Qualifying Exam responses to Committee approximately 2 weeks prior Qualifying Exam Defense
- Successfully defend Qualifying Exam
  - Written responses to questions from Committee Members
  - Oral Defense of written responses to Committee Members
  - Proposal Defense
- Work on dissertation
- Submit at least one refereed journal paper from work with the Committee Chair
- Schedule Final Defense with Committee Chair and Members
- Submit admission to candidacy at least 4 months prior to Final Defense
- Submit intent to graduate to Graduate School in the final semester (term)
- Hand out final draft of dissertation to Committee Members 2 weeks prior to Final Defense
- Successfully defend Final Dissertation
  - Get Committee members signatures
  - Generate proper documents for Graduate School (requirements)

- Complete changes required by Committee to get the final document of Dissertation to Committee Chair
- Obtain Committee Chair sign off on final corrections for dissertation
- Turn in final Dissertation document to Graduate School
- Commencement Exercise (graduation)







**APPENDIX C**  
**Course List (MS IE)**  
**MASTER OF SCIENCE - INDUSTRIAL ENGINEERING**  
**GRADUATE COURSE OF STUDY**

Name:	ID#:	
Date Entered Program:	150-HR Program	POS Filled
Leveling Required:	YES NO	COMPLETE
email:	Advisor:	
Semester	Cumulative GPA	

**30 HOURS - THESIS/NON-THESIS OPTION**

**Ergonomics and Human Factors**

POS	COURSE	SEM	GRADE
_____	IE 5301	_____	_____
_____	IE 5302	_____	_____
_____	IE 5303	_____	_____
_____	IE 5304	_____	_____
_____	IE 5305	_____	_____
_____	IE 5306	_____	_____
_____	IE 5307	_____	_____
_____	IE 5308	_____	_____
_____	IE 5309	_____	_____
_____	IE 5371	_____	_____
_____	IE 6304	_____	_____

**Operations Research**

POS	COURSE	SEM	GRADE
_____	IE 5311	_____	_____
_____	IE 5312	_____	_____
_____	IE 5314	_____	_____
_____	IE 5316*	_____	_____
_____	IE 5317	_____	_____
_____	IE 5318	_____	_____
_____	IE 5319	_____	_____

**Engineering Management**

POS	COURSE	SEM	GRADE
_____	IE 5320	_____	_____
_____	IE 5321	_____	_____
_____	IE 5322	_____	_____
_____	IE 5323	_____	_____
_____	IE 5324	_____	_____
_____	IE 5325	_____	_____
_____	IE 5328	_____	_____
_____	IE 5329	_____	_____

POS	COURSE	SEM	GRADE
_____	IE 5331	_____	_____
_____	IE 5332	_____	_____

**Statistics**

POS	COURSE	SEM	GRADE
_____	IE 5342	_____	_____
_____	IE 5344	_____	_____
_____	IE 5345	_____	_____
_____	IE 5346	_____	_____

**Manufacturing**

POS	COURSE	SEM	GRADE
_____	IE 5351	_____	_____
_____	IE 5352	_____	_____
_____	IE 5353	_____	_____
_____	IE 5355	_____	_____
_____	IE 5356	_____	_____
_____	IE 5357	_____	_____
_____	IE 5358	_____	_____

**THESIS OPTION - FINAL GRADE**

POS	COURSE	SEM	GRADE
_____	IE 6000	_____	_____

**OTHER COURSES**

POS	COURSE	SEM	GRADE
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

**\*Texas Tech IE Undergraduates may not take this course.**

**LEVELING REQUIREMENTS**

	SEM		GRADE	
IE 3341 - Engineering Statistics	_____		_____	
Other	_____		_____	

**APPENDIX D**  
**Course List (PhD IE)**  
**DOCTOR OF PHILOSOPHY - INDUSTRIAL ENGINEERING**  
**GRADUATE COURSE OF STUDY**

Name:			ID#:	
Date Entered Program:	150-HR Program		POS Filed	
Leveling Required:	YES	NO	COMPLETE	
email:			Advisor:	
Semester			Cumulative GPA	

**Ergonomics and Human Factors**

POS	COURSE	SEM	GRADE
_____	IE 5301	_____	_____
_____	IE 5302	_____	_____
_____	IE 5303	_____	_____
_____	IE 5304	_____	_____
_____	IE 5305	_____	_____
_____	IE 5306	_____	_____
_____	IE 5307	_____	_____
_____	IE 5308	_____	_____
_____	IE 5309	_____	_____
_____	IE 5371	_____	_____
_____	IE 6304	_____	_____

**Operations Research**

POS	COURSE	SEM	GRADE
_____	IE 5311	_____	_____
_____	IE 5312	_____	_____
_____	IE 5314	_____	_____
_____	IE 5316*	_____	_____
_____	IE 5317	_____	_____
_____	IE 5318	_____	_____
_____	IE 5319	_____	_____

**Engineering Management**

POS	COURSE	SEM	GRADE
_____	IE 5320	_____	_____
_____	IE 5321	_____	_____
_____	IE 5322	_____	_____
_____	IE 5323	_____	_____
_____	IE 5324	_____	_____
_____	IE 5325	_____	_____
_____	IE 5328	_____	_____
_____	IE 5329	_____	_____
_____	IE 5331	_____	_____
_____	IE 5332	_____	_____

**Statistics**

POS	COURSE	SEM	GRADE
_____	IE 5342	_____	_____
_____	IE 5344	_____	_____
_____	IE 5345	_____	_____
_____	IE 5346	_____	_____

**Manufacturing**

POS	COURSE	SEM	GRADE
_____	IE 5351	_____	_____
_____	IE 5352	_____	_____
_____	IE 5353	_____	_____
_____	IE 5355	_____	_____
_____	IE 5356	_____	_____
_____	IE 5357	_____	_____
_____	IE 5358	_____	_____

**QUALIFYING EXAM/PROPOSAL DEFENSE**

POS	COURSE	SEM	GRADE
_____	IE 7000	_____	_____

**DISSERTATION - FINAL GRADE**

POS	COURSE	SEM	GRADE
_____		_____	_____

**OTHER COURSES**

POS	COURSE	SEM	GRADE
_____		_____	_____
_____		_____	_____
_____		_____	_____
_____		_____	_____
_____		_____	_____
_____		_____	_____
_____		_____	_____
_____		_____	_____
_____		_____	_____
_____		_____	_____

\*Texas Tech IE Undergraduates may not take this course.

**LEVELING REQUIREMENTS**

	SEM	GRADE
IE 3341 - Engineering Statistics	_____	_____
Other	_____	_____

**APPENDIX E**  
**Course List (MS SYEM)**  
**MASTER OF SCIENCE - Systems and Engineering Management**  
**GRADUATE COURSE OF STUDY**

Name:		ID#:	
Date Entered Program:	150-HR Program	POS Filed	
Leveling Required:	YES	NO	COMPLETE
email:		Advisor:	
Semester		Cumulative GPA	

**30 HOURS - THESIS/NON-THESIS OPTION**

Core 1				OTHER COURSES			
POS	COURSE	SEM	GRADE	POS	COURSE	SEM	GRADE
	IE 5320						
Core 2							
POS	COURSE	SEM	GRADE				
	IE 5321						
	IE 5322						
	IE 5324						
	IE 5325						
Core 3							
POS	COURSE	SEM	GRADE				
	IE 5323						
	IE 5329						
Core 4							
POS	COURSE	SEM	GRADE				
	IE 5311						
	IE 5318						
Core 5							
POS	COURSE	SEM	GRADE				
	IE 5316*						
	IE 5319						
	IE 5346						

**THESIS OPTION - FINAL GRADE**

POS	COURSE	SEM	GRADE
	IE 6000		

**\*Texas Tech IE Undergraduates may not take this course.**

**LEVELING REQUIREMENTS**

	SEM	GRADE
IE 3341 - Engineering Statistics	_____	_____
Other	_____	_____

**APPENDIX F**  
**Course List (PhD SYEM)**  
**Doctor of Philosophy - Systems and Engineering Management**  
**GRADUATE COURSE OF STUDY**

Name:		ID#:	
Date Entered Program:	150-HR Program	POS Filled	
Leveling Required:	YES	NO	COMPLETE
email:		Advisor:	
Semester		Cumulative GPA	

<b>Core 1</b>				<b>Core 7</b>			
POS	COURSE	SEM	GRADE	POS	COURSE	SEM	GRADE
_____	IE 5320	_____	_____	_____	IE 6329	_____	_____
<b>Core 2</b>				<b>Core 8</b>			
POS	COURSE	SEM	GRADE	POS	COURSE	SEM	GRADE
_____	IE 5321	_____	_____	_____	IE 6331	_____	_____
_____	IE 5322	_____	_____				
_____	IE 5324	_____	_____				
_____	IE 5325	_____	_____				
<b>Core 3</b>				<b>Core 9</b>			
POS	COURSE	SEM	GRADE	POS	COURSE	SEM	GRADE
_____	IE 5323	_____	_____	_____	IE 6339	_____	_____
_____	IE 5329	_____	_____				
<b>Core 4</b>				<b>Qualifying Exam/Proposal Defense</b>			
POS	COURSE	SEM	GRADE	POS	COURSE	SEM	GRADE
_____	IE 5311	_____	_____	_____	IE 7000	_____	_____
_____	IE 5318	_____	_____				
<b>Core 5</b>				<b>DISSERTATION - FINAL GRADE</b>			
POS	COURSE	SEM	GRADE	POS	COURSE	SEM	GRADE
_____	IE 5316*	_____	_____	_____	IE 8000	_____	_____
_____	IE 5319	_____	_____				
_____	IE 5346	_____	_____				
<b>Core 6</b>				<b>OTHER COURSES</b>			
POS	COURSE	SEM	GRADE	POS	COURSE	SEM	GRADE
_____	IE 6323	_____	_____	_____			
_____		_____	_____	_____			
_____		_____	_____	_____			
_____		_____	_____	_____			
_____		_____	_____	_____			
_____		_____	_____	_____			
_____		_____	_____	_____			
_____		_____	_____	_____			

**\*Texas Tech IE Undergraduates may not take this course.**

**LEVELING REQUIREMENTS**

	SEM	GRADE
IE 3341 - Engineering Statistics	_____	_____
Other	_____	_____

