



TEXAS TECH UNIVERSITY

Department of Industrial Engineering

Graduate Handbook

Master of Science in Industrial Engineering (MSIE)

Master of Systems and Engineering Management (MSSEM)

Master of Science in Manufacturing Systems and Engineering (MSMSE)

Doctor of Philosophy (PhD)

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

Department of Industrial Engineering

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Revised November, 2006

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 Systems & Engineering Management (MSSEM), Master of Science in Manufacturing Systems and Engineering (MSMSE), or Doctor of Philosophy with an industrial engineering major. The industrial engineering program dates back more than 40 years. Graduate studies in industrial engineering at Texas Tech have produced over 740 M.S. and over 150 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 three primary areas of specialization:

- I. Ergonomics and Human Factors Engineering,
- II. Manufacturing and Quality Assurance, and
- III. Operations Research 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: <http://www.depts.ttu.edu/gradschool/admissions/how.php>. If application materials are sent to the Department of Industrial Engineering, application processing will be delayed, as we simply forward them to Graduate Admissions once we receive them.

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 Faculty in the Department of Industrial Engineering. Applicants for admission are notified of their success or failure 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 is provided to allow people to enroll in graduate courses for one semester prior to full 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 a 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 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 you are active in consecutive fall and spring semesters, with or without summer enrollment. Otherwise, you must reapply each term you intend to be active in the graduate program.

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; however, students are encouraged to submit their materials early in the semester prior to their desired entry semester. 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); and (4) a non-refundable application fee. The GRE is required for both the MS and PhD programs. Students are encouraged to submit high 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.I.E. program 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. In addition, the Ph.D. program applicant's credentials are examined to assess his/her potential for in-depth research work.

Foreign students are subject to additional requirements as dictated by Graduate Admissions. 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 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. If a student's admission status is conditional, this condition is stated in the letter of acceptance issued from the Graduate School along with the requirements for removing the conditional status.

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 and/or GRE reexamination. 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. This requirement is usually stated as "the student must obtain no grade lower than a 'B' on the first 12 credit hours of study." When the background leveling, retesting, 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" in non-degree studies. Special students are allowed to take graduate courses for one semester without being admitted to the Graduate Program in Industrial Engineering. The Department of Industrial Engineering will accept course work (up to 12 graduate credit hours), taken at Texas Tech under this classification, which is consistent with a legitimate plan of study for either the M.S.I.E. 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 two general categories of courses: (1) fundamental industrial engineering courses and (2) undergraduate leveling work.

4.1 Fundamental Industrial Engineering Courses: Fundamental industrial engineering knowledge in three areas is required:

1. Probability and statistics,
2. Work analysis and design, and
3. Engineering economics.

An applicant lacking fundamental industrial engineering knowledge is required to develop a plan of study which includes those topics. This plan of study is developed jointly by the student and the I.E. Graduate Advisor.

4.2 Undergraduate Leveling: 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.

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 "Math through MATH 2350" 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. A grade of 'C' or better in MATH 3350 at Texas Tech or its equivalent at another university satisfies this requirement.

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. Such 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 graduate faculty 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 no 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. A grade of 'C' or better in each engineering science course or its equivalent at another university is expected. 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 graduate faculty of the equivalency of the proposed course(s).

5.0 PROGRAM REQUIREMENTS

The Department of Industrial Engineering maintains three 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 - Environmental Ergonomics
- IE 5303 - Work Physiology
- IE 5304 - Occupational Biomechanics
- IE 5305 - Cognitive Engineering
- IE 5306 - Safety Engineering
- IE 5307 - Loss Assessment and Control
- IE 5309 - Human Factors in Engineering and Design
- IE 5331 - Theoretical Studies in Advanced Industrial Engineering Topics
- IE 5332 - Experimental Investigation in Advanced Industrial Engineering Topics

II. Manufacturing and Quality Assurance

- IE 5331 - Theoretical Studies in Advanced Industrial Engineering Topics
- IE 5332 - Experimental Investigation in Advanced Industrial Engineering Topics
- IE 5342 - Design of Experiments
- IE 5344 - Statistical Data Analysis
- IE 5345 - Reliability Theory
- IE 5346 - Total Quality Systems
- IE 5351 - Advanced Manufacturing Processes
- IE 5352 - Advanced Manufacturing Engineering
- IE 5353 - Lean Tools for Manufacturing
- IE 5354 - Computer Control in Manufacturing
- IE 5355 - Computer-Aided Manufacturing

III. Operations Research and Engineering Management

- 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
- 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 5327 - Inventory Systems
- IE 5328 - Activity Scheduling
- IE 5329- Project Management
- IE 5331 - Theoretical Studies in Advanced Industrial Engineering Topics
- IE 5332 - Experimental Investigation in Advanced Industrial Engineering Topics
- IE 5340 - Robust Design and Optimization for Systems

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 36-hour nonthesis program or (2) the 30-hour thesis program. In either case, the plan of study and application for candidacy (Program for the Master's Degree and Admission to Candidacy) must be 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. In addition, an intent to graduate (Statement of Intention to Graduate) must be filed 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.

Nonthesis Program. The 36-hour program requires a minimum of 36 graduate credit hours, approved by the Graduate Coordinator and the Graduate Dean, and successful completion of the M.S. final examination. Students under the 36-hour M.S. program must take at least 6 hours of course work in each of the three specialty areas in the Department of Industrial Engineering.

The 36-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 I.E. Graduate Coordinator and the Graduate Dean. Considerations include the course content, the strength of the graduate program and the grade earned. 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 Graduate Coordinator. The Graduate Coordinator is responsible for administering the 36-hour M.S. degree option.

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 or summer term. 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 Coordinator'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 under the 30-hour M.S. thesis program must take at least 3 hours of course work in each of the three specialty areas in the Department of Industrial Engineering.

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. The student's plan of study must be approved by his/her committee, the Graduate Coordinator and the Graduate Dean.

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 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 I.E. Graduate Coordinator must approve 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, students must maintain their enrollment each term until they defend their thesis and complete 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. 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.

5.2 Master of Systems and Engineering Management (MSSEM). The Department of Industrial Engineering at Texas Tech also offers a master's degree in Systems and Engineering Management. This degree will be offered both on-campus as well as through distance education (video/internet). The degree has more flexibility in the course requirements so that it can be tailored to student's industrial needs. This degree has 15 hours of core credits: IE 5311 principles of optimization, IE 5320 systems theory, IE 5321 decision theory, IE 5323 the engineering management environment, and the choice of either taking IE 5346 Total Quality

Control, or IE 5316 Simulation. It can be obtained with a thesis or non-thesis option just like the MSIE.

5.3 Master of Science In Manufacturing Systems and Engineering. The Master of Science in Manufacturing Systems and Engineering (MSMSE) is a multi-disciplinary program which the participating academic units including the Departments of Chemical Engineering, Computer Science, Electrical Engineering, Industrial Engineering, Mechanical Engineering within the College of Engineering and the Information Systems and Quantitative Sciences, College of Business Administration. The MSMSE program is directly administrated by the Department of Industrial Engineering and is supported by the Center for Applied Research in Advanced Manufacturing (CFAR). It is designed so that a full-time student should complete the curriculum in less than two years, including an internship course and practice, under normal circumstances.

The MSMSE curriculum includes a wide variety of courses from colleges of Engineering and Business Administration. It is designed to provide students with a working knowledge of both theory and practice in the design, control, and management of manufacturing systems. The program is organized around a core curriculum that provides students with basic understanding of the science and technology common to all manufacturing systems. This degree has 15 hours of core credits: IE 5351 Advanced Manufacturing Processes, IE 5352 Advanced Manufacturing Engineering, IE 5353 Lean Tools for Manufacturing, IE 5355 Computer Aided Manufacturing, and the choice of either taking IE 5342 Design of Experiments, IE 5346 Total Quality Control, or ISQS 5338, and MGT 5379. It can be obtained with a thesis or non-thesis option just like the MSIE.

5.4 150 Hr. BS/MS Program

The 150 hour program is available to high performing Texas Tech Industrial Engineering undergraduate students. Students apply to the program at the end of their Junior year and their application is reviewed by the graduate faculty in the department to determine their acceptance into the program. Acceptance into the 150 hour program will be based on the student's academic performance to date and faculty assessment of their suitability for graduate work. Status as a student in "good standing" will not necessarily lead to acceptance into the program. Students accepted in the 150-hour BS/MS program substitute three 4000 level courses (normally taken during the senior year) with three graduate (5000 level) courses. The course substitutes will be credited towards both the BS degree plan requirements and the MS degree plan requirements. By participating in this program, students can reduce both the time and associated expense required to obtain an M.S. degree (by up to one semester).

Most students participating in the program will substitute three introductory graduate classes for the three required 4000-level Industrial Engineering Technical electives. However, all graduate course substitutions must be approved by the graduate advisor prior to enrollment in the graduate courses. Students will not be allowed to enroll in graduate classes unless they are within 30 hours of completing their undergraduate degree. Poor academic performance in the graduate program can lead to dismissal from the 150 hour program.

Students in the 150 BS/MS program will receive the BS degree once all degree requirements for that program have been met.

Admission Requirements: To participate in the 150-hour BS/MS program, students must be admitted to the IE Graduate Program prior to taking any graduate classes. Admission to the graduate program requires:

- Completion of the Graduate Record Exam (GRE).
- Completion of a TTU Graduate School application form.

Applications are usually processed by the TTU Graduate School and the Department of Industrial Engineering in approximately one month. However, results from the GRE exam must be received before an application can be processed. This can take up to 6 weeks. Students interested in the 150-hour BS/MS program should begin the application process during their junior year. A completed application (including GRE scores) should be submitted no later than the last semester of the junior year (as long as the student is within 30 hours of completing the undergraduate degree).

Student Status: Once a student has been admitted to the Graduate School, the student's official classification is that of a graduate student even though the requirements for the B S degree have not been fulfilled yet. However, from a practical viewpoint, students in the 150-hour program maintain most, perhaps all, privileges that would be associated with undergraduate student status, including:

- Students can be officers in organizations such as IIE, APM, and SME;
- Undergraduate scholarship eligibility remains intact until the B S degree is completed.

5.5 Doctor of Philosophy: Once admission has been gained (Section 3), the Doctor of Philosophy with a major in industrial engineering is earned by completing a minimum of 60 graduate level semester credit hours (beyond the B.S. level) plus at least 12 credit hours of IE 8000 and the successful completion and defense of a dissertation. At least 45 semester credit hours must be completed in industrial engineering or closely related courses. This total must include at least 30 semester credit hours of course work completed at Texas Tech University. Doctoral students must take at least 6 hours of course work in each of the three specialty areas in the Department of Industrial Engineering (transfer courses may be used with approval of the Graduate Advisor).

A minimum of 15 semester credit hours may be completed to serve as a minor. The minor credit hours may be directed at a specified minor or at a non-specified minor. The minor areas should be chosen to support the Ph.D. research work.

A total of up to 24 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 Ph.D. committee 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 department 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.

Once admission to the Ph.D. program has been obtained, a number of specific requirements must be met. 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:

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 course, under the direction of a member of the Industrial Engineering Graduate Faculty. The subject matter and exact content of this work is proposed, in writing, by the student and approved, in writing, by the graduate faculty member. 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 results should be completed as early as possible in the student's plan of study, typically by the end of the second or third semester.

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 Coordinator and the Graduate Dean. A Ph.D. committee is typically made up of 3 (or 4) industrial engineering graduate faculty members and 2 (or 1) graduate faculty members from outside industrial engineering. One of the industrial engineering faculty members is expected to serve as the committee chairman and the research advisor. Formulation of a plan of study is primarily the responsibility of the student and major professor. The Doctoral Proposal and Report of Preliminary Examination form, Appendix B, is used to obtain approval of the Ph.D. plan of study. The Graduate Coordinator will not sign this form until (1) all plan of study entries are in order, (2) a list of courses has been identified and approved by the dissertation advisor, (3) all committee members are listed on the form, and (4) a doctoral research topic is listed on the form.

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, 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. Once the proposal is approved, the student may register for IE 8000. This registration must be maintained until all graduation requirements are completed.

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. A report of the outcome is written by the major professor and submitted to the Graduate School. The committee chairperson's letter must also be signed by the Graduate Coordinator.

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. 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. 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 C 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.

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 C. The Graduate School issues a complete list of deadlines each term, relative to graduate requirements.

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 Faculty on an annual basis to determine whether satisfactory progress in the program is being made. The Graduate Faculty 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 Faculty, 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

Significant financial support is available within the Department of Industrial Engineering. Support consists of three primary forms: (1) scholarships, (2) research assistantships, and (3) teaching assistantships. All assistantship appointments require that the appointee be enrolled in a minimum number of credit hours. The number of hours required is determined at the beginning of each term.

Scholarships. A number of scholarships are granted each year on a competitive basis. Students are directed to apply through "Call for Scholarship Applications" postings in the department. All applications are evaluated by graduate faculty members representing each of the three areas of specialization in the department as well as the Chairman and Graduate Coordinator. Scholarships granted for the Fall term typically covers a 12-month time period and allow the recipient to pay tuition and fees at "resident" rates. Fall scholarships are valid for the first 12 months of the student's plan of study towards an industrial engineering major at Texas Tech University. Scholarships granted for the Spring term typically cover the Spring and Summer terms only.

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.

9.0 MINORS IN INDUSTRIAL ENGINEERING

Non-industrial engineering majors are allowed a minor in industrial engineering at both the M.S. and Ph.D. levels. Declared minors require the signature of the Graduate Coordinator of Industrial Engineering.

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 on a nonthesis, 36-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.