Purdue University Calumet
College of Technology

Master of Science in Technology
Graduate Handbook
2016

COLLEGE OF TECHNOLOGY

PURDUE
UNIVERSITY
CALUMET

Experiences for a Lifetime

College of Technology Graduate Handbook

NOTE: This document supersedes the Graduate School Policies & Procedures Guide where it imposes stricter requirements. Throughout this College of Technology Graduate Handbook, **XXX** refers to any relevant program prefix code (e.g., **OLS** 58100, **CGT** 58100, ECET 58100, **ITS** 58100, CMET58100).

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This handbook is based on the COT Graduate Handbook at Purdue University, used with permission of the College of Technology per Gary Bertoline.

FORWARD

This document is intended to clarify and emphasize the expectations that the College of Technology (CoT) has relative to the pursuit of graduate studies. If you have questions about how to interpret what is in this Handbook, please consult with your major professor, the CoT Associate Dean for Graduate Studies, or the CoT Graduate Program Coordinator.

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INTRODUCTION

General Information

The Master of Science in Technology degree program is offered to graduate students admitted to the College of Technology. The College of Technology offers three opportunities to meet the educational needs of industry and business, as well as those of educational professionals.

Master of Science in Technology – prepares students to become leaders in technology areas. The program allows students to pursue an advanced degree in a focus technology area, with the flexibility to pursue interdisciplinary interests and develop leadership skills based on ethics and an understanding of global issues affecting technology. Specific concentrations have been developed for this on campus degree program in Computer Information Technology, Electrical Engineering Technology, Industrial Engineering Technology, Mechanical Engineering Technology, and Mechatronics Engineering Technology.

Master of Science in Technology Online – offers a concentration in Technology Leadership and Management that prepares students to manage and lead in technology professions. All required coursework for this major will be offered via distance education technology over an eighteen month to two-year period.

Master of Science in Modeling, Simulation and Visualization – meets the growing demand for the application of modeling, simulation and visualization in complex processes and systems. Through visualizing, manipulating, and interacting with computer-generated simulations and models, an individual can interact efficiently with 2D and 3D computerized environments in real time using his/her natural senses and skills.

Master of Science in Technology

There are six areas of concentration and four disciplinary foci offered by the College of Technology (See Table 1). ***The degree offered is a Master of Science in Technology. However, a student may choose to focus on any of the program areas, or an approved interdisciplinary area.***

Table 1: Areas of Concentration and Disciplinary Foci

Areas of Concentration	• Computer Information Technology • Electrical Engineering Technology • Industrial Engineering Technology • Mechanical Engineering Technology • Mechatronics Engineering Technology • Technology Leadership and Management
Disciplinary Foci	• Construction Management Technology • Computer Graphics Technology • Mechatronics Engineering Technology • Organizational Leadership and Supervision

The Master's program requires a minimum of 33 credit hours of approved course work and is designed to be completed in four (4) semesters of full time study. The program requires a primary Technology area with a minimum of 12 credit hours of courses with TECH (or IT or departmental prefixes) and a minimum of one related area of at least 6 credit hours. The Master's degree is offered with two options; "Directed Project" or "Course Work Only". The Directed Project degree requires a minimum of 30 hours of coursework plus 3 credit hours of TECH or XXX 59800 dedicated to the directed project. Students choosing the "Course Work" option will take a 3 credit hour course in lieu of the directed project with approval of their advisor.

Master of Science – Alternative Delivery

When demand exists, the College of Technology may offer the Master's degree and/or its component courses via innovative delivery modes, including hybrid and online classes. Any such program will have the same credit hour and core course requirements as the on campus master's degree or courses.

Specific information about the College of Technology graduate program may be obtained from the web page at http://webs.purduecal.edu/techgrad. Written inquiries may be directed to the Associate Dean for Graduate Studies, College of Technology, Anderson Building Room 230, Purdue University Calumet, 2200 169th Street, Hammond, IN 46323, phone 219/989-2966, or the Graduate Program Coordinator.

ADMISSIONS

Requirements

Applicants to the College of Technology's graduate program are required to have earned a baccalaureate degree. Applicants are to submit an electronic application for admission along with a resume, three letters of recommendation, statement of purpose indicating their career goals and purpose for pursuing graduate studies, and official transcripts of all undergraduate work. TOEFL, IELTS, or PTE scores are required for international applicants. The College of Technology requires minimum scores for TOEFL, IELTS, and PTE that can be found at the school webpage. Check Admission Requirements under Colleges of Technology Graduate Studies for the required test scores. The Graduate School will also require an official diploma or certificate of undergraduate education for international students. Applicants may bring their original diplomas to the International Students Officer to have a copy attested for sending to the Graduate School. Although the College of Technology does not require GRE scores for admission, however, they are recommended. Applicants are strongly encouraged to submit the result of their GRE, especially if they are looking for a graduate aide position or if they do not possess a high GPA.

Admission Process

Once all the necessary materials have been submitted by the applicant and processed by the College of Technology Graduate Studies program, the complete package is reviewed by the Graduate Education Council (GEC) in the College of Technology. Upon completion of the review, one of the three recommendations is to be made by the Graduate Education Council:

- Unconditional admission,
- Conditional admission with specified conditions, or
- Rejection.

Thereafter, the admission recommendation is forwarded to the College of Technology (CoT) Associate Dean for Graduate Studies for review and recommendation to the Purdue University Graduate School. The College of Technology Graduate Education Council has not specified minimum scores for GPA because it prefers to consider the overall potential of each student. There are, however, well established prior performance expectations. Typically, the GEC seek candidates with overall undergraduate GPAs at or above the 3.0 out of 4.0 for unconditional admission. It must be noted that many applicants have been out of school for many years and the transcript information is only of minimal value. More importantly, the GEC examines the student's background, relevant professional experience, reasons and goals for seeking entry, and determines whether the student would benefit and be successful in the program.

Conditional Admission

For those students who do not meet unconditional admission criteria to the master's degree program (e.g., 3.00/4.00 or better average in prior study), certain other evidence of performance may be considered. For example, substantial career accomplishment as evidenced by the resume

or high performance on the GRE may indicate the students' potential for success is not adequately reflected in their prior academic record. GRE scores may be used as evidence of academic potential, if the applicant's GPA falls below 3.0.

The conditional admission requires that certain minimum performance standards be established, such as "must achieve at least a 3.00/4.00 graduate index at the completion of the first 12 credits following admission to the master's degree program." In addition, the GEC may require certain undergraduate prerequisite coursework to satisfy a deficiency in the student's background (leveling courses).

Academic conditions of admission for all conditionally admitted students will be monitored by the College of Technology's Graduate Studies program and/or the Graduate School, depending on who has imposed the condition. *Each semester the Graduate School will remove the eligibility to register for future sessions for all students who have failed to satisfy their conditions of admission in the previous session. (Thus, there is a grace period of one semester.)*

Departments are to justify and indicate any conditions under which these students should have their eligibility to register restored and be allowed to continue to study for the degree. This shall be requested by a memo from the **major professor/faculty advisor** and routed through the Associate Dean for Graduate Studies, detailing reasons why the student should be permitted to continue. Upon Graduate School approval, the eligibility to register will be restored.

Financial Assistance

Availability

A limited number of graduate aide positions from the College and departments within the College of Technology are available. Students interested in graduate aide positions should contact the Department Head of the appropriate department/program. Additional appointments are available from other areas of the University, such as other academic units. Additional information may be available from the College of Technology's Department Heads and Associate Dean of Graduate Studies.

Aide Appointments

In order to provide opportunity for the recipient to progress satisfactorily toward the degree objective, graduate aide appointments will usually be offered for no more than one-half time and for a maximum of two academic years based on student's performance.

MASTER'S DEGREE PROGRAM STRUCTURE

Credit Hour Requirements

The master's degree program administered through the College of Technology is available as a directed project or coursework only based degree, requiring minimum 33 credit hours.

Degree Options	Directed Project	Coursework only
Course Credits	30 credit hours	33 credit hours
Capstone Course	TECH 59800	N/A
Capstone Hours	3 credit hours	N/A
Total Credit Hours	33 credit hours	33 credit hours

Residency Requirements

The total number of hours of academic credit used to satisfy residency requirements consists of all course credit hours that appear on the plan of study, other graduate course credit hours with grades of "C" or better that appear on the Purdue transcript, and research credit hours with grades of "S" that appear on the Purdue transcript. In fulfilling these requirements, a maximum of 18 credit hours will be allowed from any one semester (maximum hours proportional to length of summer session equals nine (9) credit hours).

Time Limitation

Students are encouraged to complete their degrees in a timely fashion. All students must comply with the "five year rule" in the Graduate Policies and Procedures manual, as follows:

"***Five-year Rule**:* Course credits earned by a student whose graduate study or professional activity has been inactive for five years or more cannot be used on a plan of study for an advanced degree. A plan of study approved prior to such a period of inactivity is invalid.

Further, students who have interrupted their graduate study must submit a new application if three or more consecutive academic sessions (including summer session) have elapsed since their last registration. Upon the recommendation of the department and on a case-by-case basis, special consideration will be given to students returning to continue their graduate studies after being called to active military service."

A candidate for the master's degree is encouraged to complete all requirements for the degree **within five years** from the completion of the oldest course on the plan of study.

Appointment of a Major Professor/Faculty Advisor

Each graduate degree plan of study is unique to the individual student and the student's academic background, professional experience, and degree objectives. To guide the student in the development of a degree plan, a major professor/faculty advisor will be appointed to chair the student's advisory committee and assist the student through the program. Note that a student may request a major professor in the application for admission, although it is not guaranteed.

The major professor/faculty advisor will become the most important contact person, and the major professor/student relationship must be a mutually acceptable one. The major professor/faculty advisor serves concurrently as an advocate, mentor, and supervisor of the graduate student. The determination of the initial major professor is done upon admission or shortly thereafter. The initial advisor plays an important role in establishing a timely and effective initiation of a graduate student's program. If the applicant does not specify a desired major professor on the application, the graduate faculty of an academic department should make every effort to identify a member who has expertise consistent with an applicant's expressed area of concentration and desires to supervise the graduate studies of the student.

In rare circumstances, the Associate Dean of Graduate Studies may serve as a temporary advisor until a faculty advisor is assigned.

Advisory Committee

The student and the major professor are responsible for the selection of an advisory committee. The duties of the advisory committee are to assist the student in the preparation of the plan of study and to offer advice during the course work of graduate studies. It is important that the initial advisor, whether or not he/she continues as the permanent advisor, initiate activities to assist students in becoming acquainted with potential faculty to serve on the advisory committee.

The advisory committee consists of minimum three members of the graduate faculty. As mentioned in the College of Technology Graduate Faculty of this handbook, the major professor and one of the committee members should be from the College of Technology graduate faculty, and the other committee member must also be a member of the Purdue University graduate faculty in the related area. Members of the committee do not need to be faculty with whom the student has taken course work. A co-advisor may be designated when advantageous to the student and where it can build faculty experience.

Both students and major professors should note that if a student's plan of study and/or research project would be significantly improved by the expertise of a faculty member or a person outside the university, they may request consideration for special certification for such service. Such requests require a rationale and description of the expertise and are routed to the Graduate School via the College of Technology Graduate Program. The request for appointment of the advisory committee should be made as early as possible, when a plan of study is approved for that student.

Purdue University Calumet Graduate School is responsible for the appointment of Graduate Faculty based on 1) credentials, 2) employment status, and 3) evidence of ability to mentor students. The faculty selected by the student for service on committees and as an advisor must possess the appropriate level of graduate faculty appointment. Refer to the College of Technology's Policy for Serving on Graduate Student Committees for Regular Graduate Faculty in the College of Technology Graduate Faculty section of this handbook. The CoT Graduate Program maintains a current but unofficial list of graduate faculty and their identifiers.

The advisory committee should be selected preferably **during the first enrollment semester, but generally not later than the second enrollment semester for full time students. Under exceptional circumstances, committee members may be selected later, especially for students attending part-time and who will not complete the degree in four semesters.** The committee will then be in place to help the student develop the plan of study and review/approve the student's directed project proposal, which must be approved before actual work on the project may begin. The student should discuss the plan of study with their preferred potential advisory committee members and secure their permission to list them on the plan of study **before** the plan is submitted for signature.

POLICY ON MONITORING, PROBATION AND DISMISSAL

Minimum Cumulative GPA Requirements (in graduate courses)

The College of Technology has a specific GPA requirement for graduation as shown below. It is the same as the University requirement. This also applies to the GPA requirements for probation and dismissal relative to the College's programs.

- Graduation: minimum 3.00 on a 4.00 scale

Monitoring

The GPA of each graduate student in the College of Technology is monitored each semester to ensure the performance as well as the qualification of the student toward graduation. The following shows the monitoring procedures.

- Graduate student grades and academic progress will be monitored at the College level.
- If a student has a **semester** GPA less than 3.00, the student will receive a written notification by the Associate Dean for Graduate Studies with regard to the student's unsatisfactory performance in the previous semester. A copy of the notification will be sent to the major professor/faculty advisor and the Graduate School, and kept in the student's file. This periodic review will take place after six (6) credit hours have been attempted and every semester thereafter in which the student is enrolled.

Probation

Probation occurs when a student performs below the COT standards in a semester. The following shows the condition of probation and the follow-up procedures.

- If a student has a **cumulative** GPA less than 3.00, the student will be placed on academic probation.
- The CoT Associate Dean for Graduate Studies will send a written notification of the probationary status to the student, major professor/faculty advisor.
- A copy of the notification will be forwarded to the Graduate School and kept in the student's file.
- Upon receipt of the probation notification, the student will have two semesters to raise their cumulative GPA to the required level and return to good standing.
- Eligibility for an assistantship will be left to the Department Head's or Associate Dean's discretion.
- During the probationary period, remedial coursework may be required.

Dismissal

A student may be dismissed from the program if they remain on probation for two consecutive semesters without improving their cumulative GPA to 3.00 or above.

Appeal

A student may appeal their probationary or dismissal status by contacting the Associate Dean for Graduate Studies in writing within thirty (30) days of the date of the probationary or dismissal notification letter. The appeal should include the student's specific reasons for exception to the probation or dismissal policy. The appeal will be reviewed by a three (3) member subcommittee of the College of Technology Graduate Education Council (excluding the Graduate Education Council representative from the student's home department). The decision of the appeal subcommittee will be considered final and will be delivered within thirty (30) days of the student's request for exception to probation.

If the appeal subcommittee recommends reinstating the student, the reinstatement must be approved by the student's major professor/faculty advisor. If the major professor/faculty advisor does not approve it, the Associate Dean for Graduate Studies will render a final decision. In cases where a student is reinstated without the approval of the major professor/faculty advisor, a new advisor may need to be assigned.

PLAN OF STUDY

The philosophy of the Graduate School of Purdue University Calumet is that advanced study should be tailored to the individual and his/her professional and intellectual objectives. Thus, the plan of study is unique to each student's needs and desires. To facilitate such an individually tailored program, each Master's degree plan of study consists of a primary area and one or more related areas. Both the primary area and the related area(s) are based on the relationship of the course content and not on the departmental course prefix.

The development of the plan of study should begin as part of the initial course registration. The major professor or temporary advisor will discuss the student's background, interests, and degree objectives as part of the preparation for the first enrollment. Based on this discussion, the major professor will request spaces in the appropriate courses. The major professor will also recommend possible related areas and advisors. It is important that major professors maintain a reference list of potential Purdue University Calumet courses, and appropriate faculty contacts, relevant to their areas in order to assist graduate students in developing their plan of study.

Students selecting the "Coursework only" option should complete the required 33 hours of coursework in consultation with their advisor. Those selecting "Directed Project" option, in addition to course work requirements of 30 credit hours, must complete and successfully defend a research project known as a Directed Project (TECH or XXX 59800). The plan of study should be developed to support this research requirement (Refer to the sections on "The Directed Project")

The plan of study must list all courses the student will take to meet the degree requirements. These include the names for the primary and related areas of study; the course number, course title, and credits for each course; the date when the course was or will be completed; and the research area. The plan of study is signed by each member of the advisory committee and the student. After review, the plan is signed by the Associate Dean for Graduate Studies. The plan is then submitted to the Graduate School for formal approval.

It is important that each student, with the help of his/her major professor/faculty advisor periodically review the plan of study and the progress of its completion with the graduate student. After the Plan of Study is on file, committee and course changes can be made at any time up until graduation.

To access the electronic Plan of Study generator, please go to the MyPUC link https://mypuc.purduecal.edu/cp/home/displaylogin sign in, click on the Academic & Student Services tab, scroll down to the Graduate Students box and click on the Graduate Plan of Study Link. You will then need to sign in to the graduate database using your career account

Upon approval by the Graduate School, the plan of study becomes a contract among the student, the College of Technology, and the Graduate School. When all requirements of the plan of study are completed satisfactorily, the student is awarded the Master of Science (M.S.) degree. (Refer to the sample plan of study form in Appendix A.)

Primary Area

All Master's Degree plans of study will have a Technology primary area or principle focus. This primary area will have either a technology emphasis or a teaching/research emphasis. It will include between 15 and 24 semester hours (exclusive of the 3 semester hours in the directed project XXX 598), with a minimum of 15 semester hours in courses with a TECH (or IT or XXX departmental) prefix. The primary area should include the following core courses (or acceptable substitutes to be discussed with the major professor):

- IT 50700 Measurement and Evaluation in Industry and Technology **or** MGMT 67000 Quantitative Methods (**or** an acceptable substitute approved by the student's advisor)
- IT 50800 Quality and Productivity in Industry and Technology **or** an acceptable substitute approved by the student's advisor (recommended, but not required)
- TECH 64600 Analysis/Research in Industry and Technology

The other courses included in the primary area are selected to enhance the career goals of the student. **Undergraduate courses may not be included in the primary area of the plan of study without special permission from the College of Technology Associate Dean for Graduate Studies.** In any case, these courses should be 40000 level at minimum and total number of 40000 level credits in any plan of study cannot be more than six. In addition, these courses must be in excess of the baccalaureate degree requirements.

Related Area (Technical Electives)

Each plan of study must include a related area or electives of at least 6 semester hours from another area. In some cases, there may be two related areas if such a plan will enhance the student's professional goals. Common related areas on plans of study include Curriculum and Instruction, Adult Education, or one of the disciplines within the College of Technology (e.g., ECET, MET, CGT, etc.) It is encouraged that each related area should have a faculty representative on the student's advisory committee.

Undergraduate Credit in a Related Area

A related area may include undergraduate courses (40000 level) **only when followed by appropriate 50000- and/or 60000-level courses**, and are subject to the approval of the student's advisory committee and the Associate Dean for Graduate Studies. Undergraduate courses listed in the related area must be in excess of the baccalaureate degree requirements. Graduate School policy stipulates that 10000- 20000 and 30000-level courses may not appear on a plan of study and that **no more than 6 semester hours of 40000-level courses may be applied to graduate work and a grade of "B" or better is required.**

Credit Limitations

The combination of undergraduate excess credit, transfer credit, post-baccalaureate registrant credit, and independent study credit included in a Master's Degree plan of study must not exceed 15 semester hours. These credit categories are defined as follows.

Undergraduate Excess Credit

Undergraduate students attending Purdue University Calumet who have time available to take courses in excess of their undergraduate degree course requirements may earn a maximum of 12 semester hours of credit in 50000 and 60000-level courses which were taken and declared as graduate work at the time that grades were filed for that semester. Undergraduate excess credit will be certified by the Registrar only if the student (1) took the course during the senior year; (2) received a grade of at least "B" in the course; (3) the course was designated as a graduate course; and (4) the student's work in the course was performed at the level required for graduate students in the course.

Transfer Credit

A maximum of half the required course credit hours completed at another institution may be included in the Master's Degree plan of study. Graduate School policy states that transfer credit will be allowed only for courses in which a grade of "B" or better was obtained. A catalog description of the course and an official transcript showing completion of the course and the grade received must be submitted with the plan of study.

Post-baccalaureate Registrant Credit

The Graduate School has created an enrollment category known as "post-baccalaureate registrant" to enable those who have a bachelor's degree to enroll in courses that are considered appropriate to the registrant's personal objectives. A limited amount of credit earned in this category is available for inclusion on a plan of study at the discretion of the advisory committee, the recommendation of the Associate Dean for Graduate Studies, and the approval of the Graduate School.
A maximum of 12 semester hours of graduate credit earned as a post-baccalaureate registrant may be included in a plan of study; no post-baccalaureate course in which a grade of less than "B" was earned will be permitted on the plan of study.

NOTE: The sum of credits earned as undergraduate excess credit and in post-baccalaureate registrant status that may be used on a plan of study is limited to 12 semester hours.

Independent Study Credit

A maximum of 6 semester hours of independent study credit (e.g., XXX58100, OLS 58100, CGT 58100 etc.) may be included in a plan of study.

Examination Requirement for the Directed Project Option

The purpose of this oral examination is for the student to defend the directed project. The examination is considered public and is taken during the session in which candidacy is declared. The candidate's examining committee will conduct the examination and evaluate mastery of content related to the plan of study. A second purpose of this oral examination is for the student

to defend the directed project. The final oral examination should be scheduled through the College of Technology Graduate Studies Program no less than three weeks prior to the date of the examination. If the student's performance is not acceptable in one or more areas, the examining committee will specify what the student must do in order to eliminate the deficiencies.

Examining Committee

The examining committee will normally include the members of the student's advisory committee. Additional members may be appointed by the Associate Dean for Graduate Studies. The advisory committee chairperson (the major professor) may recommend additional members for appointment (Refer to the section on "Post-Project Activities").

REGISTRATION FOR AN INDEPENDENT STUDY COURSE (XXX 59000)

Regulations and Restrictions in the Use of Independent Study Courses

Independent study courses may be included in a graduate plan of study. A copy of the final product or a complete report of the study must be submitted to the professor in charge. Failure to do so may result in an incomplete or failing grade. This work must be independent of other required course studies (previous, existing, or future). ***Registration in XXX 59000 may not be initiated until all of the following procedures have been satisfied. (Note XXX refers to departmental or College prefix code.)***

Enrollment Procedures

The student must:

1. Obtain an independent study authorization form from the Graduate Program Coordinator. This form is a request for permission to enroll in an independent study course (refer to the sample form in Appendix C).
2. Meet with the major professor/faculty advisor to discuss the proposed study and secure his/her approval.
3. Prepare a detailed prospectus (typed or word processed, APA format, title page) including the following sections.
   a) **Problem**: Describe the problem you propose to address clearly, delimit the problem area, and provide a rationale for its significance.
   b) **Purpose and Objectives**: Provide a numbered listing of all educational objectives to be accomplished.
   c) **Define** how the course relates to your degree objectives, i.e., what it will do for you.
   d) **Procedures**: Explain the methods to be used and any unusual requirements for materials, equipment, or facilities. A graphic time line and two progress reports must by submitted by the student to the professor in charge between weeks three and ten of the semester. Provide a narrative, flow chart, or outline of step-by-step procedures used to complete the study. If applicable, provide a supply and materials cost worksheet.
   e) **Outcomes**: Itemize and describe the deliverables/products, i.e., tangible results (software source code, papers, reports, products, or summaries) of the study and list whom will receive copies (office, professor in charge, student).
   NOTE: *This prospectus should be about one to three pages in length. A good way to prepare a prospectus is to subhead it using the above categories and presents the information below each subheading.*
   f) Meet with the professor (the professor in charge) who will guide the study to discuss the prospectus.
4. Complete the INDEPENDENT STUDY AUTHORIZATION FORM (refer to the sample in Appendix C), attach it to the prospectus, and secure the signatures of the major professor (academic advisor), the professor in charge, and the Associate Dean for Graduate Studies.
5. Submit the signed copy of the request to the Office of Graduate Studies along with a completed Form 23. The Form 23 MUST NOT be submitted for processing Prior to securing the necessary approvals for the prospectus.

Directed Project Requirement College of Technology Master's Degree Plans of Study may contain a synthesis requirement that is a Directed Project. An explanation of this requirement and how it differs from a master's thesis is presented in the following listing. Each requirement is then detailed explicitly in subsequent sections.

DIRECTED PROJECT

Directed Project

Total immersion in corporate environment, i.e., business/industry focus

Definition of Directed Project

The directed project was originally defined as an applied research project that was more extensive and sophisticated than a graduate-level independent study and less formal than a masters thesis. The overall objective of the requirement was to engage each graduate student in a study, typically industry or business focused, which is sufficiently involved as to require more than one semester to conceive, conduct, and report. The focus is to be placed on a topic with practical implications rather than original research.

Directed Project Characteristics

- Written for industry
- Includes a business presentation
- Results in a) a tangible product of value to business and industry, or b) education for business and industry
- Can be measured in dollars, but this is not a requirement
- Usually involves a technology2 problem solving activity
- Is documented to permit replication
- Can be published, but this is not a requirement
- Usually involves some form of business or industrial validation
- Generally requires application of a synthesis of coursework

Project Format

- Executive summary
- Introduction
- Project Report Body
  - Section 1: Statement of the problem
  - Section 2: Significance of the problem
  - Section 3: Statement of purpose
  - Section 4: Background
    - Relevant history
    - Definitions
    - Literature
    - Assumptions
    - Delimitations
    - Limitations
  - Section 5: Procedures employed
    - Development process, or
    - Methods
    - Data collection
    - Instrumentation
    - Analysis

  - Section 6: Time action plan
  - Section 7: Conclusions, recommendations, and financial implications
  - References
  - Appendices
- Business Writing Style Manual or preference of advisor

Purposes of Directed Projects

Successful completion demonstrates:

- Ability to identify a business or industry relevant solution to a technology problem
- Ability to define and/or validate a business or industry relevant problem
- Addressing a technological problem in a systematic and replicable manner
- Effective use of technical/professional research and/or development procedures
- Identifying criteria for success/solution of the problem
- Gathering information appropriate to the problem by employing business research procedures (e.g., 70% business/industry sources and 30% academic sources versus the reverse)
- Ability to document the research and development activity in a manner that permits replication and assessment of key decisions and alternatives
- Write effectively in a form customary to business and industry
- Prepare and deliver a presentation in a form customary to business and industry

Effective Directed Project Practices

1. Directed projects should require students to select and employ an effective Research & Development procedure(s) to address the problem.
2. A directed project generates a new solution, product or procedure. It may involve "proof of concept" and it must be of direct value to business or industry or to the education for business or industry.
3. Directed projects should incorporate a strategic financial overview component depicting such characteristics as cost, ROI (Return on Investment), etc.
4. A component of the directed project should be an Implementation Plan (i.e., recommendations for deploying the developed solution). This plan should include the suggested near and Mid-term steps.
5. Industry partners are encouraged for validation or other involvement.
6. Teams of students working on larger projects are allowed provided each has a unique and significant contribution and that there is a high degree of independence so that one student's success is not predicated on another's.
7. Employ either a) business or industry style manuals such as the *Chicago Manual of Style*, b) other relevant business/industry writing style manual, or c) the APA manual when required by the advisor.

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DIRECTED PROJECT PROCEDURES

WL has a section on the overall procedures for completing the directed project first.

Directed Project XXX 59800 Enrollment

Exact enrollment timing can vary, but at least two consecutive enrollments in TECH or XXX 598 are required. Typically, **the first enrollment is for 1 semester hour of credit in the next-to-last** *(but earlier enrollment is permitted if appropriate)* **academic term**. During this academic session, a proposal is developed and approved by the advisory committee. Subsequent registration in XXX 59800 is not permitted until the approved and signed proposal has been filed in the Graduate Studies Office. **The second XXX 59800 enrollment is for 2 semester hours of credit**, in which the study is conducted, the final report written, and the study defended in an oral examination.

Should the student not complete the project in the two enrollment periods describe above, s/he is required to enroll for 1 semester hour of credit each term until the project has been completed. **The candidate must be enrolled in XXX 59800 for at least 1 semester hour of credit in the academic session in which the degree is awarded.**

Grades for XXX 59800 Directed Project Research

Performance in any XXX 59800 Directed Project course is graded using the following scale:

- Pass – used where the student has met or exceeded requirements
- No Pass – used where the student has not met requirements and has not invested appropriate amounts of effort
- Incomplete – used where the student has invested appropriate amounts of satisfactory effort but the project is not yet finished

Preparing Directed Project Proposals

There are no absolutes in the preparation of a directed project proposal. Every individual and every proposed project is unique. The exact approach that the student takes is ultimately at the discretion of the major professor (advisor) and the student's graduate committee.

It does not matter whether a proposal is being prepared for a graduate advisory committee or for an employer. Proposals must be succinct and direct. Clear, jargon-free prose that establishes the need for the study and a proposed method of solution are required--nothing more (or less). While CoT faculty have not established specific proposal length requirements, a proposal should be sufficiently detailed to enable the graduate committee to provide effective judgment and share appropriate advice. Typically, directed project proposals are 15-25 pages (including figures, tables, and references but not counting appendices) to communicate essential detail.

Besides content, a proposal or a final report should consider two important factors: format and style. Format is the physical layout of a paper. Rules for indention, type face, line length, etc., are considered format issues. Style requirements are created to facilitate clear communication. Globally, style indicates the manner of expression and the sequence in which material is organized. At a micro level, style concerns formality, person, tense, spelling, and abbreviation

standards. Both are important, and both have their place. Most publication manuals include both style and format guidelines.
Proposals are always written in future tense. Thus, statements that refer to procedures should be stated as, "This proposed study will collect data using . . ." or "Results of this study will be used to . . . ."

Similarly, College of Technology standards recommend that the proposal be written in third person. It is seldom necessary to refer to oneself in a formal paper. A writing style that does not include either personal identification with a personal pronoun (I, we) or a given name (Jane Doe) should be used. If such a strategy is not possible, an appropriate third person term such as "this developer" or "this researcher" should be chosen. This practice should be used only as a last resort, as it is considered ambiguous in most cases.

Directed Project Proposal Contents

Cover Page

The cover page must follow the format on the sample in Appendix C. This format includes spaces for each advisor to sign and date the proposal. The original signed proposal must be submitted to the Associate Dean for Graduate Studies as soon as all committee members have signed it. This original document then serves as the contract for the directed project.

NOTE: *The same format is used for the Directed Project's final report cover.*

Committee member information should be entered using the first name, middle initial, and last name. Do not use academic or degree titles such as Professor, Dr., etc., before the name. The major professor (committee chairperson) should be listed first, the second person from the primary area next, and then each related area advisor. The committee member's relationship to the plan of study should be listed below his/her name. Thus, if the primary area on the plan of study is listed as "Technology", the committee chairperson (major professor) and the second person from the primary area would be listed as follows.

Susan P. Jones, Chair
Technology
Fred Ross
Technology

If the plan of study included two related areas titled "Communications" and "Applied Computing", the committee members would be listed as follows.

Alexander G. Bell
Communications
A. Paul McIntosh
Applied Computing

Abstract/Executive Summary

The student must prepare a one (maximum) page abstract that succinctly describes the proposed project's problem addressed, purpose for the study, the significance of the proposed study, an overview of the proposed methods to be employed and of the anticipated deliverables.

Typically this section is less than 400 words.

Introduction

The form of the introduction will vary with the nature of the proposed project. Typically they range are 1-3 pages in length. It is important to remember that this is the sole chance to establish a frame of reference in the reader's mind. Appropriate introductions are brief and designed to establish the need for a study. There is no "right way" to write an introduction. There are, however, several possible ways to craft an introduction that will accomplish its intended goal. One common method is to identify the problem in global (vis-à-vis specific) terms. This approach creates an overall frame of reference that makes it much easier for the reader to focus on the more detailed portions of the proposal.

Another method is to identify a plausible alternative to established methods of addressing the problem at hand. For example, sometimes when employing conventional methods, an unexpected outcome (anomaly) occurs. Given this, the proposal could be focused on ascertaining if the outcome was due to chance whether other factors exist that would make the unexpected a more likely future occurrence. Given the pace of development, often wholly new techniques or procedures may offer an alternative to current methodologies. The beginnings of these new approaches are placed in the introduction to set the stage for the proposed project.

Statement of the Problem

There is no section of a proposal that gives beginning proposal writers more challenges than the "Statement of the Problem" section. Too often their early drafts present either a restatement of the introduction, a detailed description of the methods to be used, or a suggested solution. None of these are appropriate statements of the problem. A problem is something that is wrong. Therefore, the statement of the problem is merely a brief description of what is wrong, written in specific enough terms that the reader can see the problem and not simply a problem space. One test of the quality of a problem statement is always, "Could the problem be recognized if the statement were being read for the first time?"

Research Question/Hypotheses

Once the statement of the problem is generated, *where applicable*, the research question and hypotheses follow. The research question is a testable statement of the problem. For instance, the statement of the problem may acknowledge that a new method of learning is needed within a particular class. The research question would then be phrased, “What is the effect of learning technique X on scores in class Y?” This statement would be used to generate hypotheses that could then be tested statistically.

Another example might be that a new algorithm is needed to solve a problem on in some computer domain. The research question might be, “Can an algorithm be developed to solve computer security in educational environments?” In this example, rather than statistics being

used, the student might create the algorithm, test it, to see if it works or does not work under certain conditions.

A final example might be that company X needs to solve a workflow issue in a manufacturing process. The research question might be, “Can software X be used to make the workflow in company ABC more efficient and effective?” In this example, maybe the student will implement the software and then report on the effect related to efficiency and effectiveness. While these are merely examples (and should not be assumed to fully define the wide range of technology theses or directed projects), nearly all projects should have a defined research question that is derived from the statement of the problem. Such a question should also be testable. Whether a thesis or directed project has hypotheses will depend on the type of research being conducted (quantitative or qualitative).

Significance of the Problem

Once the problem has been stated, the significance of the problem must be established. The significance section should be drafted in a manner that removes any question of the importance of the proposed study. In the context of a directed project or thesis, this is the part of the proposal in which the proposed project is tied to the student's overall plan of study and career goals. Generally, this section should "sell" the project as being worthy of doing in the business/industry and/or academic/disciplinary context. One of the effective methods of strengthening this section is to highlight key citations from credible sources that indicate that the problem is real and that things would be better if it were solved.

Statement of the Purpose

Once the problem and its significance have been stated, the purpose of the project must be described. **Here is where the student indicates what they propose to do about the problem, i.e., what part of it they wish to address and what the deliverables of their work will be.**

“Often this section will also be used to define and limit (generally) the scope of the project. Typically the nouns and verbs that are a part of the statement of the problem or research question will be clarified and bounded. Later in the proposal the assumptions, limitations and delimitations provide further insight related to the scope and outline specific details related to scope limitation.

Definitions

Definitions must be included in a directed project proposal whenever it is necessary to inform the reader of the unique way in which the terms are to be used in the proposed research. For example, if learning is to be defined as "a change in behavior", both the entering and terminal behaviors must be defined. But, when terms are used in standard ways, it is not necessary to include the definitions.

An important issue to remember related to definitions is that each definition should have an associated citation. The students use (and definition) of terms should be based upon the academic or industrial literature. As such, because definitions usually use the words of others, most

definitions are typically directly quoted source material. When this is the case, the citation should include source, date, as well as page number where the material occurs.

Be sure to spell out all acronyms. The sample paragraph below is what you should NOT do.

> What would happen if the president of the BBB requested the assistance of the FTC in order to convince the DOC that it should investigate the effect of WSJ interference with NAFTA signatories regarding concerns about the impact of UL standards on GATT? Hopefully, that need will never arise.

The preceding paragraph demonstrates the inappropriate and excessive use of acronyms. If acronyms are used to reduce volume/repetition in a proposal, convention requires the term to be spelled out in full the first time it is used and then followed by the acronym in parentheses. Thereafter, the acronym may be used in lieu of the full term.

Assumptions

Every study requires some assumptions; they will vary with the type of problem. For example, one assumption could be that all members of the group being studied know Windows-based operating systems. Another assumption may be that employees will be willing to participate in the training exercise being proposed. Assumptions, of course, must be established as part of the proposal writing stage and the major professor and committee must approve them.

Delimitations

Delimitations are restrictions in the scope of a project, i.e., statements about things that you will NOT address. There are always constraining factors in a study. This is particularly true of directed projects in which time, money, and other resources are limited to those that the individual student can bring to the study.

Delimitation is a factor that will narrow the scope of the study being proposed. This is a factor that is known about before the study is performed. For example, one delimitation may be that a follow-up after the initial treatment or evaluation may not be possible due to time constraints. Will the study be limited to a single facility of Corporation X, or will it be conducted at multiple sites? Clearly, a multiple-site study is more generalizable than a study at a single location. The signed proposal is the contract for the study. If the proposal were ambiguous about its limits, the student could be in the position of having to gather further information.

Note that delimitations are distinctly different from limitations. A limitation is a weakness or restriction on inference. An example would be a survey having a response rate low enough to produce unreliable and invalid information.

Limitations

Limitations are descriptions of weaknesses of a study. If the student knows about these at the time of generating the proposal they are advised to reveal them explicitly in advance. Often, however, in addition to any weaknesses known in advance of conducting a project, some

invariably arise during the course of project execution. When this occurs, these new limitations are to be added to the limitations section of the final project report and they must be taken into account when discussing the project conclusions.

Review of Literature/Background

The review of literature serves several important functions. First, it is a method to indicate that the problem is more universal than the specific proposal. Second, it serves as a justification for the proposed study in that others have addressed related problems. Third, it positions the work in the field giving context to what has and has not been done and where this project/thesis is positioned therein. Fourth, it identifies possible methods for the conduct of the study by identifying possible data collection strategies, statistical procedures, or sources of other procedural information. Finally, the review of literature should document justification for the proposed study.

There are three principle justifications for additional investigation of a problem. One justification is that there are plausible alternative hypotheses to conclusions reported in existing studies. That is, there may be another possible variable that is influencing the results of existing studies. The second reason for proposing a new study is to determine if the reported study can be duplicated (replicated) in a new environment. A third reason for conducting a study accounts for the introduction of new data or procedures that have become available. In this case, the review of literature serves to demonstrate that no examples of the use of new techniques could be found.
Typically reviews of the literature sections include some appropriate description of four sections:

- A description of the methodology and terms employed to conduct the review of the literature itself
- A description of the problem and its significance
- A description of the literature pertinent to choices of data collection and analysis
- A summary of the review of the literature section

For the purposes of a proposal, the review of literature should focus on the key studies. These cannot be determined without extensive review of the literature prior to the preparation of the proposal. The review must be sufficiently extensive to insure that all sides of an issue have been researched and that a balanced evaluation of the problem area has been accomplished. Because a proposal is limited by space constraints, only the most germane studies should be included.

Procedures (or Methodology)

All procedures to be used in the proposed study should be defined. Whenever possible, the proposed procedure should be justified by reference to other published studies that were used and recommend the steps defined. This will insure that the advisory committee understands the steps the student wishes to take and establishes those steps as appropriate in other published studies.

Directed projects and theses in the College of Technology typically include the creation of something and an assessment of it. The “something” might be an intervention to be used on humans, an apparatus, a new process, a new technology and so forth.

However, this alone is not sufficient for a directed project or thesis. The thing created must also be assessed or evaluated. This assessment could be a physical test (such as testing the new thing to see how it performs), a statistical test (such as comparing measures before and after and executing statistics on it to evaluate how it performs). Most directed projects and theses can be classified along multiple dimensions as to the type of research being done. Projects can fall in to the following classifications:

- Quantitative, qualitative or mixed methods
- Clinical or technical
- Human subjects or "things and stuff"
- Theoretical or applied

The important thing to note about research in the College of Technology is that there is not one type or only one class of research. Research in the College of Technology is as varied as the physical attributes of the students who choose to pursue their degree within it.

Time Action Plan

A time action plan establishes the time frame in which the conduct of the proposed study will occur. This section is vital when there are strict time constraints on data collection or other factors affecting the conduct of the study. This plan also helps communicate the student's proposed time allocation for each major component of the project. Many proposed studies will demand a time action plan. One of the most frequent ways to document the time action plan is to use a Gantt chart.

Activity	**Duration of Activity**															
Review of the literature																
Selection of the sample																
Data collection																
Development of the survey instrument																
Validation of the survey																
Analysis of the collected data																
Follow-up of non responding sample																
Development of findings and conclusions																
Interacting with major professor to finalize the final report																
Committee review of final report																
Final examination																
Make final edits																
Submit final directed project report to TEC Graduate Studies Office																
Sep 1	Sep 14	Oct 1	Oct 14	Nov 1	Nov 14	Dec 1	Dec 14	Jan 1	Jan 14	Feb 1	Feb 14	Mar 1	Mar 14	Apr 1	Apr 14	May 1

(Note: Individual procedures vary, so the above activities should not be considered complete.)

References

The reference list should include only the publications cited in the body of the proposal. All reference citations within the body of the proposal and the reference list must comply with the standards of the most recent edition of the style guide selected by your advisor. This may include Publication Manual of the American Psychological Association (Thesis), the Chicago Manual of Style (Directed Project) or APA style.

Comments on Writing Directed Project Proposals

All proposals must be succinctly written and to the point. After the proposal is approved, all sections may be elaborated/evolved if needed in the final report of the project. It is important that students write the proposal, and in particular the sections up to and including the purpose of the project, in such a way as to capture the interest of the reader. A shorter, well-written proposal is better than a long, rambling discourse that does not directly focus on the problem and its proposed solution.

In the review of literature, which typically follows the proposal's introductory sections, the writer can refer to the work and findings, or lack of work, by others as a powerful justification for the proposed project. In addition, students should devote a portion of their review of the literature section to inform and support their choice of methodologies and instrumentation. This approach allows the weaving of literature references into both the "Statement of the Problem" and the "Procedures" sections and is preferred to placing the "Review of Literature" section at the end of a proposal. The latter makes it very difficult for the student and the advisory committee to establish a frame of reference for the study.

Committee members will typically ask discipline- and literature-based questions regarding the problem, significance, purpose and procedure sections. While it is imperative that the proposal's literature review be summarized, it is equally important that extensive literature review be done before undertaking the writing of the proposal. It is infinitely easier to do a thorough research review prior to the writing of the proposal for another reason: the more the problem is studied, the more possible solutions will be discovered. Also, it should be noted that reviewing of the literature does not cease after a proposal is accepted. Typically, effective researchers/developers continue to review the most pertinent literature throughout their conduct of the study. Subsequently, all appropriate literature will be integrated into the final report/thesis, so the time and effort will not be lost.

The review should generally concentrate on the current literature. For example, if the student is interested in a "Hawthorne effect" study, reference to the original work is only appropriate in a historical context. Failure to review the current literature can fatally flaw the proposal. A study that has recently been conducted may inadvertently be proposed.

Obtaining Permissions to Conduct Research

To conduct research often requires various types of permission, depending on the type of research being conducted. For example, use of human subjects (even for what many consider

innocuous research such as anonymous surveys) requires IRB approval. Purdue University's Office for the Vice President for Research (VPR) provides information on the necessary approvals needed for various types of research (http://www.purdue.edu/research/vpr/). Graduate students are encouraged to discover the type of permissions they might need to obtain by reviewing the materials provided online 36 COT M.S. Graduate Student Handbook, August 2011 via the Vice President for Research's (VPR's) web site, discussing it with the chair of their graduate committee, and reviewing the available workshops provided by the Graduate School's Responsible Conduct of Research (RCR) web site (http://www.gradschool.purdue.edu/RCR/).

Preparing the Final Directed Project Report

General Information

The directed project final report uses the project proposal as its foundation. During the proposal development process, a procedure was evolved that should have been followed to conduct the project. The final report now describes what exactly was done, and what the findings and conclusions are. Any deviations from the proposal must also be noted and justified.

The tense found in the proposal draft is changed from future (what is planned) to past (what was done) when converting the proposal document into the final report. The information contained is not changed, however. Variations between what was planned and what actually occurred will be contained in one of several new sections as part of the final report.

Final Report Contents

The final report will typically retain the following sections of the proposal.

1) Cover page
2) Abstract/executive summary
3) Introduction
4) Statement of the problem
5) Significance of the problem
6) Purpose of the project
7) Definitions
8) Assumptions
9) Delimitations
10) Limitations (if used)
11) Review of literature
12) Procedures

    NOTE: *The Time Action Plan of the proposal is not included in the final report.*

13) References

WL report content is different as shown below:

1) Cover page
2) CoT Form 3: Research Integrity and Copyright Disclaimer
3) Copyright & Dedication (optional)

4) Acknowledgements
5) Table of Contents
6) List of Tables
7) List of Figures
8) Executive summary
9) Statement of the Problem
10) Significance of the Problem
11) Scope of the Study
12) Purpose of the Study
13) Research Question/Hypotheses (if applicable)
14) Definitions
15) Assumptions, Limitations & Delimitations
16) Review of literature
17) Procedures
18) References

NOTE: *The Time Action Plan of the proposal is not included in the final report.*

The following sections are added to the original proposal items.

1) Limitations (if not already incorporated and/or may be expanded)
2) Findings (and discussion if useful)
3) Conclusions (and discussion if useful)
4) Recommendations (for implementation and/or further research/work)
5) Implications if appropriate

Thus, the final directed project report is structured as follows.

1) Cover page
2) Abstract
3) Introduction
4) Statement of the problem
5) Significance of the problem
6) Purpose of the Project
7) Definitions
8) Assumptions
9) Delimitations
10) Limitations
11) Review of literature
12) Procedures (instrumentation & data collection)
13) Data or Findings
14) Conclusions, discussions, and recommendations
15) References
16) Appendices (as required)

Delimitations and Limitations

During the proposal process, the delimiting factors were noted. These are variables or dimensions used to restrict the scope of the project, i.e., to clarify what will be excluded from consideration in a given study.

Limitations, on the other hand, are factors that weaken a study or which reduce its generalizability. Generally, these are factors that are out of the control of the researcher or are mistakes that occurred and which cannot be corrected. Occasionally these are known in advance, i.e., at the time of the proposal but more frequently they arise only during the conduct of the actual project/study.

For example, if one planned to survey a particular segment of a population, e.g., just new students to Purdue University Calumet, this would be delimitation. On the other hand, if this survey's response rate was only 13% and if it could not be raised by any methods, this would cast doubts on the reliability and validity of the survey data. Since this occurred during the performance of the project, it was an unanticipated factor that results in a significant weakness in the project. It will be up to the committee members to decide whether the overall project was conducted well enough to be acceptable or whether the limitation is so serious that it renders the study unacceptable. Academic integrity and the student's commitment to ethical principles require the presentation of all known limitations regardless of possible consequences.

Findings

In this section, the results of the project are reported and discussed. When reporting findings, simply report factual information. This might be test scores, changes observed in lab performance, etc. If useful, these findings can be followed by discussion that interprets or explains the significance of the findings.

Students are reminded that the directed project is the capstone of the master's degree program. Regardless of the data analysis outcomes of the project, it is a success. Often there is a preconceived notion of what the results should be. What is important is what the results really are. Important information can be obtained from any project, even if the results are not what were expected.

Conclusions, Discussions, and Recommendations

Based on the findings obtained, conclusions can be drawn. Such conclusions must always be interpreted and considered within the context established by the study's delimitations and limitations. Additionally, it is often useful to link the conclusions to key findings from the literature review. The conclusions form the basis for the final evaluation of the project. Once the conclusions are drawn and the effect of the study determined, final recommendations for further work and or research may be made.

For example, assume that a new laboratory activity is developed. This activity was implemented in one laboratory section. During post-testing, the laboratory scores were higher in the section

that utilized the activity. However, the activity required twice as much laboratory, compared to the normal activities. It might be concluded that the instruction was effective, as evidenced by the test scores. A recommendation might be that the instruction should take less time. A second recommendation might be to track students who received this instruction and note if improvement in related areas was found, compared to students who did not receive the special instruction.

POST-PROJECT ACTIVITIES

Appointment of the Examining Committee

The examining committee will usually be identical to the student's advisory committee. The major professor and student are jointly responsible for finding a common date, time, and period when all advisory committee members can meet for the examination and this must occur within the deadlines established by the Graduate School. The student is expected to take initiative in this procedure. The date, time, period, facilities, and equipment needs for the meeting are to be transmitted to the College of Technology Graduate Program Coordinator by the major professor. This notice may be transmitted electronically; HOWEVER, major professors should not assume the notice has been received until they have written confirmation from the College graduate program.

Scheduling the Final Oral Examination

Following the notice of final examination date, the College's graduate office will schedule an appropriate meeting room (equipment other than standard equipment offered by Purdue is the responsibility of the student to arrange). The student, together with the major professor, is to prepare the necessary forms.

The College graduate office will then distribute copies of approved forms to the student and all advisory committee members. This activity must be completed **NO LESS THAN THREE WEEKS PRIOR TO THE EXAMINATION DATE.**

The day prior to the final examination date, the College graduate office will forward a file of relevant student records, including Graduate School Form 7, Report of the Examining Committee, and candidate audit forms (if available) to the major professor.

If, however, the examining committee is to be different from the advisory committee (for example, when a committee member is unable to serve), a replacement member must be appointed, a Request for Appointment of Examining Committee form completed and submitted to the Office of Graduate Studies to be forwarded to the University Graduate School **NO LESS THAN TWO WEEKS PRIOR TO THE EXAMINATION DATE**.

It is the major professor's responsibility to obtain all required committee member signatures and return the signed form to the College graduate office in advance of the established deadlines.

Declaring Graduation Candidacy

Completing the XXX 59800 Requirement

At the conclusion of the final oral examination, the major professor and each member of the examining committee will sign the Report of the Examining Committee form; the major professor will forward the form to the Associate Dean of Graduate Studies for processing.

NOTE: *The Graduate School permits NO EXCEPTIONS to the deadline. If all degree requirements are not met in the semester in which candidacy is declared, the student must register for CAND course each subsequent semester until all requirements are met.*

If any problems or deficiencies in the report are indicated by the examining committee, these must be corrected before the project or report will be approved by each committee member. In order for graduate to occur during any semester, completion of all required edits/corrections must occur and be approved before the established deadlines.

The last step involves submitting a copy of the approved project report to each of the following.

A. The Associate Dean for Graduate Studies
B. The major professor/faculty advisor
C. Each member of the examining committee requesting a copy

OVERALL MASTER'S DEGREE PROCEDURAL CHECKLIST

To help students meet their degree requirements, the following checklist will help them map a path through the College of Technology's Master of Science program. This visual representation of when program requirements should be completed is intended to communicate a general picture of the process. Specific and official deadlines are announced each semester, and are also available from the College's Graduate Program.

First Semester (for full time students)

1. If the transcripts submitted with the application for admission were not complete, arrange to have two (2) copies of the final transcript showing receipt of the baccalaureate (bachelor's) degree sent to the Associate Dean for Graduate Studies, College of Technology, Anderson Building, Purdue University Calumet, 2200 169th Street, Hammond, IN 46323.

With the help of the major professor:

2. Discuss your career and educational objectives and, within the framework of the College of Technology Master's Degree, draft a preliminary plan of study. Review the optional Areas of Specialization as you work.
3. Select a Master's committee consisting of your Major professor and at least two graduate faculty members. At least two of your committee members must be regular, College of Technology graduate faculty. You may select one or more additional faculty to serve on your Master's Committee and in some cases this is clearly advantageous.
4. Discuss the preliminary plan of study with each of the members of the advisory committee.
5. Using the Electronic Plan of Study (EPOS) system, submit your draft plan of study to your committee members and the College of Technology Graduate Office.
6. Refine the plan of study, if needed, based on the committee's suggestions.
7. Using the Electronic Plan of Study (EPOS) system, submit your final plan of study to your committee members and the College of Technology Graduate Office.
8. Identify a tentative directed project problem area.
9. Register for classes for the next semester following approval of the plan of study.

Succeeding Semesters

1. Register for TECH 64600 (during your second or third semester) and begin planning for your directed project or thesis.
2. During your third semester at the latest (if a full time student), and your next to last semester if a part time student, register for 1 semester hour of XXX 59800 and begin work on the directed project proposal.
3. After the directed project proposal is approved, begin work on the directed project (2 semester hours of XXX 59800, to complete the actual directed project).
4. Register for classes for the next session.

Final Semester

1. Notify your major professor and the Associate Dean that you expect to graduate at the end of the semester.
2. Register for at least 2 semester hour (or the remaining number of hours to bring your total to a minimum of 3 semester hours) of XXX 598 and complete work on the directed project.
3. Register for any remaining courses on the plan of study.
4. Insure that any changes in your plan of study have been approved using the Change process within the electronic plan of study generator or Form 13 for paper plans of study.
5. Arrange the scheduling of the final oral examination at least three weeks prior to the exam date.
6. Satisfy the final oral examination requirement and make any revisions to the directed project that is required by your committee.
7. Submit a final copy of your directed project to the College of Technology Graduate Studies Office prior to the deadline established by Purdue's Graduate School.

CHECKLIST OF STEPS IN COMPLETING A DIRECTED PROJECT

1. Explore a topic as part of plan of study development.
2. Prepare a brief typewritten preliminary proposal describing the problem, rationale, related literature, and procedures.
3. Discuss the preliminary proposal with the major professor.
4. Expand and refine the proposal, if needed, based on the major professor's suggestions.
5. Circulate the tentative proposal for advisory committee comments and revisions.
6. Secure approval signatures from all members of the advisory committee on the cover page of the final version of the proposal.
7. Distribute a copy of the approved proposal to each advisory committee member and file the original in the Graduate Studies Office.
8. Carry out the proposed investigation.
9. Prepare an appropriate report including, but not limited to, a description of the problem, rationale, related literature, procedures, results and/or recommendations, and a discussion of the results/recommendations.
10. Confer with all members of the advisory committee to establish a date and time for the final oral examination. Submit your request for scheduling to the Graduate Studies program secretary. This must be done a minimum of three weeks prior to the exam date. A conference room will be arranged and confirmation sent to all committee members.
11. Meet with the major professor to edit the report into a final draft.
12. Only after receiving permission from your major professor, **deliver a copy of the final report to each** examining committee member at least two weeks prior to the final oral examination.
13. Defend the investigation to the examining committee and other interested faculty and students during the final oral examination.
14. Correct any identified deficiencies.
15. Secure approval signatures from each member of the examining committee on the completed report.

16. Submit the original signed final project report to the College of Technology Office of Graduate Studies, a copy to the major professor, and a copy to each examining committee member requesting a copy.

COLLEGE OF TECHNOLOGY GRADUATE FACULTY

General Structure

The duties of administering the CoT master's degree program are assigned to the Associate Dean for Graduate Studies. The Associate Dean for Graduate Studies administers the program. The Dean of the College of Technology assigns that position. The Associate Dean coordinates all graduate program efforts within the College and chairs the TEC Graduate Education Council.

Graduate Education Council

The TEC Graduate Education Council is comprised of one faculty member, who is also a member of the graduate faculty, from each degree program (two per department under current structure). The Committee consists of eight members, and is chaired by the Associate Dean for Graduate Studies (ninth member), who serves as a voting member. The College's Graduate Education Council establishes program policy, criteria, and direction.

Graduate Faculty Members

The offering of graduate courses and the detailed supervision of graduate students is the province of the graduate faculty. Members of the university faculty are not automatically members of the graduate faculty. Authority to teach graduate-level courses and to supervise graduate students is granted by the Dean of the Graduate School upon recommendation by the head of the graduate program.

The Graduate School recognizes two types of appointment to the graduate faculty; regular and special. Faculty with a regular appointment is Purdue employee. Prior to be eligible to be considered to the graduate faculty, faculty members are expected to attend a mentoring workshop. Special appointments are for non faculty Purdue employees and non Purdue employees. Upon appointment to the graduate faculty, the faculty member and their department head will receive notification of graduate faculty appointment.

Policies for Serving on Graduate Student Committees for Regular Graduate Faculty

This document establishes policies for regular graduate faculty serving on graduate student committees in the College of Technology (CoT). It builds on the broad policy adopted by the Graduate School in Fall of 2005 which is covered in the *Policies & Procedures for Administering Graduate Student Programs* published by the Graduate School at Purdue University. That document is located on the web at http://www.gradschool.purdue.edu/faculty/publications.cfm .

In this document, under Section I. E. 1., it is stated that: "Appointments to the Graduate Faculty will enable the faculty member to teach graduate-level courses, to serve on graduate student committees, and to co-chair graduate student committees. It is the responsibility of the head of the graduate program to approve the level of participation of a Graduate Faculty member on a student's committee."

The College of Technology's policy for Graduate Faculty serving on graduate student committees is as follows:

> Faculty who are appointed graduate faculty approved by the Graduate School at PUC can serve on and chair MS directed project and thesis committees, if their faculty appointment so permits.
>
> Faculty with an earned master's degree is encouraged to co-chair on their first MS directed project committee. After co-chairing their first MS committee they can then serve as a chair for MS directed project committees.

Policies for Review of Regular Graduate Faculty

This document establishes policies for regular graduate faculty to maintain graduate faculty status in the College of Technology. It builds on the broad policy adopted by the Graduate School in Fall of 2005 which is covered in the *Policies & Procedures for Administering Graduate Student Programs* published by the Graduate School at Purdue University. That document is located on the web at http://www.gradschool.purdue.edu/faculty/publications.cfm . In that document under Section I. E. 2. it states: "At five-year intervals, heads of graduate programs will be asked to evaluate the performance of graduate faculty in their programs and to recommend either continuance of graduate faculty status for another term of five years or a review of graduate faculty status by the program and the Graduate School. Heads of graduate programs may initiate reviews at any time. If a review is called for, it will be conducted by the program head, in consultation with other program Graduate Faculty, and the dean of the Graduate School."

The College of Technology's policy for reviewing graduate faculty is as follows:

1. At intervals identified by the graduate school, faculty members must summarize their graduate program activity over the previous five years. The documentation should include scholarly publications, grants awarded, activity on graduate student committees, graduate courses taught, and any other service to the TEC graduate program.
2. The documentation will be reviewed by the program head and the chair of the program's graduate committee. As specified by the graduate school, the review will consider two criteria: continued productivity as a graduate faculty member and effectiveness as a graduate faculty mentor.
3. Upon completion of a successful review, graduate faculty status will be renewed for another five year term.

GRADUATE FACULTY RESPONSIBILITIES

Students may request a specific major professor; these requests are honored insofar as possible, considering an equitable distribution of students to major professors. The major professor/student relationship must be a mutually acceptable one. Students may request a change in advisor, but such changes should be made early in the program of study.

Faculty Advisory Committee

Each graduate student will have a faculty advisory committee consisting of at least three graduate faculty members: the major professor, who serves as advisor; a second faculty member, whose area of expertise relates to the student's primary area; and the third member, whose area of expertise relates to the student's related area.
It is the responsibility of the students' major professor and committee members to maintain current knowledge of the various schedule and deadlines published by the Graduate School and the College of Technology Graduate Studies Program.

Major Professor or Faculty Advisor (Committee Chair)

As the primary contact and guide for the graduate student, the major professor's tasks include the following.

1. Advising the student
2. Assisting with the development of the plan of study
3. Assisting with the development of the directed project or thesis proposal
4. Supervision of the performance of the directed project or thesis
5. Conducting the final oral examination

The major professor has the leading role in the development and guidance of the student. As an advisor, the major professor assists the student in determining goals and the methods of meeting those goals through course work and the directed project or thesis, in the development of the plan of study and advisory committee, and in course registration each semester. The directed project or thesis, while developed and conducted with input from all advisory committee members, is primarily under the guidance of the major professor. The final examination is also conducted by the major professor in cooperation with the other committee members.

Advising the Student

Advising the student occurs at several levels. First, when working with a new student, the major professor will need to help that student determine personal goals and objectives, and how obtaining this degree can help to meet those goals. In some situations, the advisor may need to assist the student in finding another advisor more suited to the student's academic interests. This is typical as students discover their interest and craft a plan of study that addresses those interests.

Secondly, the major professor works with the student to develop a plan of study. The courses selected for the plan of study should be related to attainment of the previously determined goals.

Third, the major professor works closely with the student to develop the directed project or thesis proposal and in the subsequent performance of the project.

Finally, the major professor assists the student in registering for courses each semester. In short, the major professor becomes the main contact person for all phases of student activity.

Course Registration

Graduate faculty serving as major professors (advisors) to technology graduate students may assist them with their course registration each semester.

Development of the Electronic Plan of Study (EPOS) or Plan of Study (POS)

The plan of study is a contractual agreement among the student, the advisory committee, and the Graduate School, listing the courses to be taken, when the courses will be completed, and the advisory committee members. The major professor (advisor) is listed as committee chair. The second committee member must be a member of the College of Technology graduate faculty, approved to serve on master's degree committees. The third member's expertise must be in support of the student's related area; this committee member may be from any College and is often an instructor in one of the student's related area courses, but is not required to be. The faculty member representing the related area must also be a member of the graduate faculty. All committee members serve in an advisory capacity on the plan of study and the directed project or thesis, as well as participate in the final oral examination.

Courses selected for the primary area should meet the objectives and goals developed during the initial advising of the student. Typically, a student will list 15-24 credit hours in the primary area, with the remaining credits in the related area(s). The related area must consist of a minimum of 6 credit hours of course work supportive of the primary area goals. The student may list up to 15 credit hours in a related area or multiple related areas; however, a separate advisory committee must be listed for each related area.

The Directed Project courses (TECH 59800 A and B) are not listed as part of the regular coursework on the plan of study. On the Master's Degree Electronic Plan of Study form, the XXX 59800 is stated in the "Supplemental notes" space in the upper section of the form.
The plan of study not only identifies the courses to be taken, but also when those courses are to be completed. The student may need to contact the specific departments to find out when certain courses will be offered. Interfacing with the second and third committee members should occur during development of the plan of study. Once the courses are selected, dates are identified, and committee consensus is obtained, a plan of study is submitted electronically and automatically forwarded to the Office of Graduate Studies for approval.

The student is responsible for monitoring the progress of the electronic plan as it progresses through the approval process.

A normal course load for graduate students is 9 or more credit hours per semester if they do not have a graduate appointment. *For Graduate Assistants (either teaching or research) 6 or more*

credit hours per semester is considered a full load. If international graduate students wish to take fewer than these hours per semester, they must first secure approval from the Office of International Students and Scholars using the Request for Reduced Course Load form.

Supervision of the Directed Project

The student works closely with the major professor during the writing process. As drafts are completed, students should secure their major professor's permission before they are provided to the other advisory committee members for review and comment. The student and major professor review all suggestions and comments, and revisions are made as indicated. **It is the major professor's responsibility to resolve any inherently incompatible suggestions advanced by committee members.**

It is the responsibility of the major professor to determine that the student is ready for the examination and completion of the degree program. **Poorly prepared students or those with an unfinished directed project should not be scheduled for the examination.** The major professor should brief the student on what can be expected during the examination.

The directed project or thesis is completed when all stated work has been performed and a final report, approved (signed) by all advisory committee members, is filed in the Graduate Studies office.

Conducting the Final Oral Examination

The final examination (oral presentation of the directed project) is held during the final semester of the student's degree program. It is College of Technology graduate policy that the presentation portion of all final examinations be open to the university faculty and student communities. If a member of these communities wishes to raise a question, they must submit it in writing to the major professor who, in concert with the committee, decide whether and how to raise the question with the degree candidate.

Each student and major professor are responsible for finding a common date and time when all advisory committee members can meet for the examination. A request for scheduling must be submitted to the secretary of the program of Graduate Studies ***no less than three weeks prior to the examination date.*** This submittal will trigger an announcement to the College of Technology community about the defense.

The day before the examination date, the Major professor will be provided the student's oral examination file, including Graduate School Form 7, Report of the Examining Committee, and candidate audit forms (if available).

The major professor chairs the actual examination process, with input from the remaining advisory committee members. A typical examination proceeds as follows:

A. The advisory committee reviews the student's plan of study and the directed project report, during which the student waits outside the examination room. Committee

members can determine the exact procedure to be followed and/or questions they wish to ask.

B. The student and any observing faculty, students, and guests are invited into the room.
C. The committee members may ask questions about course work, the student's objectives, etc.
D. The student is requested to give a presentation concerning the directed project. The student will typically review all sections of the project. After the presentation, the committee may ask questions concerning the project, indicate changes or corrections in the report, etc. If a non-committee member of the faculty wishes to raise a question, they must submit it in writing to the major professor who, in concert with the committee, decides whether and how to raise the question with the degree candidate.
E. Once all questioning is complete, the student is requested to wait outside the examination room. All other observers are also to be excused from the room. The committee then determines the outcome of the examination: pass the directed project as is, pass with conditions (such as report revision), or not pass.
F. The student is invited back into the room and informed of the outcome.
G. If the committee members agree that the student should be awarded the degree, all committee members sign the Graduate School Form 7, Report of the Examining Committee, adding their graduate faculty identifier number, and marking either "yes" or "no" under the Ph.D. recommendation space. The major professor also signs both copies of the candidate audit form, then returns the entire file to the Office of Graduate Studies for processing.

The preceding procedure is not intended to be a rigid structure. It may be appropriately adapted by concurrence of the committee conducting the examination. The purpose of the oral examination is to review the directed project and ascertain if the student has accomplished the goals of the project and the plan of study, so the format should be flexible to accommodate individual faculty preferences.

NOTE: If all degree requirements are not met in the semester in which candidacy is declared, or if all requirements are not completed by the Graduate School deadlines, the student must register for 1 credit hour of XXX in each subsequent semester until all requirements are met.

Participation in Commencement Ceremonies

Occasionally students will contact their major professor to inquire if they may participate in a particular commencement ceremony as they near graduation. It is Graduate School and Registrar's Office policy that students are to be allowed to participate in commencement exercises only if they are eligible to receive their degree upon successful completion of all course work on their plan of study and the final oral examination. They are not eligible to participate in commencement if they do not meet these criteria.

APPENDIX A:
SAMPLE PLAN OF STUDY

IT50700 Meas/Eval Ind & Tech
IT50800 Qual & Prod Ind & Tech
TECH64600 Anlys Res Ind & Tech
Manufacturability
Mechanical Vibration
Design for X
Design of Experiments
Project Management
Leadership & Ethics
Technology from a Global Perspective
Directed Project Phase I
Directed Project Phase II

APPENDIX B. SAMPLE DIRECTED PROJECT COVER PAGE

Purdue University Calumet
College of Technology

<Title>

In partial fulfillment of the requirements for the
Degree of Master of Science in Technology

A Directed Project Proposal

By

<Your Name Here>

<Date>

Committee Member	Approval Signature	Date
<Name>, Chair	_____	_____
<Name>	_____	_____
<Name>	_____	_____
<Name>	_____	_____

COLLEGE OF TECHNOLOGY

PURDUE UNIVERSITY CALUMET

Experiences for a Lifetime

APPENDIX C: INDEPENDENT STUDY AUTHORIZATION FORM

GRADUATE INDEPENDENT STUDY AUTHORIZATION FORM
College of Technology
Purdue University Calumet
(NOTE: A maximum of 6 hours credit for XXX 59000 is permitted on any plan of study program) (XXX=Dept. prefix)

(Please type or print all information clearly)

Student Name _____ Student I.D. # _____
Classification: Ph.D. M.S. PBR Current or previous number of credits
(Circle one) of Independent study credit: _____
I hereby request permission to enroll in XXX 59000 for _____ credits during the Fall Spring Summer semester, 20__-20__. I plan to pursue an independent study project of the problem, _____

_____
(Please insert title of course)

I will submit all deliverables by: _____
Date

_____ _____
Student's Signature Date

I request that credit apply to: Master's Degree Doctoral Degree Non-degree Study
(Circle one)

I am willing to guide the independent study outlined in the attached prospectus and I agree to the deadlines indicated above. H:\Grad Handbook r6-07.doc 45

_____ _____ _____
Professor in Charge of Instruction Signature Printed Name Date

Enrollment in the above independent study is consistent with the degree objectives of this student and is
⬟ on ⬟ not on his/her plan of study. This student will not exceed six (6) credit hours of XXX 590 on his/her plan of study with this enrollment.

_____ _____ _____
Major Advisor's Signature Printed Name Date

Approved

_____ _____
Department Head Signature Date

Documented

_____ _____
Director of Graduate Studies Signature Date

(circle one)

INDEPENDENT STUDY REQUEST INSTRUCTIONS
College of Technology
Purdue University Calumet
REQUEST FOR PERMISSION TO ENROLL IN AN INDEPENDENT STUDY COURSE

Procedures

1. Meet with your professor to discuss your proposed study and secure his/her approval for the project you envision.
2. Incorporating your professor's input, prepare a detailed project prospectus (typed or word processed, use APA format, title page), including the following indicated sections.
   a. *Problem:* Define the rationale and delimit your problem area (explain your interest in pursuing the project, why this area is of concern to you). How does this project relate to your degree objectives?
   b. *Purpose and Objectives:* What do you hope to accomplish? Provide a physical numbered listing of all objectives you expect to accomplish.

c. Procedures: Explain the methods you expect to use and any unusual requirements for materials, equipment, or facilities. A graphical time line and two progress reports from the student must be submitted by the student to the professor in charge between weeks three and ten of the semester. Specifically, indicate key deadline dates for each progress report and deliverable. Provide a narrative, flow chart, or outline of step-by-step procedures used to complete this study. If applicable, provide a supply and material cost worksheet.

d. Outcomes: What will be the tangible results (deliverables, i.e. source code, papers, reports, products, or summaries) of your study? Who will receive copies (office, professor, co-working professor, and student)? Will you conduct a formal presentation of your results?

3. Meet with your professor in charge to discuss and refine your project prospectus.

4. Revise the prospectus as necessary. Complete the INDEPENDENT STUDY AUTHORIZATION FORM (reverse side of this page); attach it to the front of the prospectus; and secure the signatures of your academic advisor and the professor in charge of the independent study course you will be taking.

5. Submit the signed copy of your request to the Graduate Secretary in the Student Services Office, Room 150 KNOY, for approval. The prospectus must be accompanied by a completed course request (Form 23). A copy of your project -prospectus must be given to the professor in charge. DO NOT submit the Form 23 at the Graduate desk in Student Services prior to securing the department head's approval for the prospectus. Approval criteria include: 1) total numbers of independent study courses on Plan of Study; and 2) Focus on a College of Technology discipline.

6. The Graduate Secretary will make and distribute copies to appropriate persons and file the original in the departmental office. Make sure to keep a copy for yourself.

Regulations and Restrictions in the Use of Independent Study Courses

1. Independent study may be included in a graduate plan of study only when enrollment is scheduled after the plan of study has been approved. Check with your advisor for other restrictions which may apply to you. Typically, such courses cannot be added to your schedule after the third week of classes.

2. You must submit a copy of your final outcomes (using APA format) for the study to the department head for departmental files, and a copy to the professor in charge before the beginning of finals week. Failure to do so can result in an incomplete or a failing grade.

3. All work submitted must be independent of other course work (previous, existing, or future).

APPENDIX D:

GUIDING STANDARDS FOR ADVISING AND MENTORING GRADUATE STUDENTS

(Developed by Purdue University Graduate School Committee on Ethics, December, 2003)

• Graduate faculty will foster the development of excellence in every graduate student.

• The agreement by a member of the graduate faculty to advise a student must be done carefully and thoughtfully. The graduate faculty advisor acts as the student's mentor, shaping the student's values and understanding of research. Before agreeing to advise a student, the advisor and student should consider their research goals; their mutual interests; the compatibility of their expectations, work habits, and personalities; and the career goals of the student.

• The best student/advisor relationships are those that closely approximate the relationship between senior and junior colleagues.

• It is the advisor's responsibility to guide the graduate student through the student's first research experience and to understand and constructively critique the research accomplishments made. In relations with students, graduate faculty will be candid, fair, and committed to the students' welfare and progress.

• Integrity in research is an essential part of Purdue University's intellectual and social structure, and adherence to its spirit and principles must be maintained. These principles include commitment to truth, objectivity, fairness, honesty, and free inquiry.

• The goal of research and scholarship is the discovery of knowledge.

• Graduate faculty are responsible for all phases of graduate education and will be accessible to students who are under their guidance.

• Graduate faculty should establish and communicate clear expectations regarding student commitment and effort to be devoted to the student's graduate program.

• The graduate advisor has the responsibility to discuss career opportunities with the student throughout the student's graduate program, and often after the student has completed their immediate degree objective.

• Graduate faculty must not condone nor tolerate discrimination against any individual on the basis of race, religion, color, sex, age, national origin or ancestry, marital status, parental status, sexual orientation, disability, or status as a disabled or Vietnam-era veteran.

• Graduate faculty will advise students concerning the ethics of the profession; encourage the practice of ethical and responsible conduct in research, scholarship and publication; and assist students in addressing ethical issues.

• Early in a student's graduate tenure, their advisor should make the student aware of university and departmental policies regarding the conduct of research, and rights in data and intellectual property developed in the course of thesis research. Also critical is ensuring that the student understands their advisor's policies and procedures governing authorship and publication of research results.

• Graduate faculty have a responsibility to serve as an exemplar in recognizing and acknowledging the scholarly contributions of others; in providing complete and accurate records and reports of the results and conclusions of their research, scholarly, or artistic endeavors; and in preserving the integrity of the research record.

• Graduate faculty have a special obligation to exemplify the best qualities and highest standards of personal and professional conduct.

• Graduate faculty will strive to enhance the educational value of student assignments/experiences as teaching and research assistants.

• Graduate faculty will be objective in the evaluation of research and academic performance and will communicate that evaluation fully and honestly to their students. Graduate faculty will report accurately on the competence of students to other professionals who require such evaluations.

• Graduate faculty will not permit personal or intellectual differences with colleagues to impede student access to those colleagues or interfere with students' research or progress toward a degree objective.

• When engaged in teaching, research, or supervision, graduate faculty will recognize the power and influence they hold and avoid engaging in conduct that exploits or demeans students or that could be construed as an abuse of that power.

APPENDIX E:
SAMPLE CERTIFICATE PROGRAM PROPOSAL

Proposal for a Graduate Certificate in
Information Assurance Education – Track 2
Submitted
by the
College of Technology
Calumet Campus

Graduate Certificate Proposal

Information Assurance Education – Track 2

College of Technology

Purpose: In order to meet the demand for well prepared faculty to develop and teach Information Assurance programs at Schools and universities across the nation, Purdue University, Department of Computer Science has developed and implemented an 11 credit hour graduate certificate program for computer science faculty who want to develop Information Assurance (IA) programs at their institutions. This was approved by the Purdue University Graduate Council in November, 2002. However, there are a considerable number of Information Technology (IT) faculty who also need a similar program rooted in information technology. The purpose of this proposal is to develop a parallel graduate certificate, offered by the College of Technology, but targeted on IT faculty.

It should be noted, that there is existing grant support for this program. The National Security Agency has funded Purdue University to offer academic programs in Information Assurance Education for faculty members at higher education institutions across the nation. The grant proposal was submitted by Melissa Dark (Principal Investigator). However, we anticipate the graduate certificate program continuing after the completion date of the NSA project, which is 9/30/05.

This (track 2) Information Assurance Education graduate certificate will prepare IT faculty to integrate relevant IT security topics into their undergraduate and graduate IT related degree programs. (Track 1 is targeted at CS and ECE faculty; details of track one can be found in Appendix B). Track 2 will consist of 6 credit hours in computer technology courses, 3 credit hours in computer science and 2 credit hours in curriculum and instruction. Faculty from Purdue University will modify and upgrade modules and units from existing technical courses offered at Purdue University to be included in this certificate program. The graduate certificate will also address the pedagogical knowledge and skills that faculty need to develop IA instructional materials, and implement courses and modules into their academic programs. Therefore, 2 credit hours in the program will be derived from a curriculum and instruction course offered through the College of Education.

Target Audience: The target audience is faculty from Colleges and universities in the areas of information systems, information science, information technology, telecommunications, and networking.

Proposed Initiation Date: May, 2004

Admission Requirements

1. Faculty participants (these are the faculty who will participate as “students” in the program) must be tenure-track or equivalent at an institution receiving accreditation by an appropriate regional accrediting body.
2. U.S. citizenship required per National Security Agency specifications (*note: NSA is the program sponsor*).

Completion Requirements

[3] We are in the process of applying for a permanent graduate course number for this class. If awarded, we anticipate the number being CPT 555.

[4] This course will be taught as TECH 581 for the first time in Spring 2004. Thereafter, we plan to apply for a permanent CPT number for the class.

The graduate certificate will require 11 credit hours: 6 credits hour of computer technology courses, 3 credit hours of computer science, and 2 credit hours of curriculum and instruction courses.

1. Course requirements (see Appendix A for more detail):
   - CS 526 Information Security
   - TECH 581x Network Security[3]
   - TECH 581y Digital Forensics[4]
   - EDCI 590 Design and Development of Instructional Materials and Resources
   - Only special sections of these courses, specifically taught for the certificate program, may be used for this certificate.
2. GPA requirements – grade of B- is an acceptable grade if the overall GPA for certificate courses is above 3.0.
3. No credits may be transferred from another institution toward this certificate.
4. No credits from undergraduate-level courses may be used toward the certificate.
5. Completion of the certificate must occur within 3 years unless special permission is granted by the Computer Technology Graduate Committee.
6. No credit hours taken prior to admission to the certificate program may be counted toward completion of the certificate. Admission to the certificate program must occur before any credit hours are earned towards the certificate.

Administration

In addition to complying with the requirements of the Purdue University Graduate School, the following administrative requirements are proposed:

1. The audit process will be the responsibility of the CPT Graduate Committee or its designee.
2. The certificate shall be awarded by the College of Technology.

Appendix A

Course Descriptions

CS 526 Information Security Basic notions of confidentiality, integrity, availability; authentication models; protection models; security kernels; secure programming; audit; intrusion detection and response; operational security issues; physical security issues; personnel security; policy formation and enforcement; access controls; information flow; legal and social issues; identification and authentication in local and distributed systems; classification and trust modeling; risk assessment.

TECH 581x (CPT 555 anticipated) Network Security

This course will cover conceptual and technological aspects of network security for voice and data networks. The course will deal with the analysis, design, implementation and management issues surrounding effective network security. Technology research and presentation of research results as well as security technology implementation will be required course outcomes.

TECH 581y (CPT ZZZ anticipated) Digital Forensics

This course will introduce students to the fundamentals of computer forensics and cyber-crime scene analysis. The various laws and regulations dealing with computer forensic analysis will be discussed. Students will be introduced to the emerging international standards for computer forensic analysis, as well as a formal methodology for conducting computer forensic investigations.

EDCI 590 Design and Development of Instructional Materials and Resources
Instructional skills development; instructional analysis; instructional strategies; producing implementing, and testing instructional materials, labs, case studies, and problems; formative and summative evaluation; curriculum development; and curriculum scope and sequence.
Prerequisites
Faculty participants (i.e., faculty students) need to have or secure the following prerequisites:
CS 503 Operating Systems

Appendix B

Graduate Council Document 02-11c

Approved by the Graduate Council 11/21/02

Proposal for a Graduate Certificate in Information Assurance Education
Submitted
by the
Department of Computer Sciences
West Lafayette Campus

Information Assurance Education

Department of Computer Science, School of Science

Purpose: In order to meet the demand for trained faculty to develop and teach Information Assurance programs at Schools and universities across the nation, Purdue University will design, develop, and implement an 11 credit hour graduate certificate program for School and university educators who want to develop Information Assurance (IA) programs at their institutions. The National Security Agency has funded a grant program to develop capacity to offer academic programs in Information Assurance at higher education institutions across the nation. A grant proposal was submitted by Melissa Dark (Principal Investigator) and Eugene Spafford (Co-Principal Investigator) to develop a program to help address this need. Purdue University is one of three universities selected.
The Information Assurance graduate certificate will consist of 9 credit hours in computer science courses and 2 credit hours in curriculum and instruction. Purdue University already has relevant graduate programs established (M.S. and Ph.D. degrees in Computer Science, Multidisciplinary M.S. degree in Information Security, M.A. and Ph.D. degrees in Curriculum and Instruction). Faculty from Purdue University will modify and upgrade modules and units from existing technical courses offered at Purdue University to be included in this certificate program. The graduate certificate will also address the pedagogical knowledge and skills that faculty need to develop IA instructional materials, and implement courses and modules into their academic programs. Therefore, 2 credit hours in the program will be derived from a curriculum and instruction course offered through the College of Education.
Target Audience: The target audience is faculty from Colleges and universities in the areas of computer sciences, mathematics, computer engineering, statistics, and/or physics.
Relation to Other Certificate Programs: None of the students in this program will be concurrently working toward a graduate degree.

Proposed Initiation Date: May, 2003

Admission Requirements

1. Faculty participants (these are the faculty who will participate as “students” in the program) must be tenure-track at an institution receiving accreditation by an appropriate regional accrediting body.
2. Faculty should be from the following departments: computer sciences, mathematics, computer engineering, information science, statistics, and/or physics.

3. This program is closed to non-faculty applicants. Therefore, students who are currently admitted to a degree program will NOT be eligible to earn a certificate.
4. U.S. citizenship required per National Security Agency specifications (*note: NSA is the program sponsor*).

Completion Requirements

1. The graduate certificate will require 11 credit hours: 9 credits hour of computer science courses and 2 credit hours of curriculum and instruction courses.
2. Course requirements (see Appendix A for more detail):
   - CS 526
   - CS 555
   - CS 626
   - EDCI 590
3. GPA requirements – grade of B or better in every course.
4. No credits shall be transferred from another institution.
5. No credits from undergraduate-level courses may be used toward the certificate.
6. Completion of the certificate must occur within 3 years unless waived by the Computer Science Graduate Committee.
7. Courses may NOT be applied toward more than this certificate.
8. No credit hours taken prior to admission to the certificate program may be counted toward completion of the certificate. Admission to the certificate program must occur before any credit hours are earned towards the certificate.

Administration

In addition to complying with the requirements of the Purdue University Graduate School, the following administrative requirements are proposed:

1. The audit process will be the responsibility of the CS Graduate Committee or its designee.
2. The certificate shall be awarded by the CS Graduate Committee or its designee.

[5] According to S. Fahmy regarding CS 503 as a prerequisite for 526, if students do not need TCP/IP code and the experience building an operating system, then CS 354 would be a sufficient prerequisite for CS 526. According to M. Atallah, this is not required in CS 526. Therefore, for this program, CS 354 should be a sufficient prerequisite for CS 526.

Appendix A

Course Descriptions

CS 526 Information Security Basic notions of confidentiality, integrity, availability; authentication models; protection models; security kernels; secure programming; audit; intrusion detection and response; operational security issues; physical security issues; personnel security; policy formation and enforcement; access controls; information flow; legal and social issues; identification and authentication in local and distributed systems; classification and trust modeling; risk assessment.

CS 555 Cryptography

Concepts and principles of cryptography and data security. Cryptography (secret codes): principles of secrecy systems; classical cryptographic systems, including Vigenère and Vernam ciphers; the Data Encryption Standard (DES); public-key encryption; privacy-enhanced email; digital signatures. Proprietary

software protection; information theory and number theory; complexity bounds on encryption; key escrow; traffic analysis; attacks against encryption; basic legal issues; e-commerce; the role of protocols.
CS 626 Advanced Information Assurance Advanced topics in information assurance, including selections from the following: penetration testing, formal verification of systems, formal models of information flow and protection, distributed system authentication, protocol design and attack, computer viruses and malware, intrusion and anomaly detection models, multi-level security, active defenses, investigation and forensics, network firewalls, anonymity and identity, e-commerce support, database security models and mechanisms.
EDCI 590 Design and Development of Instructional Materials and Resources
Instructional skills development; instructional analysis; instructional strategies; producing implementing, and testing instructional materials, labs, case studies, and problems; formative and summative evaluation; curriculum development; and curriculum scope and sequence.

Prerequisites

Faculty participants (i.e., faculty students) need to have the following prerequisites:

- CS 3545 or equivalent.
- MA 351 or equivalent.
- CS 251 or equivalent.
- CS 381 or equivalent.
- CS 426 or equivalent.

APPENDIX F: NEW COURSE PROPOSALS

General Information

While development of a graduate course is similar to undergraduate course development, the approval process is considerably different. Graduate courses must be approved by each department's graduate/curriculum committee and then be submitted, with the originating department head's approval to the College of Technology Graduate Education Council for approval. Upon receiving such approval, new course proposals are forwarded to Purdue University's Graduate Council which ultimately must approve all graduate courses.

Note, graduate course proposals generated by College of Technology statewide faculty must be forwarded to the department head of the originating department by the originating faculty members Statewide Location Director. Simultaneously, the Associate Dean for Statewide Technology is to receive an information copy. Such course proposals must first be reviewed by the departmental graduate/curriculum committee before being submitted, with the originating department head's approval, to the College of Technology Graduate Education Council for consideration.

Purdue University's Graduate Council is divided into six areas, based on course content, as follows:

Area A: Behavioral Sciences

Area B: Chemistry-based Sciences

Area C: Engineering and Physical Sciences

Area D: Humanities and Social Sciences

Area E: Life Sciences

Area F: Management Sciences

The Area A first examines courses submitted from the College of Technology Committee. The committee can accept the proposal, return it for revision, send it to a related area committee for evaluation, or reject it as being unsuitable. Many of the proposals from the College of Technology are sent to Area C committee for evaluation.

If the area committee approves the proposal, it is forwarded to the entire Graduate Council for approval.

What Constitutes a Graduate Course?

A graduate-level course should contain information that builds on a basic body of knowledge a student would receive in an undergraduate program. Course materials should be of a higher level with greater demands on conceptualization and synthesis. Basic skill building or learning of facts typically does not constitute graduate level work. If the knowledge gained is something an undergraduate student in a similar program should know, then that material most likely is not of a sufficient level for graduate work. Each course originator should work with the department head and the departmental curriculum committee to ensure that graduate course proposals submitted are of a higher level of knowledge than their undergraduate courses.

Developing a New Course

Each new course must be somewhat unique in its construction. The Graduate Council routinely monitors for duplication of course materials. Courses may be cross-listed if several departments have need for an identical course. Graduate students and upper-level (junior and senior) students may take courses at the 50000 level. Courses at the 60000 level are restricted to graduate students and are generally intended for Ph.D. and thesis students.
The supporting document for a new course proposal should be limited to a maximum of four pages and should provide the following information.

1. Justification for the course - Explain how the course relates to other courses in the department and in other departments on campus and how it fulfills a recognized need. Indicate whether it is intended primarily for students in the department or as a course to serve students from other departments.

2. Level of the course - Justify the requested course level by indicating the anticipated enrollments of undergraduate and graduate students.

3. Prerequisites - It is anticipated that prerequisite courses will normally be listed to specify prior knowledge required for successful completion of the course. If no prerequisites are listed, the reasons for their absence must be explained.

4. Course instructor - The identity of the faculty member(s) who will be in charge of the course should be provided, if possible. Do not include vitae.

5. Course outline - An outline of topics to be covered and an indication of the relative emphasis or time devoted to each topic is necessary. If laboratory or field experience is involved, the nature of this component should be explained.

6. Reading list - A reading list or bibliography, while expected to be substantial, should be limited to material the students will be required to read in order to successfully complete the course. It should not be a compilation of general reference material.

Approval Procedure

The following procedure has been approved by the College of Technology Graduate Education Council as the method for submitting a course proposal.

A. A faculty member develops a course proposal and drafts the Graduate School required Form 40G http://www.purdue.edu/Registrar/Forms/general/Form40_intro.htm with the advice and counsel of the department head and the departmental graduate committee. Note- graduate course proposals generated by College of Technology statewide faculty must be forwarded to the department head of the originating department by the originating faculty members Statewide Location Director. Simultaneously, the Associate Dean for Statewide Technology is to receive an information copy. Such course proposals must first be reviewed by the departmental graduate/curriculum committee before being submitted, with the originating department head's approval, to the College of Technology Graduate Education Council for consideration.

B. The course proposal is evaluated and approved by the departmental graduate committee.

C. The course proposal and draft Form 40G, with a letter of approval from the department head, is sent to the Associate Dean for Graduate Studies to be placed on the agenda of the College of Technology Graduate Education Council.

D. The College of Technology Graduate Education Council approves, denies approval, or returns the proposal to the originating department for recommended revisions.

E. If the College of Technology Graduate Education Council approves the proposal, it and the Form 40G are forwarded to the Graduate School for consideration by Area Committee A of the Graduate Council. The Associate Dean for Graduate Studies will complete the Registrar's Form 40G to accompany the required 10 copies of the course proposal.

Course Numbering

The originator of the proposal may request course numbers. However, final selection of the course number is left to the discretion of the Associate Dean for Graduate Studies.

REVISING AN EXISTING COURSE

Minor or administrative changes, such as title, credit hours, and course description, are made by the submission of a Registrar's Form 40G to the Graduate Council. The faculty member requesting the change should work with their Department Head and the Associate Dean for Graduate Studies. All such changes must be brought to the attention of the College of Technology's Graduate Education Council. Major changes, such as revised course content, must follow the process for a newly developed course.

DEVELOPING A NEW CERTIFICATE

Sometimes, student and/or program objectives may be met by completing a program of studies that is less than a degree in length. The mechanism for this is either a Post-Baccalaureate or a Graduate Certificate. Such Certificates must first be approved by the Graduate School. The process for seeking such approval is the same as used for new courses. First the department or departments who wish to offer such a certificate secure the approval of their graduate committee. Subsequently, the certificate proposal is presented to the CoT Graduate Education Council. Upon favorable action, the proposal is forwarded to the Graduate Council for consideration.

DEVELOPING A NEW AREA OF SPECIALIZATION

Areas of Specialization constitute pre-configured paths through the CoT Master of Science degree. Typically they are designed to achieve a recognized and specific set of objectives more focused than the general degree. Such Areas of Specialization may reside with a department or they may cut across several departments either with the CoT or outside. Departments may offer more than one Area of Specialization.

The process for seeking Area of Specialization (AOS) approval is the same as used for new courses. First the department or departments who wish to offer such an AOS secure the approval of their graduate committee. Subsequently, the certificate proposal, with a letter of support from the Department Head, is presented to the CoT Graduate Education Council. Upon favorable action, the proposal is forwarded to the Graduate School for consideration by the Graduate Council.

APPENDIX G: SAMPLE COURSE PROPOSAL

CPT 555 - Advanced Network Security

1. Course Justification

Information technology is used in all types of organizations including finance, health care, manufacturing, education, and government. As information technology becomes more pervasive and ubiquitous, organizations are challenged with increasing security threats and vulnerabilities. As information security needs increase, the need for skilled information security professionals also increases. The critical shortage of information security knowledge and skills is hampering the ability of many organizations to fulfill their central missions. Organizations nationwide have installed information systems that are a key part of their business strategies. The increased dependence on information systems has led to considerable security challenges. Computer systems are interdependent entities; this interdependence brings new vulnerabilities, accidents, criminal behavior, and malicious activities. A recent study reported a 220% increase in computer security breaches from 9,859 in 1999 to 21,756 in 2000 (SEI, 2001). Similarly, another study reported loss due to cyberattacks at $203,133 per organization, among the 35% of survey respondents who were able and willing to disclose their financial losses (2001 CSI/FBI).

Information security challenges are projected to continue to rise. According to experts in the field (Accenture, 2000), the following trends will contribute to future security challenges: 1) billions of devices proliferate that are always on and always connected, 2) complex outsourcing relationships extend trust boundaries beyond recognition, 3) criminals exploit lack of cooperation and compatibility in international laws, 4) concern for privacy and security will continue to compete with convenience and features, 5) “Time to Market” increases the pressure to sacrifice the security of software, and 6) lack of security skills compounds the weaknesses of delivered solutions.

At the same time that the necessity for security is growing, the supply of security skills lags far behind. Recent reports have characterized the need for a variety of workers with computer and information security skills as critical and programs to address this need as essential (U.S. Department of Commerce, Office of Technology Policy, 1999; Presidential Decision Directive 63, 1998; The White House, 2000; Critical Infrastructure Assurance Office, 2000; AICPA, 2000). This course specifically focuses on advanced network security techniques, approaches and skills necessary for individuals who will serve as a systems security administrator, information systems security officer, or chief information officer.

2. Course Level

This course is directed toward graduate students in the College of Technology and related disciplines.

3. Prerequisites

Consent of instructor AND
Graduate status in the College of Technology with a CPT concentration OR
Graduate status in the College of Technology other than CPT OR
Graduate status in another College, with appropriate objectives and preparation.

4. Instructor

Jim Goldman, Professor, Department of Computer Technology

Jim Goldman is Professor and Associate Department Head for Telecommunications & Networking Technology. As the Associate Department Head, Jim is responsible for curriculum and facilities development in support of the B.S. degree program in Telecommunications & Networking Technology. Jim has published several texts in the data communications field, is Executive Vice President of InfoComm Systems, Inc., and is both a Certified Information Systems Security Professional (CISSP) with advanced training in computer forensics and a Microsoft Certified Systems Engineer (MCSE).

5. Course Outline

This course will cover advanced conceptual and technological aspects of network security for voice and data networks. The course will deal with the advanced analysis, design, implementation and management issues surrounding effective network security. Technology research and presentation of research results as well as security technology implementation will be required course outcomes. Coverage of security management issues will occur at an advanced level. Topics include:

- Internet/Intranet Security
- Firewalls
- Intrusion Detection
- Virus Protection
- Authentication

- Access Control Methods
- Token Authentication Systems
- Security Protocols
- Electronic Commerce Security
- Wireless Security
- Biometric Controls
- Incident response, disaster management
- Encryption/Cryptography
- Enterprise Network Security
- Security Management
- Security Architecture & Policy Development
- Network Security Policy Development
- Security Audits
- Business issues/impact of network security
- Unix/TCP Security Issues
- Windows NT/200x Security (this way it covers 2000, 2003, and future releases)
- Computer Forensics

6. Course Outcomes/Activities

Among the required course outcomes are the following:

1. Understand security goals and principles.
2. Understand the business impact of network security policy development and implementation.
3. Understand the major components of network security for voice and data networks.
4. Understand the hardware & software technology required to implement effective network security.
5. Understand the underlying protocols involved with security policy implementation on both Windows & Unix.
6. Understand the important elements of firewall construction and implementation
7. Understand how to develop and implement an effective virus protection program

7. Course Grading

Points and/or Weights

Assessment Mechanism Weighting

Class participation/Readings 15%
Homework/Papers /Cases 15%
Research Paper 1 20%
Research Paper 2 20%
Presentation 10%
Final Exam 20%

Total 100%

Grading Scale

Grade Scale

A 90-100%
B 80-89%
C 0-79%

D 60-69%

F 0-59%

8. Reading List

Computer Crime - A Joint Report". State of New Jersey, Commission of Investigation and the Attorney General of New Jersey. June 2000. .pdf format - [922,962 bytes]

Answers to Frequently Asked Questions About Today's Cryptography". Paul Fahn, RSA Laboratories. December 8, 1992. Postscript (.ps) file - [1,441,358 bytes]

"Forming an Incident Response Team". Danny Smith, Australian CERT. October 18, 1994. Postscript (.ps) file - [189,704 bytes]

"Improving the Security of your Unix System". David A. Curry, SRI International. Postscript (.ps) file - [274,262 bytes]

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