Department of Engineering Technology

Walter Boles, Chair
Voorhies Industrial Studies Complex 143

The Department of Engineering Technology offers the Master of Science degree in Engineering Technology and Industrial Studies with thesis and nonthesis options and concentrations in Engineering Technology and Occupational Health and Safety. Under the Engineering Technology concentration, the degree requires the student to select courses, as approved by the graduate advisor, that provide the student with a technical area of specialty. Currently, typical technical areas include manufacturing, environmental safety, computer integrated manufacturing, electronics, drafting and design, and quality control. Other technical areas can be designed to meet the student's individual needs, if approved by the graduate advisor. A minor in Industrial Studies is also available at the graduate level.

Normally, a minimum combined score of 800 from the verbal and quantitative sections of the Graduate Record Examination with a minimum score of 300 from the verbal section is required for admission to the master's program.

Requirements for the Master of Science Degree

Thesis Option
Candidate must
1. have completed undergraduate prerequisites of at least 18 semester hours in engineering technology or equivalent coursework approved by the advisor.
2. complete at least 30 semester hours, with 21 semester hours at the 6000 level, to include ETIS 6620 and 6640 and 6 semester hours from the following courses: ETIS 6110, 6180, 6370; 6010 or 6040.
3. complete 3 semester hours of an approved research tool with a grade of C or better on the undergraduate or graduate level to include mathematical statistics or a course containing statistics (or any other suitable course) as approved by the student's graduate advisor and the graduate coordinator of the ET Department.
4. file a degree plan with the Graduate Office after the completion of 12 graduate credits and prior to the completion of 21 credit hours to include ETIS 6620, 6 hours from ETIS 6020, 6110, 6180, 6370, and 3 hours from any industrial studies independent study or advanced technical problems course.
5. successfully complete a written comprehensive examination (may be taken no more than twice).
6. complete a major of at least 18 hours.
7. elect whether or not to have a minor. A minor, if elected, must include a minimum of 12 semester hours.

The program may include a cognate of 6 hours in management and marketing, computer science, economics, psychology, or vocational-technical education.

Nonthesis Option
Candidate must
1. have completed undergraduate prerequisites of at least 18 semester hours in industrial studies or equivalent coursework approved by the advisor.
2. complete at least 36 semester hours with at least 26 semester hours of 6000-level courses to include ETIS 6620 and 6510 or 6910 and 6 semester hours from the following courses: ETIS 6110, 6180, 6370; 6010, or 6040.
3. complete 3 semester hours of an approved research tool with a grade of C or better on the undergraduate or graduate level to include mathematical statistics or a course containing statistics (or any other suitable course) as approved by the student's graduate advisor and the graduate coordinator of the ET Department.
4. file a degree plan with the Graduate Office after completion of 12 graduate credits.
5. successfully complete a written comprehensive examination (may be taken no more than twice).
6. complete a major of at least 18 hours.
7. elect whether or not to have a minor. A minor, if elected, must include a minimum of 12 semester hours.

The program may include a cognate of 6 hours in management and marketing, computer science, economics, or psychology.

Concentration: Engineering Technology

Candidate must complete
1. requirements for the thesis or nonthesis option.
2. core, approved by the advisor, consisting of emphasizing in one of the following typical areas: environmental safety, computer integrated manufacturing, drafting and design, quality control.
3. minor/cognate and/or additional electives as approved by the advisor.

Concentration: Occupational Health and Safety

Candidate must complete
1. requirements for the thesis or nonthesis option.
2. core consisting of ETIS 6020, 6040, 6070, 6620, and 6640 (thesis option) or 6910 (nonthesis).
3. electives to be selected from SAFE 5320, 5350, 6410, 6450, 6470, 6920; EXSC 6650; ET 5420, 5440, 5450, 5970; ETIS 6010, 6110, 6510, 6920; PSY 5350.

Courses in Engineering Technology and Industrial Studies [ETIS]

6010 Safety Planning. Three credits. Advanced study of planning in occupational safety and health management, including program planning and development methods and techniques as well as various systems approaches to hazard control.

6020 Safety Technology and Engineering. Three credits. Advanced study of the technical components of occupational workplace hazards, hazards analysis, workplace design, current regulatory requirements, engineering techniques for hazard control, personal protective systems, equipment and techniques. Includes a practical application problem of hazard analysis and control.

6040 Occupational and Environmental Hygiene. Three credits. An advanced quantitative study of occupational and environmental health principles, practices, and sampling techniques as required by either consensus or regulatory standards and their specific protocols to protect both workers and the public.

6070 Anthropometric Factors in Accident Prevention. Three credits. The necessity and desirability of a thorough consideration of anthropometric factors when designing facilities and equipment and recognition of those factors most prevalent in accidents.

6110 Designing for Economical Production. Three credits. Factors determining the acceptability of a product from a producibility point of view. Includes an analysis of function and cost, relative machining cost, material cost, manufacturing method, cost of tolerances, and surface finishes for the selected manufacturing methods.

6180 Seminar in Industrial Quality Developments. Three credits. Review of current quality control practices. Investigation of new concepts and literature in the discipline. Examinations of vendor/customer relationships in quality.

6190 Six Sigma. Three credits. Prerequisite: MATH 1530 or equivalent or consent of instructor. The Six Sigma methodology is defined as a comprehensive and flexible system for achieving, sustaining, and maximizing business success. Through class instruction, simulations, and hands-on projects, students will be able to identify and focus on customers' critical-to-quality (CTQ) characteristics and solve problems using the define, measure, analyze, improve, and control (DMAIC) process and its associated tools. A Green Belt certification will be awarded upon successful completion of an industry/business Green Belt project.

6230 Advanced Technical Drafting. Three credits. Current trends and techniques such as using computers to solve design problems and the use of group suggestions (brainstorming) in solving design problems.

6240 Advanced Technical Problems in Metal. Three credits. In-depth insight into the use of metal in industry. Emphasis on industrial research and development techniques and their application in industry.

6260 Advanced Technical Problems in Electricity/Electronics. Three credits. In-depth insight into the practical applications of electronic theory. Students required to design and develop electrical/electronic applications of an advanced nature.

6370 Computer-Integrated Design and Manufacturing. Three credits. Prerequisite: ET 4590/5590 or consent of instructor. Applications of computer-integrated manufacturing. Current techniques of design for manufacturing and the integration into information flow, organization, product design, and software applications.

6510/ 6520 Advanced Topics in Technology. Three credits each. Independent investigation and report of current problems of particular interest to individual students directed by department faculty members.

6620 Methods of Research. Three credits. Introduces Master of Science students to scholarly research principles and to thesis formats for research reporting. A problem is researched and written up in thesis proposal format.

6640 Thesis Research. One to six credits. Prerequisite: ETIS 6620. Selection of a research problem, review of pertinent literature, collection and analysis of data, and composition of thesis. Once enrolled, student should register for at least one credit hour of master's research each semester until completion. S/U grading.

6650 Embedded Microprocessor Design. Three credits. Prerequisite ET 4660 or consent of instructor. Topics include basics of embedded microprocessor systems, introduction to field programmable gate arrays (FPGA), integrated software environment (ISE), embedded development kit (EDK) CAD software, and the architecture and features of the MicroBlaze soft-core. Two hours lecture and three hours laboratory.

6710 Current and Future Trends in Engineering and Technology. Three credits. Prerequisite: Graduate standing. The latest advancements and practices in various engineering and technology fields. Selected topics may include computers and electronics, networking and telecommunication, instrumentation, lasers,

automation and robotics, manufacturing and rapid prototyping, bioengineering and biotechnology, and renewable energy sources. Takes a student-centered, hands-on learning approach and focuses on understanding new technologies and how technology is used in the industry. Research projects will provide appropriate experience and accommodate individual's interest.

6910/ 6920 Problems in Engineering Technology. Three credits each. Independent investigation and report of a problem in engineering technology. Designed to meet the particular needs of the students; pursued under the direction of a department faculty member.

6999 Comprehensive Examination and Preparation. One credit. Open only to students who are not enrolled in any other graduate course and who will take the master's comprehensive examination during the term. Student must contact graduate advisor during the first two weeks of the term for specifics regarding the details of this comprehensive examination preparatory course. Credit may not be applied to degree requirements.

Courses in Engineering Technology [ET]

5220 Advanced Metalwork. Three credits. Techniques, equipment and procedures, advantages and disadvantages of current metal-casting processes used in industry. Laboratory exercises in sand molding and casting, the full mold process, investment casting, and permanent mold casting including pattern design and construction, mold making, metal melting and handling. Guest lecturer(s). Plant tour(s). Two hours lecture and three hours laboratory.

5230 Advanced Machine Tool Technology. Three credits. Taper turning, boring and thread chasing, and calculations of screw threads and other operations. Gear terminology and calculations, practice gear cutting on the milling machine, use of index head. Two hours lecture and three hours laboratory.

5280 Computer-Aided Manufacturing: Numerical Control (NC). Three credits. Role of NC in today's manufacturing environment; machines and machine control systems of a typical installation; justification. Emphasis on writing and debugging programs for a three-axis milling machine and a two-axis turning machine utilizing CNC and computer-aided part programming. For those with little or no experience with NC or those seeking to broaden their knowledge of NC. Two hours lecture and three hours laboratory.

5330 Advanced Computer-Aided Drafting. Two credits. Prerequisite: ET 3360 or CMT 3320. Interactive computer drafting and design using advanced AutoCAD software and add-ons. Primarily for students who want to increase their capabilities using CAD software and hardware. One hour lecture and three hours laboratory.

5340 Design of Machine Elements. Three credits. Analytical design methods of machine elements. Stress analysis, working stress, combined stresses, failure theories, fatigue failure. Design techniques for shafts, fasteners, gears, bearings, and belt and chain drives. Includes a design project. Lecture.

5360 Computer-Assisted Drafting/Design II. Three credits. Prerequisites: ET 2310 or CMT 3320. Utilizes AutoCAD software to develop skills in the creation and analysis of mechanical and architectural solid models for design and production purposes. Includes the use of shading and rendering to enhance three-dimensional model display and the extraction of two-dimensional engineering drawings. Two hours lecture and three hours laboratory.

5370 Tool Design. Three credits. Design of tools, fixtures, gauges, and dies. Translates product drawing specifications to tooling concepts. Utilizes computer drafting. Two hours lecture and three hours laboratory.

5420 Industrial Safety. Three credits. Safety and health problems in the manufacturing, construction, and utilities industries, including pertinent laws, codes, regulations, standards, and liability considerations. Organizational and administrative principles and practices for safety engineering, accident investigation and recording, safety education, and safety enforcement.

5440 Fire Safety. Three credits. Possible prevention activities, fire hazards and their causes, and fire inspection techniques.

5450 Industrial Hygiene. Three credits. Safety and health education training and investigation activities and how they are related to overall environmental safety.

5590 Manufacturing Automation Systems. Three credits. Provides technical, human, and business aspects of modern automation systems. Includes automation controls, levels of control and major components/subsystems, object-based software components, intelligent actuators and sensors, emerging trends, flexible manufacturing systems (FMS), computer integrated manufacturing (CIM), industrial systems and supply chain applications, organizational approaches, and automation justification.

5600 Programmable Logic Controllers. Two credits. Introduces programmable logic controllers (PLCs). Selection, operation, and troubleshooting. Ladder diagrams and programming of PLCs emphasized. One hour lecture and three hours laboratory.

5610 Instrumentation and Controls. Three credits. Devices and techniques used in the measurement of physical parameters. Consideration of accurates and sources of error, identification of typical measurements, sensors and transducers, control stability, and response. Two hours lecture and three hours laboratory.

5630 Local Area Networks. Three credits. Foundation and experience to understand the design, implementation, and management strategies of local area networks (LAN). Data communications standards and protocol fundamentals included. Lecture, laboratory activities, and a LAN design requirement. Two hours lecture and three hours laboratory.

5640 Industrial Electricity. Three credits. AC power theory and circuits for industrial applications, polyphase systems, power factor correction, and transformers. Theory, applications, and selection of motors and generators. Control subsystems with emphasis on power electronics. Two hours lecture and three hours laboratory.

5650 Introduction to Microprocessors. Three credits. Prerequisite: ET 3620. Introductory course in microprocessor-based systems and their related components. Machine language programming extensively used to solve problems and to demonstrate the relationship of the microprocessor to its supporting peripherals. Basic microcomputer architecture also emphasized. Two hours lecture and three hours laboratory.

5660 Microprocessor Interfacing. Three credits. Analog and digital conversion devices and their related systems. Introduction to individual subsystems; A/D and D/A data conversion. Organization and design of individual digital systems emphasized. Includes data transfer, conversion, storage, input and output with principal focus on systems external to computer systems. Two hours lecture and three hours laboratory.

5670 Microprocessor Design. Three credits. Advanced course in design and application of microprocessor-based microcomputers for measurement and control systems. In-depth analysis of software and hardware in the design process. Design, develop, and test an operating system for a microprocessor-based computer. Two hours lecture and three hours laboratory.

5680 Electronic Fabrication. Three credits. Prerequisite: ET 3610 or equivalent. Planning and designing electronic packaging, including printed circuit board design, component selection criteria, and construction techniques. Conventional and computer-aided printed circuit board design techniques used. Two hours lecture and three hours laboratory.

5690 Electronic System Analysis. Four credits. Theory of electronic troubleshooting and proper repair techniques of electronic devices.

5700 Transform Circuit Analysis. Three credits. Prerequisites: ET 3601 and MATH 1910 or permission of instructor. An advanced course in network analysis that stresses network theorems and solutions of time and frequency-domain problems with the use of Laplace Transforms.

5710 Industrial Seminar. One credit. Orientation to industrial job opportunities, placement practices, interview techniques, and preparation of application materials (resume, cover letter). Guest lectures, films, and student and faculty presentations.

5850 Fluid Power. Three credits. Systems and the basic components that make up these systems, including hydraulic, pneumatic, and fluidic. Emphasis on understanding the language and graphic symbols associated with fluid power and the performance characteristics of system components. Two hours lecture and three hours laboratory.

5860 Robotics. Three credits. Introduces the fundamentals of robots. Types of robots and controls, the prime movers, and the application of robots in the industrial environment. Two hours lecture and three hours laboratory.

5915 Technical Project Management and Soft Skills. Three credits. Prerequisite: Graduate standing. Project management as sanctioned by the International Project Management Institute and how to assess and boost emotional intelligence or soft skills. Student successfully completing course will earn 20 Professional Development Units (PDUs) issued by the International Project Management Institute.

5920 Plant Layout and Materials Handling. Three credits. An overview of facility planning including equipment selection, work flow analysis, activity relationship analysis, and plant layout for product, process, and JIT requirements. Teams assigned actual projects in industry. CAD layout presentations to industry management required.

5970 Engineering Economy. Three credits. Development of capital budgets; justification of capital projects using time value of money concepts; replacement analysis. Review of justification of actual capital projects and computer applications.

5980 Federal and State Safety Legislation. Three credits. The federal Occupational Safety and Health Act (OSHA) and the Tennessee Occupational Safety and Health Act (TOSHA); Environmental Protection Agency; rules and regulations and how they apply to industry.

5990 Industrial Engineering Systems. Three credits. Prerequisite: ET 3910 or equivalent. System design of work tasks including establishing time standards by time and motion study and work sampling; ergonomic design for integration of the human into the work task environment. Scientific methods supplemented by quality considerations with emphasis on statistical quality control (SQC). Computer software used for design and analyses. Graduate students will lead an industry design project team of students.

6390 Productivity Strategies/Lean Systems. Three credits. Prerequisites: Graduate standing and ET 3910 or consent of instructor. Topics include the human element (supervisory and teamwork skills), the theoretical aspect (laws and science covering service and production systems), and the practical aspect (tools for lean operational systems implementation). Theoretical and practical methods needed to complete a required industry/business project and obtain a certification in Lean Manufacturing.

Course in Concrete Industry Management [CIM]

5800 Special Problems in Concrete Industry Management. One to three credits. Prerequisite: Permission of department. Opportunity to pursue projects of individual interest in concrete industry management. Projects may be technical and/or managerial in nature and may require any combination of literature reviews, lab work, field studies, and other research methods. A faculty member will approve a formally submitted proposal for the study, supervise progress, and grade a report and a presentation which are required upon completion of the project. May be repeated. No more than 6 hours may count toward degree.

Course in Construction Management Technology [CMT]

5320 Architectural Computer-Aided Drafting and Design. Three credits. Using computers to draw and design residential architectural plans. Specifically geared toward the construction area of concentration. Three hours lecture and three hours laboratory.

Courses in Environmental Science and Technology [EST]

5770 Pollution Control Technology. Four credits. Introduces air, noise, solid waste, and water pollution control technology. Legislative regulations and equality standards, pollution types and sources, detection and analysis instruments, and treatment principles and practices.

5780 Air, Solids, and Noise Pollution Technology. Three credits. Prerequisites: 8 hours each chemistry, biology, and physics or permission of instructor. Introduces air, noise, solid, and hazardous waste pollution technology, including legislative regulations and quality standards: sources, detection, and analysis instrumentation and practices, and treatment and abatement principles, equipment, and practices.

5810 Energy and the Environment. Three credits. Introduces sources and methods of energy production and classifications of energy usages with emphasis on usage trends, energy conservation strategies, and alternate energy utilization.

5820 Solar Building Design. Three credits. Introduces environmental and economic impact of solar energy for residential and light industrial construction including topics such as day lighting, passive solar design, and hot water heating.

5840 Energy Auditing. Three credits. Introduces types of energy consumption and classifications of energy usages. Emphasis on conservation strategies and total management for residential and industrial plants.

5870 Passive Solar Design. Three credits. Introduces passive solar techniques in the construction of residential and light industrial structures. Includes day lighting, passive solar design, methods, and system integration.