

# Department of Engineering Technology and Industrial Studies

**Walter Boles, Chair**  
**Voorhies Industrial Studies Complex 143**

The Department of Engineering Technology and Industrial Studies offers the Master of Science degree in Engineering Technology and Industrial Studies with thesis and non-thesis options and concentrations in Engineering Technology, Occupational Health and Safety, and Industrial Relations. 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 satisfactory score on the Graduate Record Examination is required for admission to the master's program.

The Department cooperates with the Schools/Departments of Agribusiness and Agriscience; Business Education, Marketing Education, and Office Management; and Human Sciences to offer the Master of Vocational-Technical Education (M.V.T.E.) degree.

## Requirements for the Master of Science Degree

### Thesis 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 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 6 semester hours of an approved research tool with grades of C or better on the undergraduate or graduate level. Typical research tools include statistics, computer science programming, or foreign language.

4. file a Candidacy Form with the Graduate Office after the completion of 12 graduate credits and prior to the completion of 24 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.

### Non-Thesis 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 6 semester hours of an approved research tool to include at least one course in statistics with grades of C or better on the undergraduate or graduate level. Typical research tools include statistics, computer science programming, or foreign language.
4. file a Candidacy Form 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, psychology, or vocational-technical education.

### Concentration: Engineering Technology

Candidate must complete

1. requirements for the thesis or non-thesis 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. approved minor/cognate and/or additional electives as approved by the advisor.

### Concentration: Industrial Relations

Candidate must complete

1. requirements for the thesis or non-thesis option;
2. core consisting of ET 5420, 5940; ETIS 6010, 6620, 6640 (thesis option) or 6910 (non-thesis); PSY 5320;
3. electives to be selected from ETIS 6020, 6040, 6110, 6910; ECON 6510.

## Concentration: Occupational Health and Safety

Candidate must complete

1. requirements for the thesis or non-thesis option;
2. core consisting of ETIS 6020, 6040, 6070, 6620, and 6640 (thesis option) or 6910 (non-thesis);
3. electives to be selected from SAFE 5320, 5350, 6410, 6450, 6470, 6920; PHED 6650; ET 5420, 5440, 5450, 5960, 5970; ETIS 6010, 6110, 6510, 6920; PSY 5350.

## Courses in Engineering Technology and Industrial Studies [ETIS]

- 5490 (549) Topics in Industrial Technology.** One to six credits. Selected topics offered as required to meet class needs.
- 5700 (570) Industrial Topics.** One to six credits. Problems in any one of a variety of areas to meet class needs.
- 5790 (579) Shop Problems.** Three credits. Prerequisites: Completion of all undergraduate courses in a given area and permission of instructor. For the advanced student who wishes to work on a designated problem in a specific area. Independent work on a selected problem or project under the instructor's guidance.
- 5990 (599) Introduction to Operations Research.** Three credits. Problem solving in research and development involving operations research models, computer applications, and industrial problems.
- 6010 (601) 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 (602) Safety Technology and Engineering.** Three credits. Advanced study of the technical components of the 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 (604) Occupational and Environmental Hygiene.** Three credits. Prerequisite: ET 4450/5450. 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 (607) 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 (611) 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 (618) 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.

- 6230 (623) 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 (624) 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 (626) 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 (637) 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 (651/652) Problems in Industrial Studies.** Three credits each. Independent investigation and report of current problems of particular interest to individual students directed by department faculty members.
- 6620 (662) 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 (664) 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.
- 6910/6920 (691/692) 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.

## Courses in Engineering Technology [ET]

- 5220 (522) Advanced Metalwork.** Four 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).
- 5230 (523) Advanced Machine Tool Technology.** Four 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.
- 5280 (528) Computer-Aided Manufacturing: Numerical Control (NC).** Four 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.

- 5330 (533) Advanced Computer-Aided Drafting.** Four credits. Prerequisite: ET 5360 or CM 5320. 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.
- 5340 (534) 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 (536) Computer-Assisted Drafting/Design II.** Four credits. Prerequisites: ET 2310 or CM 3320. Utilizes MS-DOS computer and 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.
- 5370 (537) Tool Design.** Four credits. Design of tools, fixtures, gages, and dies. Translates product drawing specifications to tooling concepts. Utilizes computer drafting.
- 5420 (542) 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 (544) Fire Safety.** Three credits. Possible prevention activities, fire hazards and their causes, and fire inspection techniques.
- 5450 (545) Industrial Hygiene.** Three credits. Safety and health education training, and investigation activities and how they are related to overall environmental safety.
- 5590 (559) Fundamentals of Computer-Integrated Manufacturing.** Three credits. Identification of the terms, applications, and requirements for using computer-integrated manufacturing. An overall view of the design, drafting, manufacturing, and integration aspects of using computers for manufacturing. Includes manufacturing, human, and business elements.
- 5600 (560) Programmable Logic Controllers.** Two credits. Introduces programmable logic controllers (PLCs). Selection, operation, and troubleshooting. Ladder diagrams and programming of PLC emphasized.
- 5610 (561) Instrumentation and Controls.** Four credits. Devices and techniques used in the measurement of physical parameters. Consideration of accuracies and sources of error, identification of typical measurements, sensors and transducers, control stability, and response. Two-hour lecture and four-hour laboratory.
- 5630 (563) Local Area Networks.** Four 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.
- 5640 (564) Industrial Electricity.** Four 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.
- 5650 (565) Introduction to Microprocessors.** Four 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 and its supporting peripherals. Basic microcomputer architecture also emphasized. Two-hour lecture and four-hour laboratory.
- 5660 (566) Microprocessor Interfacing.** Four 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.
- 5670 (567) Microprocessor Design.** Four 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.
- 5680 (568) Electronic Fabrication.** Four 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.
- 5690 (569) Electronic System Analysis.** Four credits. Theory of electronic trouble shooting and proper repair techniques of electronic devices.
- 5700 (570) Transform Circuit Analysis.** Three credits. Prerequisites: ET 3600 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 (571) 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 (585) 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. Lecture, laboratory, and problem solving.
- 5860 (586) 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.
- 5900 (590) Productivity Strategies.** Three credits. Analysis, design, and implementation of productivity strategies and improvement programs for a wide variety of organizations. Touches a wide spectrum of disciplines such as work design, quality, design engineering, and employee involvement.
- 5910 (591) Maintenance Management.** Three credits. Overview of the management of maintenance in an organization such as manufacturing, hospitals, or large maintenance shops. Application of work measurement, labor utilization, preventative maintenance, and computer applications.

- 5920 (592) 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.
- 5930 (593) Production Planning and Control.** Three credits. Concepts of manufacturing planning, forecasting, material requirements, planning, and control of inventories. Emphasis on computer systems for planning, scheduling, and control. Plant tours and special presentations are supplementary.
- 5940 (594) Methods and Work Measurement.** Three credits. Design of work tasks, including analysis and improvement of existing tasks. Establishing engineered time standards by stopwatch, pre-determined times, and work sampling. Application of computer systems in work measurement.
- 5950 (595) Statistical Quality Control.** Three credits. Statistical quality analysis of manufacturing processes including product sampling and design of overall quality system; study of various systems in use in industry.
- 5960 (596) Human Factors Engineering (Ergonomics).** Three credits. Integration of the human into the work task environment. Emphasis on practical applications of ergonomics to task design and analysis. Design teams apply concepts to real world problems. Presentation of projects. Computer applications reviewed.
- 5970 (597) 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 (598) 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.

### Course in Construction Management [CM]

- 5320 (532) Architectural Computer-Aided Drafting and Design.** Four credits. Using computers to draw and design residential architectural plans. Specifically geared toward the construction area of concentration.

### Courses in Industrial Education [IED]

- 5000 (500) Program Development and Modification for the Special Needs Learner.** Three credits. Basic strategies for identifying and working with special needs learners in industrial education.
- 5010 (501) History and Philosophy of Industrial Education.** Three credits. Relation to the development of industrial education stressed.
- 5030 (503) Course Development in Occupational and Technology Education.** Three credits. Basic techniques including occupational analysis, preparing objectives, planning a learning sequence, preparing learning activities, selecting and preparing learning resources, and evaluating student performance.

- 5040 (504) Methods of Teaching Occupational and Technology Education.** Three credits. Understanding and skills required for individualizing instruction in industrial arts and trade and industrial education.
- 5060 (506) Organization and Operation of Occupational Student Organizations.** Three credits. Orientation to incorporating occupational education programs. Emphasis on establishing an organization, planning chapter activities, utilizing community resources, chapter business procedures, and competitive activities.
- 5070 (507) Laboratory Organization and Classroom Management.** Three credits. Laboratory planning and layout, purchasing supplies and equipment, inventory and record keeping, laboratory maintenance, class organization, and safety.
- 5480 (548) Topics in Industrial Education.** One to six credits. Selected topics offered as required to meet class needs.

### Courses in Environmental Science and Technology [EST]

- 5770 (577) 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 (578) Air, Solids, and Noise Pollution Technology.** Four 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 (581) 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 (582) 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 (584) 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 (587) 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.