

**Millersville University**  
**Department of Industry and Technology**

**COMPETENCIES**  
**BACHELOR OF SCIENCE IN INDUSTRIAL TECHNOLOGY**

The Bachelor of Science degree program in Industrial Technology provides broad-based liberal arts, technical and management preparation for leadership careers in business and industry. Emphasis is on the development of transferable knowledge, skills and values that are needed for current and future success in employment. Overall competencies, competencies for the technological literacy and management cores, and competencies for each of the six specialized technical options have been developed.

Validation of competencies for the baccalaureate degree program in Industrial Technology has occurred in a variety of ways. The National Association of Industrial Technology (NAIT) has nationally accredited the program. A functioning advisory committee, which contains two representatives for each technical option, meets at least once per year. Typical agendas and discussions within advisory committee meetings feature input from members on curriculum revision, new courses and observations about graduate capabilities. Surveys of ITEC majors, graduates and the graduates' employers regarding program quality occur regularly. Faculty members also are active in technical and professional organizations, read relevant publications and regularly attend professional workshops and conferences.

***Overall Degree Competencies***

Upon the completion of the Industrial Technology program, the student will be able to perform the following overall competencies:

- Demonstrate a broad-based general education, with particular strengths in oral and written technical communications, science and math.
- Display knowledge and skills related to the contemporary technological systems of production, communications and energy/power/transportation.
- Demonstrate knowledge and skills in entry-level technical management, with special emphasis on business organization and management, production planning, quality assurance, industrial organization and industrial safety.
- Exhibit competencies in applying and using technology within a selected technical specialization.
- Apply technological concepts and practices in solving problems related to industry, within both individual and cooperative team environments.
- Access, evaluate and manage technical and managerial information.
- Interpret the evolution of technology and assess its impacts on contemporary industry and society.

***Technological Literacy Core Competencies***

Upon the completion of the Industrial Technology program, the student will be able to perform the following technical competencies:

- Demonstrate a general understanding of technology – its structure, organization, systems, terminology, career opportunities and related professional organizations.
- Apply mathematics and science principles in production, communications, and energy/power/transportation systems.

- Describe typical applications and their impact on society of processes used in production, communications, and energy/power/transportation systems.
- Demonstrate knowledge of basic computer systems, including identity of typical microcomputer system components as well as potential applications, benefits and limitations.
- Communicate information electronically by encoding, transmitting, channeling, receiving and decoding processes.
- Design and produce effective two-dimensional and three-dimensional messages that use a variety of graphic reproduction processes.
- Describe major characteristics, including advantages and disadvantages, of various types of radiant and potential energy, and demonstrate methods of measuring, controlling and converting these forms of energy.
- Demonstrate knowledge of major characteristics of electrical, fluid and mechanical systems, and utilize selected devices to measure and control these forms of power.
- Describe, compare and contrast a variety of transportation systems.
- Perform safely common manufacturing techniques used to cast, form, separate, condition, assemble and finish a variety of production materials.

### *Management Core Competencies*

Upon the completion of the Industrial Technology program, students will demonstrate the following management competencies:

- Exhibit knowledge of federal and state safety legislation and identify the role of management in an industrial safety program.
- Recognize, evaluate and control varied industrial health and safety hazards.
- Demonstrate knowledge of traditional management functions and practices, including applications and limitations of various management schemes.
- Perform production scheduling, develop and monitor an inventory control system, utilize appropriate production planning techniques, and identify and exhibit key factors in project management.
- Solve problems in typical industrial organizations, work effectively in teams, and demonstrate knowledge of the managed area of an industrial enterprise.
- Use appropriate statistical techniques in variable and attribute control charts and in sampling tables for continuous improvement.
- Evaluate and/or implement total quality systems in industry.
- Apply business, marketing and economic principles to solve problems.
- Identify responsibility of supervision and management within various industries.
- Demonstrate communication skills, safe and efficient individual and group work habits, leadership within groups and an attitude of cooperation and tolerance.

### *Technical Option Competencies*

#### **Computer-Aided Drafting and Design (CADD) Technology Option**

The Computer-Aided Drafting and Design option is designed to provide students with theoretical and practical skill in drafting/design. This option provides survey experiences in drafting/design and advanced work in the areas of technical freehand drawing, design methodology, model building, residential architectural design and detailing, descriptive geometry, and technical illustration and rendering using computer-aided drafting systems. Technical electives allow students to choose advanced concentration or to explore areas of interest such as CNC or robotics. Students are also encouraged to seek an industrial internship position to gain practical experience with industrial

production procedures. All courses feature practical laboratory experiences allowing students to work with equipment, materials, and processes that will lead to successful careers in the drafting/ design field. Graduates of this option typically work in careers such as industrial design, CADD management, mechanical design, industrial sales and support, technical illustration, and residential design; they often work in administrative and supervisory positions.

Upon the completion of the CADD option, the student will be able to

- Use a wide variety of drafting/design equipment and materials to solve problems in the drafting or design environment.
- Apply drafting standards to engineering or architecture.
- Use computer-aided drafting/design systems for producing 2D mechanical and architectural drawings, as well as for solids modeling and design applications.
- Demonstrate a high level of problem-solving ability in the practical application of theoretical principles.
- Apply theories of product design for developing and refining products for human use.
- Identify the technical specifications for computer-aided drafting/design systems and for selecting and configuring appropriate CADD workstations.
- Utilize presentation drawings and models in the development of products for both mechanical and architectural applications.

### **Construction Technology Option**

The Construction Technology B.S. option provides students with both the theoretical knowledge and practical skills that are essential for careers in the construction technology. Courses included in this option provide experiences in computer-aided drafting and design (CAD/D), architectural design, blueprint reading, materials and processes, construction methods, construction planning, construction scheduling, supervision, construction estimating and take-offs, and construction contracts. All courses in this option include practical laboratory experiences and problem solving activities with the tools, materials, equipment and software that are fundamental to understanding the principles of construction technology.

Upon completion of the Construction Technology option, students will be able to perform the following competencies:

- Demonstrate proficiency in reading and interpreting working drawings and blueprints
- Use computer-aided drafting/design systems for producing 2D mechanical, architectural drawings as well as design applications
- Apply mathematical and computer skills in preparing and communicating job materials and labor cost estimates
- Demonstrate proficiency in using computer applications for creating and communicating job time schedules
- Identify the elements of a construction contract and be able to read and interpret contracts
- Analyze and evaluate construction materials to determine the advantages, benefits, and suitability for selected applications
- Demonstrate safe and appropriate use of tools, materials and processes employed in construction technologies
- Demonstrate a systematic approach to construction project management techniques.
- Explain the relationship between drawings, specifications and construction contracts.
- Apply knowledge of construction methods to practical applications.

### **Electronics/Control Systems Option**

The Electronics/Control Systems option is designed to provide students with both theoretical knowledge and practical skills in power, control and electronic systems that are essential for careers in today's manufacturing sector. Courses included in this option provide survey experiences in both power and electronics and require advanced study of either advanced electronics or control systems. Advanced electronics courses for the Electronics Specialization include analog electronics, instrumentation and control circuitry, and electronic communication systems. Advanced control courses for the Control Systems Specialization include fluid power, robotic systems, and designing industrial control systems. Technical electives included in this option permit student exposure to other related technical areas that are of special interest to students enrolled. All courses feature practical laboratory experiences that enable students to work with the components, tools, equipment and test instruments needed to design, test, maintain and troubleshoot modern electronic and control systems. Typical entry-level professions include product engineers, application engineers, control systems designers, control engineers, process engineers, control/field technologists, electronics technologists, technical managers, supervisors, team leaders and field service representatives.

Upon the completion of the Electronics/Control Systems option, the student will be able to

- Use a variety of electronic test equipment such as analog and digital meters, oscilloscopes, frequency counters, power supplies, logic pulsers and probes in order to verify proper circuit operation or to troubleshoot and solve electrical and electronic problems.
- Demonstrate knowledge related to DC/AC, digital, power conversion and control, and microprocessor circuits.
- Design, create and integrate programmed solutions via PLC and PC for problems associated with process control.
- Utilize electromechanical and microprocessor-based systems in order to implement designed solutions associated with process control.
- Retrieve and assess electronics and control information from journals, periodicals, technical manuals, component substitution manuals, Internet, and other technical sources.
- Describe the impact of various electronic and control systems on society today.
- Demonstrate the systematic research and development process in learning and applying current contemporary electronics and control systems technologies.
- Demonstrate advanced technical knowledge in either electronics or control systems through the selection of a specialization within the option. Advanced electronics knowledge will include analog, instrumentation and communication circuits, while advanced control systems knowledge will include fluid power, robotics, and control system design.

### **General Technology Option**

The General Technology option is designed to provide students with both theoretical knowledge and practical skills in broad-based industrial technologies. Courses included in this option provide survey experiences in electricity/electronic, mechanical, manufacturing, drafting/design, and graphic communication technologies. Technical electives permit the students to integrate the technological systems or develop their own specialty in industrial technology. All courses feature practical laboratory experiences that enable students to work with processes, tools, equipment and materials needed in various technological applications. Graduates of this option typically work as process/product designers, application engineers, technical salespersons, technical trainers, technologists, or managers of technical operations.

Upon the completion of the General Technology option, the student will be able to

- Demonstrate skills in the design and organization of communication, production and transportation systems to include attainment of required inputs, selection and application of appropriate processes, and the analysis and evaluation of system outputs.

- Demonstrate safe and appropriate use of tools, materials and processes employed in industrial technologies.
- Use computers to design, communicate, control, monitor and produce in the work environment.
- Demonstrate knowledge of descriptive geometry, multiview drawings, sectioning, pictorial representation, detail and assembly drawings, and the reproduction of drawings as needed for designing and manufacturing products.
- Perform graphic design, image composition, photography, image assembly, image carrier preparation, image transfer and finishing processes as needed for graphic communications.
- Apply knowledge of electrical circuits and concepts through testing, troubleshooting, experimentation and problem solving.
- Analyze, design and specify mechanical, hydraulic and pneumatic power transmission and control systems and their components for specific applications.
- Select, test, analyze and safely process industrial materials including polymers, ceramics, metallics and composites.

### **Graphic Communications Technology Option**

The Graphic Communications Technology option provides students with both theoretical knowledge and practical skills that are relevant for careers in the graphic communication industry. Courses in this option provide an overview of communication systems, graphic communication, principles of photography, contemporary printing technology, desktop publishing, digital imaging, color separation and reproduction, and design principles involved in producing various forms of graphic communication. Technical electives included in this option permit students to do research and development with current materials, software and hardware, and technical processes. All courses feature practical laboratory experiences and problem solving activities with the tools, materials, and equipment that are fundamental to understanding the principles of graphic communication. Graduates of this option typically find employment in all technical and managerial phases of the industry, from pre-press through post-press operations, including design and layout, desktop publishing, planning and estimating, customer relations, production, sales, and quality control.

Upon completion of the Graphic Communications Technology option, the student will be able to

- Identify the major developments, characteristics, applications, and impacts of contemporary graphic communication technology.
- Design and communicate information using the communication systems model.
- Demonstrate technical skills related to graphic design, digital imaging, continuous tone photography, process photography, pre-press production, image transfer, and finishing operations.
- Demonstrate a working knowledge of the tools, materials, and processes related to the graphic communication industry.
- Demonstrate the ability to communicate ideas visually, orally, and in written form according to graphic communication standards.
- Apply mathematical and scientific principles to analyze and solve graphic communication problems.
- Develop relationships between computer applications and graphic production.
- Apply business, marketing, and economic principles to solve problems related to graphic communication.
- Identify responsibilities of supervision and management within the graphic communication industry.

### **Manufacturing Technology Option**

The Manufacturing Technology option is designed to provide students with both theoretical knowledge and practical skills that are essential for careers in today's manufacturing industries. Courses included in this option provide introductory and advanced experiences in computer-aided drafting and design (CADD) and polymer, ceramic, metal, wood and composite materials and processes for manufacturing.

Computer numerical control (CNC) programming and machining of a variety of industrial materials is featured. Technical electives included in this option permit student exposure to materials testing, machine tool design, power conversion and control, and robotics. All courses include practical laboratory experiences that enable students to work with industrial materials, tools and equipment for product development. Graduates typically work in technical sales involving materials, products and systems of manufacturing as industrial trainers, manufacturing engineers or as supervisors or managers of technical operations.

Upon the completion of the Manufacturing Technology option, the student will be able to

- Design products utilizing (CADD).
- Analyze, select and use industrial materials for production including polymers, ceramics, metals, woods and composites.
- demonstrate proficiency in the manufacturing processes of casting, forming, separating, conditioning, assembling and finishing.
- Program and operate computer numerically controlled (CNC) machine tools utilized in manufacturing.
- Employ computer-aided design and computer-aided manufacturing (CAD/CAM) for the design, development and production of manufactured goods.
- Organize, manage and control a manufacturing environment.
- Demonstrate behavioral patterns that include communication skills, safe and efficient individual and group work habits, leadership within groups, and an attitude of cooperation and tolerance.
- Describe the impact of various manufacturing systems on society today.
- Recognize, evaluate and control varied industrial health and safety hazards.
- Demonstrate knowledge of traditional management functions and practices, including applications and limitations of various management schemes.
- Perform production scheduling, develop and monitor an inventory control system, utilize appropriate production planning techniques, and identify and exhibit key factors in project management.
- Solve problems in typical industrial organizations, work effectively in teams, and demonstrate knowledge of the managed area of an industrial enterprise.
- Use appropriate statistical techniques in variable and attribute control charts and in sampling tables.

### **Mechanical Technology Option**

The Mechanical Technology option is designed to provide students with both theoretical knowledge and practical skills that are essential for industrial careers with an emphasis in electromechanical and fluid systems as applied to production. The Mechanical Technology option focuses on the design and production of tools, machines, and products. This option requires course work in industrial design, materials and processes and the control of electrical, fluid and mechanical power. Emphasis is also given to computer applications in the design of products and control of power circuitry. Providing hands-on laboratory experiences is a key component of this option. Mechanical Technology graduates are typically employed as mechanical technologists, fluid power technologists, electromechanical technologists, industrial designers, product developers, technical salespersons, and project engineers.

Upon completion of the Mechanical Technology option, the student will be able to

- Safely and efficiently utilize electrical, fluid and mechanical test equipment to analyze power circuitry.
- Demonstrate a working knowledge of hydraulic and pneumatic components and circuitry.
- Utilize electromechanical, pneumatic and microprocessor based systems in order to perform industrial process control functions.

- Visualize, create and edit engineering graphics and transfer this information to appropriate storage and retrieval media.
- Apply design and production skills in the techniques used to create geometric models.
- Demonstrate knowledge in the selection, testing and evaluation of materials for use in the manufacture of products.
- Demonstrate knowledge of the applications and limitations of major processes for forming, shaping and processing industrial materials.
- Program and operate computer numerically controlled (CNC) machine tools utilized in the manufacturing process.
- Design and produce tooling and products via CAD/CAM.

### **Nanofabrication Manufacturing Technology Option (NFMT)**

The Nanofabrication Manufacturing Technology (NFMT) option provides students with both the theoretical knowledge and practical skills for careers in designing and fabricating materials and devices through machining at the atomic level. Nanofabrication technology or molecular manufacturing cuts across many technological systems and industries, including microelectronic chip manufacturing, power semiconductors, micro-electromechanical devices, information storage, computer displays, optoelectronics, pharmaceuticals, sensors, and biomedicine. Introductory courses provide basic knowledge and skills in electronics and computer aided design and drafting. The Pennsylvania Nanofabrication Manufacturing Partnership enables a full semester of hands-on experiences in nanofabrication in the Nanofabrication Facility at Penn State's University Park campus. Upper division courses at MU in chemistry and co-operative education develop advanced knowledge and industrial work experience in nanotechnology. Practical laboratory experiences within these courses enable students to work with processes, tools, equipment, and materials needed for making various nanotechnology innovations. Graduates of this option are prepared as nanofabrication technologists, application engineers, salespersons, trainers, and managers in micro- and nanotechnology high-tech manufacturing industries.

Upon the completion of the NFMT option, students will demonstrate the following technical competencies:

- Demonstrate knowledge related to DC/AC circuits, electronic and magnetic fields, and analog and digital electronics.
- Employ conventional board and computer-aided drafting systems in communicating and designing nanofabricated products.
- Interpret safety and health issues, basic processes, materials modification, and quality assurance techniques for micro- and nanofabrication.
- Use a variety of tools for machining at the atomic level that deposit films, remove films, and lay out the film deposition and removal areas, including physical vapor and chemical vapor deposition equipment, plasma deposition and etching tools, and electron beam and optical lithography.
- Apply scientific and mathematical principles to analyze and solve nanofabrication manufacturing problems.
- Synthesize the principles of chemistry required for designing and manufacturing selected nanotechnology materials, devices, and systems.
- Retrieve and assess nanotechnology information from journals, periodicals, technical manuals, component substitution manuals, Internet, and other technical sources.
- Describe the impact of microelectronics and nanotechnology on society.

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