A comprehensive program is offered for students preparing to teach industrial arts, vocational-technical subjects, and vocational home economics. Two-year and four-year technical programs are available to students desiring to enter industry as skilled technicians. Manual arts therapy and a comprehensive graduate program complete the school offerings.

**INDUSTRIAL EDUCATION**

PROFESSORS Ainsworth (Dean), Brown, Ensman; ASSOCIATE PROFESSORS Glenn, James (acad. chr.); ASSISTANT PROFESSOR Cherry; INSTRUCTORS Bach, Boone, DeCamp.

**OBJECTIVES**

The objectives of Industrial Education at Northern Arizona University are:
(1) to provide desirable experiences for the preparation of industrial arts teachers;
(2) to provide vocational-technical teacher education that will enable qualified individuals to become certified under the Arizona State Plan for Vocational Education;
(3) to provide exploratory experiences in a variety of activities for effective living, as well as for recreational and avocational values;
(4) to provide experiences with a wide variety of materials for elementary teachers to better prepare them for teaching;
(5) as a service to the community, to provide trade extension and other vocational education of less than college grade for those individuals who have entered upon and desire to advance in an industrial occupation.

**DEGREE REQUIREMENTS**

**BACHELOR OF SCIENCE IN EDUCATION**

See pages 68-71 for general degree requirements.

Majors:

*Industrial Arts Education*: 35 semester hours: Industrial Education 100, 111, 121, 131, 150, 242, 302, 330, 351, 491, Technology 102, 103, Education 430, and 3 hours elective.

*Vocational-Technical Education*: 35 semester hours: A maximum of 18 semester hours may be allowed for trade or technical experience and the remaining hours from requirements as stated in current State Plan for Vocational Education. (See page 217 for additional information.)

*Extended Major in Industrial Arts Education*: A student may in consultation with his adviser elect to complete an extended major consisting of 20 additional semester hours or 55 semester hours in Industrial Education in lieu of a minor. The purpose of this is to provide for one or more areas of specialization.

Minors:

*Industrial Arts Education*: 20 semester hours: Industrial Education 100, 111, 121, 131, 150, 242, plus 4 hours electives, and Education 430 taught by Industrial Education staff.

APPLIED SCIENCE AND TECHNOLOGY
**Industrial Arts Education for Elementary Teachers:** 15 semester hours: Industrial Education 100, 111, 121, 131, 150, 301. Fifth year requirements: graduate and/or undergraduate courses in Industrial Education from the list approved by the Committee on Teacher Education and selected by the adviser and the student.

**Vocational-Technical Teacher Education**

This curriculum is designed for individuals with a background of industrial experience who are teachers in reimbursable Trade and Industrial or Technical programs, or who wish to become teachers in such programs. The individual who successfully completes this curriculum will receive the Bachelor of Science in Education degree with a major in Vocational-Technical Teacher Education. Liberal Studies, professional education, and state certification course requirements for this curriculum are the same as those required for regular secondary education teaching degrees. A student with trade, industrial, or technical experiences may be granted, through examination and evaluation, up to a maximum of 18 semester hours of credit toward the major requirements. He may also secure credit for the required six hours of supervised student teaching in Industrial Education by presenting verification of a minimum of two years of successful contractual teaching experience in his field. Credit in both of these categories will be placed upon the individual's transcript upon completion of all other degree requirements. The Academic Chairman of Industrial Education and/or the designated Head State Teacher Educator of Vocational-Technical Education Teachers will be responsible for advising all students pursuing this degree program.

**Degree Requirements:** (Bachelor of Science in Education)

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Liberal Studies (page 75)</td>
<td>42</td>
</tr>
<tr>
<td>Major*</td>
<td>55</td>
</tr>
<tr>
<td>Technical Course Credit</td>
<td>18</td>
</tr>
<tr>
<td>Minimum Professional Voc.-Tech. Courses*</td>
<td>17</td>
</tr>
<tr>
<td>Electives (Technical, or Related Courses in Industrial Education)</td>
<td>20</td>
</tr>
<tr>
<td>Professional Education Requirements</td>
<td>19</td>
</tr>
<tr>
<td>Professional Courses</td>
<td>13</td>
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<tr>
<td>Supervised Teaching</td>
<td>6</td>
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<tr>
<td>State Certification Courses</td>
<td>6</td>
</tr>
<tr>
<td>Electives</td>
<td>6</td>
</tr>
</tbody>
</table>

**General Requirements:**

The student must:

A. Be regularly admitted to university.

B. Provide evidence of acceptable trade, industrial, or technical experience; or credentials which indicate that the candidate is qualified to teach or supervise vocational classes in his state, under the provisions of the State Plan for Vocational Education. Such credentials should be obtained from the candidate's State Department of Vocational Education and signed by the appropriate state officer.

C. Have satisfied the residence and other routine requirements of the university.

D. Satisfactorily complete the curriculum requirements outlined above.
Graduate Programs for Vocational-Technical Teachers.

A master's degree program is offered which provides a flexible curriculum designed to meet the needs of the vocational-technical education teacher, supervisor, or administrator. For further information concerning this curriculum, see the Graduate Bulletin.

Courses offered for renewal purposes:

Courses are offered for renewal purposes during the regular academic year, during summer sessions, and by extension to make it possible to meet requirements for renewal of vocational certificates. Contact the chairman of the Department of Industrial Education for further information regarding extension offerings.

'Note: In order to expedite certification as a Trade and Industrial or Technical Education Teacher, individuals already teaching in approved vocational-technical industrial education programs under requirements of the State Plan for Vocational Education, may complete their major before registering for other general university courses. The State Plan requires that an additional must complete a minimum of 15 semester hours of approved professional industrial education teacher preparation courses to be eligible for a regular vocational certificate. The first nine hours of the fifteen must be in courses dealing with the preparation of instructional materials, methods of presentation, and the construction of evaluative devices. These initial courses must be selected with the assistance and/or approval of the Academic Chairman of Industrial Education and/or the designated Head State Teacher Educator for Vocational-Technical Industrial Education.

**Manual Arts Therapy**

The program in Manual Arts Therapy is provided through the cooperative efforts of the Northern Arizona University at Flagstaff and the U. S. Veterans Administration Hospital at Whipple, Arizona. The program is designed to train Manual Arts Therapists who will be eligible for civil service positions in the area of physical medicine and rehabilitation at U. S. Veterans Administration Hospitals. Considerable opportunity for placement awaits those who are trained in this specialized field of therapy.

The program for Manual Arts Therapy leading to the Bachelor of Science degree includes the following:

Requirements:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>Liberal Studies</td>
<td>42</td>
</tr>
<tr>
<td>Major in Industrial Arts Education</td>
<td>35</td>
</tr>
<tr>
<td>Minor-Interdivisional</td>
<td>19</td>
</tr>
<tr>
<td>Education and Psychology</td>
<td>12</td>
</tr>
<tr>
<td>Hospital Internship in M.A.T.*</td>
<td>10</td>
</tr>
<tr>
<td>Electives</td>
<td>9</td>
</tr>
</tbody>
</table>

**Liberal Studies and Industrial Arts Requirements:**

Same as those for Industrial Arts Education Majors (see page 216).

**Hospital Internship:**

The student spends ten weeks in internship in M.A.T. at the U. S. Veterans Administration Hospital at Whipple, Arizona.
Administration Hospital, Whipple, Arizona. Upon satisfactory completion, the student will be granted ten semester hours credit and with the satisfactory completion of his other course work will qualify for employment in this field of therapy.

Arrangements for taking the hospital internship in M.A.T. must be made through the Dean, School of Applied Science and Technology.

Industrial Arts Education Majors with the Bachelor of Science in Education degree may qualify as a Manual Arts Therapist by serving the 10-week internship.

GRADUATE PROGRAMS IN INDUSTRIAL EDUCATION

The graduate programs in industrial education are designed to provide the student with the opportunity to increase their professional proficiency. The programs are carefully structured to be flexible enough to meet the needs of the industrial arts or the vocational-technical teacher, supervisor, or administrator. For further information, see the Graduate Bulletin.

DESCRIPTION OF COURSES

I.E. 100 Introduction to Industrial Education (1)
A course for students entering the broad field of industrial education; designed to explain the various areas involved, terminology, principles, and to assist the freshman and transfer student in planning their program of study.

I.E. 105 Principles of Drafting (3)
Use and care of drafting instruments and lettering. Introduction to orthographic projection isometric, cabinet, and cavalier drawings. Fee $2.00.

I.E. 111 Industrial Crafts (3)
Basic techniques and information involving leather, plastics, lapidary, and art metal. Fee $5.00.

I.E. 121 Basic Wood Processing (3)
Use and care of the common hand and portable power tools for processing wood; emphasis on materials, design, construction principles, and finishing applied to approved projects. Fee $5.00.

I.E. 131 General Metals I (3)
Basic experiences and information concerning bench metal, sheet metal, ornamental iron work, hot metal forming, metal casting, welding, and machine practice. Fee $5.00.

I.E. 150 Fundamentals of Graphic Representation (3)
Principles and practices in graphic representation involving orthographic projection isometric drawing, sketching, working drawings, and tracings. Fee $2.00.

I.E. 151 Engineering Drafting (3)
The graphical language of industry, including black-line reproductions; complex orthographic projection; sections; auxiliary and oblique views; dimensions and tolerances; working drawings; individual design project. One hr. lect, Five hrs. lab. Fee $2.00. Prerequisite: I.E. 150 or equivalent.

I.E. 152 Technical Illustration (3)
Methods and techniques used in developing visual presentations of complex components and principles used to produce illustrations of mechanisms. Fee $2.00.

I.E. 222 Fundamentals of Furniture Construction (3)
Selection, safe operation and care of basic woodworking machines; information on materials and design with a strong emphasis in construction for furniture. Fee $10.00. Prerequisite: I.E. 121.
I.E. 231 General Metals II (3)
Advanced processes in areas of bench metals, sheet metal, machining, hot metal forming, casting and art metal work. Fee $5.00.

I.E. 233 Metal Machining Processes (3)
Basic operations and technical information concerning common metal working machines and metal machining processes. Fee $5.00.
Prerequisite: I.E. 131.

I.E. 237 Sheet Metal Layout and Construction (4)
Information and practice on materials, tools, and processes involving sheet metals; galvanized iron, tin plate, copper and brass. Sheet different types of developments, and working out of short cuts and allowances in sheet metal work are included. Fee $5.00.

I.E. 242 Fundamentals of Electricity-Electronics (3)
For industrial arts and certain technology majors and minors; basic principles of electricity and electronics. Two hrs. lect. Three hrs. lab. Fee $5.00.
Co-requisite: Tec. 103.

I.E. 250 Machine Drafting (3)
Detail and assembly drawings, fasteners, and standard machine parts; emphasis on working drawings for objects that may be made in the metal machine laboratory or in industry. Fee $2.00.
Prerequisite: I.E. 150 or equivalent.

I.E. 251 Topographical Drafting (3)
Drawings of maps, layouts, profiles, and other topographical problems from field notes; emphasis upon accuracy and proper interpretations. Fee $2.00.
Prerequisite: I.E. 150 or equivalent.

I.E. 254 Descriptive Geometry (3)
Theory and problems on projection of points, lines, surfaces, and solids—practical applications in mining, electrical, civil, and mechanical engineering. Fee $2.00.
Prerequisite: One semester of Engineering Drawing or equivalent.

I.E. 257 Drafting and Design for Electricity-Electronics (2)
Drafting problems and techniques commonly associated with depicting electrical and electronic components, devices, and circuits. Fee $2.00.
Prerequisite: I.E. 151 and I.E. 242.

I.E. 301 Industrial Arts for Elementary Teachers (2)
Selection, care and use of tools, materials, and products of industry to supplement instruction in the elementary school. Fee $3.00.

I.E. 302 Shop Maintenance (3)
Common preventive and corrective maintenance problems, installation, adjustment, sharpening of tools and equipment in wood, metal and other types of industrial education laboratories. Fee $2.00.

I.E. 304 Historic and Contemporary Furniture (3)
Characteristics and development of the different period styles of furniture; may be elected with profit by other majors because of its general cultural value.

I.E. 311 Advanced Industrial Crafts (3)
New and advanced techniques, information, and processes in plastics, lapidary, and leather.
Prerequisite: I.E. 111.

I.E. 321 Principles of Cabinet Making (3)
Principles of design and construction applied to cabinet making. Processes, materials and machine accessories as applied to the cabinet making industry. Strict application of these procedures in the construction of cabinets. Fee $10.00.
Prerequisite: I.E. 222.
I.E. 322 Wood and Metal Finishing (3)
Information about and experience with a wide variety of transparent and opaque finishing materials by brush, spray, and wipe-on methods. Fee $10.00.
Prerequisites: I.E. 121 and I.E. 131.

I.E. 323 Upholstery Techniques (2)
Basic information and experience in design of frames and application of upholstery materials. Fee $5.00.
Prerequisite: I.E. 222.

I.E. 325 Production Methods and Processes (3)
Application of production principles to manufacturing of products including design, estimating, purchasing, mass production, construction, finishing and marketing. Fee $5.00.
Prerequisite: I.E. 222 or permission of instructor.

I.E. 330 Theory and Organization of the General Shop (3)
Methods of instruction and organization peculiar to the teaching of the General Shop. Special emphasis is given to programs at the junior high school level. Fee $3.00.

I.E. 332 Advanced Metal Machining (3)
Processes and technical related information on common metalworking machines and accessories with emphasis on design of jigs and fixtures and on a high degree of skill and accuracy on advanced projects. Fee $5.00.
Prerequisite: I.E. 233.

I.E. 333 Welding (3)
The operation of welding equipment and related theory; AC and DC electric arc, oxy-acetylene, and inert gas welding. Fee $18.00.

I.E. 351 Industrial Design (3)
Principles of design as applied to projects constructed in wood, metal, plastics, and other media. Fee $2.00.
Prerequisite: I.E. 150 or I.E. 151.

I.E. 353 Architectural Drafting (3)
Architectural design, methods, and types of construction of important details of modern dwellings. Modern architectural drafting practices. Fee $3.00.
Prerequisite: I.E. 150 or I.E. 151.

I.E. 354 Structural Drafting (3)
Structural layout, details, and preliminary design of structures. Fee $2.00.
Prerequisite: I.E. 151 or equivalent.

Tech. 381 Culture and the Home (3)
See listing under Liberal Studies.

Tech. 382 Technology and Culture (3)
See listing under Liberal Studies.

I.E. 421 Principles of Wood Construction and Carpentry (3)
Principles of carpentry with a strong emphasis in the trends of industry, upgrading of wood construction, home fabrication, miniature home building, new materials processes and procedures. Fee $10.00.
Prerequisite: I.E. 321.

I.E. 423 Materials of Wood Construction (3)
A study of the structure and properties of wood; characteristics of common species lumbering, milling, drying, grading, measurement, and marketing. Fee $3.00.
Prerequisite: I.E. 121 or approval of instructor.

I.E. 491 Shop Management (3)
School shop administration, shop safety. Planning and installation of equipment; buying materials. Fee $2.00.
I.E. 497 Hospital Internship in Manual Arts Therapy (10)

This course comprises ten weeks of intensive clinical practice with patients in the shops at the U. S. Veterans Hospital at Whipple, Arizona. Lectures, clinical practices, and procedures by medical staff, nurses, and other specialists will comprise important phases of this training.

GRADUATE COURSES

I.E. 500 Advanced Laboratory Problems (1-3)

Advanced technical and professional activities in a specific area as chosen by the individual student; entails considerable individual research; special written reports of findings required.

I.E. 501 Advanced Laboratory Problems in Industrial Plastics (3)

Technical and professional activities in the industrial plastics area including new developments, and applications of advanced design principles; involves individual research and a written report of the findings.

Prerequisites: I.E. 111, 311, and approval of instructor.

I.E. 502 Advanced Laboratory Problems in Leathercraft Techniques (3)

Advanced technical and professional activities in the leathetcrafts area with stress on individual research and design activities; a written report is required.

Prerequisite: I.E. 111, 311, and approval of instructor.

I.E. 560 Occupational Analysis (3)

Analyzing jobs and trades in occupations to determine the skills and related technical information needed for the purposes of determining content materials for a course of study.

I.E. 561 Shop Planning, Organization, and Control (3)

An advanced course in shop management procedures to promote efficient use of instruction, equipment, and materials. Shop planning will be stressed.

I.E. 562 Development of Related Instructional Materials (3)

Principles underlying the development of related instructional materials. Typical lesson plans, instruction sheets and supplementary instructional material will be developed to meet specific needs of those enrolled.

I.E. 564 Organization and Management of Evening Classes (3)

Administration of evening programs in vocational education. Organization and management of adult programs.

I.E. 565 Methods of Trade and Technical Teaching (3)

Analysis of teaching methods, preparation of instructional materials, shop management, identification and evaluation of instructional content as related to reimbursable trade and technical classes.

I.E. 566 Industrial Cooperative Programs (3)

Developing, conducting, and administering programs in secondary schools and junior colleges in keeping with requirements of the Federal Vocational Acts.

I.E. 580 Industrial Arts for Elementary School Teachers (3)

Industrial Arts activities developed as an integral part of an elementary school program leading to creative experiences that gradually broaden the child's interests and experiences Fee $3.00.

I.E. 583 Industrial Arts for the Exceptional Child (2)

Designed for teachers and prospective teachers of special education classes. Special emphasis is placed on the correlation of industrial arts activities with regular classroom programs together with developing units of instruction to serve this end.

I.E. 586 Teaching Aids in Industrial Education (3)

Selection, design, construction and use of mockups, demonstration units, charts, posters and other teaching aids similar to those used in industry.

I.E. 591 Philosophy of the Practical Arts and Vocational Education (3)

Principles upon which practical arts and vocational education are based and the place these activities should occupy as an integral part of public education.

APPLIED SCIENCE AND TECHNOLOGY
I.E. 592 Selection and Development of Instructional Materials (3)
Principles underlying the development of instructional materials in industrial education. Typical lessons, job sheets, information sheets, syllabii and other instructional materials.

I.E. 595 Evaluation in Industrial Education (3)
Principles and techniques involved in the design, selection, and administration of industrial education evaluation devices.

I.E. 602 Special Problems in Industrial Education (1-3)
Problems and procedures in the development of special instructional materials and evaluation devices of a professional nature.

I.E. 603 Special Problems in Adult Education (1-3)
Emphasis upon the needs of adults and organization and management of community programs and classes.

I.E. 661 Legal Aspects of Vocational Education (3)
Federal and State legislation as it pertains to vocational education. Interpretation and effect of reimbursement, apprenticeship, child labor, workmen's compensation, veterans' education, labor standards, labor relations, social security, and effects upon an adequate supply of trained manpower.

I.E. 680 Trends in Industrial Education (3)
Current developments in industry and trends in State and Federal programs of industrial education.

I.E. 683 History of Industrial Education (3)
The economic, social and philosophical factors that have motivated and influenced the development of general and vocational practical arts education. Development of thought and practice in industrial education.

I.E. 690 Administration and Supervision of Industrial Education (3)
Administration and supervision of local and state level programs. Emphasis upon requirements of State Plan for Vocational Education.

I.E. 691 Research Techniques for Program Planning (3)
Techniques for ascertaining the existing and future status of the community labor force and implications for vocational education.

I.E. 692 Curriculum Development in Industrial Education (3)
Planning, organizing, and constructing industrial education curricula in secondary schools and junior colleges.

I.E. 694 Vocational Guidance (3)
Problems, methods, and procedures involved in assisting individuals to choose, prepare for, enter upon and progress in their vocations.

I.E. 696 Public Relations in Industrial Education (3)
Techniques of planned programs of public relations with the community and cooperating agencies.

I.E. 697 Independent Study in Industrial Education (3)
For students who wish to carry on independent study or research in industrial education.

ENGINEERING AND TECHNOLOGY

PROFESSOR Braley (acad. chr.); ASSISTANT PROFESSORS Martin, Lewellen, Goughnoue; INSTRUCTORS Gaspari, Haver.

OBJECTIVES

Recent recommendations of the American Society for Engineering Education have accented a fact that every future engineering student should know: a